An Omnichannel Digital Banking Platform For Smart City Services: A UAE Case Study

منصة الأومني المصرفية الرقمية خدمات ذكية للمدينة الذكية : دراسة حالة دولة الامارات العربية المتحدة

by

MAITHA ALSHAIBA ALNUAIMI

A thesis submitted in fulfilment

of the requirements for the degree of

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE

at

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Thesis Supervisor
Dr. Cornelius Ncube

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ABSTRACT

The main aim of the research is to examine the omnichannel digital banking platforms within the UAE and how banking sector in UAE is providing smart service for smart cities. Digital banking and financial technology are taking the world at next level by storm and with constant advances in technology and developments in internet and mobile connectivity; the revolution of online banking is becoming a reality. The proposed study uses mixed research methods i.e. quantitative and qualitative, with key instruments being questionnaires, interviews, observation, and case design for data collection. Mixed research methods refer to the research approaches where the researcher collect and analyses the study data for quantitatively and qualitatively in the same study. This thesis addresses the proposed conceptual framework of the omnichannel banking that will fill the gap between the current digital banking services and customer need. Modelling and evaluating the omnichannel banking platform architecture design has been performed in chapter five, this chapter will further introduce simulation and automation software i.e. Arena, which will be used to demonstrate the facilities and capabilities of discrete event simulation tool (Arena Simulation 2019) by building the operational process of the omnichannel digital banking platform. Arena software is developed by Rockwell Automation, uses the SIMAN processor and simulation language on Microsoft Windows platforms. It provides an integrated environment for building simulation models for a wide variety of applications as well as provides enhancements in optimisation, animation, and modelling processes with big data. Through the analysis of the framework, the study highlighted the interoperation between system layers within the framework with diverse roles performed by a government department such as Abu Dhabi Globe Mark and Abu Dhabi Sandbox and others. This phenomenon of traditional banks being willing to work with and through FinTech companies has opened up an avenue through which the UAE government can unite its banking sector. The research proposed an alternative digital banking solution that delivers frictionless omnichannel banking experience and allows customers to enjoy a seamless, secure, smart lifestyle and personalised service across every touchpoint by smart device at any channel and anywhere in the UAE.

نبذة مختصرة عن البحث

أن الهدف الرئيسي من البحث هو دراسة منصات قنوات الأومني المصرفية الرقمية داخل دولة الإمارات العربية المتحدة وكيف يقدمها القطاع المصرفي في دولة الإمارات العربية المتحدة كخدمة ذكية للمدن الذكية. فالخدمات المصرفية الرقمية والتكنولوجيا المالية تأخذ العالم إلى المستوى التالي بسبب عاصفة التقدم المستمر في التكنولوجيا والتطورات في مجال الاتصال بالإنترنت والهاتف المحمول؛ ثورة الخدمات المصرفية عبر الإنترنت أصبحت حقيقة واقعة.

وستستخدم الدراسة المقترحة أساليب بحث مختلطة الكمية والنوعية، وذلك من خلال أدوات البحث الرئيسية كالاستبيانات والمقابلات والمراقبة وتصميم الحالات لجمع البيانات. وتشير أساليب البحث المختلطة إلى النُهُج البحثية التي يقوم فيها الباحث بجمع وتحليل بيانات الدراسة من الناحيتين الكمية والنوعية في نفس الدراسة. تتناول هذه الصياغة الإطار المفاهيمي المقترح للبنك المصرفي بقناة الأومني الذي سيملأ الفجوة بين خدمات البنك الرقمية الحالية وحاجة العملاء. وقد تم وضع نماذج وتقييم تصميم الهيكل التنظيمي لمنصة الأومني المصرفية متعددة الخدمات في الفصل الخامس، وسوف يقدم هذا الفصل المزيد من برامج المحاكاة والإحصائيات كبرنامج Arena، والتي ستستخدم لإظهار المرافق و قدرات أداة محاكاة الأحداث المنفصلة (2019Arena Simulation) من خلال بناء العملية التشغيلية للمنصة الأومني المصرفية الرقمية متعددة الخدمات. تم تطوير برنامج المحاكاه من قبل Rockwell Automation ، ويستخدم المعالج SIMAN ولغة المحاكاة في منصات مايكروسوفت ويندوز. وهو يوفر بيئة متكاملة لبناء نماذج محاكاة لمجموعة واسعة من التطبيقات، فضلا عن توفير تحسينات في النموذج، والرسوم المتحركة، وعمليات النمذجة مع البيانات الكبيرة. ومن خلال تحليل الإطار، سلطت الدراسة الضوء على التفاعل بين طبقات النظام في النموذج المقترح مع الأدوار المتنوعة التي تؤديها الجهات الحكومية مثل سوق أبوظبي العالمي وصندوق أبو ظبي الرقمي وغيرها. وقد فتحت هذه الظاهرة المتمثلة في استعداد البنوك التقليدية للعمل مع شركات التكنولوجيا المالية ومن خلالها يمكن لحكومة دولة الإمارات العربية المتحدة أن توحد قطاعها المصرفي. واقترح البحث حلاً مصرفياً رقمياً بديلاً يوفر تجربة مصرفية متعددة الخدمات لا احتكاك فيها ويسمح للعملاء بالاستمتاع بنمط حياة سلس وآمن وذكي وخدمة شخصية عبر كل نقطة اتصال بواسطة الأجهزة الذكية في أي وقت ومكان ومن أي قناة في دولة الإمارات العربية المتحدة.

DEDICATION

I dedicate this thesis to my wonderful parents, sisters, husband and children. My father has always been my role model whereas my mother has shown me unlimited love and support. I dedicate it to my sister Huda who has always been there for me whenever I need a shoulder to lean on. I appreciate my husband for the way he understands and supports me unconditionally and my children who give me the power to carry on even when I feel like giving up. Finally, I appreciate my friends who have been more than sisters to me and with whom I have strived to attain the peak of my potential. I love them all and may God bless them all

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Abbreviations and Glossary

Term	Definition
ADCB	Abu Dhabi Commercial Bank
ADGM	Abu Dhabi Global Market
AHP	Analytical hierarchy process
AI	Artificial intelligence
API	Application programming interface
APIX	Global API Exchange
ARENA	Arena is a discrete event simulation and automation software developed by Systems Modeling and acquired by Rockwell Automation in 2000.
ASEAN	Association of Southeast Asian Nations
ATM	Automated teller machine
BCH	Bitcoin Cash
Blockchain	Blockchain is the world's most trusted all-in-one crypto company.
CRM	Customer relationship management
Cryptocurrency	A cryptocurrency (or crypto currency) is a digital asset designed to work as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets.
DFSA	Dubai Financial Services Authority
DIFC	Dubai International Financial Centre
Digital banking	Digital banking is part of the broader context for the move to online banking from traditional way of banking; where banking services are delivered over the internet.
E-bill	An eBill (electronic bill) is an electronic version of a paper bill that you can view and pay online.
E-payments	E-payment system is a way of making transactions or paying for goods and services through an electronic medium without the use of check or cash.
ESC	Emirates Services and Commodities
FAIC	Federal Authority for Identity and Citizenship
FIFO	First in first out of transactions
FinTech	Financial Technologies
FNC	Federal National Council
FSRA	Financial Services Regulatory Authority
FSRA	Financial Services Regulatory Authority
GCC	Gulf Cooperation Council
GEDI	Global Entrepreneurship and Development Institute

Global financial crisis 2008	Severe worldwide economic crisis considered by many economists to have been the most serious financial crisis since the Great Depression of the 1930s, to which it is often compared
Great recession	The Great Recession was a global economic downturn that devastated world financial markets as well as the banking and real estate industries.
ICT	Information and communications technology
IFC	International Finance Corporation
IME	International Money Express
ISO	International Organization for Standardisation
IT	Information technology
Kiosk Machine	A Kiosk Machine is a small, self-standing digital structure such as a newsstand or ticket booth and also had a room inside for a person who handled the transaction
MEASA	Middle East, Africa, and South Asia
MENA	Middle East and North Africa
MoF	Ministry of Finance
Neobank	A Neobank is a type of online bank that is runs on a completely digital platform and offers its products and services through mobile apps and personal computers only.
Omnichannel	Omnichannel is a cross-channel content strategy that organizations use to improve their user experience
P2P	Peer-to-peer
PSP	Payment service provider
RFI	Responsible Finance and Investment
RQ	Research Question
SIMAN	SIMAN is a general purpose simulation language which incorporates special purpose features for modeling manufacturing systems.
SMART	Specific, measurable, achievable, relevant and timely
SMS	Short Message Service
UAE Pass	UAE Pass is the National Digital Identity and Digital Signature solution for the UAE.
UAE	United Arab Emirates
Y2K	Year 2000
4G	It is the fourth generation of broadband cellular network technology
5G	It is the Fifth generation of broadband cellular network technology

CHAPTER 1: INTRODUCTION

UAE Omnichannel Banking Platform as Smart Service for Smart City

1.1 Background of the Research

The term omnichannel or omni-channel refers to the fact that all possible channels of contact and sales between the company/bank and its customers are used and mobilised. The notion of omnichannel can refer as much to contacts made at the initiative of customers or prospects as those coming from the company. According to Kaczorowska-Spychalska, (2017), as people continue to realise the importance of the banking industry in economic development, banks are striving to adopt strategies, technologies and best practices that aimed to enhance the customer experiences. The banking industry is increasingly becoming competitive which means banks must considered to be innovative in the line with fourth industrial revolution (Kaczorowska-Spychalska, 2017). Governments regulations are also the other forces driving the adoption of financial technologies (FinTech) in the United Arabs Emirates. According to the recent world banking report based on a global survey of retail banking customers in 32 countries an interesting finding is observed which says "46% of banks plan to collaborate with FinTechs, but only 13% believe their core systems can handle the technical demands of partnerships". Many in the financial services industry believes that partnering with FinTechs is the best way to avoid disruption.

Omnichannel banking refers to the type of banking in which customers have multiple ways to transact. Customers' needs a seamless and convenient interaction with their banks and this might be across channels. Banks, therefore encourage to create a platform with multiple channels to allow and improve the interaction between the customers and banks. On the other hand, service productivity refers to the overall efficiency of bank's services with reference to its continuous business operations. Service productivity is borrowed from production and operations research to mean the ration of

bank’s output towards bank’s input resources that are invested in certain activity. Banks measure their service efficiency in term of how many customers they serve per hours, per business day in comparison to the cost of service offered by utilising human resource along with the expenses linked with infrastructures. Today, customers can enjoy the banks' services as per demand or need by just logging into their online or mobile account and executing a transaction in real time from any part of the world if they have the security credentials needed to execute such operations in a service dominant logic. Banks are aligning their services and strategies with changing customer needs and customer digital savviness. In the UAE, banks are willing to innovate new services and have the capacity to innovate by virtue of recent mergers and acquisitions that are observed in the UAE.

The diffusion of innovation theory is founded on the argument that as innovation gains momentums, it diffuses throughout the population or social systems because of the perceived ease of use. The perceived usefulness of the innovative information technology drives the user’s intention to adopt the information technology and innovation. To adopt an innovation after reviewing it, customers must understand the potential benefits of such technologies. The adoption of technologies is followed by behaviours and the change in attitude towards the technologies. Nevertheless, the adoption of innovation does not occur simultaneously as some people takes time to review the innovation before accepting the technology while some customers and banks might never accept the innovation because people usually show reluctancy while adopting any change no matter if it’s for the sake of good, the speed of diffusion of innovation depends on the user’s attitude towards the innovation (government.ae).

The omnichannel strategy integrates all the previous concepts. It uses all the available channels and connects them. With the right application, customers have the opportunity to learn more about an online product and later find the nearest store where they can get personalised advice and test the desired product directly. Learn more about customer journey mapping to better anticipate the

journey of customers and make it more intuitive. Banks will also determine the compatibility of the innovation with their core values, experiences, customer's needs, processes as well as investigating the complexity of the innovation. The other two criteria include the trialability and transferability of the innovation as well as the observability of the innovation including the potential and tangible benefits of innovation. Through omnichannel banking strategy, banks can fulfil customer needs by using data-driven strategies. Large banks provide omnichannels banking because professionals understand that customers value efficiency and convenience. Such as different banks capture customers intentions and insights then deliver personalised conversations thereby fulfilling the explicit needs of the customers and products then anticipate the customers want.

1.2 Context

An omnichannel platform is one that allows the integration and efficient management of all existing channels in the market, to offer interrelated and customer-focused paths, that is; The user who started an interaction with the company through a (desktop) channel can continue it smoothly through another (mobile) channel to provide an excellent user experience resulting from consistency and fluidity. In an era of digital disruption, more and more companies are taking strategic initiatives to achieve the inescapable digital transformation. While this represents a profound change internally that includes each of the actors in the organisation, technology is a key component to survive changes and grow in the process. From an external point of view, the adoption of new efficient platforms can help organisations to better understand the market and build better relationships with their customers.

Historically, the demand for banking services turned groups into elite bodies that did not have to market their products. However, banks are increasingly facing unique, volatiles and discontinuous changes that have seen mergers and acquisition of most banks in the UAE to leverage economies of large scale and avoid filing for bankruptcy. The mergers boom in the UAE has increased the value of

mergers and acquisition in the Gulf region to $33.7 billion. For example, in 2017, two largest lending banks merged to create the First Abu Dhabi Bank and in the first quarter of 2019, five banks have merged within Abu Dhabi and across three countries including Kuwait, Bahrain and Abu Dhabi to stay competitive and also to promote innovation adoption that is driven by unparalleled consolidation wave. With other 70 listed banks in the GCC, many banks are up for merger to enter the global market and increase the market share. To consolidate their finances. Abu Dhabi Commercial Bank has gone through the process of merger with Union National Bank (ADCB brand); later, the combined entity acquired Al-Hilal Bank to create the third-largest UAE lender.

Through the mergers, the ADCB's position will be consolidated as the third-largest bank in the UAE with an estimated total asset value of over $114bn and a customer base of 1milion bankers. In the past years, the mergers between the National Bank of Abu Dhabi and First Gulf Bank lead to the creation of the UAE's largest bank with an estimated asset base of h $175bn and promoted redundancies leading to the downturn in the capital. However, there are several mergers expected by year-end in the UAE. UAE is one of the leading overbanked markets in the world with over 50 banks directly competing for the customers. With these mergers and acquisitions, the consolidated banks are forced to develop a solution from cross-border trade and cross-banks operations. The consolidated banks are required to develop an effective solution to meet the needs of their customer post-merger. The mergers will bring changes and challenges that force banks to change their modus operandi including customer acquisition and retention. Today, banks are competing for customers and scrambling for market share. Therefore, they start focusing more on how to execute the transactions and exceed the expectation of the customers that have already acquitted.

Now, digital banking and mobile banking have become mainstream, banks must have enhanced services of digital platforms so that these can be offered to the customer as per their convenience without confining them to specific devices such as computers. Banks have adopted

multiple channels to enable services by the help of which customers and banks interact round the clock. Even in the context of digitisation and digital transformation, there are service gaps that can only be filled through integrate services such as omnichannel strategy. Banks are facing transformational changes especially in the use of financial technology products. They are required to gain consumers trust by utilising diverse growing financial technologies. Banks have diverse platforms through which users can choose any service depending on their level of technological savviness.

In order to achieve transformation, there is a need for strategy development that can integrate and address all the core aspects which may help in building omnichannel banking. First and foremost, step is to diagnose all the areas that need improvements so that efforts can be made to plan and change the highlighted area. The planning is required to be flexible so that the new approach of constant innovation can be made. The personalised attention is considered as the only aspect that is inherited from traditional banking method by new omnichannel banks. Personalisation is counted as the main key that can engage a greater number of customers that are offered by omnichannel experience. If the customer is attended with specialised attention via all the traditional platform then expectations increase for the digital platforms too because new technologies facilitate consumers more effectively as compared to the traditional channels.

In transformation, infrastructure is considered as one of the most cutting edges. There is a need of infrastructure upgrade for the financial institutions because digital services can enhance their services and make it more agile that may help in increasing the efficiency in minimal cost. Moreover, cloud is also counted as one of the innovative tools for transformation, as it allows to manage massive data along with the assistance provided to technology department to develop and do testing for all the solutions. Cloud is considered as most quick and organises way to manage omnichannel services. Application programming interfaces (APIs) is used to construct the omnichannel experiences. APIs

helps in providing and organising service with greater quality, efficiency and more quick way that can construct an exceptional omnichannel experience. Banks digital assets are required to be flexible in order to build new services and launch new products so that they can create and offer an evolutionary unified experience for the customers.

1.3 Aim of the Research

The main aim of the research is to propose an omnichannel digital banking platform within UAE and how banking sector in UAE is providing smart service for smart cities.

1.4 Thesis Scope

The main scope of the thesis is to investigate and explore the current state of Digital Banking solutions in the UAE banking sector, and the potential for adopting a unified omnichannel baking platform that can deliver frictionless omnichannel banking experience to the customers that can help them in enjoying seamless, secure, smart lifestyle and personalised service across every touchpoint by smart device via any channel anywhere in the UAE. Omnichannel enables interactions across multiple customer touchpoints where they can captivate the intentions, drive insights and arrange personalised and optimised conversations with potential consumers. Improving the interaction with the new digital clients is directly linked to the Digital Transformation processes and the construction of a new Omnichannel Banking. Currently, the financial services industry faces a complex scenario. Customers prefer to interact through digital channels - website, mobile application, among others -

without having to enter a bank branch. Figure 1.1 is showing the conceptual framework of the thesis scope.

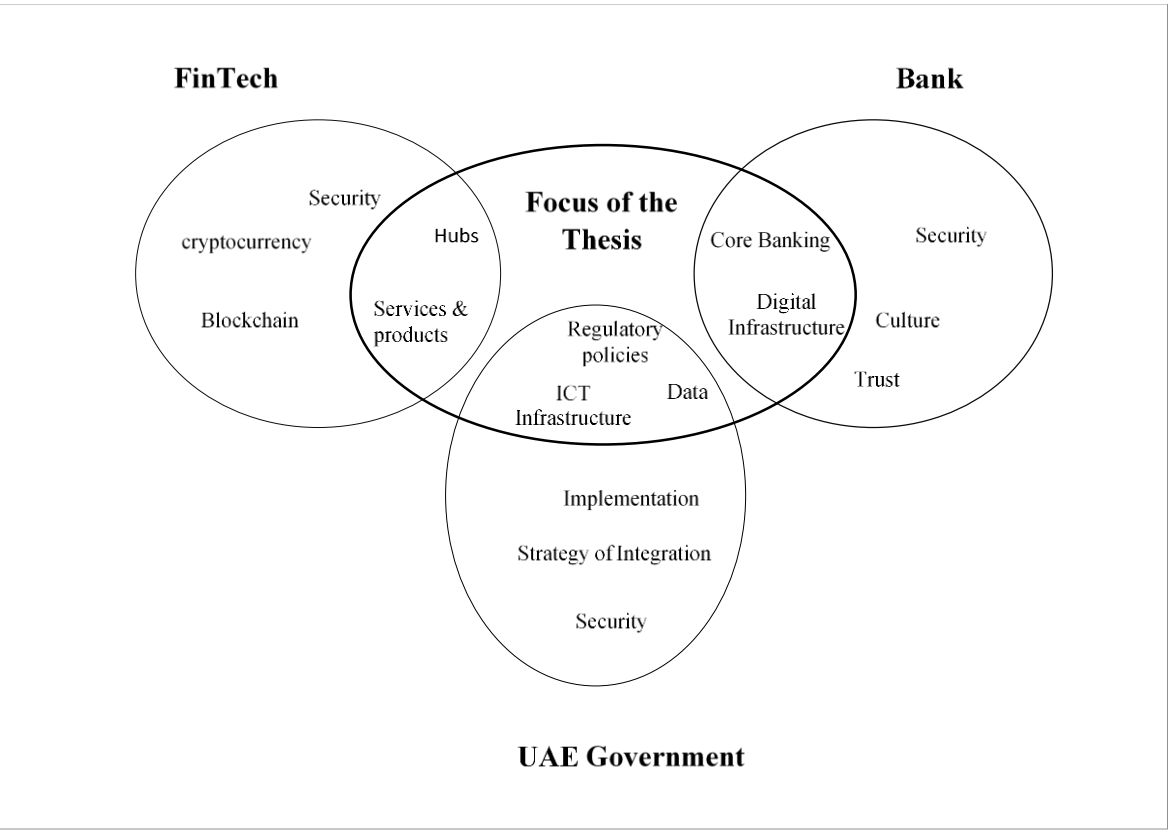


Figure1. 1**:** Intersection between the main stockholders in the research

The thesis does not:

1.4.1 Does not address the role of blockchain technology in the conceptual framework of omnichannel banking model.

In recent months, it has been seen as a notable increase in interest in blockchain technology. Researchers have observed that companies are increasingly making significant investments to explore their potential and create products and services that help in changing the market. Many banks are actively exploring what technology means to them and to the industry Blockchain technology payment services grow at a good pace establishing decentralised accounting book. SWIFT created a

Global Payment Initiative piloting service to join the growing blockchain numbers and FinTech services, reducing the cost and simplify processes. Companies make a considerable investment which explores their potential developing products that help in modifying the market. Customers expect individualised services and new digital technologies provide new possibilities. FinTech's and technology giants compete within a highly complex and changing regulatory environment. Blockchain technology reduces the time to settle transactions. The fastest transactions through omnichannel banking are processed in real-time because the strength of blockchain is the elimination of duplicate data meaning the recipient and bank have similar copies. The need for the bank to reconcile the account is less. Banking leaders believe that blockchain technology can help better customer experience, optimise product characteristics and develop a reliable exchange of services at low costs. This study will not investigate in deep of the role of blockchain technology.

1.4.2 Does not investigate the Type Of Cybersecurity Technology Used In Omnichannel Banking

The global financial sector is immersed in an irreversible and dizzying trend of innovation: banks are investing in new technologies to join the train of a worldwide digital revolution. Digitisation has already shown great benefits for entities and their customers, making it possible from big data, AI and blockchain to contactless payments or through mobile. However, on the other side of the coin, researchers have experienced rapid growth of technological crimes. Computer security has become an indispensable element to consider in relation to financial innovation. Now, the world is increasingly digitalised, the financial services sector must go one step ahead of cybercrime, otherwise it risks serious consequences. Digital transformation and competitiveness in financial services are considered as a challenge for banks and financial institutions that will continue with customer

demand. In the midst of a situation in which the traditional model consisting of physical branches loses strength, while digital platforms are consolidating at an increasingly rapid pace.

In recent years, several cases with great impact have caused significant damage to the reputation of companies around the world. It is difficult to estimate a figure, as companies are reluctant to reveal these attacks, although the tightening of regulation will make it increasingly difficult to hide these events. Within the framework of general financial innovation strategy, digitalisation, data analysis and payment modes are considered as major elements. It is believed that these are necessary to identify financial technology companies' innovation that may help in driving major structural trends in the world financial sector.

1.4.3 Does not address the consumer culture in digital spending practice

Consumer culture refers to the spending habits of customers within an economy and it is an essential element in the development and growth of a country's economy (Cross 2002). The concept of consumer culture is a complex social phenomenon whereby people buy and consume goods and services for more than just meeting their basic needs such as food and shelter, meaning that the consumer culture has changed quite dramatically over the past decade or so. This change can be seen all over the world and more specifically in the UAE where consumer culture is now driven with the urgency of satisfying customer needs. To gain insight on the changing consumer culture and mannerisms, it is first essential to understand the drivers of consumer culture on a global level and then relate it to a regional level (Saltık et al. 2013).

1.4.4 Does not focus on customer trust in digital solutions

Primary challenges faced by new FinTech start-ups include consumer trust and a lack of capital to invest in the new platforms (Wamda & Payfort 2017). Reports of fraud in the financial services communities have raised doubts and fears as to the legitimacy of FinTech start-ups and the

tangibleness of the potential returns on investment (Thanawala and Nathan 2017). FinTech services are continuously becoming popular with the rise of new and better technology with more people starting to prefer FinTech services of banking as compared to the traditional and manual system (Bloomberg Intelligence 2019). Thus, the reason that FinTech start-ups must build consumer and regulatory trust in their platforms over time. Investors may attracted towards efficient systems based upon machine learning which are also based upon ethics and high business standards.

1.4.5 Dose not implement the omnichannel banking in the really world situation.

Omnichannel banking model can be implemented in the real world that can be explained by the help of an example belong to banks, it implements in row management systems. Providing the alternative that the client can wait outside the branch, these banks allow the client to interact through a mobile application to improve the experience in branches while waiting for their turn. They also give the option of performing different operations through different channels: personnel, digital kiosks, mobile applications or online banking on the website. The integration and alignment of all customer interaction channels have the result of obtaining a homogeneous experience and the possibility for the user to finish their processes, no matter what channel they are in, even if it is different from the start one. In this way, the client's transactional processes are transverse to the channels used and what is sought is that the efforts for each channel strengthen each other.

1.4.6 Does not Investigate how the government will unite all Emirates to adopt digital banking solution

The UAE followed an in-depth policy of FinTech integration recently at municipal and state level. The move joined legislators in the country adopting plans for regulatory environment aimed at attracting more FinTech activity. They introduce disruptive innovations from frequent mobile device

use, internet and social networks which rival traditional banking processes. The loss of image and confidence in banking triggered the global mortgage crisis. Being start-up companies, they are developed with slim structures and business models adapted to a new market demanding circumstance. Knowledge of "social engineering" typologies is a preventive measure complementing authentication action to identify people. The thesis will not investigate how the government will set the rules to implement the omnichannel in the different emirates with different infrastructure.

1.5 Thesis Objectives

- The main objective of this thesis is to develop an omnichannel digital platform model that integrate customers, banks, FinTech and government.
- Use Arena software to evaluate the omnichannel model by implementing real-world criteria that are simulated with the Dubai Expo 2020 event as a case study.

1.6 Research Questions

From the background of the study, the following research questions were developed:

RQ1. How do the digital banking services driven by digital, mobile and online platforms that fulfils the need of customer interaction with the banks?

This question aims to validate the claims in the research background and literature review.

RQ2. What factors, barriers and opportunities that UAE digital banking sector is currently facing?

This question aims to validate the claims in the research background and literature review

RQ3. How does the adoption of digital banking impact the bank's ability to meet customers' needs?

This question aims at determining the benefits of digital banking especially the use of online/digital/mobile banking demands to meet and exceed customer expectations in terms of interaction with the banks anywhere, anytime and across multiple devices.

RQ4. How can the various stockholders in the interoperability of the UAE banking sector work together to facilitate the omnichannel banking system?

This question aims to determine how stockholders in three banking sectors can liaise and collaborate to develop a unified solution for cross banks and cross borders banking in the UAE.

1.7 Research Hypothesis

The researcher hypothesises that:

H_1: A significant increase in customer interaction smart device through an omnichannel banking model will increase the number of customers in a bank.

H_2: There is positive correlation between the satisfaction of consumers who own an active checking account and online digital banking solution outcomes.

H_3: There is a negative correlation between the number of online banking customer and traditional banking accounts.

H_4: Implementation of standardization and regulatory policies by the UAE government will positively impact the growth of FinTech and drive the successful transition from traditional banking to omnichannel banking model.

H_5: There is positive correlation between the UAE government strategy to transform to smart cities and omnichannel banking services across all the self-service channels.

Taking cognizance that the research method used in this paper is mixed as illustrated in table 1.1. There was a need to ensure that the development of the ideas and the growth of the ideas and the development of the methodologies run in tandem with the objectives. For instance, the use of the questionnaires would best generate public opinion in line with the development of digital banking and how it has changed the livelihood of the public. The mixed research approach also helps in creating a lasting solution towards the establishment and the verification of the hypothesis seeking to

verify and determine beyond any reasonable doubt the correlation between the UAE government and the desire to transform the economy across all the channels. The use of interviews, especially among the government policymakers and the bankers, is a sure way of creating a concrete connection between the banking sector and the overall government operations. The development of the omnichannel and the overall creation is wholly dependent on the ability to analyse and interpret the data obtained from the field. In this case, therefore, it is critical to ensure that the research methods contribute to a realistic and verifiable as well as a dependable source of information.

Research question	**Hypothesis**	**Chapter**	**Method**		
			Quantitative	**Qualitive**	**Mixed**
RQ1.	-	2	Collection of data form secondary sources as books and articles	Interview of bankers, FinTech	√
RQ2.	H2 and H3	3	Dual surveys involving customers and Fintech experts	Interview of bankers, FinTech and IT professionals	√
RQ3	H1	5	Sufficient observation and global data source	Interview of IT and banking experts	√
RQ4	H4 and H5	4	A secondary source of data including articles, research papers and books	Interview of various experts	√

Table 1. 1: The mapping between the research questions, hypothesis and research methods.

1.8 Research Contributions

The thesis makes a significant contribution to both research and practice. The thesis addresses the opportunity to implement an omnichannel banking platform in UAE:

- Develop an omnichannel model that allows customers to enjoy seamless, personalised service across every touchpoint.
- Identify barriers and challenges that can be reduced to facilitate omnichannel banking while harnessing the possible opportunities within the banking sector.

- Examine the extent to which banks are meeting online, digital or mobile banking demands and fulfil customer desire for being able to engage with banks.
- Propose an interwoven interoperability framework between the various stockholders in the UAE banking sector that work together to facilitate the omnichannel banking system and evaluation process of the proposed model;
- Supporting the UAE 2021 vision of innovation in technology is considered as the pillar of knowledge-driven and competitive economy that is promoted by entrepreneurs who value the private and public partnerships.

1.9 Rationale of the Research

Digital channels are quickly becoming the most popular way for customers to interact with banks and become critically important for the service providers. Customer expectations are growing and it is required to safely provide banking services while simultaneously generating sales through digital channels and supporting innovation. Over the past few years, the market has changed significantly, from individual online and mobile solutions to channel-independent digital platforms. Although custom-designed platforms are still widely used, lower support and development costs for a single platform and easier security management make ready-made platforms an attractive choice for banks. International researches conducted on digital security platforms expect market growth in digital banking platforms. Banks are facing increased competition, pressure from regulators, and changes in customer behaviour. Increasing the importance of digital experience, shorter update cycles and the need to provide safe and reliable service make it easier for banks to opt for a single platform for all channels before custom and internal development or individual solutions for each channel.

As excellent customer experience becomes a differentiator in the banking industry, the choice of platform affects competitiveness for the next 3-4 years. The growing importance of digital channels

has made them the main focus for investment in banks, the market moves from separate solutions for each channel to platforms, digital banking platforms can help banks to “communicate” with FinTech. According to the survey, 62.3% and 61% of surveyed banks plan to increase spending on mobile and online banking. In total costs, 29.4% and 18.4% of respondents indicated that these are top-priority IT projects in 2017.

An omnichannel platform allows companies to be more profitable because the integration of their different systems and channels can provide the opportunity to offer quality experiences in each of the points of contact with their customers, which may result in an increase in Sales and transactions not subject to branches. To this, we must add a short-term cost reduction for the optimisation and automation of the processes, and medium to long term due to a decrease in the number of physical branches. An omnichannel platform can also allow a greater degree of organisation because it will be able to operate and integrate all its sales channels and have a 360 ° vision of its organisation and its client to make better business decisions and boost growth sustained.

An omnichannel platform modifies the way in which users interact with their brand, where the coherence between the different channels of the organisation allows to improve the relationship and communication with the client, since by knowing them better, you can offer them products and services adapted to your real needs. The user receives powerful applications and functionalities, portable, with high availability, but simple and intuitive, which in the end becomes a competitive advantage for the company, thanks to the integration and efficient management of the channels. The client receives an integrated experience; It doesn't matter if the interaction comes from social networks, the web or a call to the call centre, you always receive a consonant and satisfactory experience. every banking institution aspires to grow and gain leadership in the market in which it competes. An omnichannel platform is not only a technological requirement to achieve its objectives,

it is a business tool that allows establishing the basis for being truly competitive in the market in the era of digital banking and FinTech.

Investing in an omnichannel platform is betting on a more efficient strategy to win and build customer loyalty through the different channels that users increasingly demand. In this way, the business can differentiate itself and have an advantage over its competition, but above all: it is placing the customer at the centre of the strategy. Today's customer is already omnichannel, that's why the banking core must be transformed to connect at any time and place. Opting for an omnichannel transformation process requires banks to be in all possible channels and offer services in a simpler, accessible, useful and innovative way.

1.9.1 A typical scenario Meant By Omnichannel

Omnichannel is a more client experience-driven way of dealing with client relationship the executives where clients shift between computerized and physical channels

keep up a predictable and brought together understanding. The omnichannel banking stage additionally, permits constant information synchronization between various channels. For example, clients can begin the onboarding procedure with one channel and finish it with

another without the need to give similar information again and again. Moreover, omnichannel banking has numerous ramifications for back-office activities. Such a stage can improve promoting execution, streamline onboarding forms, help client degrees of consistency, and significantly more.

A refined omnichannel banking stage permits connecting with existing customers in rehash deals without irritating them. A few instances of how an omnichannel banking stage can break down information to support promoting and deals. The framework investigations client Visa buys and finds certain purchasing behaviors. It can then naturally create offers,

limits, and discounts for specific stores or item classifications. Along these lines, clients get motivating forced to pay with their Mastercards all the more frequently when they look for specific item classes or purchase from specific stores. A bank can utilize area information of its portable application to figure future spending of its customers. For example, when a client visits a specific area, similar to a vehicle vendor, the stage sends a warning to the bank's administrators or naturally messages applicable advancements to the customer. For this situation, vehicle financing offers. Example people in the UAE can transfer money between echo other account with different banks, do all the daily transaction throw the proposed platform using different.

1.10 Thesis Outlines

The next five chapters outlines how the research aims and objectives where achieved. Chapter 2 provides a critical literature review of digital banking including the historical chronological development of digital banking. The literature review section particularly reviews the misuse of innovation and ICT Infrastructures from the published researches. These chapter also examines the diffusion of antecedents and consequences with relation to digital banking innovation. Research also examines how ICT infrastructures enable banks to provide enhanced digital banking services to their consumers. In the past, bank’s total disregards the customers’ needs that had become one of the major reasons for declining propensity to bank among the customers. It is therefore assumed that digital banking increases the customer's interest in banking. Chapter 2 also covered the competition in digital banking market and major stockholders of FinTech in UAE; it will be concluded by identifying the theoretical and methodological gaps in digital banking.

Chapter 3 outlines the research methodology and design by providing a detailed rationale of the chosen research method. The chapter adopted the descriptive research design and follow the realism research philosophy as it is considered as most appropriate research philosophy of the subject.

Also, the chapter used the mixed research method because of the inherited compensatory benefits that are associated with it. The research develops two surveys, case study design is used in the research and interviews are used as main instrument for gathering data from consumers, FinTech firms and IT experts. The first survey with the customer fulfilled the hypothesis H2 and H3; while the second survey for the FinTech banking firms and entrepreneurs is designed to fulfil H2. Moreover, chapter 3 further outlined the procedures along with the timeline for the study.

Chapter 4 investigated H4 and H5 then describe the need for a new model for digital banking services. Chapter 4 proposed an interactive omnichannel model for H4. On the other hand, H5 proposes there is positive correlation between the UAE government strategy to transform to smart cities and omnichannel banking services across all the self-service channels. Chapter 4 conclude with a recommendation for the best conceptual framework model for interactive omnichannel banking strategy.

Chapter 5 tested hypothesis H1. The chapter describes the omnichannel model evaluation criteria and results after that best model can be finalised for the study. Also, it evaluates the model in two phases in which first part includes the implemented model by using Arena simulation software that leveraged omnichannel banking strategy. Part 2 is focusing on an expert evaluation of the proposed omnichannel model developed. The expert's results then be compared against the simulation model based on the chosen method.

Finally, in chapter 6 summarises the thesis, its contribution and recommendations. it is also proposed a direction for future practices that helps in refining a unique omnichannel model.

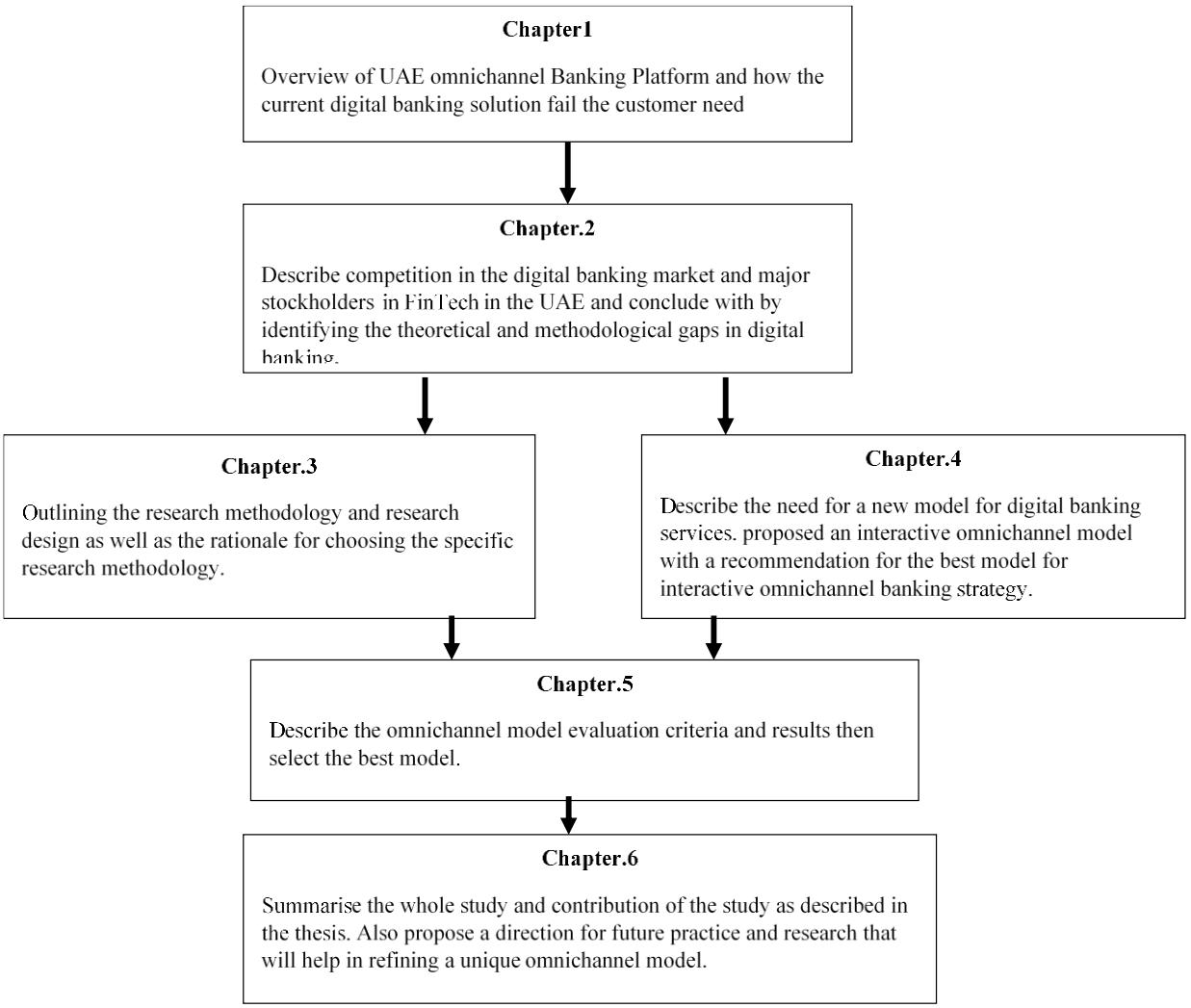


Figure1. 2: Arrangement of thesis chapters and relations between chapters.

CHAPTER 2

The Current State of Art in Digital Banking

Over the years, the banking industry has become a fast-paced industry characterised by constant innovative ways to improve services by making banking easier for the client. Unlike the previous era of banking that was defined by consumer credit; today, the banking industry is described as digital; more so, an omnichannel digital banking platform. Banks all over the world, including the United Arabs Emirates are continuously finding ways of improving the customer's experience by creating and providing a variety of platforms through which they can access diverse banking services. These platforms or channels allow customers to make transactions through their mobile phones, tablets, laptops anywhere any-time. This chapter discusses the historical background of digital banking sector as well as the various market trends that are taking place with reference to digital marketing platforms in banking sectors of UAE such as financial technology, innovation, and various digital platforms not only in UAE but in entire world.

Chapter two provides a literature review of the digital banking to examine the challenges and hindrances of implementing omnichannel digital banking platform in UAE as shown in table 2.1

Section	Title	Rational	Critical analysis
2.1	Historical Background: Digital Banking	Traditional banking history	showing the transition between the traditional banking and the digital banking.
2.2	The Unbundling of Banks	Mobile banking is the future of the financial sector and more traditional banks are starting to take note of this phenomenon.	Knowing all the factor and barriers that the banking financial sector
2.3	FinTech: Revolution and Evaluation	Traditional banking Facing competition from the FinTech companies that are joining the market every day.	To show the factor that effect the traditional banking
2.4	Technology Innovation	Resorted to partner with FinTech companies to retain their customer base and remain relevant in the financial industry. .	Finding common factors between banks and FinTech companies
2.5	Bank Supervisors and Regulatory Frameworks	Determining the stockholder in financial sector	Finding elements to build the conceptual framework that
2.6	Banking Platforms and Digitisation in the UAE	Indicating the fundamentals of digital banking in UAE and the growth of digital banking in the Middle East	Discussion of omnichannel as the basis of digital banking and the composition of omnichannel banking
2.7	Revolutionisation in Omnichannel technology	Going forward FinTech companies are most likely shift their focus from modernising the digital experience to focus on the development of new digital capabilities.	Exploring the benefits and limitations in the omnichannel banking
2.8	360 experience with satisfaction surveys	New technologies such as omni-channel will allow a greater degree of organisation by integrate all its sales channels and have a 360º vision of organisation and client.	Incorporation of feedback from digital banking users
2.9	From multichannel banking to omnichannel banking	Discussion on the need to shift from multichannel to omnichannel strategy	Substantiate the development in modern digital banking
2.10	Customer experience in other industries	Provide a digital comparison between the banking industry and others	provide a typical scenario to describe what meant by Omnichannel and the benefits of omnichannel in other industries.
2.11	Transformation of multichannel banking to omnichannel banking	How to evolution of omnichannel digital banking platform	Helps to show the resources needed to implement omnichannel banking and the challenges faced
2.12	The pillars for digital banking in 2025	Shows the future of the digital banking	Discuss the future of the omnichannel as the future of digital banking

Table 2. 1: A rational for the literature review

2.1 Historical Background: Digital Banking

Digital banking is considered as an important step towards the digitalisation or rather measured as an effective online move from all traditional forms of banking activities, functions and programs that were initially available within a bank. These activities include money transactions such as deposits, withdrawals, transfers, and management of bank accounts. The process of digital banking is not just limited to digitalisation but also includes automation of diverse bank services. Digital banking has started to come into play because of the advantages it gave to both banks and customers. Not only does digital banking helps to reduce costs, increase revenues, save time but also helps to attract and retain customers and in doing so be able to stay ahead of the competition.

In 1960s, the earliest form of digital banking in the world can be traced back to the introduction of ATMs and cards in the 1960s. With the introduction of the internet almost 20 years later, digital networks were adopted that help retailers to connect with the suppliers as well as the development of inventory software systems were also introduced in the institutions like banks. In the turn of 1990s, internet has become used widely and with its advancement online banking also introduced. Later in the followed years further improvements of broadband and e-commerce systems have been formed that played an important role in making the foundation of digital banking that can be observed by analysing current situation of digital banking. Within the next decade, smartphones developed and introduced which had opened up a new door towards mobile digital banking that is started to be preferred as compared to the traditional use of ATMs and other methods of traditional banking.

Even with the emergence of the internet and smartphones usage, many consumers were still found sceptical and hesitant to perform money transactions over internet. However, these anxieties were mitigated with the widespread adoption of electronic commerce, which was spearheaded by online retail companies such as Amazon and eBay. These platforms made the idea of online or digital transactions more familiar and user friendly and that is also most preferred method for banking

transactions. In early 2000s, acceptance of digital banking was comparatively slow but later Y2K scares that was characterised by computer bugs and other malware. However, after its resolution digital banking has been on a constant rise; with online customers now proving to be more loyal and profitable than traditional banking customers.

The current challenge for banks in facilitating digital banking is handling the demands that connect vendors with preferred channels that was highlighted and determined by customers related to money. With these demands, there is a need for new software systems development that entertains this process. Other demands include consistency in provided services along with the optimised user experience. These challenges have been facilitated by the ever-increasing number of digital banking users. In 2018, there were more than one billion digital banking users in the world (Bhas, 2018) with indications that the figure could rise to two billion in the next a couple of years. There is a high chance of rising customer expectations figures by the spread of internet and other technology advancements by focusing on offering exceptional digital banking platforms to banking sector (Fernandes & Awamleh, 2005).

In 2008, the global financial crisis has deterred the overall progress of UAE digital banking. Since the great depression of 1929, this event has been considered as the most consequential financial crisis by many economists and that was resulted in the great recession. In 2007, subprime mortgage market had faced severe crisis that became the reason of 2008 crisis. Later, this crisis developed into a full-blown global banking crisis after the collapse of Lehman Brothers Investment Bank in September 2008 (Dullien, Kotte, Márquez, & Priewe, 2010). The collapse of this bank further enhanced its financial impact at global level. A massive bailout by financial institution then led to a massive drop in stock markets internationally that was resulting in financial crisis.

However, the government of UAE put measures in place to protect its banking industry before the effects of global financial crisis of 2008 hit UAE (Khamis, Senhadji, Charap, & Cevik, 2010).

Following this crisis, banking practices in UAE went through significant advancements in which banks are starting to engage retail customers as well as collaborated with them to create an environment where customers could access multiple banking platforms including services linked with branches, ATMs and mobile banking.

Mobile banking has played a significant role in promoting digital banking platforms as it is now considered as a core business strategy for banking sector not only in UAE but round the globe. The UAE and Saudi Arabia have the highest rates of adoption of digital banking platforms with 52 and 60 percent, respectively; these figures are making these regions as highest consumption countries in Gulf region (Arabnet , 2016). This application has also been extended to the payment of bills by using mobile apps that are linked with banks. Another facilitator of digital banking is the construction of first ever internet city in Dubai that has facilitated the application of internet business, since 2000s.

2.2 The Unbundling of Banks

The concept of unbundling is a term that is used to refer the process of offering products or services separately that were initially packaged offer. This process is usually implemented when organisations feel the need for improving or focusing on specific products or services for the purpose of enhancing productivity or revenue (Ketterer & Andrade, 2016). Organisations also follow the same pattern of unbundle services while launching any new product or service in line. In the context of banking, unbundling can refer to the focus on new technologies or digital ways of delivering or improving banking services.

	Manufacturing focus	Hybrid	Distribution focus
Ambition	Best-in-class production and processing of banking products	Growth in select core markets via distinct products, customer segments, geographies	Best-in-class client insight, and management of channels and relationships
Where to play	Best-in-class solutions for specific customer segments, including other banks	Distinct choices of products, according to customer segments and geography	Full product suite, bundled and tailored to the sector and size of the customer with white-label solutions
How to win	Economies of scale; high fixed costs require large volumes to hold down unit costs	Both scale and scope; manufacturing in core local markets and distribution in select overseas markets	Economies of scope; high cost of acquiring clients makes a large share of wallet essential
Examples	Black Rock, State Street, Goldman Sachs, parts of JPMorgan Chase	Many large banks in their home markets	Community banks, smaller overseas branches

Figure 2. 1: The Unbundling of Banks (Olsen et.al., 2017)

With the rise of the internet and smartphones usage, banks have unbundled their services in response to demands and needs raised by customers. The main aim of unbundling in FinTech is to enhance the customer experience by making banking services more consumer-friendly, convenient and time-saving. An omnichannel digital banking platform is a prime example of unbundling of banking services; where these services are available at various platforms such as smartphones, tablets, laptops and physically at branches of banks.

Banks could unbundle their services in various categories that meets the needs of every customer such as individual banking, business banking, loans, and digital banking. The digital banking services include all sort of online banking platforms including mobile and tablet banking, cheque deposit via mobile, text alerts, e-statements and payment/bills deposit online. The unbundling of banking services provides the opportunity to solve each problem separately and independently without the need for central control (Transfer Wise, 2016). The process takes place with different waves – the Incrementalists, the Digital Hybrids, and the Digital Natives.

2.2.1 First Wave Banks: The Incrementalists

Incrementalism refers to a process or method which involves adding diverse small incremental changes to a project instead of a few large lumps. This process describes the first wave or phase of the unbundling process of banks. Wave that was took place in 1990s to early 2000s is characterised by an attractive quality of market where critical infrastructure is already in place for the development and establishment of innovation. During this period, the internet had been introduced for business sector of entire world and it was considered as major shift towards a new era of technology and innovation. This critical infrastructure includes the internet and smartphones, which make up the foundation of the innovation of digital banking. As stated in previous paragraphs, the era of digital banking has been made possible through the establishment and development of the internet along with the introduction of smartphones because it has made possible to create mobile banking apps and services.

This infrastructure makes it easy for banks and other FinTech providers to work with financial data as well as to facilitate online payment, stock monitoring and stabilisation of financial market. This phase or waves has become the reason for FinTech start-ups to grow exponentially as they focused on breaking monopolies in loans and money transfers procedures by protecting customers from hidden charges and high-interest loans. FinTech companies took advantage with the fact that internet and mobile technology is provided in order to filling the gap in banking industry. At the turn of 2010, innovative FinTech start-ups arising by unbundling banking services through the provision of individual services including money transfers, loans, savings, investment options. They also provide relevant financial advices to their “ondemand” clients in such a manner that it will be considered as convenient for them to use these services via smartphones or laptops.

The first unbundling wave focuses mostly on consumer banking, where customers are attracted through heavily subsidised current accounts. However, some banks add hidden charges on bundled services to make profit. However, new stockholders in the industry are playing with exactly opposite tactic – they focus on each segment and remove all the hidden charges in order to improve customer experience. As mentioned earlier, digital banking focuses on improving customer experience and that has become a core business strategy for new FinTech institutions. In the next five to ten years, by improving system and offered services exceptionally, these new FinTech companies enjoys a good market share with great profits.

2.2.2 Second Wave Banks: Digital Hybrids

Digital hybrids or rather hybrid banking is the second wave or phase in unbundling digital banking services. This second phase takes place after 2010, where there was a change in customer demographics and expectations is observed with the rise of digital native generation who prefer debit cards, online banking, and mobile banking over traditional banking methods. At this point, online banking has gone mainstream globally even the late adopter banks are also joining online banking platforms as more people (even the older generation) have started to prefer accessing their accounts as per their comfort zone at their homes without visiting banks.

A digital hybrid is a result of combining two different elements to make one unique and innovative solution or service. With advancement of technology, banks and other FinTech institutions reached at the point where creation of digital hybrids is considered as must as it enhances multiple client interactions. This was as a result of the fusion between the digital and physical world (Gasser et.al., 2018) where clients are connected to different channels from different financial service providers for example, when a client uses a mobile banking app to purchase products online or pay their bills. Older banks that were established before the digital age are now starting to embrace

technology and at the same time still retaining their traditional way of offering services. Therefore, the end product for this amalgamation is the creation of hybrid services that combine both traditional way of banking with digital banking methods. For example, banks have the option of mobile banking where customers can withdraw, deposit or make transactions with their phones but they also have the option of visiting to their bank branch or ATM to get the same service done. It creates a balance between both worlds (traditional & digital) by catering all types of customers, internationally.

Figure 2. 2: Hybrid Banking (Kobler, Bucherer, & Scholtmann, 2017)

However, for banks to adopt digital hybrid systems, they need to integrate all relevant touch points of their clients such as their insurance company, television subscription, water provider to enhance client satisfaction. Technology plays a big role in digital hybrid as it impacts commercial banking in three ways; firstly, it increases access to information and this consequently allows businesses to make more informed and better decisions. Technology also reduces friction in business

activities by bringing in new and better experiences. It also lowers transaction fees for businesses as it takes on the role of the cheaper middle man.

2.2.3 Third Wave Banks: Digital Natives

Third wave of banks is the digital natives which includes banks that have started as digital or FinTech institutions. This wave of banks represents the future of banking industry, that is set to survive in the next decade. It is the phase that takes place after 2014, where mobile banking platforms emerge and infiltrate across regions and countries. From the beginning of 2016 till today, there has been a phenomenon increase in the number of FinTech companies that have started to rise up in the market and with-it financial technologies such as cryptocurrencies, blockchain technology, artificial intelligence, and machine learning.

As stated in previous paragraphs, banks that have embraced technology and implemented it in their systems and services are part of the early adopters and remains relevant in the coming years as compared to those who are still laggards and have not yet adopted the technology. The digital native banks are those which have been established in the era of technology and they almost solely focus and embrace every digital opportunity in this digital age (Dombret, 2018). Although, the industry is comprised of mostly digital hybrids that are beginning to adopt technology and integrate it with their systems and services; digital natives are starting to be on the rise and a good number of the population are starting to prefer this new-era of banking.

Digital natives provide ease by making almost all of their services available online on their websites– from money and business transactions to loan borrowing and servicing. Their services are instant and accessible anywhere and at any time. This is a crucial aspect of modern-day banking as people want to be able to access their banks wherever they are and at whatever time they wish to do. This ability gives digital native banks an upper hand, especially with the digital generation; thus,

making traditional banks that have not embraced technology continuously seem cumbersome, formal and irrelevant.

It should come as no surprise that some digital native banks were established for the sole purpose of meeting the needs of digital age generation who seek effortless access to money, peer-to-peer money lending, as well as lower transaction fees. Digital Natives, however, are disrupting in the banking industry (PWC, 2011). An example of a digital native FinTech is PayPal, which did not exist two decades ago but is now causing disruption. To counteract this disruption, well-established banks are now partnering with these digital native FinTech companies or establishing their digital native services through unbundling some of their services.

2.3 FinTech: Revolution and Evaluation

FinTech or rather financial technology refers to computer programs and other digital or modern technologies that are used to support, enhance, enable and automate banking as well as financial services. The internet and smartphone revolutions have resulted in the exponential growth of financial technology, which has come in handy in transforming the banking industry to the vibrant nature that it is observed in this era. There has been the introduction of a broad variety of technological interventions into bank services such as personal and commercial finance in order to make these services more convenient and accessible. Financial technology is now used to describe a variety of financial and banking activities such as money transfers, cheque deposits, application of loans and credit, as well as for the management of investments – all available with the touch of the phone.

FinTech services are continuously becoming popular with the rise of new and better technological innovation that has involved more people in preferring FinTech services of banking as compared to traditional or manual system (Diemers et. al., 2015). This growing popularity has started to make FinTech banking start-ups a disruption or rather a threat to traditional banking systems. They

are starting to pose a great challenge by tapping into an underserved segment of the market through its faster and better services. Because of this, FinTech companies and banks are connecting through various ways including:

1. Investing in FinTech companies.
2. Partnering with FinTech companies.
3. Acquiring ownership of FinTech companies.
4. Establishing programs that can help FinTech companies incubate and grow.
5. Launch their individual FinTech services and solutions.

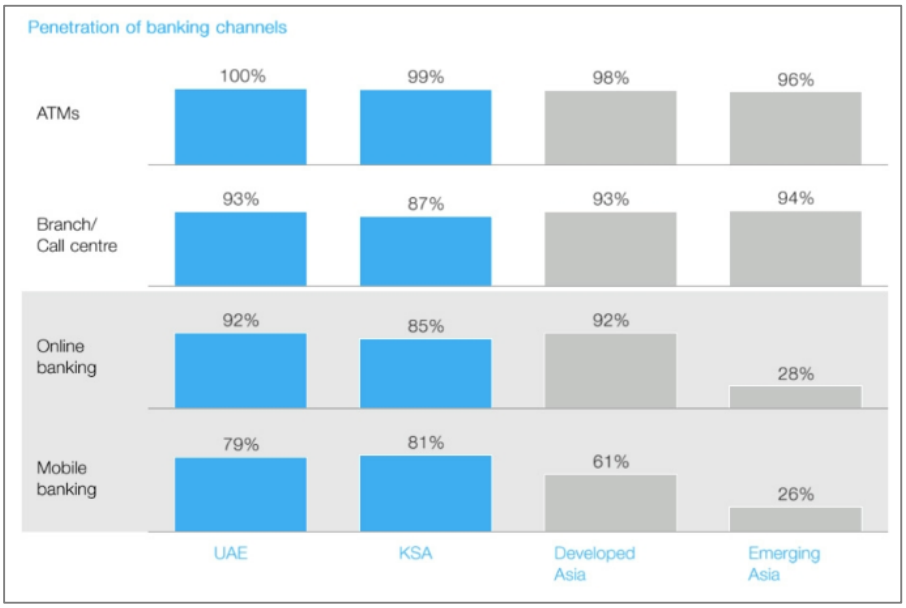


Figure 2. 3: Penetrations of Banking Channels (Consultancy UK, 2017)

In the UAE, FinTech start-ups are being initiated and growing at an accelerated pace. This is enormously contributed by the efforts of UAE government in strengthening its position as a hub for FinTech start-ups (Clifford Chance, 2017). The country raises its position by posting highest number for start-ups and investments into financial technology as compared to any other country of Gulf region. As a pacesetter in the Gulf region, UAE shows great potential even in the future as more FinTech start-ups are expected to come up with estimates placing the growth to rise from 96% in 2019 to 465% by 2022 (Bloomberg Intelligence, 2019) in the entire Middle East region. Traditional

banks find it strenuous to keep up with FinTech companies mostly due to regulatory reasons as well as their internal structures that may be rigid and not as flexible as to those of FinTech start-ups. FinTech companies have realised that financial services need to be seamlessly integrated into the lives of the tech-savvy or digital natives (millennials) who make up a majority of their clients by embracing technology and digitalisation of most of the services if unable to make it happened then maximum of the services they offered.

2.3.2 FinTech Key Areas

The FinTech industry is among the fastest growing sectors not only in UAE but also in entire world. The sector has observed dramatic growth since 2010 with more customers opting to use FinTech solutions as its customer experience trumps that of traditional financial services. The FinTech sector comprises of several key areas where it has laid its focus and by the help of which they can attract their customers. These key sectors account for almost 60 percent of the total investment by financial technology companies. They comprise of the core focus of business as well as give FinTech an added advantage over traditional banking systems. FinTech companies are undoubtedly considered as the revolution in banking and financial industry of 21st Century. With its continued growth and advancement, the sector will not just impact the financial industry but also explain how people conduct transactions in all aspects of the business.

According to PWC report (1997) in the next three to five years about 82 percent of incumbent or traditional banks across the world are expected to increase their partnerships with FinTech companies (PWC, 2017). As stated previously, this is a way to mitigate the disruption caused by FinTech companies towards established financial institutions. The reason of great success for FinTech companies are the areas and services that they focused in order to attract customers. These key areas

of focus include services such as payments, lending, and mobile applications etc that will be discussed in more details below.

2.3.2.1 Peer-to-Peer Lending

Peer-to-peer (P2P) lending refers to a system where individuals can get loans from mobile apps without visiting financial institution such as a bank. FinTech companies offer peer-to-peer lending as one of its vital service which is now seen as a better alternative method of financing. It is also among the most profitable service offered by FinTech companies (Omarini, 2018). Traditional banks seek to merge with a FinTech company or establish their FinTech solutions to tap into the profitable results of peer-to-peer lending.

This service is not just advantageous to the FinTech or financial institution, but also very beneficial for customer. This form of financing allows individuals and small businesses to get in touch with potential investors (Wolfe & Yoo, 2017). It is also much easier to get financing through FinTech companies then it is with traditional banks who also charge more interest while servicing the loan. As a consequence, FinTech solutions further fuel economic growth by providing small businesses and individuals with the finances they need to get their projects up and running (Kühnel, 2011).

Peer-to-peer lending websites facilitate the direct connection of borrowers to investors through the internet and websites. The investor opens an account with the website and deposits a sum of money that is dispersed as loans. On the other hand, applicant sets up their financial profile that determines their financial credibility for the company offer services. These transactions are not complicated as they are highly automated and can be done through a smartphone, a tablet or a laptop where the clients can access the rates and terms of the loans. Mostly, websites have a wide range of interest rates and are normally determined by the creditworthiness of an individual – the higher the creditworthiness the better the rates of borrowing.

2.3.2.2 Online Payment Processing

More people in the world including UAE are starting to prefer online payments as opposed to other traditional forms of payment method. With this trend, FinTech companies provide online payment systems to their clients and making it easier, faster, safer, and cheaper (Omarini, 2018). Examples of online payment gateways in the UAE include TELR, PayFort, CC Avenue, Checkout and others. Online payment gateways are becoming more significant and popular as they are streamlined with existing electronic payment channels, such as credit and debits cards. They also provide recurring billing options as well as secure processing of payments that are made online.

2.3.2.3 Mobile Wallet Applications

Mobile wallet or digital wallet applications is an electronic device or a service available online that allows people to make electronic transactions ranging from purchasing items online to access an individual's bank account by using a smartphone or computer (Painuly & Rathi, 2016). An individual's bank account can be linked to their mobile wallet with safe storage on their credentials such as driver's license and other identification documents. This service can be seen as a sub-section of online payment sector within financial technology as it helps clients store their money in a safe way as well as provide avenues to make payments.

Mobile wallets are becoming more common each year as maximum number of people have started to access these platforms via smartphones as compared to actual physical traditional banks (Mahindra Comviva, 2016). FinTech companies have come in to fill the gap of this limited access to banks by providing avenues that allows people to safely store and access their money as well as monitor it at the same time.

A good example of a mobile wallet globally is PayPal, which was among the first mobile wallets to be established. Other digital wallets include Apple Pay, Google Play, and Samsung Pay – all of which are available worldwide. In addition to these, the UAE also has other digital wallet platforms such as WePay and Beam.

2.3.2.4 Fraud and Security Analysis

Despite the advancement in technology and the benefits associated with it, online fraud is still considered as increasing concern for FinTech companies and their clients. Over the years diverse online frauds are reported that have cost consumers billions of shillings in losses. In 2016, for example, consumers lost nearly US$16 billion to online fraud (ACS, 2016) and this figure is expected to rise. Heavy investments by FinTech companies as well as other financial institutions have been made in hopes of mitigating online fraud cases and the losses that appears with it. FinTech start-ups have focused their energies and resources on anti-fraud and security use technology such as artificial intelligence and learning of fraud patterns in transactions (Giudici, 2018). These investments and security measures help to give customers assurance that their money and transactions are safe and are not being violated.

These are a few key areas of FinTech as more are being developed and established every day such as cryptocurrency or blockchain, wealth, investing, insurance, remittance, and web-based financial planning tools.

2.3.3 Comparison with Previous Waves of Innovation and Factors Accelerating Change

FinTech companies are measured as a new era for financial institution and with advancing technology their relevance and hold in the market continue to solidify on daily basis. There are clear, cut-out differences observed in between FinTech and other previous waves of innovation, particularly the first wave banks or the Incrementalists which comprise of the traditional banks. These differences

are based on the quality of services, focus of service delivery, as well as the methods used in service delivery.

2.3.3.1 Comparison based on purpose:

The major difference between FinTech companies and traditional banks is the purpose that they serve. FinTech products and solutions were established to fill an existing gap in the market such as the needs of the digital natives or millennials, whereas on the other hand banks cater to the wider audience. Banks focus most of their energy on risk management but FinTech companies focus mostly on enhanced customer experience.

2.3.3.2 Comparison based on key functioning:

Traditional banks are more purpose-oriented and their processes follow a system of regulatory frameworks. These characteristics make banks rigid as it restricts their ability to quickly adopt new technologies and roll out new services and products. The structure in which a traditional bank operates also restricts innovation which in turn slows down their ability to change their systems. On the other hand, FinTech companies are more customer-oriented and their operating systems are less rigid and have a better regulatory arbitrage. The structures within FinTech companies allow for innovation and because of this feature FinTech companies are always in touch with technological advances that are taking place in the market such as cloud and artificial intelligence as well as a high and unique customer experience that is anchored on personalisation, speed, relevance and seamless delivery. The structures within FinTech companies also provide them with the ability to rebuild non-performing structures.

2.3.3.3 Comparison based on perceptions on technology

FinTech companies heavily dependent upon technology and its forms for its functioning. These technologies include automation, artificial intelligence and use of machine learning are significant for the functioning of FinTech companies as all their products and services are based on technology. These technologies help FinTech companies to provide faster, secure and convenient services to their clients. On the other hand, traditional banks are less technologically advanced as compared to FinTech companies. In order for traditional banks to remain relevant, they need to incorporate technology into their products and services.

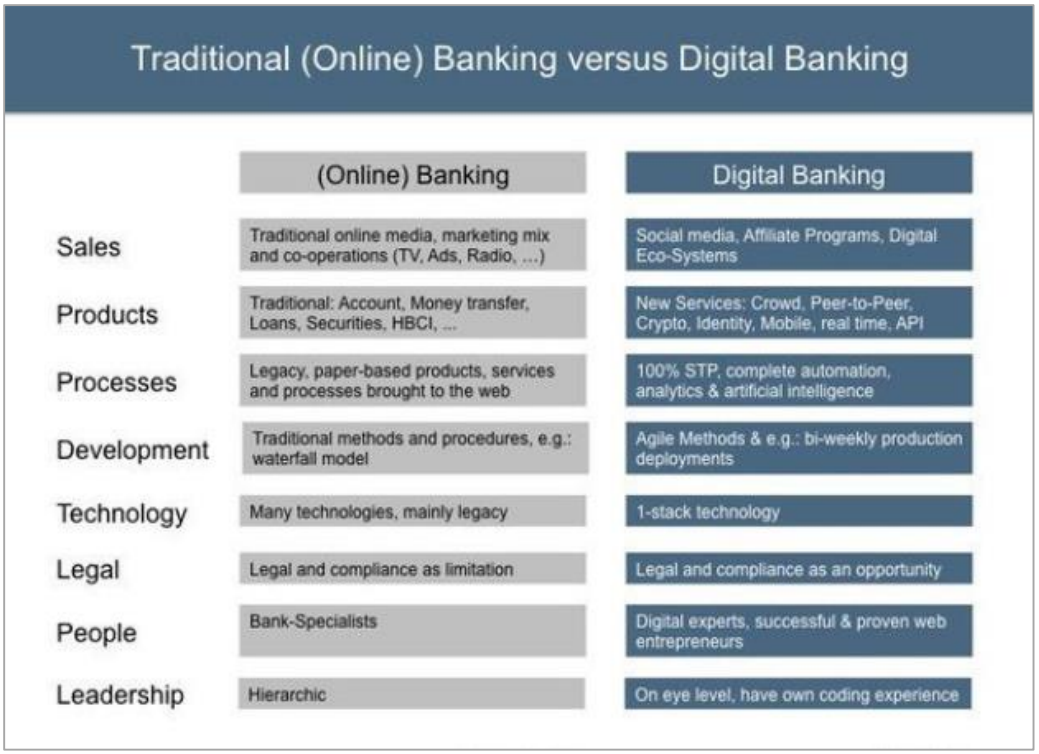


Figure 2. 4: Traditional versus digital banking (Schwab, 2015)

2.3.3.4 Comparison based on potential coverage

FinTech companies have a larger market distribution as compared to traditional banks, which are more limited. With higher mobile connectivity and internet penetration, FinTech companies have an added advantage in the market as their services are available anywhere and at any time. Traditional

banks are only limited to their physical branches which may not be as easily accessible to customers as digital platforms are.

2.3.3.5 Comparison based on personalisation:

FinTech companies are leading in customer experience as their products and services focus on functionality, accessibility, personalisation and convenience. However, traditional banks were initially considered as laggards and catching up by improving their services and customer experience. Traditional banks have started to remodel their business model from simply offering credit and deposits to a model that focuses on security, trust, and quality service for the customer.

2.3.3.6 Comparison based on loan access and interest rates

FinTech companies offer easy access to loans and credit facilities through their various platforms such as peer-to-peer lending which is ideal for individuals or small businesses. These credit facilities are easy to apply and get as compared to acquiring a loan from a traditional bank. The interest rates for FinTech companies and platforms are also less as compared to traditional banks which are usually high. This factor has brought a lot of disruption in the traditional bank industry which now opts to form mergers with FinTech companies or create their own FinTech companies to get a scope of this market gap.

There are various factors that accelerate the change from traditional to digital or FinTech banks; among the major factors is advancing speed of technology in financial systems. More countries are adopting new technologies every day and factors such as increased mobile connectivity and increased internet penetration further advance this adoption. This means there are more avenues to speed up processes and improve customer experience in banking by using technology to revolutionise the industry. Another factor that has contributed to digital banks is increased openness by the market

to digital tools, products, and solution (Jin, Seong, & Khin, 2018). More people are open to innovation and change as compared to era passed two decades where the idea of online banking was still new and unexploited. Although, digital banks are more popular with millennials or rather the digital natives' era, it is becoming a preferred method of global banking.

Another accelerator is that more countries are counted under transition phase with regard to FinTech regulations and government is creating a suitable environment for their growth. For example, UAE is establishing a digital city in Dubai which has gone a long way in promoting digital banking and FinTech start-ups. Traditional banks are also coming on board by partnering with FinTech start-ups or providing incubation that will accelerate their growth in the market. Rather than seeing them as a threat, traditional banks are now using them as an opportunity in embracing technology.

2.3.4 Speculations

There are various speculations towards the future of FinTech and based on its recent definite trends it is clear that FinTech is the next big thing. A lot has taken place in the banking and financial industry over the last decade, with a majority of these changes being facilitated by the advances in technology as well as increased mobile connectivity and internet penetration in countries such as the UAE. Going forward into the future, these are some of the speculations or trends that are likely to take place:

2.3.4.1 Traditional banks collaborating with FinTech

When FinTech was still taking shape in the market, they were competing with the traditional and more conventional financial institutions and banks. On the other hand, traditional banks consider FinTech companies as a disruption to their business thus counted as competitor. However, recent trends (specifically at the turn of 2017) have seen a shift from competition to collaborate with

traditional banks; FinTech companies are now being more open to the idea of joining forces where both can benefit from each other (Kelly, Ferenzy, & McGrath, 2017). Banks can now continue earning revenue and retain their customers, while FinTech companies can find legitimacy through conventional payment methods.

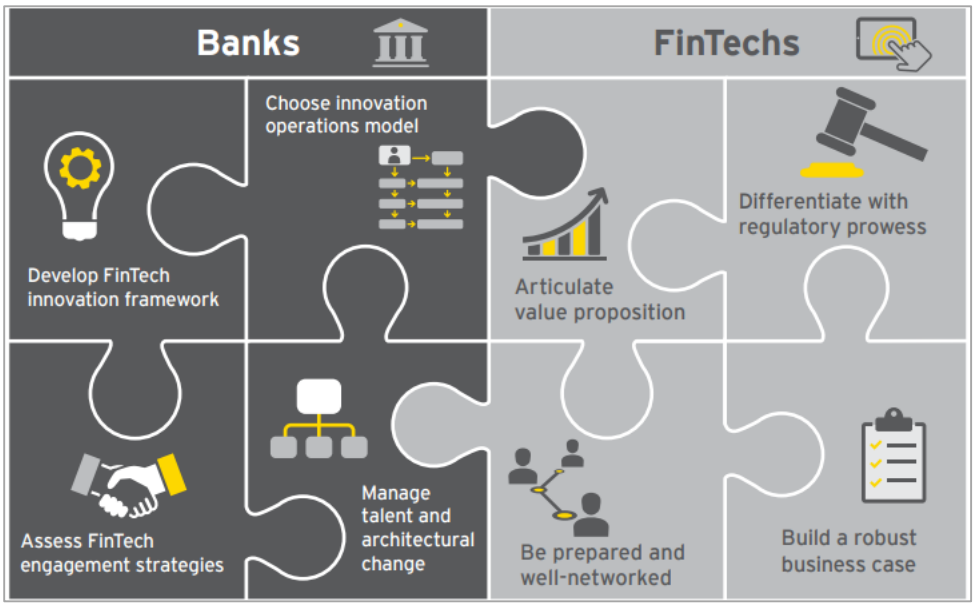


Figure 2. 5: Partnership imperatives and opportunities for banks and FinTech (EY, 2017)

2.3.4.2 Faster financial transactions

The emergence of FinTech companies has revolutionised payment systems and financial transactions. With the technology that FinTech companies employ, digital payments have been made easier and faster than ever before. Going forward, it is expected that these payment systems will be even faster, cheaper and more secured (PWC, 2016). Through collaboration with traditional banks, FinTech companies are investing heavily in cybersecurity as well as real-time payment and peer-to-peer lending.

2.3.4.3 Increased focus on artificial intelligence (AI)

Although, advancement in technology has created vast opportunities that are beneficial to all; it also comes with serious threats such as online fraud and others. Current trends are now focusing on developing and enhancing artificial intelligence and machine learning to detect fraud and ensure financial transactions (Mehta et.al., 2015). With the advancements that is made on artificial intelligence FinTech companies are now in a position to make more informed and efficient decisions as well as come up with comprehensive solutions to some of the challenges they encounter. A significant element in artificial intelligence is predictive analysis which is used in analysing big data in financial institutions like customer details.

2.3.4.4 The emergence of blockchain

At the start of 2017, FinTech companies started to explore the idea of blockchain technology. Big data in financial institutions are now being stored in a digital format and this has greatly facilitated the updating of transactions in real-time (Sultan et.al., 2018). If implemented correctly, blockchain will help financial institutions save large amounts of money – a positive and remarkable step forward for the industry. This technology can revolutionise banking industry.

2.3.4.5 Advanced mobile wallets

Mobile wallets have started to become a preferred method of storing money as plastic cards are starting to lose their charm. On the other hand, smartphones and phone wallets are continuously becoming a preferred method of payment due to its user-friendly interface (Mahindra Comviva, 2016). In the coming years, it is expected that there will be widespread use of smartphones and mobile wallet apps by a greater part of the population worldwide.

2.3.4.6 Cloud computing still be in use

Cloud computing technology has proved its efficiency over the past few years and it is expected that it will still be in use as more FinTech companies are offering cloud-based services. Perhaps FinTech companies will integrate with other cloud providers to offer more complex services such as management of content, data analytics, data storage and others.

2.3.5 Opportunities in FinTech Start-Up Solutions

There are various opportunities for FinTech start-up solutions across the world and these opportunities have been further made possible by advancing technology as well as internet availability and accessibility. These following are some of the specific opportunities that FinTech start-ups can explore.

1. Mobile banking for those who cannot access traditional banks such as people living in rural areas or expatriates and immigrants who may require a lot of paperwork to open a bank account in conventional bank. This category of people provides FinTech start-ups with the market in which they need to grow.
2. Personal finance management is also another opportunity that FinTech start-ups can explore by providing digital tools that allow customers to properly manage their finances and assets (KPMG, 2019).
3. Providing finance for individuals and small businesses is also another start-up opportunity for FinTech companies. As stated in previous paragraphs, a key sector within FinTech solutions is the provision of peer-to-peer lending which is continuously becoming popular among people.
4. Providing innovative processes for payment and money transfer is also another opportunity for start-up FinTech companies (Oliver Wyman & Omidyar Network, 2018). With the

introduction of the digital native generation, these digital payment and transaction processes are becoming more of a need rather than a want. This is a big market for FinTech companies to explore and tap into.

5. Another opportunity is accessible in investing and online trading which is starting to become popular especially with the advancements in artificial intelligence and machine learning.
6. The advancement of big data and predictive analytics also provides great opportunity for FinTech start-ups who may want to explore the technology in offering big data services and solutions.
7. Another opportunity that is currently taking shape is blockchain technology, cryptocurrency or digital currency. These two technologies has revolutionised the financial industry and FinTech companies by focusing on them will stand to gain a lot in the future.

2.3.6 Key Risks and Start-up Challenges

Despite fast growth rates and countless opportunities FinTech companies are associated with the industry also faces some risks and challenges that might undermine its sustainability in the future. Most of these challenges are manageable and can be addressed with time. These challenges include:

2.3.6.1 Regulations

This is among the significant challenges that FinTech companies have to deal with. The technology industry is constantly evolving and because of these laws and regulations that govern the sector also change constantly. These regulations come with heavy investments as FinTech companies spend a lot of time and resources (Drummer et. al., 2016) to ensure that they comply with the set regulations and changing laws. This also means that FinTech companies always need to be aware of the changes made in regulation. The burden of handling compliance in FinTech start-ups is also

greater as they have fewer people as compared to traditional banks which have whole teams dealing with compliance of regulations.

2.3.6.2 Cybersecurity:

This is also another major challenge for all technology and FinTech companies. The sensitive nature of this kind of business conduct make them a target for fraud and cyber-attacks (Gelis & Woods, 2014). Every year, cyber-criminals launch more sophisticated and frequent attacks that require FinTech companies to vigilant always. As a countermeasure, these FinTech companies have invested heavily in systems that can thwart these attacks. However, not all FinTech start-ups have the financial ability to make such investments; hence, it is recurring issue.

2.3.6.3 Maintaining and retaining the human touch

FinTech companies operate in a way that they reduce one-on-one interactions with their clients. This is a point of a disadvantage as compared to traditional banks, whose services are anchored on the 'human touch' factor. With the use of artificial intelligence and machine learning, this issue may become more prevalent in the future. By not having the 'human touch', FinTech companies also find it difficult to persuade customers to leave traditional banks and join them. However, this can be mitigated by focusing on consumer's need and experiences and implementing them on every product, service, and solution.

Other challenges and risk factors may include micro and macro-financial risks as well as operational and economic (supply and demand) risks. To mitigate some of these risks, FinTech companies can focus on diversification and decentralisation that can enhance efficiency, increased transparency, as well as increased access and convenience to the customer.

2.3.6.4 Focus on outsourcing and partnering risk

As a recent trend, FinTech companies and banks have collaborated to deliver fast and efficient services to their clients. Although, these partnerships and combined efforts have proved beneficial for both sectors, there are still some challenges and risks involved (Pollari & Raisbeck, 2017). Among those risks include internal competition which may affect the partnership as each tends to outdo the other – an element that is not good for business. Another risk is the occurrence of conflict of interest and ideas, where traditional banks have a way of doing things while FinTech companies want to explore new and untested ideas. Other risks include operation risks, third-party management risk, money laundering, compliance risks, as well as strategic and profitability risks.

2.3.7 FinTech and LASIC Principles

The LASIC principles are used to define five crucial attributes that FinTech companies can implement in achieving a sustainable social business environment for financial inclusion as well as improve income and wealth inequality (EY Global Financial Services Institute , 2015). These principles include low margin, asset-light, scalable, innovative and ease of compliance.

2.3.7.1 Low margin

Low margin is an important element in the success of FinTech companies, primarily because of the widespread internet access and use results to users seeking for the lowest prices and in most cases, free services. The initial stage of setting up a technology requires a lot of funding; however, once the critical mass is created, income and profits can be achieved through avenues such as advertisements and user subscriptions (Chuen & Teo, 2015). At the user level, profits will remain low but profits can be made through obtaining a large mass of users. FinTech companies can also attain profitability through the subsequent build-up of big consumer data which relies on the consumer's

spending habits. The low margin has a period of a high burn rate where there is little or no revenue. This is then followed by an exponential growth where multiple sources of revenue are involved such as advertising.

2.3.7.2 Asset light

Asset light entities can be innovative and achieve scalability without incurring huge costs on their assets and as a result there is a relatively low marginal cost is observed.

2.3.7.3 Scalability

In order to realise the benefits of network externalities, FinTech companies need to achieve scalability; however, this must be done without drastically increasing the costs or compromising the effectiveness and efficiency of the product technology. Online businesses are easier to scale up as they are not restricted to physical outlets. Regardless of that fact, FinTech companies also need to ensure their technologies that can be scaled up.

2.3.7.4 Innovative

FinTech companies need to be innovative and this should be reflected in their products as well as their operations. With advances in technology and the widespread use of smartphones and the internet, a lot of innovation can be done by FinTech companies.

2.3.7.5 Ease of compliance

The level of compliance regulations and regimes has a significant impact on FinTech companies. Entities or sectors that are not under high compliance have the freedom and ability to be more innovative and enjoy low capital requirements. Another added advantage of lightly regulated

sectors is companies that will spend fewer resources on compliance activities. An easy compliance environment also gives incentives to FinTech companies which is supported by social, financial and economic inclusion.

	Risks	Opportunities
Impact on consumer sector	A. Data privacy B. Data security C. Discontinuity of banking services D. Inappropriate marketing practices	A. Financial inclusion B. Better and more tailored banking services C. Lower transaction costs and faster banking services
Impact on banks and banking system	A. Strategic and profitability risks B. Increased interconnectedness between financial parties C. High operational risk – systemic D. High operational risk – idiosyncratic E. Third-party/vendor management risk F. Compliance risk including failure to protect consumers and data protection regulation G. Money laundering – terrorism financing risk H. Liquidity risk and volatility of bank funding sources	A. Improved and more efficient banking processes B. Innovative use of data for marketing and risk management purposes c. Potential positive impact on financial stability due to increased competition15 D. Regtech

Table 2. 2: Risks and Opportunities associated with FinTech (Ajlouni & Al-Hakim, 2018)

2.4 Technology Innovation

Technology innovation is the backbone and driving force for FinTech companies. Their products, services, and solutions are based on technology and innovation that makes these processes better and more convenient for the customer. Innovation in this context refers to the application of new and better ideas or solutions that will meet or fill in the current need of market. FinTech companies are unique from traditional banks because of innovation factor. They are known to be more technologically advanced as their products and solutions are technology-based. Innovation is crucial in digital banking as FinTech companies need to constantly come up with new ideas, products and solutions not only to attract and retain their customers but also to be ahead of the competition (Saksonova & Kuzmina-Merlino, 2017). With the frequent advances in technology, FinTech companies are in constant competition with each other. The only element that sets each FinTech company apart is its ability to be innovative technologically.

2.4.1 Digitation of Infrastructure

FinTech is creating a revolution in the financial and banking sector through the digitisation of traditional banks and its infrastructure. The FinTech revolution is bringing with it a new era of developments that is affecting the entire financial industry from start-ups to well-established traditional banks. Despite the threat, it poses on the survival and relevance of conventional banks, FinTech is bringing in much-needed innovations and as a consequence, high-quality, digital services are now available to the public. This new wave of technology is not just being embraced by individual people and small businesses, but also by large global institutions who have acknowledged the transformative effects of this new-age financial transaction being offered by FinTech companies.

As a consequence of this global trend, traditional banks are now showing a willingness to actively seek out innovations by FinTech companies that could help to enhance their services and enable them to retain their market share (Accenture, 2016). A step forward for banks in digitalising their infrastructure is improving their core banking systems by the use of technology, which could significantly reduce the operating costs. However, most banks opt to improve their already existing systems and infrastructure as opposed to replacing them with new and advanced ones. These changes include improvements on how banks handle big data, as well as the introduction of cloud computing, artificial intelligence and data analytics in their existing systems. Through these systems, banks are now more sustainable and resilient to market changes and most of all, it reduces the potential of loses and increases profits.

Mobile network technology is also continuing to make remarkable progress as mobile network provider Etisalat introduced the 5G network in February 2019. The telecom operator is currently working with Huawei (Gulf Tech News, 2019) in deploying the network as well as putting in place network infrastructure by building 600 5G sites and 300 5G Etisalat towers that will provide and support 5G to all its customers across the UAE (Gulf Tech News, 2019). This new technology will

allow customers to experience maximum speeds as compared to the 4G network. The 5G network technology can support up to a million devices per square kilometre, unlike the 4G network which can only support 4000 devices per square kilometre. In addition to that, when a user crosses from one tower cell or site to another, their mobile device is handed off automatically and in a seamless manner to the antenna in the new cell. With faster data connectivity and high speeds and frequencies of between 28 GHz and 60 GHz, this technology will revolutionise the financial technology industry in UAE.

Another advance in infrastructure is cloud computing which allows banks to reduce their infrastructure costs even to about 30 percent or even more. However, the implementation of this digital infrastructure depends on a few elements such as whether the bank is outsourcing its IT functions, or bank plans on using a public, private or hybrid cloud and the applications they will use. The amount of data also determines the application to use – horizontal applications are easy but occupy less, while vertical applications are more complex but take up more data. Another improvement in infrastructure is the adoption of automation in services such as cash transactions, borrowing, and customer experience among other applications.

2.4.2 Instant Payments

The introduction and revolution of digital banking system brought with instant payments which has been among the core functionalities of products by FinTech companies. Instant payments allow customers to exchange money or make transactions in real-time regardless of where they are and what time they are making the payment. This has been greatly facilitated by advances in financial and banking technology as well as the increased internet penetration in various parts of the world.

Instant payments have revolutionised banking and business transactions as banks and businesses are now connected, thereby, facilitating trade.

The growth of e-commerce has also changed people's spending patterns as people are no longer limited or confined to regular business hours. Because of this trend, banks and FinTech companies are constantly under pressure to upgrade their systems to make payments easier, faster, convenient, and cheaper. More people are purchasing items online or making credit card payments such as Visa or MasterCard instead of cash as it is viewed as a safer method of making transactions. These transactions also come with immediate notifications of account activity either through SMS notification or daily, weekly or monthly statements sent via email. In meeting the customer demand as well as adapting to technological changes in the market, more traditional banks are now offering instant payment platforms or they collaborate with FinTech companies to make instant payments more convenient for the consumer.

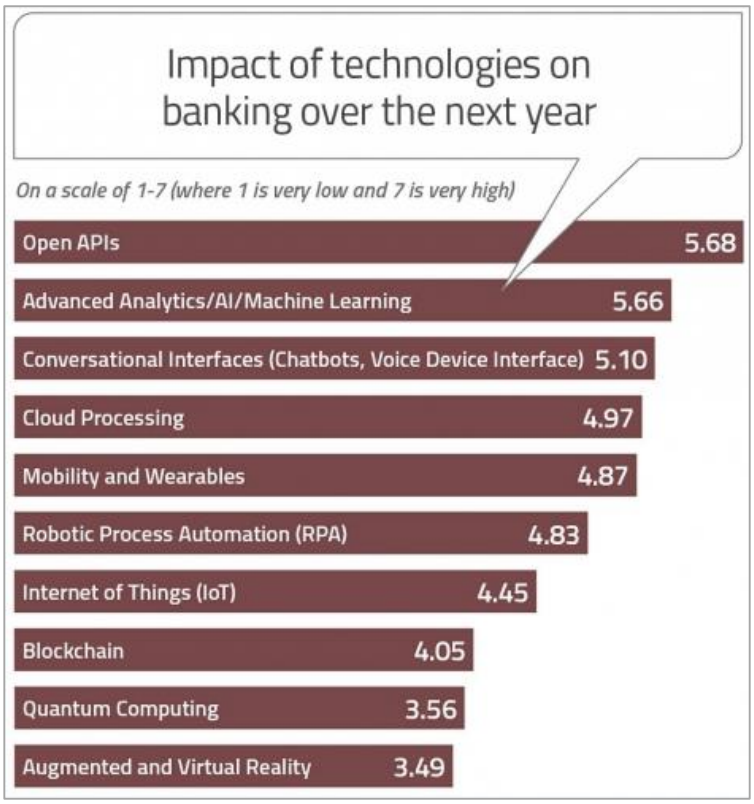


Figure 2. 6: The impact of technology on banking over the next years (Marous, 2018)

2.4.3 Cryptocurrency and Financial Transactions

Cryptocurrency refers to a digital or virtual form of currency that applies cryptography or in simpler terms codes as a technique for security. This technique or feature makes cryptocurrency difficult to counterfeit or forges as its systems are based on blockchain technology. These two features (cryptocurrency and blockchain) are as a result of technological advances in digital banking in making financial transactions more secure (DeVries, 2016). Cryptocurrency is by far the most advanced form of digital banking because of its organic nature as it is not issued by any other central authority, unlike actual currency and notes that are easily susceptible to government interference and manipulation.

Bitcoin (BCH) is considered as among the pioneer and most popular blockchain-based cryptocurrency, globally. Today, there are several other cryptocurrencies each with varied functions and specifications such as Litecoin (LTC), Zcash (ZEC), Ethereum (ETH), Dash (DASH), EOS (EOS) and Ripple (XRP) among many others (Houben & Snyers, 2018). Despite the security associated with cryptocurrencies, they are not fully immune to the ever-impending threat of hacking which is now measured as a global threat, especially for FinTech.

2.4.4 Blockchain

Blockchain refers to a distributed, decentralised public ledger that consists of the record-keeping technology behind cryptocurrencies such as bitcoin. The blockchain is made up of blocks that consist of digital pieces of information which have three parts. The first part is the blocks that store information about the transaction such as the date, time and amount in dollars or any other currency. The second part is blocks, that store information about who is participating in the transactions for example, who is sending and receiving the money transaction. Every digital transaction is categorised with its own unique digital signature that identifies the participants in the

transaction (Zheng et. al., 2017). The third part is blocks, that store information which distinguishes it from other blocks. Each block has a unique code or hash that makes it unique from other blocks.

Each time a block stores fresh data, it is added to the blockchain. However, for this to take place a transaction needs to first occur then this transaction needs to be verified by a network of computers that consist of thousands or millions (in the case of Bitcoin) computers across the world. For example, while purchasing something online, a network of computers will check if the transaction took place was intended by confirming the purchase details such as time, amount of money and participants. The transaction also needs to be stored in a block once it is verified. Thereafter, that block is given a hash or a unique code and added to the blockchain (Adam-Kalfon & Moutaouakil, 2017). It should be noted that when a block is added to a blockchain, it is made available for anyone to view. Blockchain technology is secure as new blocks are added in a linear and chronological manner that makes it difficult to alter previous contents of the block. Each block also contains its own hash which is created by a math function or algorithm and cannot be altered unless the hash is also altered.

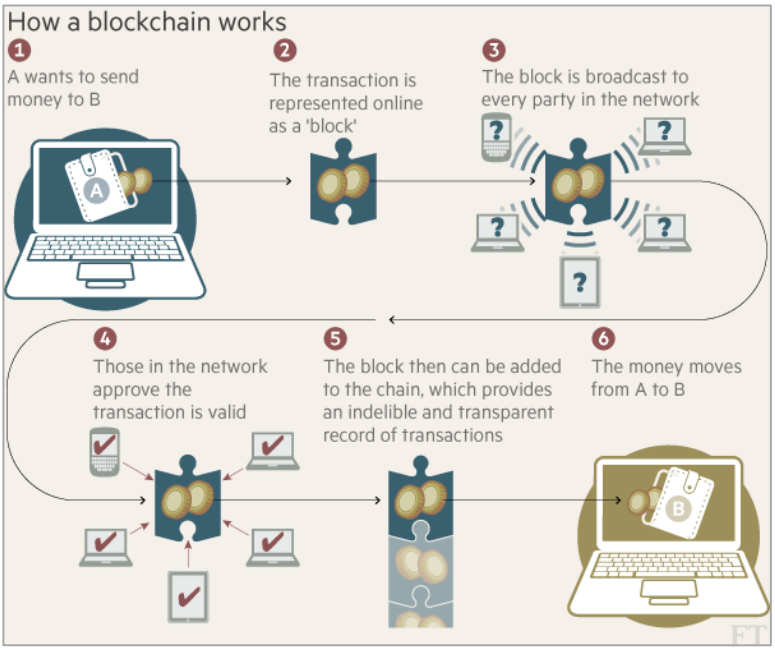


Figure 2. 7: How a blockchain works (Wild, Arnold, & Stanford, 2015)

2.5 Bank Supervisors and Regulatory Frameworks

Bank supervision and the establishment of regulatory frameworks are determined by the Central Bank of each country, including UAE. In addition to these regulations and supervision, individual banks set up their frameworks to monitor their activities too. In the UAE, banks are regulated through established laws such as the UAE Federal Law No. 14 of 2018 that is commonly referred as the Banking Law. Other laws include UAE Federal Law No.18 of 1993 (the Commercial Code) as well as other various circulars, notices, and resolutions that are issued by the UAE Central Bank from time to time (Hashmi, 2007).

The Banking Law in the UAE as with most countries, gives the Central Bank the provision for the issuance of currency, supervision of banking activities, directing the credit policy, maintaining gold and foreign exchange reserves, acting as the government's bank, advising the government on financial matters as well as acting as a bank for other banks in UAE in order to perform certain functions on their behalf (Central Bank, UAE, 2016). The role of the Central Bank in supervising the banking industry is significant as it ensures that financial institutions are operating in accordance with the law and the set regulations (BIS, 2012). It is also important as it ensures that there are no bank failures which might have a devastating effect on the country's economy.

2.5.1 Increased need for collaboration

Digital banking is continuing to take root in the financial industry, there is now an increased need for collaboration in between banks and FinTech. The financial ecosystem is in a transformation phase as new FinTech entrants are joining the market at a regular basis, while traditional banks are adapting to digitalisation, advances in technology and the need to enhance the customer experience. With the competition getting stiffer, traditional banks now realise that collaboration is the ideal path

for them if they want long-term growth (EY, 2017). It should be noted that there is a big difference between realising the need for collaboration and taking the necessary steps to make it a reality. With the differences in culture, infrastructure demands and ever-changing compliance regulations; a collaboration between banks and FinTech is not as easy as it sounds.

For collaboration to be successful, both banks and FinTech companies must build their partnership around four pillars – people, finance, business, and technology. They also need to be aware of each other's strength and weaknesses to improve the customer experience as well as reduce operational costs and maximising profits (Moore, 2018). The goals for these collaborations must be set and analysis should be conducted on whether it can deliver the level of personalisation, transparency, speed, and seamless service to their clients while mitigating potential threats from competitors.

The rationale behind the collaboration is to join forces in creating a stronger entity that would not be possible if different entities would stand on their own. It is viewed as a win-win for both banks and FinTech as each fills the weakness of other and both enhances each other's strengths. Traditional banks lack the digital backbone in their operations and because of this, it is very difficult for them to be innovative and catch up with the market trends. FinTech companies lack market trust as they are not well established as their traditional counterparts (Marous, 2018). A partnership between the two, therefore gives traditional banks an innovative boost, while FinTech companies get access to the traditional bank's well-established market and distribution network – it is a win-win situation for both.

2.5.2 Banks supervisors' internal organisation

The banking sector is supervised by the Central Bank; however, it is also monitored and controlled by other government entities such as the Ministry of Finance as well as a regulatory sandbox which is unique in every country.

2.5.2.1 UAE Ministry of Finance

The UAE Ministry of Finance (MoF) is a government ministry that is charged with the management and development of financial resources of the UAE Federal Government. It does through the efficient and creative implementation of effective financial policies and premium national and international relations geared in protecting the financial system of the country. The ministry also formulates and implements the federal budget of the country each year (UAE Ministry of Finance, 2019). In this process, the ministry prepares an annual draft budget law, prepares a draft resolution of the medium-term plan, and submits both drafts to the Cabinet for discussion and final approval. Once this process is complete, the ministry submits the draft law for the federal budget to the Federal National Council (FNC) two months before the commencement of the fiscal year. Once the FNC responds, the draft together with the feedback responses is sent to the Supreme Court for enactment.

The current Minister of Finance is Hamdan bin Rashid Al Maktoum who is in charge of various departments within the ministry such as General Revenue, General Budget, Financial Operations, Government Properties, and Coordination of Fiscal Policies, among others. The ministry is guided by six finance strategic goals (UAE Ministry of Finance, 2018), which include:

a. Enhancing the culture of innovation.
b. Promoting the fiscal planning of the Federal Government and the general financial stability of the country.
c. Strengthening the fiscal and economic competitiveness of the UAE.
d. Maintaining the financial and economic interest of the country at a global level.
e. Improve the efficiency and effectiveness of the budget by managing financial position and cash flows of Federal Government.

f. Rendering all administrative services as per the highest standards of quality, efficiency, and transparency.

2.5.2.2 Central Bank of UAE

The Central Bank of UAE is the state institution that is responsible for managing the currency, monetary policy and banking regulation in the United Arab Emirates. The Central Bank was established in 1973 as Currency Board of UAE; two years after UAE attained independence and was originally intended to issue independent currency that would be in use i.e. UAE dirham. In 1980, the Union Law was passed which established current Central Bank of UAE and given the authority to manage currency and ensure its stability, manage the country's credit policy in order to develop and regulate the banking system in the country. It has to be managed in order to act as the Government's banker and provide monetary and financial support to manage the country's gold, currency reservoirs and act as the lender of last resort to commercial banks in the UAE (Central Bank of the UAE, 2019).

The Central Bank of the UAE is overseen by a Board of Directors which consists of seven members (the Chairman, Vice Chairman, Governor, and four other members). The Governor must have the rank of Minister. Each of the seven members is appointed by a Union Decree after the approval from UAE Council of Ministers and serve a term of four years. The seven members are not allowed to serve on the board of any commercial bank in UAE; they should also not be worked as Cabinet Ministers and or members of the UAE Federal National Council.

2.5.2.3 Regulatory Sandbox in the UAE

A regulatory sandbox is an approach that is a live-like testing environment which summarised and published to ensure compliance to the regulation and security checks for financial operations of novel financial product, business models, and technologies, including cryptocurrencies and

blockchain systems. These operations are tested against a set of rules, supervisory requirements and set safeguard measures. A sandbox helps create conducive and contained environment in the financial sector (UNSGSA, 2017). It also helps in bringing down the cost of innovation, reduces the barriers to entry in the market, and facilitates the collection and analysis of important insights by financial regulators such as Central Bank.

2.5.2.3.1 Abu Dhabi Global Market: Abu Dhabi Sandbox

The Abu Dhabi Global Market (ADGM) is a broad-based international financial centre for local, regional and international institutions. The global market was established in accordance with the Federal Law No. 8 of 2004, Federal Decree No.15 of 2013, Cabinet Resolution No. 4 of 2013, and Abu Dhabi Law No. 4 of 2013. Chaired by Ahmed Ali Al Sayegh, the Abu Dhabi Global Market consists of three authorities that function independently; they include the Registration Authority, the Financial Services Regulatory Authority (FSRA), and ADGM Courts. These three authorities ensure that the business environment in Abu Dhabi operates in line with international best practices. It also develops and helps to support member institutions with the regulatory framework, legal jurisdiction, and a friendly business environment that is required for the sustainability of businesses.

The Abu Dhabi Global Market launched its digital sandbox in September 2018 with the aim to accelerate the innovation of financial services as well as facilitate financial inclusion in the UAE and surrounding region. ADGM has partnered with ASEAN financial innovation network to take advantage of the global API Exchange (APIX) platform in driving financial inclusion globally as well as connecting banks and FinTech companies in the Middle East and North Africa (MENA) region with the ASEAN network (ADGM, 2018).

This digital sandbox allows financial institutions and FinTech companies to join forces and experiment on products and solutions in a digital environment. This has made possible through the

support of regulatory standards developed by FSRA. The digital sandbox allows banks to source and procure solutions developed by FinTech companies both locally and globally. This has given them an opportunity to run digital tests and adopt those most suitable for the market as well as their business objectives (ADGM, 2018). The sandbox also in turn allow FinTech companies to offer their innovative solutions to stockholders in the international market and tap into cross-border markets. This allows a connection between the UAE and international markets.

Despite the advantages digital sandbox brings into the market, one of the possible setback or challenge has the ability of banks to embrace innovation and integrate their existing systems with FinTech solutions. As a resolution, the ADGM sandbox supports the process to ensure that it is cost-effective and secure (ADGM, 2018). The FSRA in return may develop guidelines on the standard requirements for IT security for open APIs and cloud adoption.

2.5.2.3.2 Dubai International Financial Centre: Dubai Hive

The Dubai International Financial Centre (DIFC) is among the world's most advanced financial centres and a leader in the Middle East, Africa, and South Asia (MEASA) financial hub. The DIFC is considered as the region's largest financial ecosystems. Moreover, it has engaged for 15 years in facilitating trade and investment in the MEASA region connecting it to Asia, Europe, and the Americas (DIFC, 2018).

The financial centre was established in 2004 and offers a comprehensive FinTech and capital environment that consist of cost-effective solutions, purposeful regulations, innovative programs, and funding for FinTech start-ups. In April 2017, DIFC under the leadership of CEO Arif Amiri who has launched the FinTech Hive (the Dubai Hive) to help accelerate the growth and development of financial technology in the region (DIFC, 2018). This hive may connect innovators within the financial technology sector with banks and other financial institutions within the region.

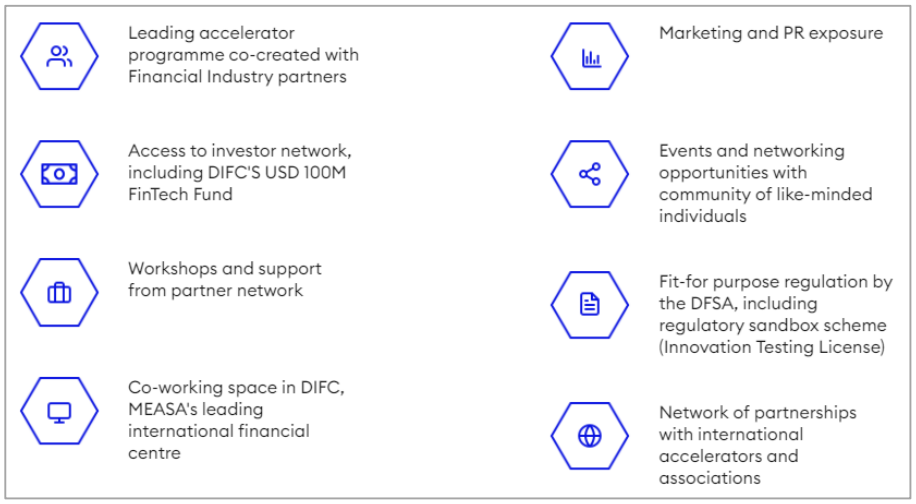


Figure 2. 8: Services offered by DIFC FinTech Hive (DIFC FinTech Hive , 2019)

2.5.2.4 The Responsible Finance & Investment Foundation

The Responsible Finance and Investment (RFI) Foundation was established to help bring together various forms of responsible finance practices as well as stimulate an agreement on the standards, practices and regulations that would govern the financial sector in the UAE and globally. It is paramount to note that regulations are necessary and most beneficial when the best ideas are incorporated into them; it is crucial in protecting economies from another financial crisis like the one which took place in 2008 (RFI Foundation, 2019). The financial crisis brought the realisation that financial ethics and regulation are crucial to the survival of businesses across the world. Having said that practicing responsible financial practices are important in determining the future of global markets and economies. These financial practices include sustainable, responsible, and impact investing (SRI), environmental and governance (ESG), and Islamic finance.

2.6 Banking Platforms and Digitisation in the UAE

There is a great urgency (about the next three to five years) for banks to become digitally proficient or risk becoming a laggard in the industry. In the few coming years, banks that are

successfully implementing digital technologies to automate their processes as well as adopt innovation in their products and improve customer experience will have more revenues and profits as compared to banks which have not adapted to technology solutions (UN, 2017). Laggards who fail in adopting new technologies might risk becoming irrelevant in the next three to five years.

However, it is crucial to note that the digital transformation process is not as easy as it seems because it requires change in entire business structure as well as a cultural adjustment in the application development and data flow (World Bank, 2016). These changes should also be geared towards the adherence of quality and compliance as well as the establishment of security protocols to ensure the protection and integrity of private data.

In recent years, banking industry in the United Arab Emirates has become a leader in digital banking in entire Middle East; joining the global trend of technology transformation, innovation and digitisation of the financial sector. Consumers in the UAE are fast adopting digital banking services by demanding more digital solutions that facilitate the ease of doing business as well as saves costs and time. Banks in the UAE are now venturing out to more advanced digital banking initiatives such as digital-online banking platforms as well as further enhancing the existing mobile banking services that have been in used. The banks are also rationalising their bank networks as well as refocusing their staff on value-added services that are less repetitive and more profitable.

In the entire Gulf region, UAE undoubtedly has the most advanced digital technology infrastructure in entire industry of finance and banks including banking sector of UAE. The government has played a major role in ensuring the development of digital infrastructure in the country by investing in technology as well as attracting private investors towards the digital platforms for banking sectors. As a result, banks in the UAE are experiencing an upward rise in their cost to income ratios. With the digital transformation pace the country is taking, it will soon be among the most digitally advanced countries in the entire world. UAE is already ranked among the top countries

with regards to internet and social media usage, mobile subscriptions, digital optimism and mobile banking penetration (We are Social, 2018). This market trends to provide UAE banks with the better opportunities to invest in digital innovation with specialised focus on mobile banking.

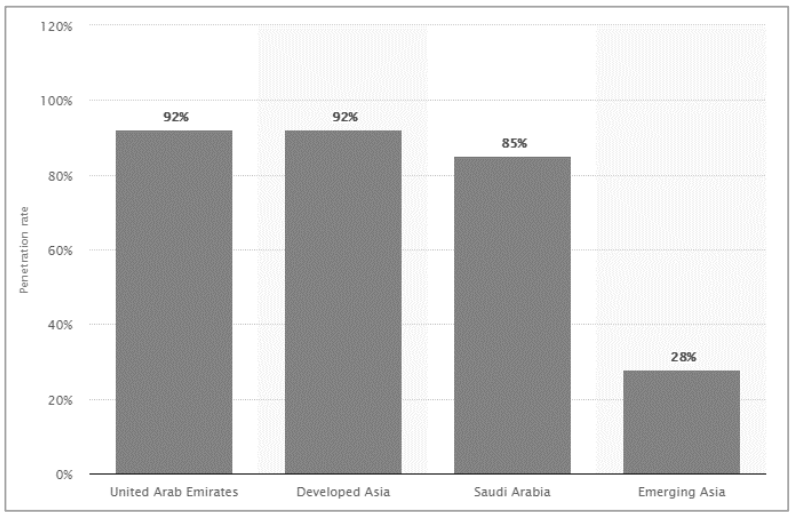


Figure 2. 9: Penetration of Online Banking in the GCC (Statista, 2017)

In embracing digitalisation, banks in the UAE are increasingly applying advanced analytics to enhance their risk assessment and drive revenue as well as implement and refine the concept of 'open banking' and 'omnichannel digital banking platforms' which allow the connected ecosystem of financial services across various applications and platforms. At least 80 percent of urban consumers in the UAE and Saudi Arabia prefer to access their banking details on their phones and tablets (Shaikh & Karjaluoto, 2019) and only visit their bank branches in case of any complex circumstances.

The UAE market characteristics are what make it a pacesetter in digital banking. The market has strong customer adoption with nearly 90 percent of the population using digital banking channels (Shirish et. al., 2016). The market is also characterised by consumers who increasingly adopt multiple banking channels in their day to day lives and it is also characterised by the consumer's openness to use digital banking platforms. These three characteristics make UAE the most suitable place for digital banking and its platforms.

2.6.1 Neobank - Challenger Digital Banking Model

A Neobank is a type of online bank that is runs on a completely digital platform and offers its products and services through mobile apps and personal computers only. Neobanks do not function like the traditional banks as they do not have physical branches (Caplain, 2018) but rather are driven by technology such as artificial intelligence (AI) and machine learning- elements which are crucial in the war against cyber insecurity such as online fraud and hacking. Neobanks are slightly different from digital banking; same as the way digital banking is different from traditional banking method because it offers branch service as well. Neobanks are not associated with any traditional bank but they operate like a normal bank, where people can deposit their money, withdraw or borrow with interest. The establishment of Neobanks is the current innovation in digital banking and transforming this platform is seem as the future of banking.

The rise of Neobanks has been significantly facilitated by the rise of digital banking, which aims to enhance customer experience by offering fast, convenient, and cheaper banking alternatives for public. Neobanks are associated with low costs (which can be attributed to the lack of operational costs), great mobile and personal computer app experience, tracking of a consumer's spending habits and current bank balances. These features pose a great threat to traditional banks as more people are starting to be open to the idea of digital banking (WUP, 2019). Despite the convenience it has, Neobanks cannot offer in-branch service (especially for services such as mortgages); they are also less reliable than traditional banks which have the advantage of experience and they are limited to the number of services they can offer – another advantage that traditional banks have. However, Neobanks are guided by the same regulatory frameworks as traditional banks; hence, they are secured and trusted.

2.7 Revolutionisation in Omnichannel Technologies

According to the research omnichannel technologies revolutionises the way banks communicate with their customers. Liu, Abhishek & Li (2017) explains in this study the benefits of digital signage technology that brings to financial institutions and allowing to optimise and create value in communications with their clients and obtain competitive advantages. The emergence of omnichannel technologies has revolutionised the way many banks communicate with their customers. According to Liu, Abhishek & Li (2017), among other advantages, these solutions transfer the ease of analysing the results of the digital environment to the offline world. It also provides banking offices with valuable data to better understand their customer's needs, check the effectiveness of their marketing strategies, increase ROI and above all create unique experiences for consumers.

The omnichannel has been confirmed as a necessity in the banking sector. According to data from the latest Global Consumer Banking Survey 44% of consumers say that they would not trust bank without offices and 66% consider it very important that the entity has an online presence (Hosseini et.al. 2018). Despite the boom that digital communication has experienced, online world still cannot be considered as a substitute for offline but both channels must be aligned and complemented to offer a cohesive and enriched consumer experience; this opinion is uniform. The gap between banks are concerned while improving customer experience and those banks that are not growing for them technology is required to be considered so that banks can optimise and create value in communications with their customers and gain competitive advantages (Cook 2014).

2.7.1 Offline Analytics For Banks

With offline analytics systems it is possible to set key performance indicators and know the effectiveness of communication campaigns based on measurable data. By installing offline analysis equipment such as WiFi devices and video analytics (and after combining and interpreting the data

obtained in both ways), banks can learn about the behaviour and profiles of their customers and adjust their advertising campaigns (Hosseini et.al. 2018). Some metrics of interest for banks are the number of visits and recurrence, entry ratio, time spent in the office, differences in influx between time slots, habits of different age segments, percentage and customer profile that can go to cash and customers to use the cashier and customers who come to more than one office of the entity. With monitoring of these metrics is possible to observe the incidence of any change in the bank's communication strategy and readjust some action that is not working as expected in time (Manser, Peltier & Barger 2017).

2.7.2 The Digital Signage In Bank Offices

Digital signage is optimal for the banking sector because of its versatility and agility to renew messages. In fact, 60% of financial institutions already applied in order to boost their brand awareness, advertise their products, differentiate themselves from among competitors and promote cohesive communication at all channels (O'Brien 2013). In addition, 95% of these entities claim to be satisfied with the implementation of digital screens, an action that translates into significant savings in the launch and distribution of promotional material throughout the agency network (Schmidt, Drews & Schirmer 2017). If this technology is equipped with a video analytics system, the managers of each branch can get the information regarding how customers react to each campaign, how many people see an ad? What content is more attractive? How do they work with each demographic segment?

The agility of this system allows to update messages easily, at all times (even remotely) and adjust them to the target segment. For example, if the analytics shows that between 10 and 12 in the morning, 80% of clients of an office are of a certain profile, it is a good idea that the contents emitted via digital signage during that time slot conform to the language and needs of that segment (Lazaris, Vrechopoulos & Doukidis 2017). There are also digital signage devices with facial detection software

that offer an absolutely personalised and attractive experience at the point of sale and give the office an innovative look and feel. These screens project one message or another depending on the age and gender of the person in front of the monitor (Bianchi, Cermak & Dusek 2016).

2.7.3 Own App and Beacons

For banks, a mobile application is measured as a good tool to communicate with customers, as it helps in increase their loyalty and explore new ways to improve the consumer experience. If the development of an own app is complemented by the installation of beacons, banks can project dynamic and personalised content (such as welcome messages or information on relevant products) on digital signage screens distributed by the office, accompanying customers during entire stay (Bennett & Azhari 2015). Also, if the consumer authorises it then it is also possible to send notifications to your smartphone. These devices provide information on customer preferences when moving around the entity (very important to detect the busiest areas and obtain the best performance of the space), and can provide information to the office staff that can optimise their workday, anticipate the demands and needs of the client and offer a VIP treatment.

2.8 360º Experience with Satisfaction Surveys

A client should feel well served at the moment when he steps into the office until he leaves. A technology that offers the consumer an unforgettable and comprehensive experience are surveys linked with customer satisfaction; it is not only provide feedback to those responsible for the banking entity but also demonstrate customers that their opinion is important and is taken into account while designing future strategies and implementing any plan of action (Liu, Abhishek & Li 2015).

Thus, one way to add a golden touch to the experience at the point of sale is to place a tablet at the exit with a message that encourages customers to participate in this activity and express their

overall experience with bank. A simple and very visual option is to offer the possibility of clicking on the drawing of a sad, neutral or happy face (Reis, Amorim & Melão 2017).

2.9 From Multichannel Banking to Omnichannel Banking

The digitalisation process that most companies are experiencing has raised the need to provide new services and products to the consumers in order to establish new communication channels between the brand and the user. In the banking sector, digital transformation has not only transformed the activity of financial institutions but has promoted the creation of new digital systems to adapt to the needs of customers and increase their competitiveness in the market (Reis, Amorim & Melão 2017). Bank digitalisation has encouraged the development of a new multichannel system that focuses on the client in order to offer a totally satisfactory experience through different contact points. Multichannel banking aims to respond to all customer needs and integrate all the key parameters in platform including online channels, offline channels and all the data that is generated during the process.

Digital banking is considered as a blessing for many customers as multichannel banking platforms facilitates customers to send or borrow money while sitting at home or anywhere and they do not have to visit their banks. They can carry out most of the procedures online by using different applications (Reis, Amorim & Melão 2017). The advantages of multichannel banking are uncountable apart from the convenience and speed of online management, customers have the possibility of moving from one channel to another, during the same process without the need to provide their data again and again. In addition, for banks it is measured as simplification in the processes of incorporating new clients and increase the retention rate of clients among other benefits (Dermine 2016).

Traditionally, the banking industry has focused on use and development of technologies that guaranteed security and execution of financial transactions through various channels. Multichannel banking is a reality that allows customers to carry out operations, payments, inquiries and claims at ATMs, internet banking, mobile banking, telephone banking, offices, etc (Frazer & Stiehler 2014). However, multichannel banking is evolving continuously and because of this financial institution face a new challenge. User expectations have changed due to the influence of other industries that are based on new technologies focus on providing an omnichannel experience that facilitates customer life.

2.10 Customer Experience in Other Industries

Customers of the airline communicates via email the best prices on usual routes of frequent traveller, the client buys ticket online and suggests the location on the plane according to his seat preferences. On the day of the flight, the client checks and reserves a parking space through a mobile application and also receives information in real time on delays, changes of boarding gates or cancellation of flights (Reis, Amorim & Melão 2017).

Customers of the retail fashion industry are used to searching online and buying or returning a product in the preferred channel: online or physical store. These customers also expect to receive relevant recommendations and offers based on their purchase history. In summary, customers expect to experience a personalised service according to their preferences at the moment and through the channels of their choice (Cuesta et.al. 2015).

2.11 Transformation of Multichannel Banking to Omnichannel Banking

The new expectations of the client represent a challenge and at the same time an opportunity for the banking digitalisation. Based on the transnationality that is already developed, multichannel

banking evolves to generate a consistent and transparent experience across all the channels. Each point of interaction with the client is used not only to make offers but to collect information that allows establishing a more personal and coherent relationship (Skinner 2014). It becomes essential to define a customer strategy based on thorough knowledge of their needs and behaviour; all this is related to the stage of life cycle the they are going through. For this, customer analytics tools, segmentation models and statistical models such as machine learning etc are used.

These tools allow defining priority of customer service channels that respond both to the user's preference and to the bank's profitability model; deriving the least profitable operation to digital channels. There are diverse models developed and assigned to a group of specialised executives' clients that can give remote attention or in offices with the objective of increasing the value, cross-selling and satisfaction of their portfolio (Kotarba 2016). The omnichannel strategy must offer client a transparent transit between all channels. In this area the tools of customer relationship management, customer service and marketing automation with technology is preferred (Kotarba 2016).

2.11.1 Omnichannel or Multichannel Strategy

Consumers are always confused whether to adopt omnichannel or multichannel strategy. Technology is changing the way brands approach their customers on internet. If, at the beginning they barely had the chance to launch their messages on their own channels, over time they have learned to use search engines, social networks and other platforms to appear in front of users when they need them most (Liu, Abhishek & Li 2016). However, more and more expert internet users is an increasingly flexible way of connecting and increasingly immediate needs as they have forced companies to start choosing the way in which they send their messages to their target audiences. This involves a larger approach begins by determining if our company needs an omnichannel or multichannel strategy (Liu, Abhishek & Li 2016).

2.11.2 Multichannel strategy

Multichannel strategy is measured as an independent platforms and messages. It is a set of tools and methodologies that company uses to transmit messages to the target audience through any of the platforms at its disposal I.e. web, e-mail, blog, instant messages, applications, social networks, Google Adwords, digital media, etc. This is the way brands have traditionally related to their potential customers on the Internet. The most important thing is to adapt the message to the channel through which consumers are launched (Bhalla 2014). Thus, the experience of traditional banking is totally different from digital channels specially from email marketing campaigns in which demographic data of users are also focused that is retrieved from corporate blogs or company app. Hence, it is measured as totally different experience that a client received; depending upon the channel or platform that is used to perform communication (Lazaris, Vrechopoulos & Doukidis 2017).

In order to achieve a satisfactory user experience that brings good results, the ideal thing would be to follow four fundamental steps: define the audience to which messages is required to be directed, analyse the channels by the help of which it has distributed, customise the information that guarantees effective communication between brand and customer and automate the processes that helps to reduce resource expenditure (Bhalla 2014).

2.11.3 Omnichannel Strategy

Omnichannel strategies put the user experience at the centre of the board. The continuity of the message is sought in each of the places where it is available. So, it doesn't matter what channel customer has approached to reach brand because user will always find the same messages and the same ease of use (Ericsson et.al. 201). Here everything is interconnected. It is no longer about isolated messages like in the multichannel strategy but about fluid messages that seek customer loyalty and

repeat purchase. For example, in the retail sector when a user starts a mobile purchase and service providers give him the opportunity to follow it on desktop computer without having to return to the beginning of the process. This is often called cross-channel marketing and one of the tactics that is used by famous brands such as Amazon or Zara. In omnichannel strategies, management of communication and marketing processes is same in all the brand's platforms, so that the information generated by a client from anywhere is stored in a trunk way so that consumer can enjoy totally satisfactory experience (Ericsson et.al. 201). Here, it is important that the user is able to perceive the process as unique; that is why it is necessary to put a lot of focus on offering the same information in the designing of channels and promotions announcement of brand's contact points with client (Parise, Guinan, Kafka 2016).

2.11.4 Omnichannel or multichannel strategy

It is always difficult for companies to choose any one strategy among omnichannel or multichannel for business needs. However, it depends on the situation as both are valid strategies, but it is better to adapt one or the other companies based on a multitude of factors like the history of company if have strong digital culture (Bianchi, Cermak & Dusek 2016)? If growing business through the network? the target (if digital natives, navigate on different devices) etc. Moreover, it is also considered if the available channels have invested in a powerful website or it has presence in social networks; have an email marketing strategy? Etc; the type of conversion (like if your customers convert online or offline etc).

It should be borne in mind that in order to implement an omnichannel marketing strategy, the company's technological level is usually higher than for a multichannel strategy. Therefore, the choice of an omnichannel or multichannel strategy for business depends on the conclusions that appear after

analysing the data of digital ecosystem and answering the questions among others (Cook 2014). Brands with greater digital penetration often opt for omnichannel strategies that improve the user experience. Placing it at the centre of the process may end up being an advantage for the company. It is proven that users prefer brands so that things become easy for them. It is a fact that internet users prefer to recover the purchase process and considered that omnichannel experience can achieve by making everything interconnected so that a unique and powerful user experience can be observed.

2.12 The Pillars for Digital Bank In 2025

In an increasingly digital world, banks must have the right tools to compete against large technological companies. According to a report of FinTech Backbase software provider, banks must opt for digital-first platforms. Backbase proposes that for a successful digital banking or digital-first platform in 2025 (Hosseini et.al. 2018), four pillars need to be supported:

2.12.1 Omnichannel Banking

Omnichannel banking has a traditional structured approach to websites, internet or physical branches. This type of channel is not efficient or comfortable for the client or staff, since the workflow and contents need their attention, so that work can be remade many times without any relationship with the final result. For this type of banking, it is important to integrate two speeds: one slow and continuous in the central system and another fast for the digital level, combining the best of the old and new user can observe an exceptional experience. The two speeds allow banks to continue working with their central systems without losing modern demands with a digital layer in order to improve the customer experience with quick responses. Backbase recommends banks to avoid complying with creating a mobile application that does not evolve. The right thing is to invest in a strategy to become omnichannel from the beginning (Hosseini et.al. 2018).

2.12.2 Modular Bench

The dynamism in the interface of a mobile bank must have a system that is skilled enough to provide exceptional product. By incorporating a digital-first platform with a modular architecture, banks can be more agile. A modular bench is similar to a construction with Lego blocks, where modules are used on one side or other that is depending on needs. These modules can be created and reused to infinity by creating a fluid and efficient structure for the most recent customer demands. Companies like Uber and Facebook can make major modifications without disrupting their central systems and much be less effect on costs. Banks must innovate in the same way to implement platforms that respond quickly to customer needs without affecting their systems completely (Schmidt, Drews & Schirmer 2017). With an agile modular architecture, it is possible for banks to adapt, eliminate or add distribution channels with much lower variable costs compared to traditional formats which allows free resources to be dedicated to improvement that provide value and not losses.

2.12.3 Open banking

Previously, banks had full control of all the entrances and exits related to banking services, the data was kept secret and hidden. But the world has changed and open with reference to banking. As the Payment Services Directive (PSD2) have transformed banks into a more open business model. With the entry into force of the PSD2 directive, it has caused banks to open their APIs even for the competition in providing bank data. Although, there are threats, open banking provides new opportunities for the business (Schmidt, Drews & Schirmer 2017).

Customers have the opportunity to choose their banking providers through open APIs, in addition to which incorporating intelligent products and services from other companies is also considered as an opportunity for banks. Banks must use open APIs to connect both internally and

externally in order to maintain the interest of their customers. They can also take advantage of creating new consumers through other APIs, offering their own access for third-party features; it can be understood with the example of Uber. However, banks should be careful to preserve ownership of the experience when opening their APIs to avoid giving away data to the competition (Liu, Abhishek & Li 2017).

2.12.4 Smart banking

Clients demand hyper-personalised services at larger extends so that the use of technologies such as artificial intelligence and intelligent targeting engines are essential to meet these demands. The generalisation of services was in the past, giving way to technologies that allow automating the customisation process. This automated tracking provides valuable information on customer needs by allowing banks to provide focused offers and advice (Cook 2014).

For example, when a user is searching for real estate products, a mortgage offer appropriate to their interests can be presented. For this bank must adapt to big data to get to understand their own data and those of third parties. The goal is to create more efficient operations and happier customers. Regarding artificial intelligence (AI), banks can use it to predict specific needs of each client and be able to influence the decision-making process before they even think about acting. Smart banking enters the field to create efficient customer paths as well as to provide optimal and timely solutions (Hosseini et.al. 2018).

2.13 A critical analysis of the literature review

The literature review gives an opportunity for the close assessment of the challenges and deterrents that the modern condition of omnichannel in the much more advanced world. This condition has pulled in several considerations of structures that numerous analysts who have attempted to decide the advantages emerging from the spread of the omnichannel in the UAE. The

assessment of the historical background of the omnichannel and how it has become throughout the years is figured that the survey analyzes. The recorded results of omnichannel innovation have given close access to the possibilities of the business in the financial division. The justification for the writing survey additionally shows how innovation has stock detectable quality. The literature review gives conducive room for the stock view, as well increased look at the challenges that confront the implementation of the omnichannel project. The problem statement will also emanate from the compete and elaborate writing of the literature review, as such, there is need for consideration of all the stakeholder factors such as the FinTech companies, and the interpretation of the resources needed to implement the omnichannel project.

2.14 Summary and Chapter Conclusion

Digital banking and financial technology are taking the world at next level by storm and with constant advances in technology and developments in internet and mobile connectivity; the revolution of online banking is becoming a reality. Traditional banks are now at risk of being irrelevant as they face stiff competition from the numerous FinTech companies that are joining the market every day. Without a doubt, mobile banking is the future of the financial sector and more traditional banks are starting to take note of this phenomenon. However, shifting to digital world is not as easy as it seems, primarily because it requires a huge infrastructure capital – something that most traditional banks are not willing to incur. Not just because of this but the tough market competition in banks have resorted to partner with FinTech companies to retain their customer base and remain relevant in the financial industry.

The fourth industrial revolution is mostly become a reality in the next three to five years as more people are getting on board with the new way of banking – an effortless, time-saving and convenient form of transactions for both individuals and businesses. The revolution is not only being

seen in individual banks and countries but also in entire regions, where various countries are collaborating with each other to make digital banking accessible to all. Digital banking has now facilitated the interrelation between countries by the creation of financial hubs that serve entire regions. Going forward FinTech companies are most likely shift their focus from modernising the digital experience to focus on the development of new digital capabilities. Technologies such as blockchain, artificial intelligence, cryptocurrency, digital infrastructures, and instant payments may further enhance to ensure more efficiency, effectiveness, security, trust and convenience. What is predictable, will be less physical or one-on-one interaction as all banking and financial services are available online.

This chapter focused on the background of banking and the transition into digital banking as is witnessed today. Therefore, in further analysing the banking sector, new approaches and technology for digital banking service is applied. This thesis proposes new technologies such as omni-channel and the following chapters describe the research and case studies that contributed to adopting omni-channel digital banking technology. The following chapter reported on how data about current omni-channel is gathered as well as how the analysis of this data is relevant to the aims and objectives of this research.

CHAPTER 3

Methodology and Research Design

3.1 Overview

This chapter provide the detailed overview about the research design and approach that is required to be used in this study. Section 3.1 describes the research design that is used to gather data for the research. Section 3.2 describes the selected participants in this study that aids in the responses important for the study. Section 3.3 explains the selected participants in this study which will aid in the responses important for the study. Section 3.4 describes research instruments that is used in this research to collect data. Section 3.5 describes the procedure and timeline that identifies in the thesis. Section 3.6 entails the analysis of the result that has been obtained from both surveys to relate it to the research hypothesis:

- **H_2:** There is positive correlation between the satisfaction of consumers who own an active checking account and online digital banking solution outcomes.
- **H_3**: There is negative correlation between the number of digital, mobile or online bankers and those who own active checking accounts.

Finally, section 3.8 provides a summary and chapter conclusion.

3.2 Introduction to Methodology and Research Design

The proposed study has used mixed research methods i.e. quantitative and qualitative, with key instruments being questionnaires, interviews, observation, and case design for data collection. Mixed research methods refer to the research approaches where collect and analyses the study data for quantitatively and qualitatively in the same study (Creswell & Plano, 2018). It has been established that government regulations play an important role in the UAE banking sector. To

understand the impact such decisions are needed on the omnichannel banking; there is a need to collect both qualitative data and quantitative data. In this regard, this approach mainly involves research design that includes collection and analysis of quantitative data such as surveys and case study designs retrieved from bank's entrepreneurs, customers and investors. Among other respondent's qualitative data is chosen that include observations, interviews and focus groups discussion with customers who are United Arab Emirates residents.

In this study, a closed-ended information survey has used to collect that measure responses via rating scales, behaviours, as well as the performance of the instruments of study regarding organisational behaviour for banking institutions as shown in figure 3.1. This data could be analysed statistically based on the score from filled in questionnaire. Conversely, the qualitative data involved the open-ended information which has sought by this chapter through the use of interviews and observations in order to get an understanding about the respondent's opinions and views on omnichannel banking. Therefore, the analysis of this type of data includes the texts, words, and behaviours regarding the path they follow and the category of information obtained (Creswell & Plano, 2018). Therefore, the mixing of these methods was noted to be an appropriate way to identify a breadth of data that helps to gain in-depth understanding of the concept that are under investigation.

Using mixed methods requires a purposeful mixing of methods while data collection, analysis, as well as for the interpretation of the available evidences. In this regard, a quantitative approach was used based on the nature of the study, especially the correlation and integration of findings of service productivity in real-world scenarios with a focus on UAE. While, banks measure their service efficiency regarding the number of customers served the digital channel by banks is anticipated to have a direct implication on the attraction of customers. Therefore, there is a need to establish the use of high technologies like internet, mobile and digital banking through the use of quantifiable data. It should be noted that a quantitative research approach is based on the investigation of phenomena.

This is done through the collection of quantifiable data that enables the mathematical and statistical analysis, as well as computational techniques that are imperative for the study. Considering this, study seeks to find out how the digital banking services are driven by digital and mobile platforms that can fulfil the needs of the customer interaction with banks; based on the measures of customer satisfaction and other outcomes. The use of quantifiable data can be used to do the imperative analysis in this study. This approach enables to do proper sampling of UAE respondents that are going to represent the entire population in the study. This approach is also facilitate the finding of objectives regarding the opportunities to adopt a unified digital banking solution in UAE. It can deliver a frictionless omnichannel banking experience in an elaborated manner while investigating the nature of findings related to customer that impact efficiency. In order to collect quantitative data, a survey and case design has used which contain the questions for the respondents that are in line with the research hypothesis and scope of this study.

Additionally, a qualitative research approach is used in this study to collect qualitative data that aids a deeper understanding of the concepts of customer satisfaction based on seamless services, secure, smart lifestyle, and personalised services that is required to be evaluated statistically. It should be noted that a qualitative approach is mostly used in an exploratory manner as the study seeks to analyse the ideas. Therefore, this chapter seeks to evaluate and gain a deeper understanding of the underlying reasons, opinions, and motivations for various stockholders in the banking sector and how they can make use of collaboration in order to facilitate improved omnichannel banking system in UAE.

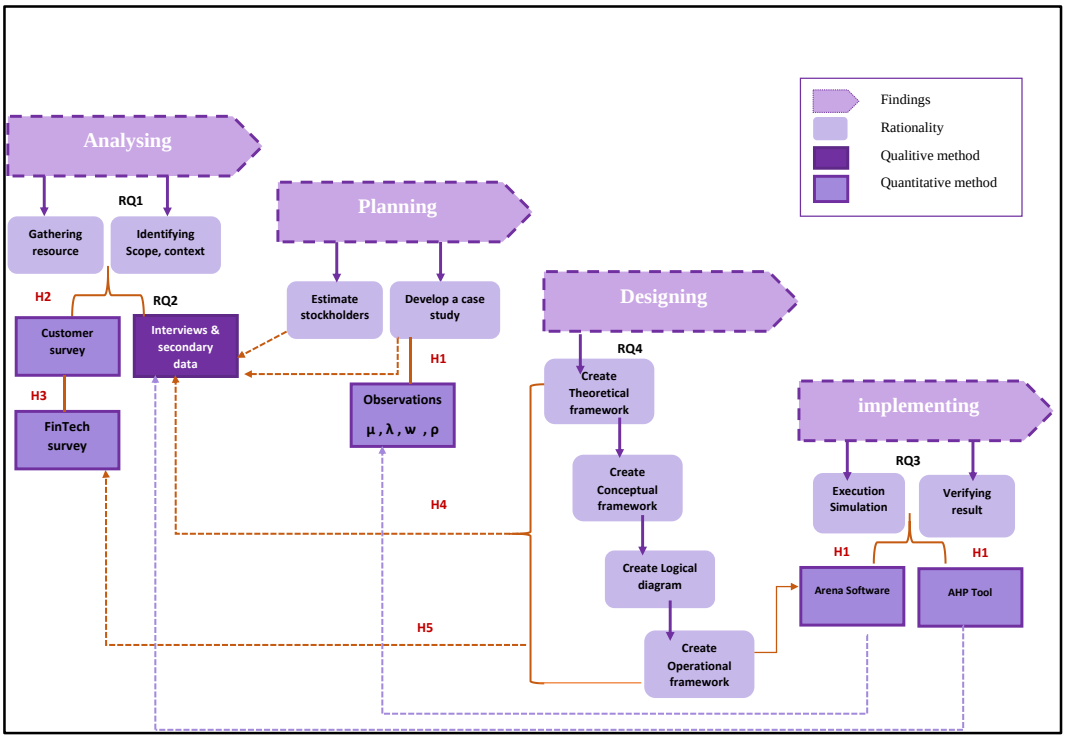


Figure 3. 1: Illustration a traceability between the method and the findings

Besides, the chapter demonstrates a deeper understanding of the factors, barriers, and opportunities that are currently facing the digital banking sector in the United Arab Emirates. However, it should be noted that the nature of qualitative research has proved to be a challenge to many researchers, considering most of them are accustomed to the traditional deductive method (Tashakkori & Teddlie, 2008). In this regard, this approach allows the collection of data which is used to find the meaning and derive the suitable explanations as opposed to the inductive reasoning that is described in the quantitative part. Therefore, observation of different types of data regarding the interoperability of banking is carried out and analysed in a prolonged and systematic manner within the setting of UAE banks. Therefore, the researcher is actively involved in the research.

Therefore, a mixed method design was chosen for this study as it is facilitated the breadth and depth of understanding of the issues influencing on the choices made by bankers and institutions in UAE, with reference to digital banking solutions versus the traditional approaches. It should also be

noted that be able to use triangulation, which enables satisfaction of research questions with broader perspective. It has been established that triangulation is one of the important traits of mixed methods which involves the use of several means of methods, researchers and data sources while examining the same phenomena. Considering, banking sector is a very complex sector concerning many practices in UAE; research should be conducted to establish the methods that are imperative in research integration. Therefore, the use of triangulation facilitates the identification of many aspects of the phenomenon of banking approaches in UAE in a more accurate manner by approaching it from different vantage points. In addition, the researcher noted that the weaknesses of a single approach would be covered by the strengths of the next one. Therefore, the use of mixed methodology i.e. quantitative and qualitative methods was chosen to answer the research questions completely.

3.3 Participants

3.3.1 FinTech and banks entrepreneur

Data collection is a very important part of any research since any kind of biasness can result in vague results. Therefore, it is important to choose the respondents and participants wisely to ensure that the anticipated data is collected effectively to enable investigation of the research questions (Treiman, 2009). A survey is used to collect primary data that is needed for evaluation of quantitative data of the study that was sent to various respondents within the banking sector in the United Arab Emirates. Those respondents are focused that have important information regarding the observed changes of banking sector and how these changes may affect the trends of the decisions made by them and other stakeholders. It was established that the best way to get both quantitative and qualitative data regarding the United Arab Emirates banking sector with reference to their services a random sample was provided with a survey. Therefore, in order to collect this data from the

participants, a questionnaire that contained survey questions was prepared. A questionnaire is an appropriate and effective tool for data collection from chosen sample.

Different stakeholders of the banking sector provide data which included UAE entrepreneurs, investors, accelerator program managers and finance experts. The participants were deemed as important in giving responses that can aid the description of bank entrepreneurship and FinTech companies in UAE. FinTech refers to the new technologies that seek to improve and even automate the delivery as well as the use of financial services. In this regard, the use of this approach targeting the finance and banking entrepreneurs that would ensure the establishment of technologies used by financial institutions in the UAE and it is measured as main reason for choosing various methods. Besides, these respondents were chosen on the basis of the skills and knowledge that they had demonstrated regarding management in the banking sector. This implies the important information which bankers have aid while taking key decision.

3.3.2 Customer survey

Customers in the banking sector are important stakeholders who have a wide knowledge regarding the use of any approaches in the industry as they are affected directly by research method that is used. Therefore, a survey is developed and used to collect primary data from the customers of banking sector it mainly includes the residents and visitors of UAE. However, it was decided that the respondents who is included in the survey are the ones lies in between the age of 14 - 55 years. This choice was made on the basis of maturity and expertise. It should be noted that people aged from 14 years in UAE are likely to be acquainted with banking knowledge in various areas. Besides, the population between this bracket is actively involved in various business activities; hence huge cash flows that needs to be deposited in banks. This population bracket is also well-aware about the usage of smartphones that is considered as another requirement for the respondents. Respondents from

bankers and banking customer were focused while considering the fact that they have wide knowledge about the banking sector and its services; hence, their responses are considered as important that can help in investigating the development of UAE banking sector.

3.4 Instruments

3.4.1 FinTech and Banks Entrepreneur Survey

A survey was conducted while focusing on a number of FinTech entrepreneurs in UAE between 02 -25 of May 2019. It should be noted that the survey was originally used by Blythin and Van Cooten (2017) in their research *The Development of FinTech in Nairobi: Contributions to Financial Inclusion and Barriers to Growth*, a dissertation published by Lund University. This survey was imperative as it addresses the second hypothesis and question "*what are the factors, barriers and opportunities do banking sector of UAE is currently facing the digital banking*." It should be noted that this question helps to identify barriers and challenges that can be reduced to facilitate omnichannel baking or to address problems while harnessing the possible opportunities. Therefore, hypothesis 3 indicates that the number online digital banking and those who own active checking accounts demonstrate a negative correlation. To respond and investigate the hypothesis, FinTech and banks entrepreneur survey was adopted for data collection from the different respondents within the banking sector. As described in section 3.3, these included the UAE entrepreneurs, investors, accelerator program managers, and finance experts. The developed survey entailed an online questionnaire that was consisted of various questions about the sector. First, the respondents were required to identify themselves by explaining a bit about them regarding the company which they represent and confirm whether they had the authorisation that is required in order to take part in the survey. Besides, the respondents would indicate which services their company was offering in a bid to understand the correlation of sector and responses in banking sector.

Respondents were also required to indicate how their company was different from a formal financial institution, it would be possible to establish the relationship they have established with the banks and how it affects the use of digital approaches by the financial institutions to serve these types of customers. The respondents were asked on their opinion whether the FinTech sector within and outside UAE has been growing rapidly. They would then need to indicate their opinion regarding the development of FinTech sector and whether it is expected to benefit the Dubai Expo 2020. Through collection of this data, the researcher would be able to investigate how the digital banking services are driven by digital, mobile and online platforms and fulfils the needs of customer interaction process with banks; in comparison to the digital solutions outcomes as well as customer satisfaction. In this regard, it was established that the collection of data from these stakeholders would help the researcher to investigate first research question.

Therefore, survey a research instrument was chosen as it is measured as a helpful tool to investigate about the random sample size with high representatives and general capability while representing a large population. Hence, the relationship between growth at banking and FinTech sector has been anticipated to be affected by the increase in digital services. Therefore, the questionnaire was set to reflect the perception of respondents regarding their belief with reference to its impact on growth. The researcher wanted to understand whether the FinTech sector has significantly grown in UAE due to the exclusion of people from traditional banks for various services and products. As noted in the survey, researcher also wanted to know whether the banks are likely to compete with the FinTech sector or integrate their services in a collaborative manner. The investigation would help the researcher to determine how different stockholder in the interoperability of banking in the UAE work together to facilitate the omnichannel banking system.

Therefore, this would enable the researcher to investigate the fourth research question. The use of survey with these questions was chosen as it is a convenient and considered as a low-cost way

of collecting data that can easily be administered in diverse ways. In this regard, the survey offers a good statistical significance since the information undergoes thorough scrutiny as well as standardisation in order to ensure that all the subjects are well represented in the gathered data. For example, the issues of development of FinTech sector versus traditional banking would be analysed with a variety of issues and challenges that were affecting the entire United Arab Emirates banking industry.

3.4.2 Customer survey

A bank customer and non-bank customer survey were also conducted that was covering the UAE. This survey was conducted and the responses were collected during 02 -25 of May 2019. The survey was important as it assisted the researcher to address hypothesis 2 and research question RQ1 "*How do the digital banking services driven by digital, mobile and online platforms that fulfils the need of customer interaction with the banks?*" it should be noted that the question helps to identify the degree banks meet online/digital/mobile banking demands and fulfil customers' aim of engaging financial institutions regarding time and place. Therefore, the research identifies the first hypothesis for an investigation that a significant, positive correlation exists between the satisfaction of people who own an active checking account and digital banking solution outcomes.

In the collection of data, the respondents were first required to identify themselves regarding their age, gender, place/residence, level of education, marital status, employment status and average monthly expenditure in the United Arab Emirates. The evaluation of the respondent demographics was noted to be an imperative aspect it would familiarise the researcher with respondents and facilitate categorisation of responses. The respondents were also evaluated based on their view on the financial services that were offered by the non-banking centres (FinTech). They evaluated the quality of services, availability, functionality speed and ease of use. This would enable the evaluation of the

quality of services that are offered and their impact on the environment as well on the overall customer satisfaction.

3.4.3 Expert interviews

The expert interviews are conducted in this research in order to evaluate the results in most effective way. The expert interviews include one entrepreneur, two investors from the financial sector and two accelerator program managers from Dubai and Abu Dhabi. These experts are required to provide an analysis of the FinTech services, hence provide good insight to the researcher regarding UAE FinTech industry. This is discussed extensively in chapter four of research as the experts is required to evaluate model that is built in the study. Also, in chapter five of the research the experts are required to perform verification of the simulation model through Analytical Hierarchy Process (AHP).

The Analytical Hierarchy Process (AHP) model is formulated in three steps; two of the steps extensively use AHP. The first one is the data collection and validity, whereas the second one is the goal prioritisation. A group of decision makers are involved in the strategic development process to identify the necessary goals and criteria. The goals and criteria are derived from the strategic plan of the health development system. The decision makers, then, are involved in providing the judgments for the AHP table. They also review the data set and provide the validation. In the goal prioritisation phase, the evaluation of the elements is done by the use of AHP. Goal model is formulated in the third phase, and optimized in the given constraints. The authors concluded from the model that banking system requires re-engineering of the infrastructure. The decision makers need to work closely with other departments, and integrate the efforts of the support personnel to successfully implement the strategic planning in the resource allocation.

Momoh and Zhu presented an integrated approach for reactive power price. Part of the power price, i.e., the variable price is determined on the basis of the capability and contributions to the improvement of system performance as security, reliability and economics. For the variable rate planning, three parallel indices, namely, benefit/cost ratio index, voltage reactive sensitivity index, and the bus voltage security index were considered. For example, AHP is used to comprehensively consider the effects of indices and the network topology. Weistroffer et al. presented a city tax model based on AHP. Opinions from tax experts are used to relate tax plans to decision criteria. Kim attempted to construct an analytic structure of Internet function. AHP was used in order to measure the relative importance of each function to achieve such objectives. The study is based on the survey with three groups of management, namely, top, middle and bottom management.

The results were evaluated and implemented to the development of intranet system. Benjamin et al. used a multi-objective decision model to guide decision making in allocating space when planning facilities in an academic environment. The AHP and LGP (linear goal programming) are used, and explained with an example of computer integrated manufacturing laboratory. Wu and Wu applied AHP for storage for strategic planning model in the first part of the model. The complex strategic problems are broken into a three level AHP model. In the other half, the objective is to process the collected data, analyze and verify. The application of AHP enabled the authors to consider marketing production, quality of life, financial security, personal achievement, and independence in the model. A methodology to assist development planners in a LDC (Low-income Development Countries) in formulating development plan consistent with the national objectives is presented by Ehie et al. In the methodology proposed, hierarchy of development goals and the objectives are framed from the literature. AHP is used to analyze the judgments from world-bank experts, and a priority structure is developed to assist the main objective. In tax planning, a model that allows city

officials to explicitly take into account the existence of multiple decision criteria for selecting new tax options is the need of the hour.

3.4.4 Secondary data

This research is also deploying the use of secondary data to support the hypothesis and findings. It should be noted that secondary data in research entails the data that was already collected by other researchers apart from the current researcher. This data is imperative as it enables the researcher to conduct quantitative analysis and hence evaluate the findings mathematically. For this research, the data entails by the GEDI, World Bank, IFC, as well as the leading consultancy reports. In this regard, the case studies regarding the start-ups has built on the publicly available information that is provided by both regional and international newspapers. This approach is effective as the provided data is credible and readily available hence it has saved time as well.

3.4.5 Dubai Expo2020 case study simulation model using Arena

Simulation modelling and observation methodology are fast becoming an important aid in achieving higher levels of efficiency and productivity. Historically, the most frequent uses of simulation modelling have been directed to the improvement of manufacturing operations (Manaye & Worku, 2018). More recently, simulation has measured as a powerful tool for improvement of operations within the services sector. Simulation is one of the most powerful tools available to decision-makers which is responsible for the design and operation of complex processes and systems. It makes the study, analysis and evaluation of situations inclined that would not be possible otherwise. In an increasingly competitive world, simulation has become an indispensable problem-solving methodology for engineers, designers, and managers (Manaye & Worku, 2018). Simulation can be defined as “the imitation of the operation of a real-world process or system over time” (Manaye &

Worku, 2018). The process of interest is usually called a system. When building a simulation model of a real-life system under investigation, one does not simulate the whole system. Rather, one simulates those sub-systems which are related to the problems at hand.

This involves modelling parts of the system at various levels of detail. In order to study the system, research makes a set of assumptions about it. These assumptions constitute a model. Assumptions are expressed in the mathematical or logical relationship. If the model is simple enough, it may be solved by mathematical methods such as calculus, algebra or probability theory. A simulation model has been noted to be a representation that enables the incorporation of time as well as the changes take place over a period of time (Dhar & Rahman, 2013). These models can be classified to either continuous vs. discrete, static vs. dynamic, and deterministic vs. stochastic depending on its nature and usability. It should be noted that simulation is an art that requires a high level of training which implies the modelers and may require special training and skills. If there are two models constructed by two different but competent individuals then they depict various similarities although it is very unlikely that they can be the same. Therefore, simulation modelling has become a major application in various sectors such as service industries, military operations, assembly lines, flexible telecommunication systems and factories among others (Muchemi & Muchai, 2012).

In this study, the researcher seeks to build a case study by using observation method. It should be noted that building a simulation model is only one component of a complete simulation project. Therefore, this study has used various case scenarios, an ATM, and Kiosk machines. In both ATM and Kiosk, the study has used a queuing theory with simplest and most widely used model being the M | M | s queue with parameters λ, μ, and s, the primitives: the arrival process, assumed Poisson at a constant rate λ, the service times, assumed exponentially distributed with mean μ, and the number of agents, s. From all these case samples, the study chose the queening theory that entails a mathematical

study of waiting lines. Therefore, the study is able to establish queueing model that is used in the estimation of waiting time and queue lengths (Sundari & Srinivasan, 2012). The concept of this problem formulation represents Dubai Expo 2020 a world-class event that last six months and provide a critical opportunity for companies around the world**.** Besides, event is a need to facilitate multi-channel and multi-currency transactions. Given that more than 25 million people will be hosted from more than 190 countries, there is a need for an integrative, robust and easy-to-use omnichannel digital banking platform that overcomes these traditional banking sector issues. Such a solution would also be providing further opportunities to the globally focused residents of Dubai long after the event in the form of improved choices for omnichannel in a number of foreign currencies which is imperative in evaluating the success of Dubai Expo 2020. The objective of this case study is to collect data that is used to simulate the proposed omnichannel banking platform by using Arena (such as λ, μ, and s, ρ,L and P_0).

According to Sundari & Srinivasan (2012), the investigation of ATM M/M/s queuing, the next variables is explored:

λ=The mean customers arrival rate.

μ=The mean service rate (average number served per time period) per server (channel)

c= The number of servers

cμ= The mean effective service rate for the system, which must exceed the arrival rate.

The formulas for the operating characteristic of the multiple-channel model are as follows: page 636 for book (introduction to management science)

$\rho = \frac{\lambda}{\mu}$: Utilisation factor. **(1)**

Probability of zero customers in the ATM:

$P_0 = 1 - \rho$ **(2)**

P_n : The probability of having n customers in the ATM

$P_n = P_0 \rho^n = (1- \rho) \rho^n$ **(3)**

L: The average number of customers in the ATM

$L= \frac{\rho}{1-\rho} = \frac{\lambda}{\mu-\lambda}$ **(4)**

Lq: The average number of customers in the queue:

$Lq = L- \rho = l - \frac{\lambda}{\mu}$ **(5)**

Wq: The average time a customer spends in the queue

$Wq = \frac{Lq}{\lambda} = \frac{\rho}{\mu-\lambda}$ **(6)**

W : The average time spent in the ATM, including the waiting time.

$W = \frac{L}{\lambda} = \frac{1}{\mu-\lambda}$ **(7)**

We have collected data daily for two-week from customers by observation during banking time from 10 am to 4 pm from 22 of May 2019 to 5 of June throw 2 employees of a bank located in UAE:

Day	**Weekend**	**Weekdays**					**Weekend**
week	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
1st	112	171	155	121	145	167	178
2nd	90	182	158	135	164	178	165
Total	**202**	**353**	**313**	**256**	**309**	**345**	**343**

Table 3. 1: Customers data observation

The average number of people that comes to the ATM per time = (112+90)/2 =101 people **λ**=101/60 = 2 customer/minutes (cpm). From the observation, it can be established that each customer spent 2 min on average in the ATM (**W**) the queue length is around 5 people (**Lq**) on average and average waiting time is around 3.5 min (210 seconds).

Theoretically, the average waiting time is, $\mathbf{W_q} = L_q / \lambda = 5 / 2 = 2.5$ minutes = 150 second

Next, calculating the average number of people in the ATM using (7).

L= 2cpm x 2 minutes = 4 customers.

Service rate $\boldsymbol{\mu} = \lambda (1 + L) / L = 2 (1 + 4) / 4 = 2.5$ cpm

Hence $\boldsymbol{\rho} = \lambda / \mu = 2 / 2.5 = 0.8$

If no customer comes to the ATM, the probability is very small as can be derived using (3)

$\mathbf{P_0} = 1 – \rho = 1 - 0.8 = 0.2$

If n customers visit the ATM, the probability can be evaluated as follows:

$P_n = (1- \rho) \rho^n = (1 – 0.8)(0.8)^n = (0.2)(0.8)^n$

In this case, it is assumed that if there are impatient customers, they are likely to start to balk once they observe five or more people queuing at the ATM. Also, the research assumes that the maximum length of the queue that a patient customer can tolerate is 12 people. Considering that an ATM has a capacity of a single person, then the probability can be calculated for six people in the system. Therefore, the probability of customers going away

= P (more than 5 people in the queue)

= P (more than 6 people in the ATM) is

$P_{7\text{-}13} = \sum_{n=5}^{13} Pn$

The same approach was done for the Kiosk. Therefore, the data from both areas are used for the analysis by using the simulation model that is developed later in the other chapters.

3.5 Procedure and Timeline

	Procedure	From	To
1.	Form the Questionnaire base on the research questions and hypothesis	10 of December 2018	14 of February 2019
2.	Get Approval of Ethical form from the Research Ethics Committee to conduct data.	22of May 2019	
3.	Data Collection for the e-customer survey	22 of May 2019	25 of May 2019
	Data collection form observation ATM and Kiosk machines.	22 of May 2019	5 of June 2019
4.	Data Collection for the FinTech and Bank interveners.	23 of May 2019	2 of June 2019
5.	Data Collection throw observations of ATM and Kiosk		
6.	• Finish data collection • Data cleaning, coding, and transcription (as needed).	5 of June 2019	
7.	Data analysis	15 of June 2019	22 of June 2019
8.	Additional analysis, as needed	23 of June 2019	28 of June 2019

Table 3. 2: Research Timeline

3.6 Analysis

The analysis is based on three parts; first part indicated the frequency analysis of the survey questionnaire; second part provide analysis by using correlation and ended up with ANOVA and regression analysis. A multiple regression analysis technique was used to assess the influence of various factors on the satisfaction level of banks with overall digital banking solutions. The ANOVA technique has produced a computed F-statistic equal to 33.338 with a significance or probability value equal to 0.000, less than the 0.05 alpha value set by the researcher. The coefficients of the model were equal to 0.756, 0.401, 0.321, 0.024, -0.141, and 0.077 for the constant, seamless access, quality of services, availability, functionality speed and easy use. One factor, functionality speed had a negative impact on the banks overall digital banking solutions. The analysis has described the research methods that the current study deploys to investigate the research questions. It should be noted that the study seeks to establish how the digital banking services driven by digital, mobile and online platforms fulfil the needs of customer interaction with the banks in comparison to digital solutions outcomes and customer satisfaction. It should be noted that this question helps to identify the degree

banks meet online/digital/mobile banking demands and fulfils customer need for bank engagement. Besides, the study seeks to establish the factors, barriers, and opportunities that the digital banking sector is currently facing in the UAE. To investigate these research questions, the researcher is utilised both qualitative and quantitative research method which entails the collection of both primary and secondary data through surveys and credible databases. However, the study has conducted with high integrity to ensure all the ethical perspectives of research especially the protection of respondents. The analysis of the model and evaluation of results has done extensively in the next chapters of study.

3.6.1 Frequency Tables

With reference to the frequency analysis there are numerous questions have been asked to the respondents. In response to the statement the company that I work for has strong differentiation from competitors; it has been observed that almost 70% of the respondents are with the statement that they have found strong differentiation; as it is indicated in table 01 of frequency analysis in appendices. Whereas, getting the response against question in which it has been asked what if the company that I work for targets the local population within the UAE rather than a global population; majority of the responders agreed with the statement i.e. 80%; as it can been seen in table 02 in appendices. While, asking about the opinion about the rapid development of FinTech sector in the UAE almost 90% of the respondents agreed because according to their opinion and observation FinTech sector UAE is growing exponentially by the time; as it is indicted in table 3.3 in appendices.

When considering the entire gulf region, the horizon of the above-mentioned question has expanded and asked if the FinTech sector is developing more rapidly outside of the UAE and in the region; almost 45 respondents agreed (see table 3.4 in appendices) with the statement. In response to the statement, attendees at Dubai Expo 2020 would benefit from the FinTech products and services offered by [company name]; frequency of choosing agreed as option is high i.e. 12 (See table 3.5 in appendices) in comparison to other options. It has been asked in the survey question that FinTech in

UAE is growing because many people are excluded by traditional banks from the products and services that they need. Surprisingly, the percentage of respondents chosen neutral and agreed option is 45% each. Hence, it is indicated that respondents are not sure about the facts or statistical data that is linked with the general knowledge; as indicated in frequency analysis table 3.6 in appendices.

It is indicated in the survey questionnaire that the growth of FinTech in the UAE is largely due to the international and cosmopolitan nature of many of its cities, such as Dubai, with a high percentage of foreign visiting workers as well as international tourists and business persons. 50% of the respondents agreed with the statement as international market has become the main reason of FinTech services development in the region (see table 3.7 in appendices). The UAE is the main FinTech hub for the GCC/Middle East is another question that has included on the questionnaire in order to get the response of experts specially. 75% of the respondents had agreed with the statement because vast development in FinTech sector has been observed in the UAE as compared to other GCC or Middle East regions; frequency of this statement can be seen in table 08. In the UAE, it is likely that banks partnered with, rather than compete with, FinTech products and services and mostly (50%) respondents agreed with the statement because it is highly difficult for the banks to compete with FinTech sector because their core focus is to make advancements in the sector so that it can be implemented in rest of the sectors including banking, as seen in table 3.9 in appendices.

Regulatory compliance comes under the head of technical domain and this question was design specifically to get experts opinion as well as to get the idea about bankers and FinTech individuals to learn if the issues of regulatory compliance are a burden for FinTech companies and 50% of the respondents has chosen neutral as response of this questions because they don't have much idea about the statement (See appendices table 3.10). The products and services offered by the company that I (respondent) work for are primarily geared to businesses; 50% of the responses are in favor of the statement and agreed to it (See table 3.11 in appendices). Almost 70% of the respondent

agreed that targeting or attracting new customers is a major objective of the company that I work for (see table 3.12 in appendices); while only 10% of the respondents strongly agreed with this statement.

According to the stats received in response of statement that there is considerable demand for the company products and services among UAE residents. 65% of the respondents agreed that mostly UAE residents are encouraged to demand products and services that company is offering (see table 3.13 in appendices). According to 60% of the respondents UAE residents are the ideal customers because of challenges with international banking while 25% of has neutral opinion about this statement; whereas 15% strongly agreed with it (see table 3.14 in appendices).FinTech has a very narrow market segment in terms of demographics; it is agreed by 65% of the respondents because FinTech services are dedicating their teams in every region in order to spread their services (see table 3.15 in appendices). According to 60% of the respondents, expansion of products and services beyond the UAE would not make sense at this time and they agreed with the designed statement; however, 30% views were neutral and rest of the 10% individuals disagreed (see appendices table 3.16).

The company I (respondent) work for currently provides products and services that are marketed towards underserved or marginalised groups which have historically had little access to traditional banking, such as the poor and the respondents had agreed (65%) with it; whereas 30% has neutral opinion (see appendices table 3.17). Almost 40% of the respondents agreed that their company has partnerships with other FinTech firms or banks that can be seen in table 3.18 in appendices. Traditional banking products and services are still needed, as the state of FinTech in the UAE has not reached maturity; in response to this statement 40% people strongly agreed whereas 35% of the people agreed with it (see table 3.19 in appendices). 65% of the respondents agreed that traditional banking has major disadvantages in comparison to FinTech products and services available in the UAE because FinTech services had provided ease to the customers as compared to the traditional way of banking (see table 3.20 in appendices).

It has been observed that financial illiteracy is considered as a problem for the customers or clients of the company where usually people work; however in response this question, respondents that strongly disagree (5%), disagree (30%), neutral (40), agree (20%) and strongly agree (5%) which means people don't have enough idea about it or they don't need to disclose (see table 21 in appendices). One problem with FinTech products and services in the UAE is the negative impact they can have on an individual credit score, in response of this statement people don't have much information and they had chosen either disagree (35%) or neutral (35%) as an option of showing their response with 15% each of agreed and strongly disagreed (see table 3.22 in appendices). The products and services offered by the company where respondents work for are geared towards urban professionals, with reference to this almost 50% of the respondents had agreed with the statement (see table 3.23 in appendices). The barriers to further growth are regulatory and structural with reference to this statement neutral view are 55%, respondents agreed with it are 40% and only 5% individuals had strongly agreed with it (see table 3.24 in appendices).

In survey questionnaire it has been asked to the customer that the barriers to further growth are regulatory and structural; while answering to this question almost 55% of the customers had given the neutral opinion about the question, almost 40% of the respondents had agreed with the statement while only 5% of the individual had strongly agreed with the statement; as it is indicated in table 3.24 of frequency analysis in appendices). Analysis of table 25 in appendices had shown that 45% of the respondents had agreed with the statement that banks cannot easily offer the same products and services as the company they are working with, however 35% individuals had neutral opinion about it; as it can be seen in appendices table 3.25). Competition is considered as the biggest problem that companies are facing from their competitors as indicated by 60% of the respondents who agreed to it; however, 25% people has neutral opinion and 10% people strongly agreed with it because every

now and then competitors are launching superior products and services in order to satisfy their clients and let other consumers attract (see table 3.26 in appendices).

Competition in FinTech drives further innovations in the field and 60% of the respondents agreed with the statement because it is rapidly growing sector with reference to development as well as advancement. Furthermore, its horizon is vast and growing; as indicted in frequency analysis of table 3.27 in appendices). It is said that additional regulation could facilitate FinTech growth in the UAE hence this statement has been included in the questionnaire; in response to this question almost 50% of the respondents agreed with the statement and 40% of the people strongly agreed with it because there are certain rules and regulation had been documented and became part of constitution, recently (see table 3.28 in appendices). Models of FinTech in other countries could serve the UAE as well; 60% of the respondents agreed because diverse models are developed throughout the world that are taken into consideration and starts implementing in UAE because this country is considered as the Hub of all the FinTech serviced for Middle East and Gulf Region; as it can be seen in table 3.29 of frequency analysis in appendices.

There are considerable challenges to attracting an international market for UAE based FinTech companies; almost 60% of the respondents agreed with the statement because as soon as FinTech companies has launched diverse services and products there are a number of challenges generated with the advancement; as seen in table 30 of frequency analysis in appendices. There are few barriers to starting a FinTech company in the UAE because of limited human resources in the field and almost 45% respondents have neutral opinion about it whereas 40% of them had agreed with it (see appendices table 3.31). The UAE market is sufficient to satisfy the ambitions of the company where respondent is work; while asking this question is to get enough data with reference to the company where respondent work and to get the idea about the overall approach of the company. In

response to this question, 55% respondents had disagreed whereas 25% had strongly agreed and 20% has neutral opinion about the statement (see appendices table 3.32).

While, knowing about getting the overview if investors are interested in FinTech in the UAE; 55% of the people are agreed with it while 30% of the responses received with strongly agreed and only 15% are the people says that they have neutral opinion about it; as indicated in table 33 of frequency analysis in appendices. In table 3.34, it is indicated that FinTech companies are treated unfairly in comparison to banks in the UAE and 40% of the people agreed with the statement while 15% disagreed and have neutral view and rest of the 25% respondents are strongly agreed with it.

3.6.2 Correlation ANOVA & Regression Analysis

RQ1. How do the digital banking services driven by digital, mobile and online platforms that fulfils the need of customer interaction with the banks?

The study used a Pearson's correlation analysis to investigate if there was any significant positive correlation between the variables.

Hypothesis: H_2: There is positive correlation between the satisfaction of consumers who own an active checking account and online digital banking solution outcomes.

The first research question sought to examine how the digital banking services driven by digital, mobile and online platforms fulfil the needs of customer interaction with the banks in comparison to digital solutions outcomes and customer satisfaction (see table 3.38 in appendices). From the analysis, the correlation was 0.64 implying that the two variables were fairly related with each other. Also, the positive value indicated that there was a positive association found between the two variables. Hence, an increase in one caused the increase in another variable. The probability value (significant value) was equal to 0.000. The value was less than 0.05 set the level of significance

implying that the correlation was significant. In this regard, the study rejected the null hypothesis in favour of hypothesis H2 which means a significant, positive correlation exists between the satisfaction of people who own an active checking account and digital banking solution outcomes.

RQ2. What are the factors, barriers and opportunities the digital banking sector is currently facing?

The study used regression analysis technique in order to test hypothesis which is related to the second research question. The hypothesis was:

- ***Hypothesis H_3:*** There is a negative correlation between the number of digital, mobile or online bankers and those who own active checking accounts.

A multiple regression analysis technique was used to assess the influence of various factors on the satisfaction level of banks with overall digital banking solutions. The independent variables include easy to use, availability, seamless access, quality of service, and functionality speed. The analysis has produced R and R-squared values equal to 0.687 and 0.473 respectively. The R-value implied that a positive correlation existed between the model's dependent variable hence it impacted on independent variables. On the other hand, the R-squared value suggested that 47.3% of the variations in the satisfaction with bank's overall digital banking solutions were explained by the easy to use, availability, seamless access, quality of service, and functionality speed.

The ANOVA technique has produced a computed F-statistic equal to 33.338 with a significance or probability value equal to 0.000, less than the 0.05 alpha value set by the researcher. The analysis implied that the independent variables joint effect on the digital banking sector in the UAE was significant. Hence, the model fit was good. Therefore, the study rejected the null hypothesis that there is no significant barrier and opportunity currently facing the digital banking sector in the

UAE. Hence, a conclusion was made that several factors including easy to use, availability, seamless access, quality of service, and functionality speed, presented significant barriers and opportunities currently facing the digital banking sector in the UAE.

The coefficients of the model were equal to 0.756, 0.401, 0.321, 0.024, -0.141, and 0.077 for the constant, seamless access, quality of services, availability, functionality speed and easy use. This meant that four factors namely seamless access, quality of service, availability and easy to use had positive effects on the banks overall digital banking solutions. One factor, functionality speed had a negative impact on the banks overall digital banking solutions.

3.7 Ethics and Limitations

This study has observed key ethical principles with the respondents. It should be noted that the research study participant reserves the right to retain agency and autonomy as well as the right to reject an invitation to participate. The research is obligated to "do no harm" to the sample population in the course of the investigation (CIRT, 2014). Therefore, the potential participants must not be bullied or coerced rather must volunteer to participate in the survey. Beneficence is an important aspect of the study as it may seek to promote and benefit not to harm anyone. In this case, when the research may require to gather intimate details, the participants must be willing to share. Further, the participants must provide informed consent to take part in the study.

Informed consent is one of the ethical considerations that seeks to incorporate the rights of autonomous individuals through the self-examination. In this regard, the study seeks to protect the integrity of patient by protecting their personal liberty as well as veracity. In this regard, researcher acts with integrity to keep the promises as well as agreements and being consistent throughout the research. The respondents are engaged regarding any possible risk that may arise but ensured of protection. The research has also observed anonymity and confidentiality where applicable.

Confidentiality and anonymity are closely related to the fidelity and dignity of the respondents. In this case, when the respondents do not want to be linked to the responses, they is protected by ensuring their personal details are not included in the study. Besides, they will have the autonomy to choose the questions to respond to. Therefore, the research has embraced utilitarianism in which the best interests of all are respected for a better society.

The ethical considerations of the survey administration encompass:

- Extensive research on the appropriate handling of research data.
- Verification of the appropriate language to be used in the correspondence and survey administration.
- Pledges of confidentiality from the researcher and any affiliate.
- Collection of informed consent forms for all participants.
- Honesty and transparency in all communication with participants.
- Documentation of clear, concise instructions and expectations.
- The mailing of surveys and pre-stamped, self-addressed envelopes for confidential return mail.

3.7.1 Ethical Consideration of Qualitative Research

The excellence of qualitative research has been an issue that has generated a wide debate among researchers, while it has become a matter of concern for those who decide to start in the field of research using this paradigm as a methodological reference. From a qualitative perspective, the phenomena are studied in context, trying to find their meaning or interpretation based on the meanings that people grant them. Therefore, to assess qualitative studies, the realities of qualitative research and the complexities of the human phenomenon is required to be understood and must be taken into account.

It is recognised that qualitative research cannot be evaluated under the parameters of the positivist paradigm since both differ in their ontological, epistemological and methodological approaches, and are located in different paradigms. In this regard, it has been debated that the standards for assessing the quality of quantitative studies are precisely defined and widely known by members of research groups and clinical ethics committees. On the other hand, the parameters to assess the quality of qualitative studies seem to be subjected to continuous debates, partly because some researchers - under a positivist mentality - apply the canons of quantitative methodology to the assessment of qualitative studies.

Specifically, ethics of qualitative research there is a debate centred on the idea that using methods related to this paradigm makes the research to be considered morally superior or more human and, contrary to this approach, there is a need for emphasise that, in order to adjust a qualitative design under the ethical standards established for research with human beings, more than the proximity with the participants, the application of informed consent or that the investigation may or may not entail, through the methods is required used to collect data, therapeutic effects, as can be said in the case of interviews.

On the other hand, the ethical criteria of a qualitative investigation must respond to the reflection that the researcher must make about the effects, scope, consequences, relationships that is established with the subjects involved in the study and the way in which researchers examines the results. In addition, these reflections need to be presented throughout the entire research process from design adjustments to the preparation of final report.

It should be remembered that the stages of the qualitative research process are dynamic and flexible and are not guided by a linear process but are interactive and overlap each other. The construction of a qualitative study operates as a system where each stage - the definition of the topic to be investigated, problem and objectives statement, design, field work, data analysis and its

interpretation, as well as the presentation of results and final report - must be in sync and be an active part. Therefore, it is essential to take care of the quality of the study in general from the criteria of rigor, as well as the ethical considerations that govern the work of the researcher according to the characteristics of the paradigm in which he enrols.

3.8 Chapter Summary and Conclusion

The new digital banking has transformed the way of relating between banks and customers. A few years ago, banks were fully anchored in offering the classic physical services, always related to credit quality. Now, the picture has changed radically. One of the priorities of the new digital banking is to present itself to the user as a technological, digital and innovative entity. As indicated in the survey results, physical products had moved to applications designed to check accounts, make transfers or even hire services. Nowadays, it is very common to hear the general manager of a financial entity talk about software and big data instead of merely economic calculations. The digitalisation of the financial sector has forced the entities of the banking sector to change the paradigm and redesign the foci of their commercial strategies of visibility, acquisition, conversion and loyalty. The transformation of banking due to new technologies has been total: of course, it has transformed the way they communicate with customers, but it has also tested even their business models. Faced with this changing era, there are seven keys that cannot be lost sight of.

To improve the customer experience is one of the most important challenges to achieve success and differentiation in the new digital banking, and to achieve this excellence in customer satisfaction, any new product or service must be intelligent and agile, and must be designed to meet customer needs and problems. The new digital banking has helped generate customer satisfaction. A 90% of banks prioritise their strategy loyalty and customer satisfaction, above even the maximisation

of profits, with the aim of eliminating the high rates of infidelity customers who are registered in their sector, one of which More leaks suffer today.

The marketing automation opens the possibility for banks to provide personalized content, completely adapted to the problems and needs of the user. This added value, which for example is not able to offer you a traditional CMS (Content Management System), allows you to adapt the content according to the phase or stage of the sales funnel in which the user is located. The creation of valuable content through inbound marketing, capable of solving user problems, mixed with the automation of all processes, to offer that personalized content to the right person, at the perfect time, they form the necessary cocktail to increase customer acquisition and conversion in the banking sector. It is not the same to offer a series of assets to a person who has just visited the web for the first time, then to a user that you know is interested in a certain product or service (for example, a pension plan). Elimination of barriers between departments the new digital banking system has been able to transform the sector at the organisational level. The digitalisation of banking entities it is one of the main strategic levers to be able to differentiate itself from the competition, position itself as a market leader and strengthen the relationship with customers.

CHAPTER 4

Omnichannel Banking Platform Framework Design

This chapter discusses the dissimilarity between the multi-channel and omnichannel platforms and why the researcher chooses to focus on the omnichannel in this research. The chapter also introduces the proposed conceptual framework of the Omni-channel Digital Banking Platform and how the regulatory framework components interoperation with each other. The goal of the chapter analyses the approaches that the UAE is implementing in expanding its financial efficiency with regard to digital banking in global perspective. The chapter addresses Hypothesis 4 and RQ4, which seeks to analyse how various stockholders in the interoperability of UAE banking work together to facilitate the omni-channel banking system.

H4 suggests that Implementation of standardization and regulatory policies by the UAE government will positively impact the growth of FinTech and drive the successful transition from traditional banking to omnichannel banking model. On the other hand, H5 proposes there is positive correlation between the UAE government strategy to transform to smart cities and omnichannel banking services across all the self-service channels. Both hypotheses are analysed in depth throughout this chapter.

4.1 Introduction: Transformation of Digital Banking to Omni-Channel

Just like the shift from traditional to modern banking, the transformation of digital banking to omnichannel is an inevitable consequence of advancing technology. The omnichannel approach (which is to provide access to similar services or products in various platforms such as online or offline) first started in retail industry at the beginning of 2010. However, the approach has quickly been taken up by other industries including media, telecommunications and most recently in retail

banking (Didur, 2018). The approach allows banks and FinTech companies to cut their costs on various processes by automating processes and procedures; hence, through increased customer experience, banks are now able to increase their revenues tremendously.

Recent studies show that more people are starting to opt for digital banking services, about 50 percent of the consumers also want to have bank branch access either through telephone or face-to-face (CGI Group, 2014 p.10). It is just because of the recent trend that omnichannel platforms are becoming increasingly popular as they cater the needs of all client – both online and offline. An omnichannel approach gives a consumer ability to make financial transactions such as sending and receiving money as well as checking their bank balances through digital platforms on their mobile gadgets and laptops. It also gives customers the reliability that they need by being aware and can access any bank branch for customer inquiries and help.

The principal goal of omnichannel platforms is to present customers with a seamless and real-time experience. A good example is real-time data synchronisation, where customers do not need to constantly input their data as it is all saved in the cloud. Digitalisation and the rise of FinTech companies brought a disruption in the banking industry; more so for traditional banks whose services were not based on digital platforms. However, traditional banks can now use omnichannel platforms to their advantage by targeting customer with high demand for convenience and simplicity regardless of the digital devices they use (Obilisetty, 2018). This can be best done by integrating physical and digital channels; hence, shifting focuses from bank-centric transactions to customer-centric is observed recently.

4.1.1 A multi-channel system

A multi-channel system refers to distribution management where organisations such as banks provide access to the same service through various platforms or ways. For example, in banking, a customer can check their bank balance through an ATM machine, over the counter at a bank branch or through digital banking on their mobile devices. A multi-channel system in most cases is supported by advances in technology as well as the integration of this technology into ongoing systems within an industry or organisation (Pavlovski, 2013, p.2). Despite the complexities associated with multi-channel systems more organisations (and in this case, more traditional banks) are adopting its use primarily because of the demands of the consumer. As the world evolves and new technologies are joining the market, more consumers are starting to have the need of having access to banking options (see table 4.1)

ICT	Description
Internet Technologies	Internet technologies such as web servers, on-line chat, authentication servers, messaging gateways and proxies, enable on-line banking access to customers over the Internet.
Mobile Networks	Traditional cellular 3G and 4G mobile networks and wireless technologies to support mobility. These systems are largely used to extend Internet accessibility.
RFID and NFC	Near Field Computing (NFC) wireless communication based on Radio Frequency Identification (RFID), used for contactless payment by major credit card institutions.
SOA	Service Oriented Architecture is an approach for defining services consumed by IT applications; which can be internally shared or extemally accessed over the Internet.
TOGAF	The Open Group Architecture Framework specifies both a process and framework for defining enterprise and system architectures.
BIAN	Banking Industry Architecture Network defines a set of IT services based upon a Service Oriented Architecture.
NLU / NLP	Natural Language Understanding & Processing technologies extend conventional voice recognition with natural speech. Traditional IVR is directed speech and restrictive, whilst NLU technology supports unrestricted (human-like) conversational interaction.
eWallet	Emerging use of mobile phones as a payment device, leveraging the embedded SIM (subscriber identity module) smart card chip, where the eWallet application is deployed.

Table 4. 1: Technologies and Standards for multi-channel banking (Pavlovski, 2013)

In addition to meeting customer demand, multi-channel systems allow organisations to increase their profits as well as their appeal and loyalty from their customers. Because this system is primarily based on pleasing and accommodating the consumer, great efforts are placed by companies that are offering multi-channel services in ensuring that the customer gets quality experience (Barrué, Staib, & Tessitore, 2010, p.4). In banking, this is exhibited through quick online services that are available on various channels such as mobile phones, tablet, and laptops. It is also exhibited through real-time financial transactions and data synchronisation. Moving from a single-channel to a multi-channel platform also requires structural support such as systems, analytics, and capital. These structural systems, once integrated with technology, ensure consistency, sustainability, and profitability of the multi-channel system (Omarini, 2013, p.85).

4.1.1.1 Key Benefits and Challenges

There are many benefits of multi-channel systems, both for an organisation and a consumer. Major benefits increased efficiency in an organisation as well as in the provision of services. This is made possible through the allocation of processes, technology and data by banks. Another benefit is increased flexibility by an organisation. Previous paragraphs and chapters have revealed the rigidity of traditional banks as compared to FinTech companies, which are considered to be more flexible. However, as traditional banks adapt to technology such as the provision of multi-channel banking, they have become more flexible in their service and product providers as well as their target market (Stone, Hobbs, & Khaleeli, 2002, p.41). This has consequently given way to increased efficiencies by banks in dealing with stakeholders as well as exploiting customer data to identify their needs (Gajanan & Basuroy, 2007); hence, it may help in creating a new channel for growth.

On the part of the consumer, multi-channel systems have increased the convenience and efficiency in the banking experience (Goersch, 2002, p.752). Through multi-channel system,

customers can access various platforms of financial services; hence, giving them a sense of freedom and control over their finances. Banks offer quality customer service based on multi-channel systems, in turn; get customer loyalty and positive brand perception – an important element for any business organisation. Customers now have the ability to choose the platform which best suits them and their current needs. For example, if the customer is not near an ATM, they could opt to transfer their money to their mobile wallets and make transactions from there. Similarly, they may also opt to pay for goods via card or withdraw money and pay cash – multiple choices at their fingertips.

Despite numerous benefits for both banks and consumers, multi-channel systems also face a few challenges. A major challenge is a poor return on an investment after investing heavily on multi-channel strategies both on physical structure and technology upgrades. Because of this challenge, FinTech start-ups find it especially difficult to offer multi-channel platforms and instead focus on omnichannel strategies. Another challenge associated with multi-channel systems is collecting and standardising data from customers (Stone, Hobbs, & Khaleeli, 2002, p.42), which helps to create an analysis of customer behaviour and needs. Another major challenge is unifying different systems or integrating data across channels which may have different data models (Neslin, et al., 2006, p.97).

4.1.2 An Omni-Channel Platform

An omnichannel platform is quite similar to a multi-channel system as both are content strategies used by organisations in order to enhance their user experience. An omnichannel platform seeks to offer customers a seamless experience in banking industry by offering diverse services, these services include financial transactions and online banking among others. Unlike a multi-channel system where a product or service is available through various platforms, omnichannel platforms offer different services or products on one package or outlet. For example, customers can check their

bank balance, send and receive money, request and pay for loans, among others through one mobile app platform.

The omnichannel platform focuses on retaining and gaining loyalty for the consumer through integrating various channels, services and products such that they are made more accessible, convenient and easy for the customer (Koszela, 2017, p.17). This platform is not deterred by physical and geographical barriers as it uses the technology of digital banking or e-commerce. A major contributor to the development of omnichannel platforms is the advances in technology such as increased internet and mobile network penetration as well as the development of smartphones (Avoka, 2016). With the rise of digitalisation, online banking has become more of a necessity as more people demanding its use. The internet has become an innate part in individual's daily lives and just like the multi-channel system, omnichannel platforms are propelled by the need to satisfy the needs of the customer (Komulainen & Makkonen, 2018, p.194); thus, this platform is purely customer focused.

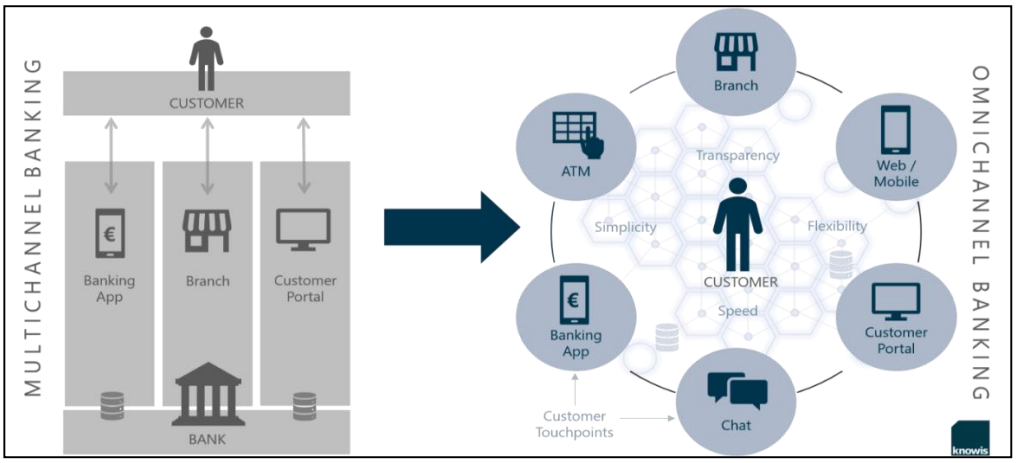


Figure 4. 1: Multi-channel versus Omni-channel banking platform (Rehfisch, 2019)

4.1.2.1 Key Benefits and Challenges

As a rennet global technological trend, omnichannel platforms have various benefits for both the consumer and the organisations while implementing it. The benefits of omnichannel platforms are quite similar to those of multi-channel systems such as increased efficiency for both financial

institutions and customers, increased revenues and reduced costs for financial institutions as well as quick service provision (Komulainen & Makkonen, 2018). The customer experiences in omnichannel platforms are not only unique but they are also of good quality and offer a high-level of convenience unlike what has been experienced before. Omni-channel platforms have also increased digital security through technologies such as blockchain, machine learning, and artificial intelligence.

Despite the advantages, there are also a few disadvantages associated with omnichannel platforms such as it disconnects the association between a consumer and the bank since most transactions are made online. This reduces the physical or face-to-face assurance that customers get from institutions (Rosman, 2015, p.8). Other challenges include implementation of omnichannel platforms such as the upgrading of new technology and the financial input especially by traditional banks that are seeking to offer digital banking services.

4.2 Architecture Framework Proposed

An architecture framework, also known as an enterprise architecture framework, is used to describe how to create and use well-defined practices while analysing, designing, planning and implementing strategies for an enterprise. This framework uses principles and requirements related to architecture to steer organisations through changes associated with the business, information and technology (Singh, Mudholkar, & Balani, 2015). The framework then utilises the various elements of an enterprise to best maximise these changes for their gain. Models are used to represent how objects in a system fit structurally into the system as well as how they behave as part of that system (Kotusev, 2016). In the case of this specific research, the architecture framework also focuses on how banks are adapting to technology and the strategic frameworks or models they need to follow and implement in order to achieve the desired change; that is required to become digitally evolved.

4.2.1 Organising the Omni-channel Digital Banking Platform

While organising the omnichannel digital banking platform, banks need to have in place formulated frameworks or guides that enables them to make a successful transformation from traditional multi-channel systems to current digital omnichannel platforms. In being able to do so, banks need to focus on three main points of interest – they need to identify the business objective; they are required to divide omnichannel digital banking platforms into smaller, manageable parts and the prioritisation of requirements. Financial institutions such as banks and FinTech companies can use the enterprise architecture framework to efficiently breakdown these three points of interest. The stability of the structures provided by the enterprise architecture framework is useful during transitions as it enables banks to keep in track and not deviate.

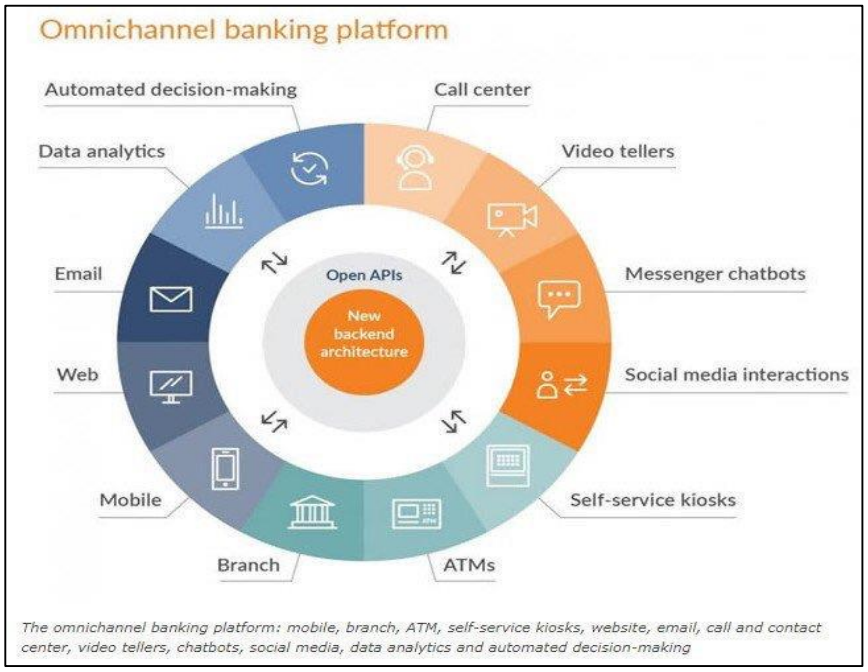


Figure 4. 2: The division of omnichannel platforms (Digital Banking Report 2018)

4.2.1.1 Identifying the Business Objective

The business objective is a primary element for any business enterprise regardless of the nature of business or industry it belongs. As a simple definition, business objective is the goal or

purpose of a business – these goals are short-term aspirations of the enterprise and are all geared in ensuring that the business is successful. Every organisation has its business objective; whether long term or short-term. To ensure success, these objectives or goals are need to be SMART (specific, measurable, achievable, relevant and timely).

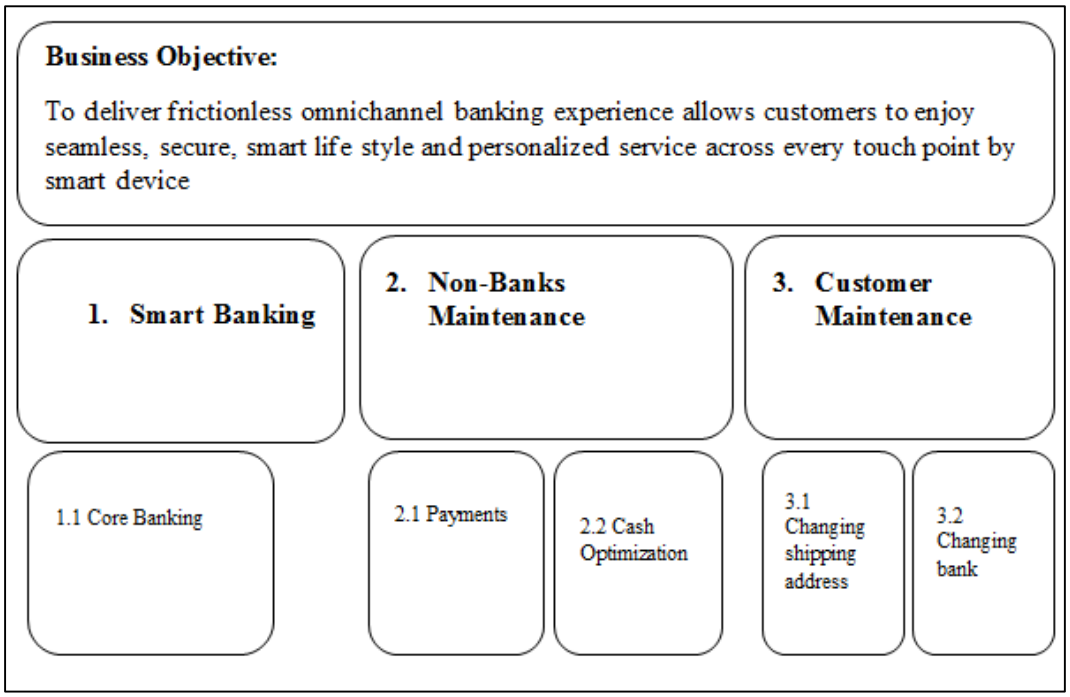


Figure 4. 3: Breaking down a project into subparts to enable controlled execution and monitoring of the project.

The advances in technology have resulted in reshaping the goals and objectives of financial institutions, these top goals can help in the transformation of digital banking. These objectives need to be addressed in such a manner that where all efforts are geared in the organisation towards achieving the goal (Root & Thompson, 2019). That means for a bank to offer efficient digital banking services, they need to change their entire framework and focus on driving towards digitisation such as the change in infrastructure, training of staff, and adoption of new technologies. Business objectives are usually geared in improving productivity, compliance, organisational culture, sustainability, reduction of risk, expanding operations, or building brand loyalty.

In regards to omnichannel digital banking platforms, financial institutions need to have three objectives which are based on three aspects – what, how and why. In addressing the what, financial institution seeking to adopt digital banking services need to have the objective of delivering frictionless or seamless omnichannel banking experiences to their clients. The factor that makes omnichannel platforms unique is its ability to provide seamless services to the user. This means that banks should create or establish applications that will meet the client's needs without giving them a hard time. Money transactions should be as easy as pressing a button on a phone's screen; checking bank balances should be fast and available at all times and at any place in the world.

In addressing how, financial institutions need to implement omnichannel banking platforms which have been personalised across every touch point and are accessible through smartphones, tablets or laptops. After establishing what the objectives for banking are in regards to digital baking, the financial institution can then identify how to implement it. Customers want seamless services that are available all the time and anywhere just a click away; banks then step in and establish an omnichannel platform that allows a consumer to access their banks through their smart devices at anytime and anywhere (Kumar, 2018). This digital platform should provide nearly all services a traditional bank provides such as money transfers, checking of balance, loan application and repayment.

Financial institutions are able to justify the reason that authorises a digital shift. As stated, before in previous paragraphs, these shifts are primarily attributed to the need of consumer anticipating more digital services that are also seamless, secure and offer a smart lifestyle (Avoka, 2016). The digital generation is also known as millennials driving factor for this shift. This generation grew up using technology and the internet; thus, traditional banking no longer seems of any interest to them. However, this is not just limited to millennials; older generations are also showing a keen interest in digital platforms such as online or internet banking. In addition to customer demand,

technology trends and innovations such as increased internet penetration, smartphone accessibility, as well as improved networks of 4G and 5G (Gecko Solutions, 2018) have immensely contributed to the need for a digital transformation.

4.2.1.2 Dividing omnichannel digital banking platforms into smaller, manageable parts

This is the second element in organising an omnichannel digital banking platform, which comes after identifying the business objective. Once the bank has established its business objective by identifying the what, how and why; the next step is to divide omnichannel banking platforms into smaller, manageable parts. This is essential as it makes processes much easier, fast, and efficient. There are different types of services that banks offer and these services can be accessed through various platforms such as smartphones, tablets, laptops, and bank branches.

In order to optimise the value for omnichannel banking platforms, as well as to enhance the consumer experience, banks can subdivide their services into three – branch services, ATM services and online/mobile services. By dividing the platform into these three categories, banks and their customers find it easy to offer and access services respectively. The platform can be further segmented individually into various sections such as balance, loans, transfer money, and finance manager. These sections can be made available on the mobile platform, web platform, or at bank's branch.

4.2.1.3 Prioritisation of Requirements

While advancing in adopting and providing digital services to enhance customer loyalty and experience, need to appreciate the fact that omnichannel also incorporates the human side. In order to make high profits, banks must effectively synthesise digital and human channels to establish an absolute omnichannel platform. Therefore, many stockholders are required to make omnichannel efficient.

A Decomposed Business Objective Performance Criteria	**A Decomposed Business Objective Performance Criteria**
Provide an efficient response to basic interactions of the customer with a platform	Response time—less than 2 seconds online Response accuracy—99%
1. Smart Banking 1.1. Core Banking	99% of all inquiry (informative) transactions and 100% of all core banking transactions should be accurate; anomalies to be automatically flagged and reported by the system.
2. Non-Bank customer maintenance 2.1. Payments 2.2. Cash Optimization	Managing the details of the non-bank customer to occur on a daily transaction; payment, refilling e-Walt, transfer money locally and international, check cash flow;
3. Customer maintenance 3.1. Shipping address and user profiles. 3.2. Banks 3.3. Payment method	99% of address changes/updates should be right the first time when undertaken by the system, 90% accuracy when by the customer on their own devices; format flagging and redressing of inaccuracies.

Table 4. 2: Applying Performance Criteria to Decompose Business Objective

In relation to digital banking in the UAE, sphere of regulation homogenises the financial interactions and ventures between the UAE smart connectivity network, Payment Service Providers (PSPs), the Abu Dhabi Global Market (ADGM), Abu Dhabi Sandbox Emirates ID Federal Authority, Dubai Financial Services Authority (DFSA), Dubai Hive, Dubai International Financial Centre (DIFC), Emirates Services and Commodities (ESC) and The Central Bank of UAE.

omnichannel banking layer. The study is focused on the omnichannel banking layer.

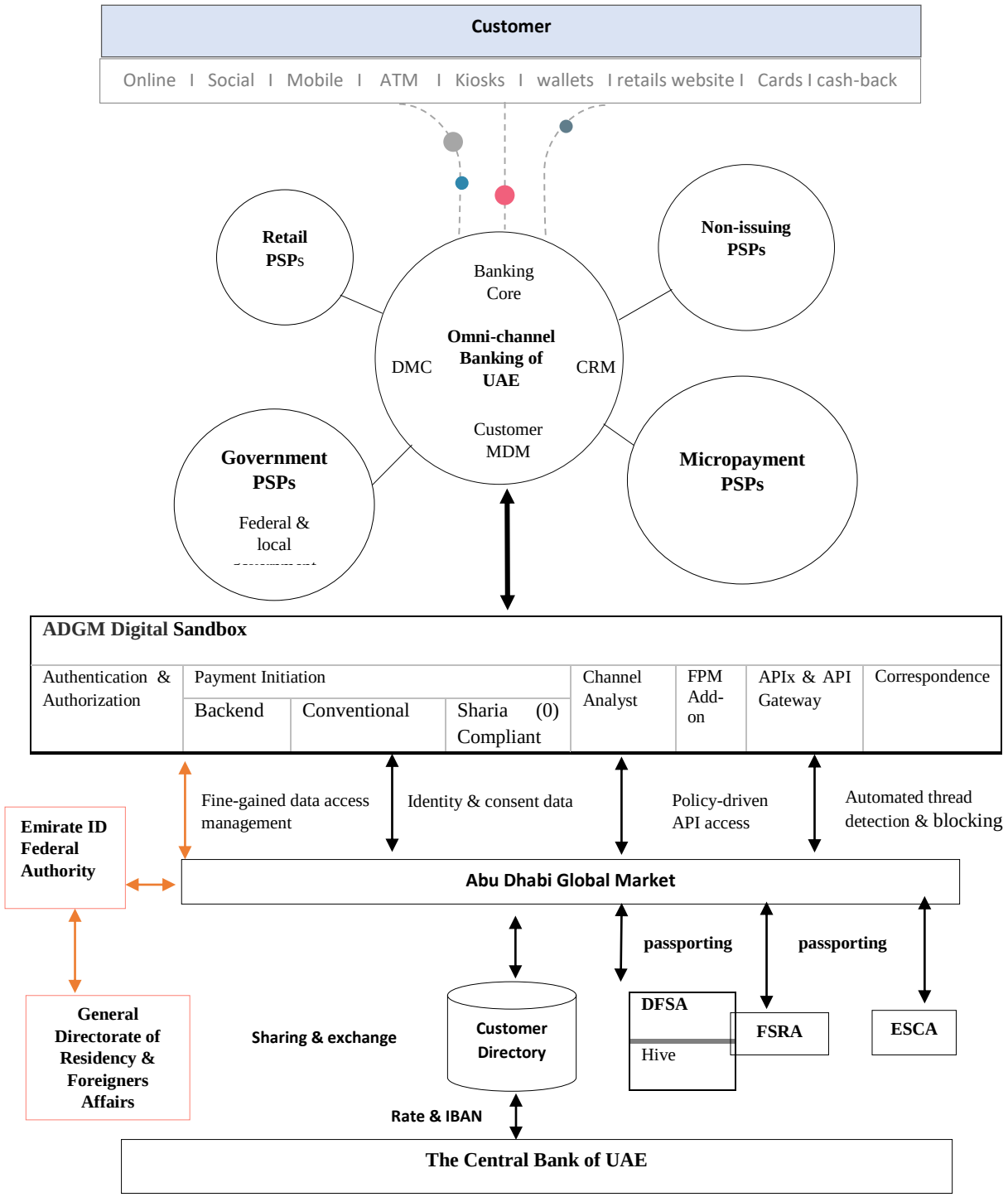


Chart 4. 1: The Theoretical Framework: show interoperation between the government department and system.

Chart 4.1 further illustrates with much detail the correlation between elements of the proposed theoretical framework in this research study. The proposed theoretical framework – the complete UAE Omni-channel Banking model – is achieved by smart connectivity and current FinTech start-ups through the RegLab. The omnichannel Banking model are linked at a global level through the PSP, the Abu Dhabi Global Market and the UAE Central Bank by sharing and passporting IBAN. We assumed that Abu Dhabi Sandbox provides a Hubs layer contain authentication & authorisation (Fine-grained data access management), Payment Initiation (Identity and consent data), Channel Analyst, FPM Add-on, APIx and API Gateway (Policy-driven API access) and Correspondence (Automated thread detection and blocking).

With relation to regulatory concerns, the main challenges for FinTech start-ups include factors such as talent on IT and e-commerce, as well as the availability of partner companies, customers and investors. In addition to that getting approvals and licenses for start-ups take a lot of time which can prove costly to the young company who in most cases do not have a lot of capital. The ADGM Regulatory Lab was launched in 2016 as part of the FinTech legislative framework in the MENA region. This lab provides a channel through which proposals on financial technology can be submitted and tested. The lab has also partnered with the Central Bank in UAE in creating a conducive FinTech ecosystem which also includes the Al Maryah Island-based free zone.

In addition to that the UAE has also established the Dubai International Financial Centre (DIFC) Hive and the RegLab Sandbox, which has been a doorway for new blockchain start-ups in surrounding regions such as the United Kingdom and China. Furthermore, there have been an agreements between ADGM, Emirates Services and Commodities (ESC), and Dubai International Financial Centre, which has aided the development of FinTech start-ups.

The UAE omnichannel digital banking is divided into four segments: the payment service providers (PSPs) such as Retail PSP which offer retail, government and peer-to-peer digital payment services.

The second segment is Government PSPs which consist of federal and local government; the third is Micropayment PSPs which comprises of licensed operators, money exchange businesses and public transportation providers. The fourth segment is Non-issuing PSPs, which consists of non-deposit taking institutions which do not issue digital currency but offer retail, government and peer-to-peer digital payment services.

The significance of the proposed framework is providing Sharia0compliant. Checking financially-related activities in the UAE is controlled by rules that are set up by the Institute of Islamic Banking and Insurance, which mirrors the Shari'ah. according to Lacasse, Lambert, and Luxembourg (2017), the Shari'ah requires the banking industries to make incentives for investors with products that are Shari'ah consistent. Appraisals that are made for the Fintech industries might be placed into the customary budgetary system of the UAE that encompasses *riba, qimar, maysir, and gharar* applications to money related exchanges.

Islamic banking and Shari'ah rules are more mind-boggling than the gauges used for ordinary banking models. Industry experts have tried to demonstrate or refute the inevitable relocation of customary financial foundations in the UAE, the Islamic money related principles, and rising economies by fintech (Zalan and Toufaily, 2017). The financial division continues to be isolated from the regular and Islamic financial models for as far back as 40 years (Ahmed, 2017). The emergence of the blockchain business has contributed fundamentally to an expansion in enthusiasm worldwide, national economies and financial specialists and foundations (Sadaqat, 2018). WAMBDA Capital, BECO Capital, and Middle East Venture Partners are driving the fintech center point, research, and innovation speculations dependent on the quantity of month to month and yearly exchanges (Hariharan, 2017).

4.2.2 Conceptual Framework

The chart 4.2 below illustrates the proposed conceptual framework for the UAE omnichannel Platform, with contain four layers: customer layer, channels layer, data layer and omnichannel banking layer. The study will focus on the omnichannel banking layer.

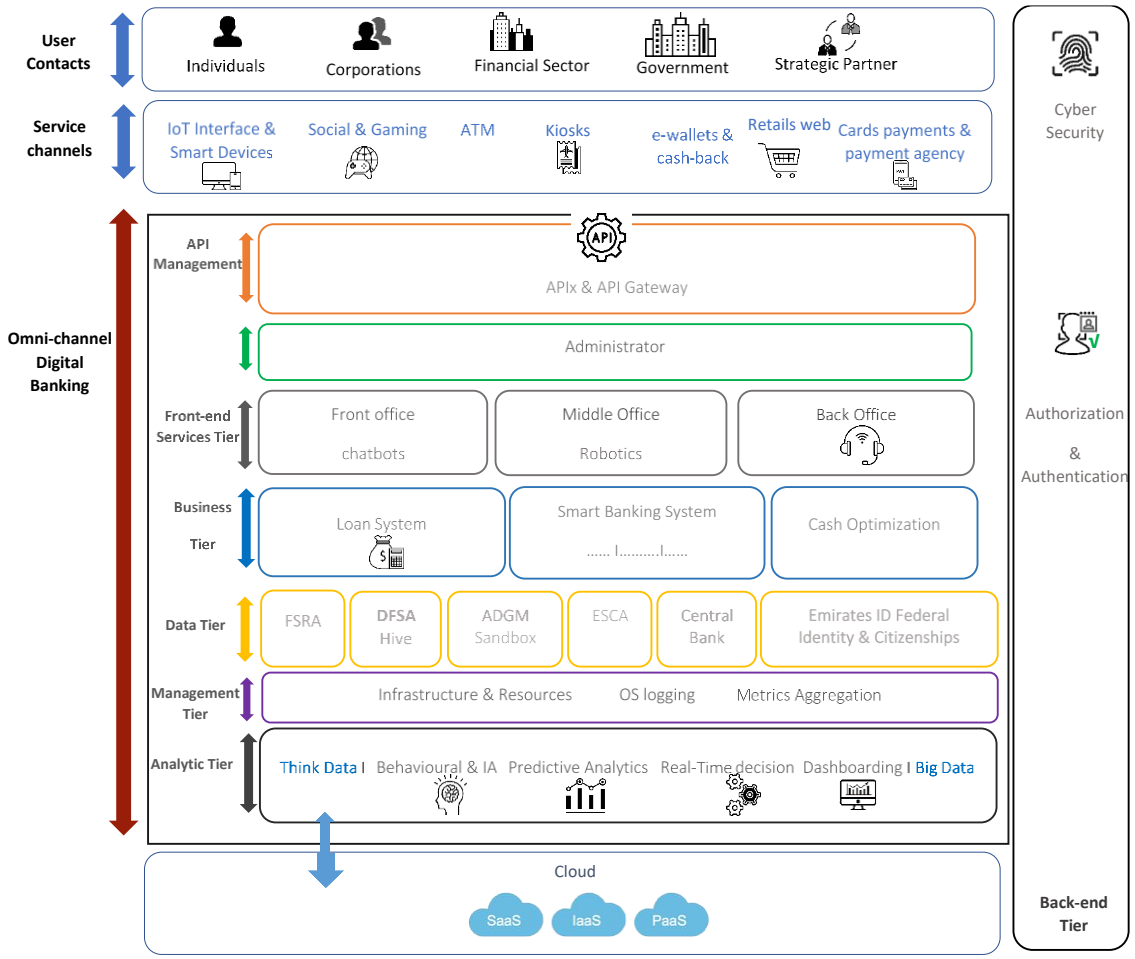


Chart 4. 2: The Proposed Conceptual Architecture Framework for the UAE omnichannel Digital Banking Platform

4.2.2.1 Bank-end Tier

Security is an important element in the omnichannel platform, not only in the UAE but across the world. In order to ensure the security measures, it is essential for financial institutions to use platform for data encryption at all levels of the network – whether it is at rest, at flight, or in isolation.

The UAE uses a tiered omnichannel configuration known as Virtual Private Cloud that provides a network that has been shared. Patroonship Dubai then provides a security framework that is layered with compartmentalisation between different components. The UAE also uses Direct Connect, which supplies links to banks and their networks throughout the country. In addition to that, an IPSec VPN is used concurrently with this link and by doing so; they allow the encryption of data while it is in transit. Abu Dhabi has a similar hub provided by the Correspondence Hub.

4.2.2.2 API Management

API management in the UAE is done by establishing an external user entry point into the omnichannel platform. This entry point is created around an APIX Gateway, which is an API management service that can be scanned and this process helps in configuring the program. The ASEAN financial innovation network is the current provider of this management service in UAE that have partnered with the Abu Dhabi Global Market, which houses the Sandbox APIX and API Gateway Hub. The partnership is a boost in digital banking in the UAE, as it has increased drastically the time to create and ensure the accessibility of APIs by the help of internet.

4.2.2.3 Authentication and Identification.

The conceptual architecture framework allows UAE omnichannel digital banks to become identity suppliers by accessing data of organisations and individuals who have been verified and are using the APIs. As a result, people can now log into the UAE pass service while going through an authentication process, which is closely related to OAuth or OpenID. A third-party identity provider may also be needed in this process. In the UAE, this service is provided for by APIX and API Gateway.

4.2.2.4 Front-end Service Tier.

The front-end service tier is essential in allocating personalisation and interaction features between a financial institution's API and its various online clients (both web and mobile). Since this is the first point, the security of this service is paramount; thus, necessary security measures are put in place, for example, connecting a user with a digital assistant on their devices such as Siri or Google Assistant.

4.2.2.5 Business Tier

This tier is comprised of program applications that hold the domain-specific platform's functionality. The communication channels under this tier are secured with back-end systems within the omnichannel platform. Analytics are then used to give feedback to these services, including queries; thus, creating a feedback loop. This tier can be categorised into three functions; Smart Banking, which includes all bank functions both online and offline; Make Payments and Cash optimisation. In the UAE, these services are connected to the payment hub provided by the Abu Dhabi sandbox in partnership with Dubai Hive and the Central Bank.

4.2.2.6 Data Tier

Just like any other internet-backed platform, the omnichannel also face a huge challenge in risk management; as banks open up to third-party stockholders. As result, data and analytics are used to do security profiling, monitor threats, as well as analysis of how the platform is being utilised. In the UAE, data is transported from AI Gateway or business logic domains and is archived in a data tier where it is analysed for risk. This data tier contains traditional relational databases, NoSQL data stores, and an in-memory Redis data store.

4.2.2.7 Management Tier

This tier consists of resources and structures that are used to ensure the continuity and sustainability of the platform. It includes services such as OS logging and metrics aggregation which can also be used in an alerting platform.

4.2.2.8 Analytics Tier

This tier contains services that are essential in facilitating visibility from interactions by users in the platform. These flexible and transparent interactions are crucial to data scientists and specialists who use machine learning in being able to gather data that can be used in determining customer behaviour.

4.2.3 Logical Flow

The chart (chart 4.3) represents the logical flow of the system, which highlights in detail the steps a customer can take while using an omnichannel platform in the UAE. The process starts when the customer first enters at the platform. The loading time is less than 1.5 seconds as the platform is run on a 5G network. The customer is required to register using their digital emirates ID (UAEPass) number if they are a UAE resident or credit card number if they are non-residents. The UAE Pass is a smart service offered by the federal authority for identity and citizenship (FAIC) and Smart Dubai, allows the customer to use mobile device as a secure form of identification. UAE Pass can be used for the seamless authentication to smart services as well as the digital signing of the documents.

After registration, authentication and authorisation, the system processes and check the customer data transaction and store it in the Central Bank of UAE. Regardless of whether a customer has a bank account or not, the system connects automatically to user device digital assistant or Chabot.

When the customer logs in, the channel has asked the customer which service they want to use. It does so by using artificial intelligence and machine learning form customer previous transaction to generate a listing choice. If a customer has a bank account, the Smart banking service is displayed offering the entire core banking service offer by customer bank.

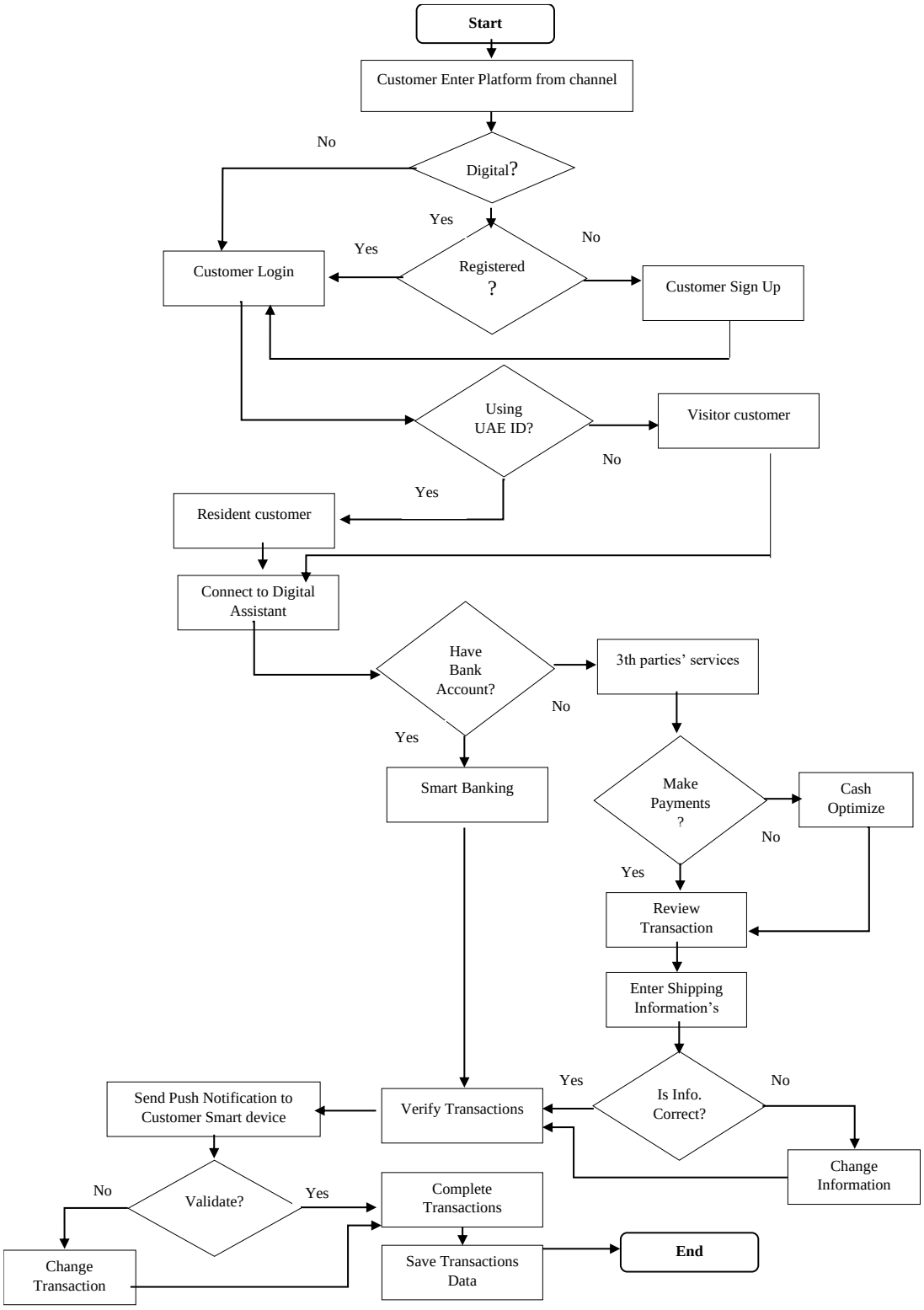


Chart 4. 3: The Logical Flow of the Omnichannel Digital Banking Platform

Peculiarities of the Omnichannel in the proposed model:

- Smart banking:

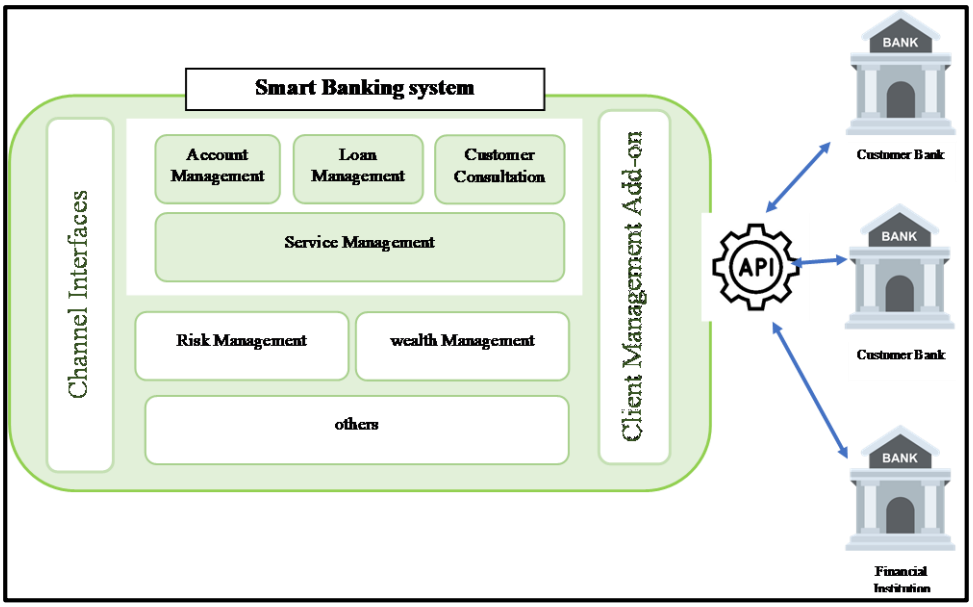


Figure 4. 4: Business tire in the omnichannel model-Smart banking system.

1. E-payments: this is the most important feature in smart banking, where the customer can pay their e-bill(s) or physical invoice(s). It involves three steps: first, the invoice code bar is scanned using the smart device; secondly, the system will automatically send a notification to the customer who will confirm the invoice details and finally, the bank of choice will complete the transaction through the regular steps of payment.
2. Account management.
3. Customer relationship management (CRM).
4. Load management (retail, micro, SMEs and Corporate).
5. Deposit module.
6. Foreign exchange.
7. Current account management.
8. Bankcard management and card system

9. Teller application: a process involving the creation of an account within the Omnichannel banking platform. It will then create an e-wallet account that can be filled by customer's bank account or through an exchange house account.
10. Fee handling.
11. Workflow handling.
12. Statement generation.
13. Debt collection management

Otherwise, if customer does not have a bank account, the system will automatically display making payment and cash optimising (Peer-to-Peer) services that offered by PSPs. They include Make Payments services and Cash Optimising services (P2P) (table 4. 3.)

Make Payments services	**Cash Optimizing services (P2P)**
Risk management services for card and bank-based payments.	**Bill Payments (**Utility, Credit Card, Subscriptions, Loan Instalments, Insurance Premium and **Air Ticket and Tour Package Payments)**
Transaction payment matching.	Wealth management
Reporting.	Foreign Exchange
Fund remittance and fraud protection in addition to multi-currency functionality and service.	Seamless Money Transfer. Safe and Secure.
Cash payments.	Bank Account Transfer.
E-wallets.	Instant Money Transfer.
Prepaid cards or vouchers.	International Money Express (IME).
Paper or e-check processing.	**Cash to Card Transfer.**

Table 4. 3: Display making payment and cash optimizing (Peer-to-Peer) services

The system then verifies the transaction by sending a notification to the customer's mobile phone to authorise it. At the same time, it will also check the customer's account with their bank or

PSP to see if they have any money to complete transaction. Finally, the system will exchange the authorisation code with the PSP and complete the transaction (See chart 4.4).

4.2.4 The System Use Cases

4.2.4.1 Main Functions of the Omni-channel Digital Banking Diagram

The chart below represents the main functions of the UAE omnichannel banking platform use case diagram, showing the different stockholders including the customer, banks, UAE ID authority, and Payment service providers (PSPs). Further details on the use case description can be found in figure 4.4.

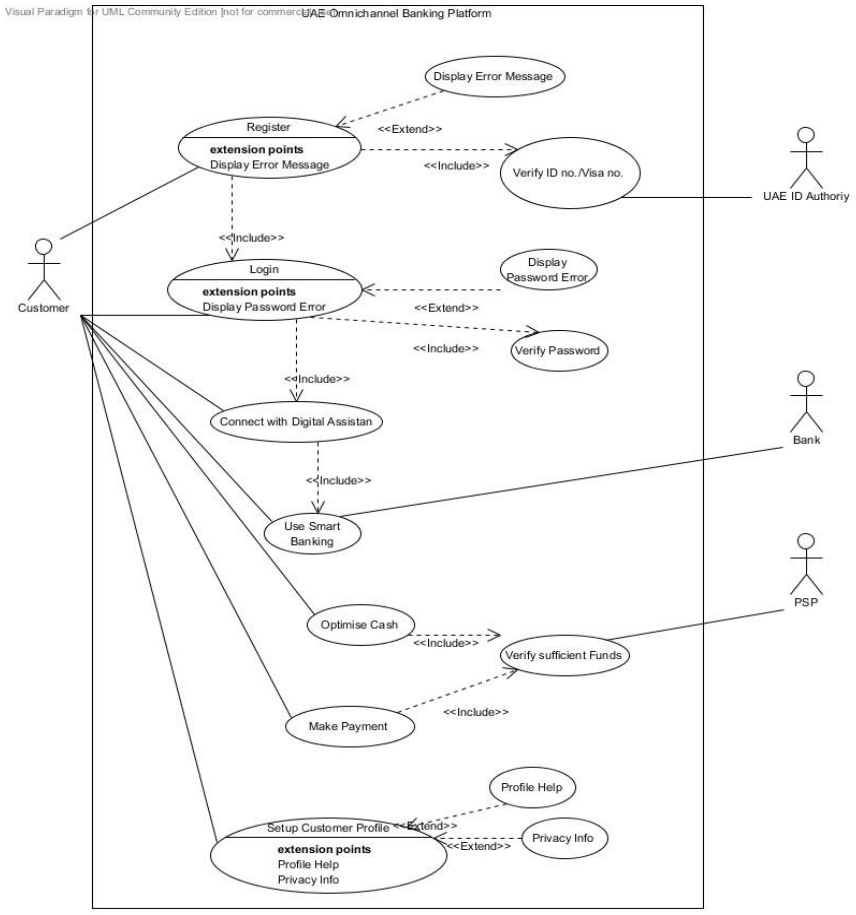


Figure 4. 5: The System Main Function Use Case Diagram

4.2.4.2 Transaction of bank customer use case diagram

Below figure illustrates the transaction of bank that consumer uses, where the relationship between bank and consumer are analysed. Further details on the use case description can be found in figure 4.5.

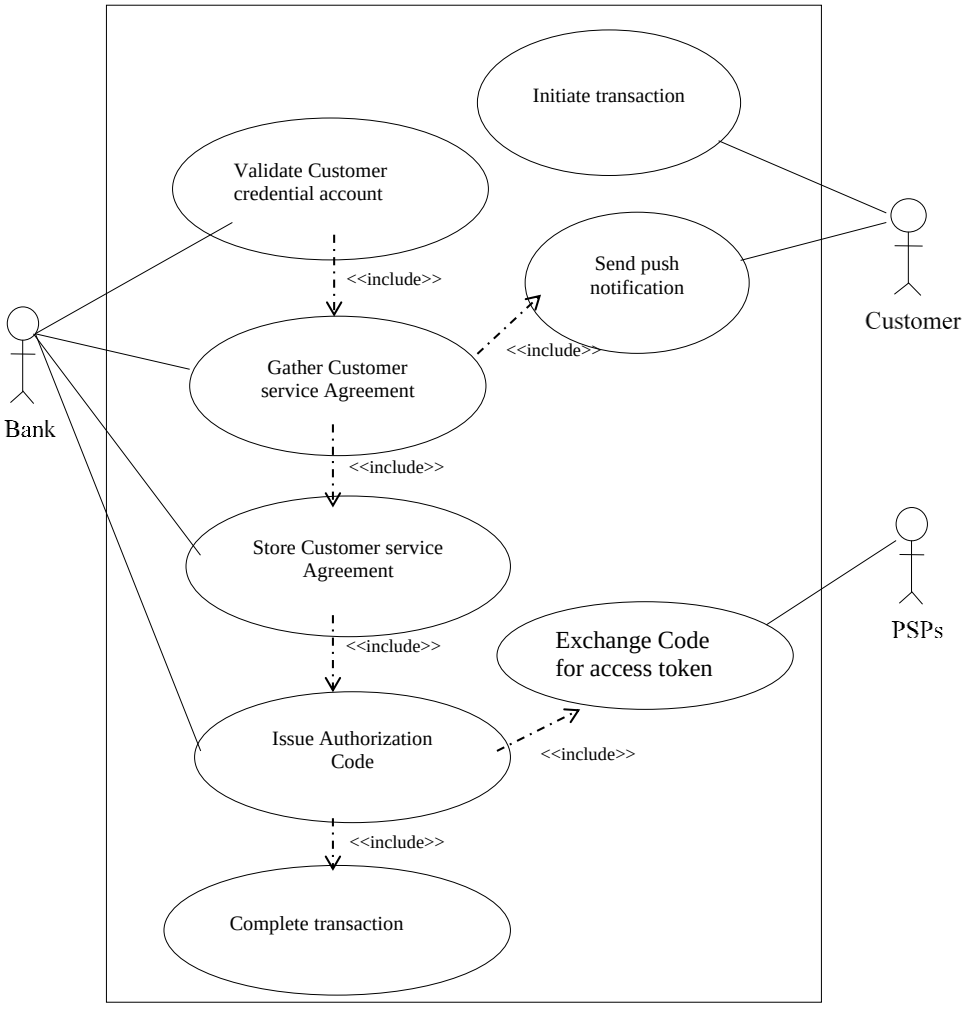


Figure 4. 6: Bank customer transaction with the system

4.2.3.3 Transaction of non-bank customer use case diagram

The figure below shows the transaction of a consumer who does not have a bank but has access to payment service providers (PSPs). Further details on the use case description can be found in figure 4.6.

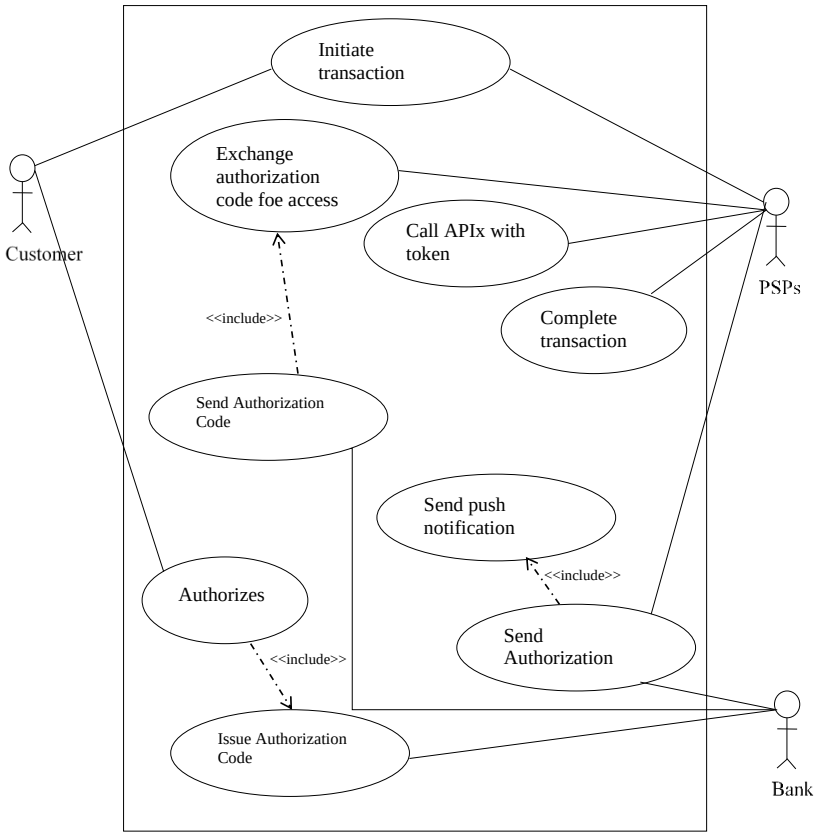


Figure 4. 7: Non-bank customer transactions with the system

4.5 Analysis

The architecture framework of the omnichannel platform has been structured in such a way that it caters for all stockholders in the market from consumer to the financial institutions and third-party stockholders along with government departments in the UAE. The framework also highlights

how these stockholders interact with each other and the contributions they make on the platform. The framework also addresses risks associated with security, third-party stockholders, and data management – all of which are real and urgent issues. It is important to note that this framework is guided by the main objectives of the financial institution, which is to provide digital banking services to their consumers. Thus, the framework is established in such a way that it caters primarily to the consumer by making it accessible from multichannel, easy to use and available at any time.

In order to cater the needs of clients in better way with the assurance that the platform is efficient; financial institutions need to breakdown the omnichannel platform into manageable sizes. This makes it easy for both the consumer and the bank institution. Stockholders including government, Sandboxes and other digital hubs should be included in the formulation of architecture framework as their services provide great support to the digital banking services that banks offer. By working together through partnerships and contracts, the digital banking industry is working efficiently and as a result, saves a lot of resources, which would have been wasted or unavailable.

4.6 Summary and Chapter Conclusion

This chapter focused on the omnichannel banking architecture design specific to the UAE. Through the analysis of the framework, the study highlighted the interoperation between system layers within the framework with diverse roles performed by government department such as Abu Dhabi Globe Mark and Abu Dhabi Sandbox and others. The enterprise architecture framework is critical in digital banking as it provides more visibility that is essential in developing a better vision or objective for the entire project. The framework also facilitates the unification or processes through information technology (IT), which then improves the interoperability between systems; thus, reducing the number of applications as well as preventing a repetition in processes. In addition to

transparency, the framework is also essential in streamlining systems within the framework by reducing operational costs and the occurrence of errors.

This chapter effectively addressed Hypothesis 4 and 5 which sought to understand how various stockholders' interoperability of banking in the UAE collaborate in ensuring an efficient omnichannel banking system. H4 sought to explore the implementation of standardisation and regulatory policies by the UAE government. While, H5 sought to understand the positive correlation that exists between UAE government strategy in order to transform smart cities and omnichannel banking service with seamless access across all self-service channels. However, the method described above addresses hypothesis H4 and H5, the effectiveness of the method cannot be tested at this point; because it is addressed in chapter 5. Therefore, at this point, hypothesis H4 and H5 cannot be fully accepted or rejected. Chapter 5 presents and describes the evaluation and testing of the modelling that have been proposed.

CHAPTER 5

Modelling and Evaluating the Omnichannel Banking Platform Architecture Design

5.1 Overview

This chapter has deliberated the modelling and evaluation of model that is proposed in the previous i.e. chapter four; the Omnichannel Banking Platform using Arena Simulation and Reviews by Experts. The chapter focuses on addressing research question three, RQ3, which states: *How does the adoption of digital banking impact the bank's ability to meet customers' needs?* This research question helps and guide the research in identifying opportunities to adopt omnichannel banking across the UAE. this chapter also addresses hypothesis one, $H_1$of the research study, which suggests that: a significant increase in the customer interaction smart device through an omnichannel banking model will increase the number of customers in a bank.

The chapter further introduces simulation and automation software i.e. Arena, which is used to demonstrate the facilities and capabilities of discrete event simulation tool (Arena Simulation 2019) by building the operational process of the omnichannel digital banking platform. Arena software is developed by Rockwell Automation, uses the SIMAN processor and simulation language on Microsoft Windows platforms. It provides an integrated environment for building simulation models for a wide variety of applications as well as provides enhancements in optimisation, animation, and modelling processes with big data. The Arena also integrates all the functionalities required for a successful simulation, including Input and Output data analysis, Model logic, and Animation.

5.2 Simulation of the UAE Omnichannel Digital Banking Platform for Dubai Expo 2020 – an ARENA Case Study

In selecting and developing the most suitable research plan, the researcher analysed the research questions and orientation of the study in determining the research design. The research design is a set of methods and procedures or a systematic plan that is used in the collection and analysis of variables that were highlighted in the research problem. The research design acts as a conceptual framework or blueprint of a research study and is also used to define the study type which includes: the experimental design, the longitudinal design, cross-sectional design and case study design (Akhtar 2016). It also helps to further define the research question, hypotheses, data collection methods, statistical analysis plan, as well as the dependent and independent variables. These designs are further divided into fixed and flexible research design or quantitative and qualitative research designs, which are essential in ascertaining the purpose of study, type of data to be collected, the type of sampling to be done, the timeframe of the research and the nature of study.

This study has adopted the case study as it is considered as the most appropriate design and allows the focus to be placed on queue occurrence within its real-life context. The case study design method involves an up-close, in-depth, and detailed examination of the study or research area that is omnichannel digital banking sector of the UAE in current study. This design could be either qualitative or quantitative research and often implemented by conducting formal research such as conferences and formal research venues etc. (Yin 2013). When conducting a case study, it is important that the researcher selects insight-stimulating cases that is not only add value to the research but it is also address the research problem and objectives. The case study allows the researcher to make observations as well as gather essential information for the research study and its hypotheses. The aim of this study design is to enable the researcher to know precisely about the factors and causes which smoothen the behavioural patterns for the research study area (see figure 5.1).

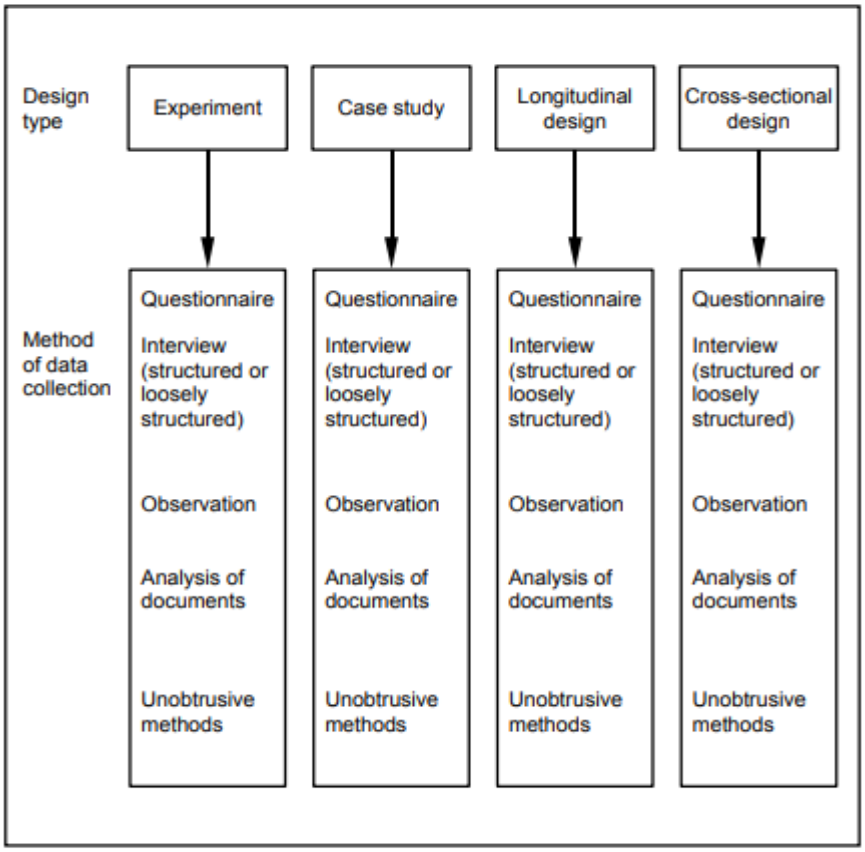


Figure 5. 1: Types of research designs and methods of data collection (Vaus 2001, 10)

For this research, case study participants are one who is attending the Dubai Expo 2020; hence the design is chosen. The reason to choose this method is the typical issue that is focused in the research and its focus is on the customer needs to facilitate multi-channel and multi-currency transactions. These transactions are designed to decrease queues at ATMs and Kiosks by using ATM and Kiosk module application which facilitates customers to pay bills, exchange currency and make card-less cash withdrawals. The transactions also facilitate international payments and financial transfers within the existing regulated market exchange space – a potential limitation to the outcomes for local businesses as well as those who attend the event. Considering that more than 25 million people from more than 190 countries are hosted in the event (Expo 2020 Dubai 2019); there is a need for an integrative, robust and easy-to-use omnichannel digital banking platform that overcomes challenges facing the traditional banking sector. Such a solution would be providing further

opportunities to the globally focused residents of Dubai, long after the event is done through the form of improved choices for omnichannel in any number of foreign currencies. This is a key determinant of success of the Dubai Expo 2020.

The design here is based particularly on multiple channels where the researcher for this study aim to increase the touch points by categorising the channel into a physical-type machine which would offer more services through ATMs and Kiosks. This is consequently attract more customers and provide them with seamless experience. This appropriately provides the researcher with the needed environment in order to collect required data for analysis. The researcher has provided the example of discrete event simulation application in evaluating the performance of servicing multiple lines in physical machines and digitals apps platforms.

A simulation model provides a visual animation of the service delivery process. selecting simulation tool for this case was because it can't implement the proposed model in the real world, so using the simulation and build Dubai expo 2020 as a use case. Also, to measurement the model scientifically. Through the simulator model, the implementation of the omnichannel in the banking sector can be tested for viability. The fact is that the omnichannel model cannot be implemented and run in the real world as it currently is in the UAE. Therefore, the use of some statistical data and information can help in coming up with the analytical framework for the implementation of the omnichannel project as a whole. The transformation of the banking sector and the UAE city depends on some of the analytical at a provided from the examination of the demographics, population, banking transactions, and traffic. The simulation model will, therefore, use these statistics to come up with a reliable program that will form the ground for the implementation of the omnichannel project. The simulation model helps in the detection of the imbalances that need to be corrected in coming up with the digital omnichannel banking. The simulation model approach allows the researcher to initiate

contingency plans to deal with probable disappointments that may arise from the loose implementation of the entire project in the UAE.

The data was collected from Company A facility of an ATM and Company B, Kiosk machine and applied the M │ M │ S queue model on collected data. Mobile and online apps collected from google first ranks, gathering data was used in implementing and simulating the model using Arena software. An ARENA® simulation model was developed, verified and validated to determine the performance of the Omnichannel Digital Banking Platform as a smart service for smart cities.

5.2.1 The M │ M │ S Queue Model

The M │ M │ S Queue model is a discipline within the probability theory in mathematics which represents the queue length within a system that has a single server and where arrivals are determined by a Poisson process (a kind of random statistical object comprising of points randomly located within a structure). Whereas, job service times have an exponential distribution in this multiple-server model, the queuing model needs to be first characterised by certain factors such as the arrival time distribution which refers to the inter-arrival time following a distribution pattern; a Poisson distribution service time distribution model consists of exponential Number of four servers (ATM, kiosk, mobile, online); and queue lengths, where the queue in a system modelled with having infinite queue length. Other factors also include the system capacity, which refers to the maximum number of customers in a system is 25,000,000, and the queueing discipline which consists of FIFO (First in first out of transactions).

Studies have shown that while using the queuing model, the five essential operating characteristics include the utilisation rate, the percent idle time, average time spent waiting in the system. On the other hand, in queue, average number of customers in the system and in queue and probabilities of various numbers of customers in the system (Mohammad Shyfur Rahman chowdhury

2013, 29). The queuing model and theory can be applicable in a wide range of real-life situations including the digital banking industry in the UAE. By understanding how to model a multiple-server queue, one can be able to determine how many servers is needed to maximise financial efficiency in both traditional and digital banks across the UAE and more so during the Dubai Expo 2020.

5.2.2 Case Study Description

With a primary focus on Dubai that is working towards achieving smart city status, it is important that the city is prepared for the financial systems that are needed to ensure a world-class event. The case study is therefore working on the assumption that omnichannel digital banking platform face is financial challenges that is required to be treated with ideal solutions along with the management of 25 million customer that are expected visitors for the Dubai Expo in October 2020. The study simulates an operational description in analysing how data was collected from ATM and Kiosk facilities as well as from mobile apps and online platforms. Simulation in this context refers to an emulation of the operations of a real-world process or system over a period of time (Mousavi 2011). Through this process, the researcher designs a model of an actual system and conduct demonstrations with it for the purpose of perceiving and comprehending the mannerisms of the system as well as evaluate the various strategies for its operation.

Through this simulation process, the researcher is able to examine and report the mannerism of a system by asking relevant ‘what if’. questions about the actual system. This consequently aid in the design or improvement of real system. Simulations are essential in exploring possibilities as well as diagnosing problems and identifying constraints within a system. Furthermore, simulations are crucial for researchers and studies that want to develop a better understanding of the subject matter that is digital banking omnichannel platform in the UAE, further in capturing the complexities within the system.

While conducting a successful simulation, there are certain fundamental principles that a researcher needs to observe. The first principle is conceptualisation, where the modeller of the simulation needs to understand the structure and operating rules of a system. To achieve this, a successful model requires proper system knowledge, engineering judgement, and model-building tools. A crucial element in conceptualisation is focusing on the reasonable assumptions along with the components and interactions that are need to be added into the model in order to make it as similar to the actual system as possible. In the omnichannel banking platform simulation, this research is required to be comprehend and analyse all the digital and traditional banking structures of the banking system. Through this understanding, the research study can make better and more accurate assumptions in the simulation process.

The second principle is to observe the ability to remodel the structure. Ideally, a distinctive feature of a model is being interactive and graphical. Because of this, a mode is often and continuously refined, updated, modified, and extended. It is crucial for researchers to always update their models in order to fit into the ever-changing world of technology, because these models form the base of future models. Aspects like diverse channels that are used in the omnichannel model should be updated with changing technology. A decade ago, there were no mobile banking apps but now there are functional; thus, new technologies that could arise in the future should also be added into the omnichannel model. The third principle is an extension of the second one in the existing modelling process that evolves with time. Important information gathered during the modelling process in this research is essential in increasing the relevancy and accuracy of the omnichannel model. As stated in the second principle, the process of modelling is continuous and only stops when there is no more additional information or detail is left to add that has further resolved the problem. At the end of the modelling process, the study will have established relationships between the systems with the resulting correspondence and considered as a tool for problem solving and a base for future research.

The fourth principle is that the problem statement for the research study is most significant controlling element in model-based problem solving. This problem statement is derived from the needs and requirements of the system (in this case, the need for an omnichannel digital banking platform) is the guiding factor in the development of omnichannel model. Input to the model is provided by the data that is derived from the system, it is essential in establishing the boundaries and details of the model. It is important to note that while using the model-based problem solving, a researcher needs to first understand the context, identify the goals of the project, specify the performance measures of the system, establishing and setting specific modelling objectives and defining the system to be modelled. The fifth and last principle in creating a perfect model is focusing on the continuous elements of the problem. This should be followed by developing the discrete aspects of the model such as events, networks, algorithms, procedures for control, and logistical capabilities.

This study implements the use of a descriptive symbolic simulation, where the characteristics of the real system are captures in a symbolic form. The operational description of the model used in this study is as follows:

Channels A and B represent the two facilities on the platform, where Channel A represents the physical channel such as one ATM and one Kiosk machines and Channel B represents the Digital/Online channels such as one mobile app and one online platform. In this simulation, as highlighted in Figure 5.2 the user needs to login to both channels by using their UAE Pass. In the event if the user does not have an Emirates ID (Visitor), they will use his/her credit card to login into the channel. Channel, A arrives at a rate (λ) described by an exponential distribution with a mean of 5 (each expressed as minutes), which had been gathered during data collection in chapter three.

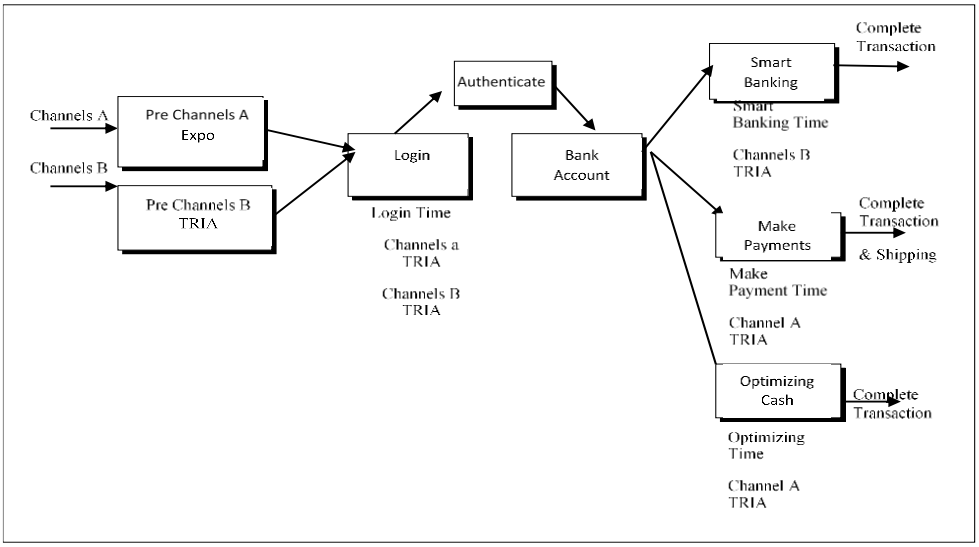


Figure 5. 2: Description of the operational function of the omnichannel banking platform

At the login area, functional checks are performed on the customer detail to determine if they are authorised or not. After the login process, 99% of the customer's processed log in and get connected with their digital assistant. If the customer logs in with Channel A, a chatbot will appear on the screen; whereas if they log in using Channel B, it will automatically connect with the smart device assistant. The AI will first categorise the customer-type based on their login tool – if they used a UAE Pass, the system will categorise them as a resident customer; while a credit card will be categorised as visitor customer. Once that process is done, the system will then suggest a list of options for the customer based on the individual customer's previous usage of the system.

If the customer has a bank account, the system will check with the customer's bank account through the data layer tire and once confirmed, it will transfer the customer to the smart banking service. On the other hand, if the customer has no bank account, the system will ask which service the customer wants to use such as "make payment" or "peer-to-peer(P2P)" and then transfer the customer to the particular service of choice. Finally, the system will collect the complete transaction and store it in the customer data.

5.2.3 Build Model: Omnichannel Digital Banking Platform

Going by the assumption that all previous steps highlighted in the case study description and simulation have been carried out, the next step is to break down the simulated system into identifiable sections that is convenient for efficient modelling. With that in mind, the main aspects of this model will be to:

- Create arrival of the customer to Channels
- Send customers through prep channels process
- Send customer through the Login process
- Decide where each customer type after login
- Connect to Digital Assistant process
- Decide whether customer has a bank account
- Send customer to Smart Banking service
- Decide which service to choose if the customer has no bank account
- Send customer to Make Payment services
- Send customer to Peer-to-peer (P2P) services
- Record transaction after Smart Banking
- Dispose to complete the transaction after Make Payment
- Record transaction after Make Payment
- Dispose to complete the transaction after Peer-to-peer(P2P)
- Record transaction after Peer-to-peer(P2P)

To do the above, the research will require the following modules:

- Two Create modules

- Two Assign modules
- Nine Process modules
- Four Decide modules
- Four Record modules

Each Create module will represent the arrival of each channel that the customer will use.

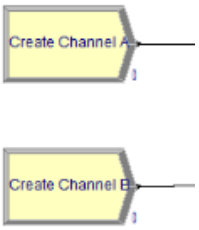


Figure 5. 3 : Create Modules in Arena for Channel (A) and Channel (B).

Each Assign module will also be used to assign attributes to each channel that the customer uses. Two Process modules will represent the Prep process for each channel type; one for the login process and another for the connection with Digital Assistant process, Smart Banking process, Make Payment process, and the Peer-to-peer(P2P) process.

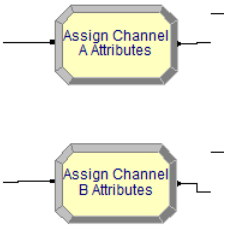


Figure 5. 4 : Defined an attribute Channels and assign it the entre processing time, which is dissimilar for each channel.

One Decide module will be used after the login process to split the customer as 'Authorised' or 'Threat'. The second Decide module will be used to separate customer type from Resident customer

and Visitor customer. The third Decide module will be used to the distinct customer from having a bank account or not having a bank account while the fourth and last Decide module will be to ask the non- bank customers if they wish to use the 'Make Payment' services or the 'Peer-to-peer(P2P)' services. Before each stream of channels is disposed, the researcher will use a Record module to collect statistics on the time spent in the system. Finally, the four Dispose modules will be used by customers to complete the transaction of smart banking, make a payment, and optimise cash transaction and threat.

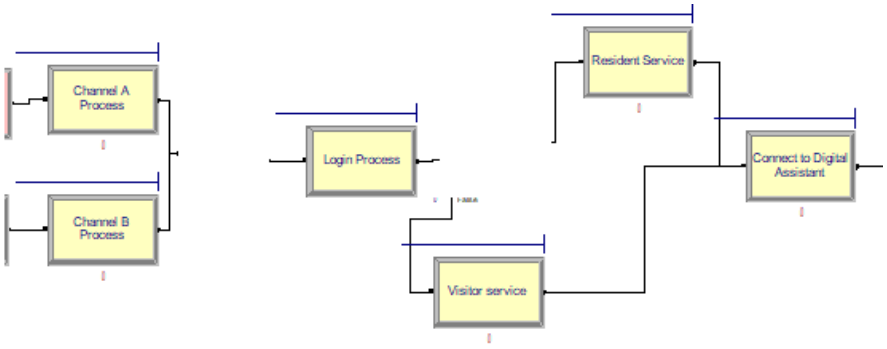


Figure 5. 5: the seven process

It is imperative to remember that arrival rates and Prep times are unique for each channel type. The study will use four attributes – login time, smart banking time, make payment time and peer-to-peer(P2P) time – to assign the different times spent at the login, smart banking, make payment and peer-to-peer(P2P) processes for the various channel types. For the purposes of this study, the researcher will call the resources Prep Channel A and Prep channels B, Login, Smart Banking, Making Payment and Peer-to-peer(P2P) respectively for the Prep processes, Login, Smart Banking, Making Payment and Peer-to-peer(P2P). This model description is summarised in Figure 5.3 below.

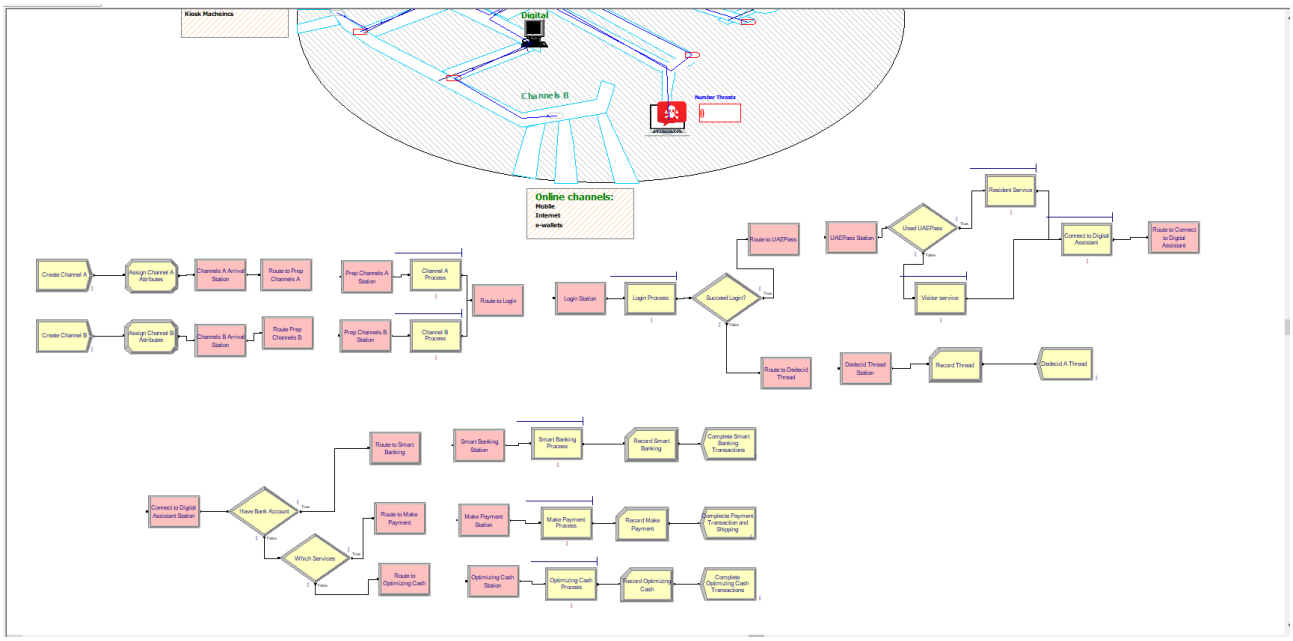


Figure 5. 6: The complete operational model of UAE omnichannel Banking Platform in Arena

5.2.4 Adding animations

In order to create an effective simulation model, it is important to emphasis on the visual display of the simulation. For the purposes of presentation, deeper understanding and data analysis in research, it is crucial to ensure that the model's animation used in the study is similar to the real system. In the particular case of this study, the researcher used animation in describing and breaking down the omnichannel digital banking platform of the UAE. In its simulation, as illustrated by figures 5.2 and 5.3, the chapter clearly demonstrate the processes (including internal process) that take place once a customer access either platform. Animations have also proved to be very useful for the purposes of verification, which simply means it ensures that the model is working as it is expected to. Additionally, it also helps in detecting any possible errors in the model logic; which reflects on the actual system, as seen in figure 5.4.

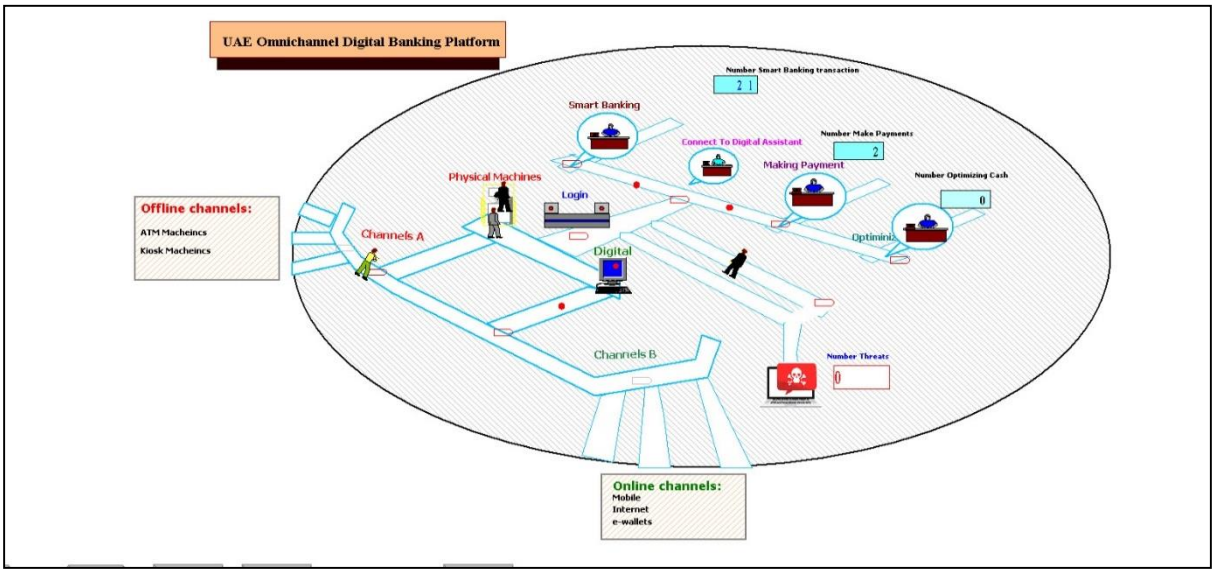


Figure 5. 7: The UAE Omnichannel Digital Banking Platform Animation

5.2.5 Generate Results

Before the simulated model is run, it will be set up to run for 16 hours in 7 days as the Dubai Expo 2020 begins on 20th October 2020. The Expo will run for six months to 10th April 2021 (Expo 2020 Dubai 2019). The expo will have a wide range of demographic sample comprising of the younger generation, or rather, 'tech millennials' as well as the older generation, that are less inclined to technology. Figure 5.5 illustrates the run setup.

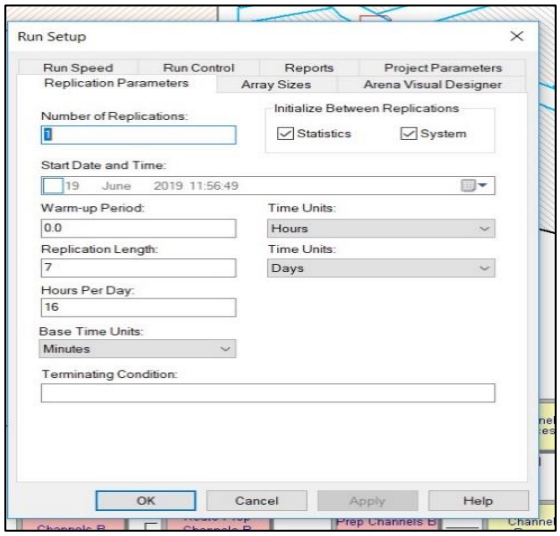


Figure 5. 8: The Run Setup environment for the module

The simulation report displays all queues in the model, the time spent by channels waiting in each queue, as well as the number of Entities waiting at each time. By looking at the average values for waiting time in queue and number waiting in queue, one can easily notice that the Channels A process has much longer waiting time and queue length than the other Channels B processes. This is obviously a source of concern; either the process doesn't have enough capacity to handle its work or there is a great deal of variability at this process.

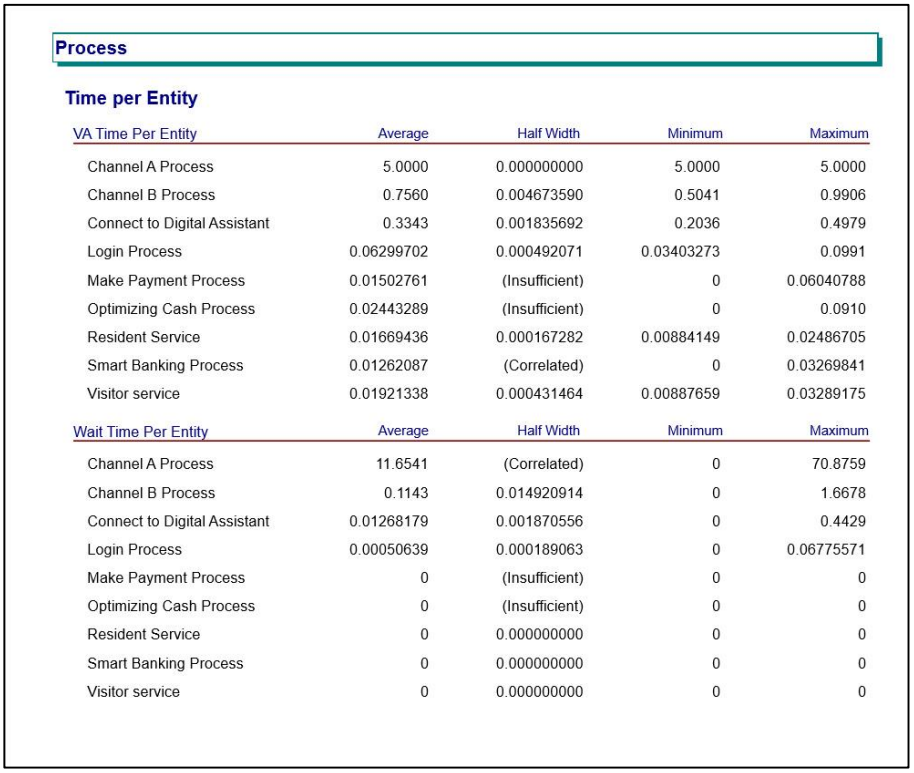
- **Entity → Time → Total Time:**
    - Offline channels: Avg. time in system was 8.8619 min., max was 43.65 min
    - Online channels: Avg. time in system was 0.020 min., max was 0.06 min
- **Resource → Usage → Instantaneous Utilisation:**
    - Offline channels: Utilisation was 0.84 (busy 84% of the time)
    - Online channels: Utilisation was 0.004 (busy 0.4% of the time)
- **Process → Other → Number In:**
    - During the run, 2281 entered the Channel A Process
    - During the run, 16847 entered the Channel B Process
    - During the run, 19126 entered the Login Process
    - During the run, 1636 entered the Make Payment Process
    - During the run, 1786 entered the Peer-to-peer(P2P) Process
    - During the run, 15681 entered the Smart Banking Process
- **Process → Other → Number Out:**
    - 2280 entities left the **Channel A Process** (so were complete transaction)
    - 16847 entities left the **Channel B Process** (so were complete transaction)
    - 19126 entities left the **Login Process** (so were complete transaction)

- 1636 entities left the **Make Payment Process** (so were complete transaction)
- 1786 entities left the **Peer-to-peer(P2P) Process** (so were complete transaction)
- 15681 entities left the **Smart Banking Process** (so were complete transaction)

- **Entity → Time → Wait Time:**
  - Offline channels: Avg. wait time in all queues was 6.361 min. (counts only entities that left the *system*, but Queue → Time → Waiting Time → offline channel. Centre Queue counts all entities that left *this queue*, so can differ)
  - Online channels: Avg. wait time in all queues was 0.00052 min. (counts only entities that left the *system*, but Queue → Time → Waiting Time → online channels. Centre Queue counts all entities that left *this queue*, so can differ)
- **Entity → Other → WIP:**
  - Offline channels: Average Work in Process was 3.098 min, max WIP was 16
  - Online channels: Average Work in Process was 0.611 min, max WIP was 5

The difference between the Number In and Number Out counters found zero which implies that either the login area does have enough capacity to handle its work or there is a great deal of variability at this section All of these results validate and address the third Hypothesis $\mathbf{H_1}$ of this research, which states that an increase in the customer interaction touch points through an omnichannel banking model will significantly increase the number banked customer and impact the UAEs government's objectives to transform traditional banking. From this hypothesis and the simulation report above, the study can conclude that smart banking has the highest rate of complete transaction and less waiting time in queue. The time per entity in the simulation is significantly lower for channel B, which consist of mobile apps and online banking as compared to channel A, which consists of ATMs and Kiosks.

Ideally, the next step is assuming that the model has been successfully verified that validates the model by comparing the results with similar measures in the actual system. Based on diverse reasons, simulation experts even admitted that the true model validation is almost impossible. Some of the reasons for this occurrence are the validation that implies the simulation which behaves just like the real system that may not even exist; hence, it is impossible to describe. Even in the event where system does exist may not be possible to capture all its complexities in the model; therefore, it is bound to be some variation between model and real system data. However, an idealistic goal invalidation is to ensure that the simulation is good enough so that it can be used to make decisions about the system. Obviously, the difficulty in validation grows with the complexity of the system being modelled. Thus, with this current model it is pretty easy to validate by just cross-checking with the information given in the problem description as shown in figure 5.6.



Process

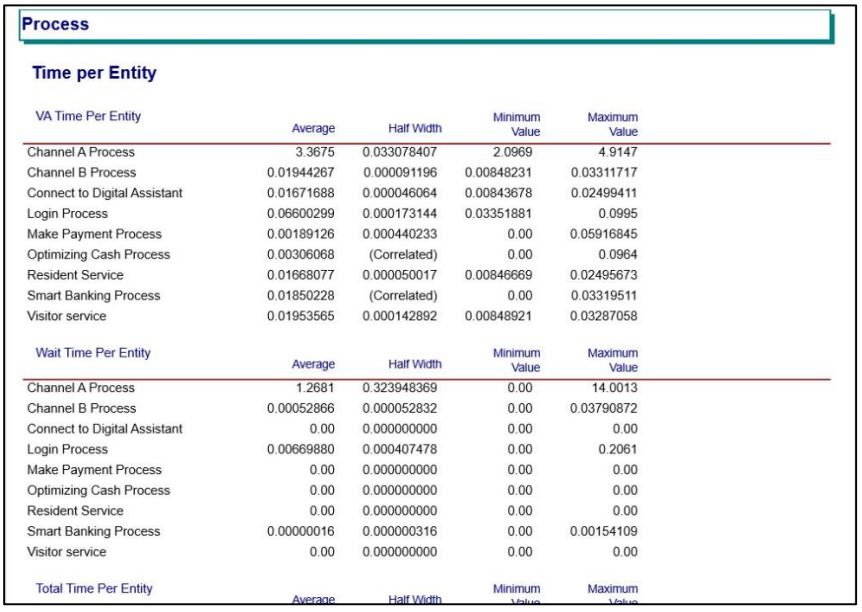
Time per Entity

VA Time Per Entity	Average	Half Width	Minimum	Maximum
Channel A Process	5.0000	0.000000000	5.0000	5.0000
Channel B Process	0.7560	0.004673590	0.5041	0.9906
Connect to Digital Assistant	0.3343	0.001835692	0.2036	0.4979
Login Process	0.06299702	0.000492071	0.03403273	0.0991
Make Payment Process	0.01502761	(Insufficient)	0	0.06040788
Optimizing Cash Process	0.02443289	(Insufficient)	0	0.0910
Resident Service	0.01669436	0.000167282	0.00884149	0.02486705
Smart Banking Process	0.01262087	(Correlated)	0	0.03269841
Visitor service	0.01921338	0.000431464	0.00887659	0.03289175

Wait Time Per Entity	Average	Half Width	Minimum	Maximum
Channel A Process	11.6541	(Correlated)	0	70.8759
Channel B Process	0.1143	0.014920914	0	1.6678
Connect to Digital Assistant	0.01268179	0.001870556	0	0.4429
Login Process	0.00050639	0.000189063	0	0.06775571
Make Payment Process	0	(Insufficient)	0	0
Optimizing Cash Process	0	(Insufficient)	0	0
Resident Service	0	0.000000000	0	0
Smart Banking Process	0	0.000000000	0	0
Visitor service	0	0.000000000	0	0

Figure 5. 9: First Simulation report displaying the result for each operation chart

Many enhancements were made to produce the best result of the simulation and it has exposed increasingly improved as shown in figure 5.7 below.



Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Value	Maximum Value
Channel A Process	3.3675	0.033078407	2.0969	4.9147
Channel B Process	0.01944267	0.000091196	0.00848231	0.03311717
Connect to Digital Assistant	0.01671688	0.000046064	0.00843678	0.02499411
Login Process	0.06600299	0.000173144	0.03351881	0.0995
Make Payment Process	0.00189126	0.000440233	0.00	0.05916845
Optimizing Cash Process	0.00306068	(Correlated)	0.00	0.0964
Resident Service	0.01668077	0.000050017	0.00846669	0.02495673
Smart Banking Process	0.01850228	(Correlated)	0.00	0.03319511
Visitor service	0.01953565	0.000142892	0.00848921	0.03287058

Wait Time Per Entity	Average	Half Width	Minimum Value	Maximum Value
Channel A Process	1.2681	0.323948369	0.00	14.0013
Channel B Process	0.00052866	0.000052832	0.00	0.03790872
Connect to Digital Assistant	0.00	0.000000000	0.00	0.00
Login Process	0.00669880	0.000407478	0.00	0.2061
Make Payment Process	0.00	0.000000000	0.00	0.00
Optimizing Cash Process	0.00	0.000000000	0.00	0.00
Resident Service	0.00	0.000000000	0.00	0.00
Smart Banking Process	0.00000016	0.000000316	0.00	0.00154109
Visitor service	0.00	0.000000000	0.00	0.00

Total Time Per Entity	Average	Half Width	Minimum	Maximum

Figure 5. 10: The best report results of the simulation.

5.2.6 Result, Analysis and Discussion

From the simulation report, the time per entity for Channel A, which stood at 8.8619 min, was significantly higher than that of Channel B, which was at 0.020 min. That means customers spent more time while accessing services at Channel A's platforms, that include the ATM and the Kiosk as compared to the time customers spent while accessing services at Channel B's platforms, which consist of mobile apps and online banking. There was also a huge discrepancy with the minimum and maximum time per entity for each channel. Channel A had an average minimum time per entity of 3.36 minutes and a maximum of 4.91 minutes for each machine in the channel, while Channel B has an average minimum time per entity of 0.0194 minutes and a maximum of 0.033 minutes. These figures indicate the speed time and efficiency of Channel B's platforms. To solve this long queue waiting time, the study has increased the number of machines in each zone as shown in figure 5.8; thus, in each zone of expo there will be four machines, therefore, the maximum time will be 2.5 minutes. Similarly, with regard to the queue waiting time, Channel B also proved to be more efficient as compared to Channel A; delivering a less queue time of 0.11413 while compared to a queue time of 11.6500. It can be concluded that platforms on Channel B have the highest rate of complete transaction, making it ideal for both business and personal banking.

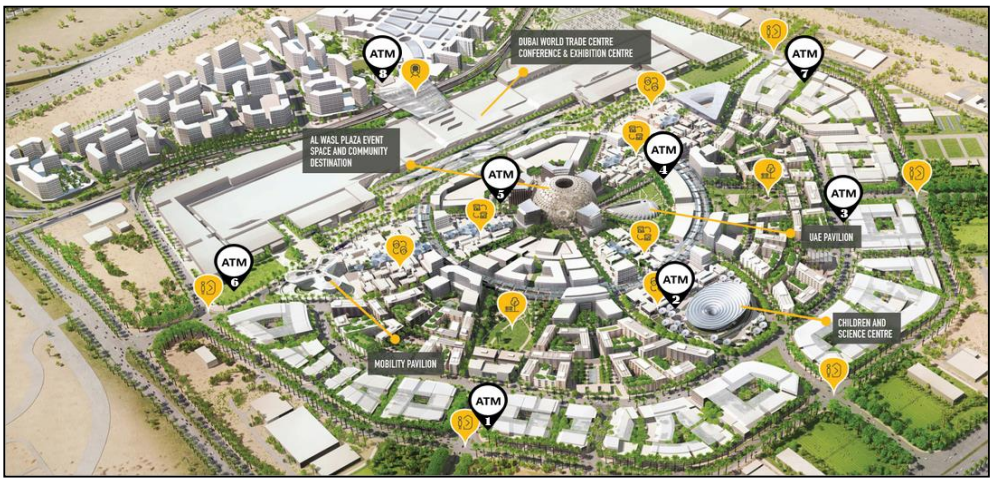


Figure 5. 11: The distribution of ATM and Kiosk machines in each zone of the expo 2020. (Expo 2020 Dubai 2019)

By analysing the simulation report, Channel A has a higher waiting and service time with fewer complete transactions. On the other hand, Channel B has a lesser waiting and service time with more complete transactions. With that observation made, the study is trying to integrate all the physical channels with digital banking services by using ATM and Kiosk application module not only to meet the customer needs and demand for more ATM services, but also increase bank transactions for the customer shown in figure 5.8.

In responding to this observation, omnichannel banking solution integrates all consumer's ATMs with other traditional and digital channels. In doing so, this channel or platform allows the offering of more services which in turn attract more customers due to the seamless experience that the platform has to offer – no matter which banking services they want. The distinction between the Number In and Number Out were zero, meaning that the login platform does not have enough capacity to handle the task. However, this proposed omnichannel platform adequately address the financial concerns and challenges of the Dubai Expo 2020.

When analysing these results from the simulation, it is important to note that for the results to truly reflect the actual system, it must be accurate and idealistic – factors that have been met by this simulation. It is expected that the results obtained in this simulation reflect with reference to the results of actual system. By taking this assumption, the results analysed by this research can prove useful in making the necessary preparations while setting up an omnichannel platform in the UAE. The simulation clearly shows the challenges and issues that can be anticipated in the course of running system. It also shows that digital platforms such as mobile apps and digital banking are useful tools in the omnichannel platform as it can access all banking services from one single channel. Channel A has tremendous challenges, for those concerning the time it takes to complete a transaction – a factor that has been addressed efficiently by Channel B platforms.

An additional problem in determining whether a simulation model is a valid representation of the system under analysis and relates to starting conditions. A contradiction arises in deciding if the simulation should be started with the system when it is empty (should we start by simulating a queueing system with no customers in line), or should the simulation be started as close as possible to a normal operating condition. Another problem that has already seen is the determination of how long the simulation should be run to reach true steady-state conditions. In general, a standard full proof procedure for validation is simply not possible. In many cases, the user of a simulation model must rely on the expertise and experience of whoever develops the model.

5.3 Verification of the Simulation Model

Although, the study can substantiate the arithmetical results of the omnichannel simulation model, it would still be difficult to ascertain if the model can be reproduced to represent what is in the actual world. In general, the user of the simulation model needs to be certain that the model is not only correct in its internal features, but also operations taking place within the simulation are required to be logical and correct, statistically. In order to establish this validity, there are a number of testing procedures that user of the model can implement. Among these mathematical testing procedures is the analytical hierarchy process (AHP), which can be used to determine if the model accurately represents the actual model that is being simulated.

5.3.1 Analytical Hierarchy Process

The analytical hierarchy process (AHP) is a mathematical tool for solving decision problems by categorising decision alternatives and selecting the best one. The method was developed by Thomas Saaty in the late 1970s and has been since used in understanding the structure of a problem as well as the hindrances that come while solving the problem (W.Taylor 2013, 440-449). The AHP

tool analyses the problem in three parts – the issue to be resolved, the alternative solutions available for the issue and the criteria to be used in evaluating the alternative solutions. While using the AHP, researcher first decomposes their problem or issue into a hierarchy of sub-issues that can be easily understood and analysed separately from other. These elements present in the hierarchy can correlate with any aspect of the decision issue. Once this hierarchy is established various elements is systematically compared to each other only two at a time, where the researcher can use concrete data about them.

These evaluations are then translated to numerical values which can be processed and compared throughout the entirety of issue resolution. A numerical weight is derived from each element in the hierarchy which then facilitates incomparable elements to be contrasted with each other in a consistent and rational manner. This characteristic alone is what makes AHP unique from other decision-making tools. As a final step in the AHP process, the numerical priorities are calculated for each of the decision alternatives, which represent the relative ability of the alternatives in order to attain the objective of the decision. Through this, they facilitate the straightforward deliberation of the various trajectories. To adequately utilise AHP in this study certain steps were taken.

5.3.1.1 Develop a pairwise comparison matrix for each decision alternation (Digital Banking system) for each criterion

The study did a comparison between the current digital banking platforms and the proposed omnichannel digital banking platform. The primary criteria on which the AHP will compare the platforms include:

1) Seamless access (from any device)
2) Services time.
3) Quality of digital banking services

4) Availability (24/7)

5) Functionality

6) Acceptance of customer needs.

7) A Sharia-compliant system availability.

The researcher in this study selected these criteria based on the research objectives and then sorted them in the customer survey to get the average preference by customer. For the current digital banking service (CDB), the study got the rates from the result of the customer service as shown in Appendix B; while for the proposed omnichannel digital banking service (ODB), the study got the rates from the simulation report.

5.3.1.2 Pairwise comparisons

In the analytical hierarchy process (AHP), the role of the decision maker is to use pairwise comparisons to analyse how each alternative score performs. Table 5.1 illustrates the standard preference scale that is used for AHP in this research study. This scale has been verified by qualified and well-experienced researchers as a suitable method for comparison.

Preference Level	**Numeric Value**
Equally preferred	1
Equally to moderately preferred	2
Moderately preferred	3
Moderately to strongly preferred	4
Strongly preferred	5
Strongly to very strongly preferred	6
Very strongly preferred	7
Very strongly to extremely preferred	8
Extremely preferred	9

Table 5. 1:Preference scale for pairwise comparisons (W.Taylor 2013, 440-449)

The rating from the pairwise comparison for each of the two systems is outlined in a matrix, which refers to a rectangular array of quantities or expressions in rows and columns. This matrix

comprises of rows and columns that are equivalent to the alternatives derived from the survey result of customers in the current digital banking as well as in the report gathered from the omnichannel digital banking platform.

System	**Seamless access**	
	CDB	ODB
CDB	1	$\frac{1}{4}$
ODB	4	1

Table 5. 2: Seamless access pairwise comparisons

The above matrix illustrates that the smooth and easy access in the omnichannel model is highly preferred over the digital banking platform that is used currently. In this analysis, it is important to note that any model that is compared to itself should be equally preferred and expressed in the matrix as a value of 1. The values that are listed along the diagonal of the matrix should be equivalent to 1. In addition to seamless access, the other comparison matrices include Service time, Quality of services, availability, Functionality, Acceptance of customer needs and Sharia-compliant system availability. This information is illustrated by the matrices below.

Seamless access

$$\begin{bmatrix} 1 & \frac{1}{4} \\ 4 & 1 \end{bmatrix}$$

Table 5. 3: Seamless access matrix

Service Time	**Quality**	**Availability**	**Functionality**	**Acceptance needs**	**Sharia**
$\begin{bmatrix} 1 & \frac{1}{9} \\ 9 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{6} \\ 6 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{4} \\ 4 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{6} \\ 6 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{7} \\ 7 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{8} \\ 8 & 1 \end{bmatrix}$

Table 5. 4

5.3.1.3 Synthesisation

The succeeding step in the AHP is to hierarchise the decision alternatives within each criterion. In the case of this systems selection, the study wants to establish digital banking system that is most preferred. This step in AHP is referred to as synthesisation. The mathematical procedure for synthesisation is very complex and surpasses the scope of this research. Instead, the researcher will use an approximation method for synthesisation that gives a rationally good approximation of preference scores for each decision in each criterion. The initial step in developing preference scores is to sum the values in each column of the pairwise comparison matrices. The column sums for Seamless access matrix are illustrated below:

System	**Seamless access**	
	CDB	ODB
CDB	1	$\frac{1}{4}$
ODB	4	1
	5	$\frac{5}{4}$

Table 5. 5

Next, each value in a column is divided by its corresponding column sum. This results in a normalised matrix, as follows:

System	**Seamless access**	
	CDB	ODB
CDB	$\frac{1}{5}$	$\frac{1}{5}$
ODB	$\frac{4}{5}$	$\frac{4}{5}$

Table 5. 6

Note the values in each column sum to 1. The succeeding step is to average the values in each row. At this stage, the fractional values in the matrix are converted to decimals, as shown in table 5.7.

System	Seamless access		Row Average
	CDB	ODB	
CDB	0.2	0.2	0.2
ODB	0.8	0.8	0.8
			1.0

Table 5. 7: The row average for each system is also shown in the same table.

Seamless access	Service	Quality	Availability	Functionality	Acceptance	Sharia
$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1\\0.9\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.125\\0.875\end{bmatrix}$	$\begin{bmatrix}0.1111\\0.8889\end{bmatrix}$

Table 5. 8

The row averages in Table 5.8 provides the system's preferences for the two systems for the seamless access criterion. The most preferred system is Omnichannel Digital Banking (ODB). These preferences can be written as a matrix with one column, which is referred to as a vector.

In the Table 5.9 below, the seven preference vectors listed in the previous paragraph are summarised in one preference matrix.

Criterion / System	Seamless Access	Service Time	Quality	Availability	Functionality	Acceptance needs	Sharia
CDB	0.2	0.1	0.1429	0.2	0.1429	0.125	0.1111
ODB	0.8	0.9	0.8571	0.8	0.8571	0.875	0.8889

Table 5. 9: The seven preference vectors

5.3.1.4 Ranking the Criteria

The following step in AHP is to establish the relative importance or weight of the criteria which implies the study needs to categorise the criteria from most important to least important. This is achieved by using the same method that was used in ranking the systems within each criterion – by using pairwise comparisons. The following pairwise comparisons matrix for the seven criteria in proposed model was developed by using the preference scale in Table 5.10 below.

Criterion	**Seamless Access**	**Quality**	**Availability**	**Functionality**	**Service Time**	**Acceptance needs**	**Sharia**
Seamless Access	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{2}$	3	2	2
Quality	2	1	$\frac{1}{2}$	$\frac{1}{2}$	4	2	4
Availability	3	2	1	2	6	4	5
Functionality	2	2	$\frac{1}{2}$	1	5	3	4
Service Time	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{5}$	1	$\frac{1}{2}$	$\frac{1}{2}$
Acceptance needs	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{3}$	2	1	2
Sharia	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{4}$	2	$\frac{1}{2}$	1

Table 5. 10

The normalised matrix converted to decimals, with the row average for each criterion, is shown in Table 5.11 below.

Criterion	**Seamless Access**	**Quality**	**Availability**	**Functionality**	**Service Time**	**Acceptance needs**	**Sharia**	**Row Average**
Seamless Access	0.10714	0.077	0.113	0.1045	0.13043	0.1538	0.1081	**0.11342556**
Quality	0.21429	0.154	0.169	0.1045	0.17391	0.1538	0.2162	**0.16944692**
Availability	0.32143	0.308	0.339	0.4181	0.26087	0.3077	0.2703	**0.31786493**
Functionality	0.21429	0.308	0.169	0.2091	0.21739	0.2308	0.2162	**0.22355793**
Service Time	0.03571	0.038	0.056	0.0418	0.04348	0.0385	0.027	**0.04020738**
Acceptance needs	0.05357	0.077	0.085	0.0697	0.08696	0.0769	0.1081	**0.0795592**
Sharia	0.05357	0.038	0.068	0.0523	0.08696	0.0385	0.0541	**0.05593807**
								1.0000000

Table 5. 11

The preference vector computed from the normalised matrix by computing the row averages in Table 5.11 is follows:

	Seamless access	Service	Quality	Availability	Functionality	Acceptance	Sharia
CDB ODB	$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1\\0.9\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.125\\0.875\end{bmatrix}$	$\begin{bmatrix}0.1111\\0.8889\end{bmatrix}$

Evidently, availability is the highest-priority criterion and Functionality is second. Service time and Sharia seem to be relatively unimportant priorities in teams if the overall objective is determining the best system. The succeeding step in AHP is to integrate the preference matrices that were developed for the systems for each criterion in Table with the preceding preference vector for the seven criteria.

5.3.1.5 Developing an Overall Ranking

Note that the study earlier summarised banking digital's preferences for each system for each criterion in a preference matrix as shown in table 5.12 and is replicated as follows:

	Criterion
Seamless access	**0.1134**
Quality	**0.1694**
Availability	**0.3178**
Functionality	**0.2235**
Service Time	**0.0402**
Acceptance needs	**0.0795**
Sharia	**0.0559**

Table 5. 12: Criterion in a preference matrix

In the previous section, the study applied pairwise comparisons in developing a preference vector for the seven criteria in proposed model in Table 5.10. An overall score for each system is calculated by multiplying the values in the criteria preference vector by the preceding criteria matrix and summing the product, as follows:

CBD = 0.1134(0.2) + 0.0402(0.1) + 0.1694 (0.1429)+ 0.3178 (0.2)+ 0.2235 (0.1429) + 0.0795 (0.125)+ 0.0559 (0.1111)= 0.1625534

ODB = 0.1134(0.8) + 0.0402(0.9) + 0.1694 (0.8571)+ 0.3178 (0.8)+ 0.2235 (0.8571) + 0.0795 (0.875)+ 0.0559 (0.8889)= 0.8371466

The two systems, in order of the magnitude of their scores, result in the following AHP ranking:

System	**score**
Current Digital Banking	0.1625534
Omnichannel Digital Banking	0.8371466
	1.000000

Table 5. 13

Based on these scores developed by AHP, Omnichannel banking system should be selected as the best platform use in UAE.

	Seamless access	Service	Quality	Availability	Functionality	Acceptance	Sharia
CDB ODB	$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1\\0.9\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.2\\0.8\end{bmatrix}$	$\begin{bmatrix}0.1429\\0.8571\end{bmatrix}$	$\begin{bmatrix}0.125\\0.875\end{bmatrix}$	$\begin{bmatrix}0.1111\\0.8889\end{bmatrix}$

5.3.2 AHP Consistency

AHP is anchored primarily on the pairwise comparisons in which a decision maker uses to determine preferences between decision alternative for different criteria. The normal procedure in AHP is to develop these pairwise comparisons for an interviewer to elicit verbal preferences form the decision maker by using preference scale of Table 5.1. However, when a decision maker has to make a large number of comparisons, they can lose track of previous responses. Because AHP is based on these responses, it is imperative that these responses should be valid at some extent and responses are consistent. A preference indicated for one set of pairwise comparisons needs to be consistent with another set of comparisons.

Using digital banking system selection model, researcher has conducted three interview exports from different government departments that play a vital role in the banking and technology sectors. It has been asked by them to scale the current digital banking service and proposed omnichannel digital banking with seven criteria that were selected and ranked against each criterion using Table 5.1. To compute the consistency index (*CI*), consistency will be checked of the pairwise comparisons for the seven criteria. This matrix shown below is multiplied by the preference vector for the criteria:

Criterion	Seamless Access	Quality	Availability	Functionality	Service Time	Acceptance needs	Sharia
Seamless Access	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{2}$	3	2	2
Quality	2	1	$\frac{1}{2}$	$\frac{1}{2}$	4	2	4
Availability	3	2	1	2	6	4	5
Service Time	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{5}$	1	$\frac{1}{2}$	$\frac{1}{2}$
Acceptance needs	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{3}$	2	1	2
Sharia	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{4}$	2	$\frac{1}{2}$	1

X

	Criterion
Seamless access	0.1134
Quality	0.1694
Availability	0.3178
Functionality	0.2235
Service Time	0.0402
Acceptance	0.0795
Sharia	0.0559

The production of the multiplication of this matrix and vector is computed as follows:

$$\begin{bmatrix} 0.80749965 \\ 1.021070969 \\ 2.28332277 \\ 1.61170215 \\ 0.28581534 \\ 0.56727189 \\ 0.39466942 \end{bmatrix}$$

Next, researcher divide each of these values by the corresponding weights from the criteria preference vector:

$$\begin{bmatrix} \frac{0.80749965}{7} = 7.11 \\ \frac{1.021070969}{7} = 7.145 \\ \frac{2.28332277}{7} = 7.183 \\ \frac{1.61170215}{7} = 7.20 \\ \frac{0.28581534}{7} = 7.1 \\ \frac{0.56727189}{7} = 7.13 \\ \frac{0.39466942}{7} = 7.05 \end{bmatrix} = 49.95109$$

To be a perfectly consistent each ration should be exactly 7.

Next, researcher average these values by summing them and dividing by 7.

49.95109/7 = 7.135871

The consistency index CI is computed by using the following formula:

$CI = \frac{\mathbf{7.135871-n}}{\boldsymbol{n-1}}$ (W.Taylor 2013, 440-449)

Where,

n = the number of items being computed

7.135871 = the average as it was computed previously

$CI = \frac{\mathbf{7.135871-7}}{\mathbf{7-1}}$ = **0.022645**

If *CI* = 0, research comparison would be perfectly consistent for the decision maker. Because comparison is not perfectly consistent, the next question is the degree of inconsistency that is acceptable. An acceptable level of consistency is determined by comparing the *CI* to a random index,

RI which is the consistency index of randomly generated pairwise comparison matrix. The *RI* has the values shown in table 5.12, depending on the number of items n, being compared. In proposed models, n = 7 because research is comparing seven criteria.

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Table 5.13: RI values for n items being compared (W.Taylor 2013, 440-449)

The degree of consistency for the pairwise comparisons in the decision criteria matrix is determined by computing the ratio of *CI* to *RI* (W.Taylor 2013, 440-449).

$\frac{CI}{RI} = \frac{\mathbf{0.022645}}{1.32} = 0.017155$

In general, the extent of consistency is satisfactory if $\frac{CI}{RI} < 0.10$, and in this demonstration, it is. This means that the study has verified the consistency for AHP.

5.4 Summary and Chapter Conclusion

This chapter focused on the modelling and evaluation of the omnichannel banking architecture as proposed in the previous chapter four. The chapter's main focus was developing a simulation similar to the actual platform in addressing some of the issues that might occur as well as making an analysis of the behaviour of the omnichannel in different categories. Through the ARENA simulation, the chapter also addressed research question three by identifying opportunities in order to adopt a unified digital banking solution in the United Arab Emirates (UAE) that delivers a frictionless omnichannel banking experience as well as allows customers to enjoy a seamless, secure, smart lifestyle and personalised service across every touch point by smart device.

This chapter also effectively addressed hypothesis one, H_1 of this research study suggested that an increase in the customer interaction touch points through an omnichannel banking model would significantly increase the number of banked customer and impact the UAEs government's objectives to transform traditional banking. The principal goal of omnichannel banking platforms is to avail customers a seamless and real-time banking experience such as real-time data synchronisation and access to a wide range of services all in one platform. Omnichannel platforms offer different services or products in one system such as smart banking and online payments. The omnichannel banking design, as discussed under chapter four of this research, focuses on retaining and gaining loyalty for the consumer through integrating various channels, services and products such that they are made more accessible, convenient and easy for the customer. The UAE banking sector is ripe for an omnichannel design; with a major contributor to this is the widespread use of smartphones and high internet and mobile network penetration rates. In addition, the platform offers customer transparency, flexibility, simplicity and speed (Rehfisch 2019). These benefits are not just for the customer alone but also for financial institutions as well since transactions are much more seamless.

To have a stable and efficient omnichannel banking design, certain frameworks must be first required to be considered and implemented. Among these frameworks include identifying the business objective by answering the what, how, and why. These questions are guide the financial institution, whether it is a bank or a FinTech company in order to develop its own omnichannel platform that addresses and is in line with their business objective. For example, a business objective could be reducing the queue time at money point or increasing the efficiency of services for the customer. The second framework to put in place after establishing the business objective is dividing the omnichannel platform into smaller, manageable parts. This is essential as it makes processes much easier, fast and efficient.

The omnichannel banking design needs to address the needs of customer and at the same time make all products of bank available on that platform. As it is a digital platform, issues such as security threats as well as authorisation and authentication of clients' platforms need to be adequately addressed. This can be done through the application of various artificial intelligence techniques such as machine learning as well as back-end tier programs. The main function of the omnichannel banking design is to facilitate user log in, connection to a digital assistant and allow banking functions such as making payments, optimising cash, and smart banking facilities. The design also allows various parties such as the customer, government departments and financial institutions to interact with each other within the platform. As mentioned earlier, the framework design also addresses risks that are associated with security, third-party stockholders and data management. From the simulation and the calculations derived from the analytical hierarchy process, the research study was able to actualise this hypothesis efficiently and adequately. Through the AHP, the study was also able to test and address the effectiveness of Hypotheses 4 and 5 (H4 and H5), which were the foundation hypotheses for the previous chapter.

CHAPTER 6

Discussion and Conclusions

6.1 Discussion

This thesis addresses the proposed conceptual framework of the omnichannel banking that has filled the gap between the current digital baking services and customer need. However, the thesis does not address issues related to blockchain, cryptocurrency, cybersecurity, and customer trust. The thesis also does not analyse and discuss how to implement the proposed model in the real world as well as investigate how the government unites all Emiratis to adopt FinTech soultion. Although, these issues are outside the scope of the thesis, the following sections discuss how the omnichannel platform needs to be extended to contribute to these problems.

Technological developments have affected all sectors. Each sector is required to rethink its acquisition and loyalty strategy based on the challenges of digitalisation of the world. Inescapable stockholders in our societies, banks and insurance companies must adapt to this renewal. The customer today is omnichannel and in addition to communicating with the company through different channels (and devices) can initiate contact with the brand in one channel and end in another. Therefore, it is essential that all sectors, in this case the financial sector, have the capacity to, in addition to being in all possible channels, offer their services in them in the best possible way: simpler, more accessible, more useful, more Innovative and cutting edge.

They must master the cooperation and coexistence of all forms of communication (cloud services, Business to Business (B2B), Business to Consumer (B2C), Bring Your Own Device (BYOD), Big Data and IoT sensors to achieve success , since the latest studies related to digital transformation agree that managing that omnichannel is a key in the near future, which is why banks must be aware of the challenge and the challenges involved. Recent research shows that a large proportion of clients want to manage their financial needs by combining different channels and

devices. It is for this reason that the multi-channel strategy developed in recent years is forced to migrate towards an omnichannel strategy. The presence of a brand and offering services on each channel is no longer enough.

Most Financial Institutions have multi-channel capabilities with regard to people, systems and processes; allowing customers and prospects to be served independently in each of the channels. This reality obliges them not only to provide and maintain a channel, but to develop a fully integrated vision, in order to adequately meet the needs of the client. Banks must not only provide a multi-channel strategy in terms of access, but must be able to meet the needs of the client through the interaction of a multiple combination of channels that the Client can choose. This represents a change of approach in the way in which a multi-channel strategy was traditionally conceived.

According to the study, Emerging Technologies in Retail Banking, The Long Road to Customer Centricity, in 2012, 73% of customers used the bank branch as the primary channel, currently that figure decreased to 54%. It should also be noted that 40% of users hire products online. This new Omnichannel reality, as well as the expectation of the Clients, represents a disruptive change, generating a high impact on the banks, who are forced to constantly monitor the context of the Client, ensuring that all channels have a consistent view of the data. in transit, either to finalize a transaction or to leave according to the Client. Based on this global trend, SAP offers its Omnichannel Platform, providing solutions for both Customers and employees of the Organisation. The SAP Omnichannel Platform for Banks is a scalable platform, which allows independent sources of information as well as Channels and Technologies, providing pre-configured business content as well as the flexibility necessary to develop functionalities that guarantee consistent experiences for the Customer, whether individuals or companies.

This platform allows you to dramatically simplify the architecture of channels, optimizing time and investment in IT. The Platform supports developments made by the Bank, as well as third

parties, including SAP and its extensive network of globally certified partners. SAP already offers solutions on this platform, including Internet and Mobile Banking for both Individuals and companies, including mobile payment features, transfers, electronic wallet, geo-location-based services, check capture and processing, reality scenarios increased, integration with social networks, reports, treasury management, workflows, authorisations, among the most relevant.

The Federal Authority for Competitiveness and Statistics conducted a study that revealed that the percentage of digital banking users in the United Arab Emirates increased to 90 percent while the percentage of ATM users reached 100 percent, reflecting the increasing automation of the banking sector from the country. The same studies also show that many UAE residents use mobile phone banking, including those who use online banking services. This development is backed by the interest of banks operating in the United Arab Emirates to invest in the latest technologies and provide services to customers, including mobile banking services. The studies, which investigated the services of 19 banks, indicate that the number of downloads and installation of banking applications varied from 90,000 to 5.4 million, highlighting the demand of bank account holders for digital banking solutions.

The banking sector of the United Arab Emirates is dynamic and recently witnessed several initiatives that aim to facilitate access to banking services. According to the official news agency of the Emirates, WAM , some banks are using robots to facilitate access to their banking services . Therefore, hybrid banks may decrease staff dependence in the future. An earlier study by McKinsey showed that people in the United Arab Emirates are willing to open bank accounts online, since 48 percent of the population supports this option in the banking industry. 100% of banks understand the importance of creating a continuous omnichannel experience. However, the reality is quite paradoxical, since:

- 61% consider it extremely important the omnichannel.

- Only 1 in 5 banks is expanding its omnichannel strategy.
- In most banks, the exploration, experimentation or deployment phase of their omnichannel strategy is delayed, delaying the actual execution and showing that there is a mismatch between the objectives set and the action.

But what is the reason for this lack of coincidence between plans and results? One of them has to do with the existing channel delivery architecture. Most financial institutions lack a centralised platform from which to manage their private channels and open to clients effectively. As a consequence, back-end and front-end are isolated. The solution goes through a correct technological choice, although some digital maturity is necessary to be able to take the banks to the height of the technology companies, the startups and the neobanks. Mobile devices are present in the life of any individual, in all its spheres. From file sharing on a personal level or the use of instant messaging services, to online shopping or home insurance management. The omnichannel is a trend, not only at the linguistic level, but in regard to the final user experience.

It does not matter if it is the purchase of products or the contracting of services because the client, much more sophisticated than years ago, regularly uses multiple devices and a variety of channels to perform their tasks and hopes to enjoy the same experience in all of them. Banking consumers do not want barriers, limitations or interruptions when moving between devices and channels. To retain customers and attract new segments, companies in the sector must prioritise their omnichannel efforts. In their plans they can be inspired by the example of such successful strategies as Netflix and its offer of movies and series. It is likely that the answer is not at this time, however, there are ways to make it affirmative. For that to be possible it is necessary:

1. Understand the differences between the different points of contact, customer expectations, their usage habits and the limitations of existing systems.

2. Change from an inherited and vertical approach to a horizontal approach where there are no silos.
3. Have flexible APIs for the main processes and central systems.
4. Complete these applications with an intermediate orchestration layer that guarantees the transfer and persistence of the session.
5. Move the flexible layer of customer experience that runs independently of the main stack.
6. Acquire a holistic view of all channels avoiding simply creating a solid strategy for each one.
7. Ensure that, no matter how the customer interacts with the bank, you can always get the same brand experience and service, because the correct data is available at the right time.

61% of banks say they are not satisfied with their marketing / communication solution and recognize the importance and the need for a tool that can manage the customer relationship centrally; and 70% of these have planned to change. Many banks claim to be able to deploy commercial offers on the different channels used by customers. But for truly integrated communications campaigns, you need an omni-channel marketing solution that enables intelligent, centralized channel management to gather accurate information about customer choices, preferences, and ad campaign responses. Interesting data to analyze carefully to build future communication strategies.

The omni-digital customers expect a fluid experience: what matters to them is to be able to use the channel of their choice to see their problem solved. Companies must therefore be able to offer a consistent quality of service across all their points of contact. The name omni-digital incorporates a strong connectivity dimension that is a major challenge for companies vis-à-vis the offer of points of contact they offer to their customers or their users. In addition, digital tools such as interaction platforms, CRM, statistical tools, call platforms, process manager, etc.) have become crucial for Customer Relations departments. It is thanks to the inter-connectivity of all these tools that a more

than fluid flow of information, which has become essential, is made possible. Omni-digital is the framework for analyzing the needs of external users and employees, as well as the answers given to them by companies. This approach is a reflection of the willingness of companies to adopt the preferred digital channels of their customers and to reduce their efforts, the benefit having the greatest impact on loyalty.

6.1.1 Blockchain and Cryptocurrency

Determing that the UAE uses platforms like blockchain for advanced exchanges, thereby giving every client a one of a kind unique number that focuses on their data security chain. As seen from this thesis data and information on the blockchain cannot be hacked, thereby guaranteeing the computerization of security of national records and exchanges and in the end lessen operational cost and quickening the basic leadership. clearly, the probability of monetary transactions without central financial power to control the business has been portrayed as implausible by a few. However, there are those who still hold a contrary opinion. Blockchain innovation is portrayed by decentralized records of the exchanges which happen across distributed systems without a focal affirming authority. Holding the opinion that Cryptographic money is put away in electronic databases or blockchain. The financial exchanges are checked by thorough calculations with no interest by a national bank. Bitcoin has been on the rise over the years owing to ease of transactions. This has been a continued change in the blockchain businesses and the desire of improve on the businesses generally. It has convinced that the ventures in the digital financial sector has been on a steady rise than the traditional banking expedition. Because of the namelessness of Bitcoin and the slacking of important administrative structures, the appeal is high for Ponzi plans and different kinds of budgetary extortion. there is, therefore, a need for the UAE government to put into consideration in their budgetary structures room for blockchain businesses.

Doubtlessly, blockchains and digital currency are in the outset phases of advancement with a decent variety of proposed potential in the budgetary administrations' division. Nevertheless, contend that 'in no way, shape or form is FinTech in its outset and money guidelines should get up to speed the FinTech insurgency. The potential advantages of the fundamental blockchain innovation and digital money incorporate openness, maintained records, and decreases in cost. The vulnerability related with blockchains and digital money incorporates complex frameworks, guidelines, difficulties of execution and other existing stages.

6.1.2 Consumer Culture in digital spending behavoiur

Clearly, from the presented discussions, it convinced that consumer culture alludes to the ways of managing the consumer finances and is considered as a basic component in the improvement and development of a nation's economy. Also, that the adjustments in buyer culture can be ascribed to a few components, among them, expanding the financial position of a country. Taking an example of the UAE is considered as the main consideration. UAE has had a high growth rate owing to the proper financial management process.

Innovation is the engine behind the fast growth of the UAE economy and the world over. The converging of innovation with budgetary management is the foundation of advanced banking and FinTech companies which have contributed massively in expanding consumer control. It seems that the usage of the omnichannel stage, where every single budgetary arrangement is available at one stage will be no restriction to customer spending. Another key factor that drives consumer culture in the UAE is the nature of the item and services and this additionally incorporates administrations and items offered by budgetary establishments, for example, banks. Having said that clients look to have an advanced financial stage which is not just helpful and simple to utilize yet

additionally has consistent highlights and appealing items, for example, loaning and payment management.

6.1.3 Cybersecurity

As stated, innovation in the financial area, the future of digital banking and blockchain records still remain minimal against cybersecurity dangers to data security, misrepresentation, robbery, and business disappointments. FinTech organizations are the new industries that are missing authorization or traditional relationships with the financial divisions as high chance, present moment, or simply transient monetary administrations prevailing fashions. New innovations have helped the banks to serve their clients better through a wide scope of administrations; nonetheless, the developing advances likewise make the segment defenseless against change cyberattacks that are encouraged by the interconnectivity of gadgets and stages.

Banking establishments everywhere throughout the world including the UAE are setting up measures to forestall and balance a portion of the emerging security dangers. Some of these measures include consistencies with digital guidelines by budgetary foundations, for example, banks and other FinTech organizations. These digital guidelines feature the strategies and procedure of taking care of huge information just as the measures or steps to take in the event that there is a digital assault. Banks are currently beginning to recognize that cybersecurity is never again an innovation issue yet a business issue that could devastatingly affect both the association and its clients. Other safety efforts that have worked incorporate firewalls, strong anti-virus, discovery frameworks for the interruption, encryption documents, and frameworks, and login passwords.

6.1.4 Customer Trust

Essential challenges that have been considered by new FinTech companies incorporate buyer trust and the absence of money to put resources into the new stages. However, there are aware of reports of extortion in the banking networks have raised questions and fears with regards to the authenticity of FinTech new companies and the physical assets of the potential rates of return. FinTech companies are ceaselessly getting famous with the ascent of new and better innovation and more individuals are beginning to lean toward FinTech administrations of banking when contrasted with the customary and manual framework. Along these lines, it is a direct result of this explanation that FinTech new businesses must form customer and administrative trust in their foundation over the timeframe.

It is without a doubt that FinTech organizations in the UAE ought to exploit the government support that they are getting at the moment. Government support has been exhibited through the foundation of financial and innovation centers that have brought about high ventures new companies and requests into budgetary innovation than some other nation in the Gulf district. UAE shows incredible potential even later on for these administrations as more FinTech new companies are relied upon to come up. FinTech organizations should concentrate on improving their center items and administrations. These administrations have been talked about in detail in Chapter two of this theory and they incorporate administrations, for example, distributed loading, online instalments, versatile application services and misrepresentation security investigation.

6.1.5 Implementation the Proposed Model in the Real World

FinTech professionals propose a framework that is simple on the ground, there are troubles in the connection between various branches int the UAE. The issue does not lie with the innovation that has been proposed in this thesis but rather the guideline that oversees the financial segment in the UAE. Concerning issues of security reactions by banks in the UAE, the Central Bank needs to set up new guidelines that will bring together every one of the banks in the nation. This will help in setting up solid and solid safety efforts to counter cyber-attacks that have gotten excessively basic lately. There is the issue of recognizing and tending to brought together central government divisions in the UAE in connection to cybersecurity.

6.1.6 Analysis of how the Government will Unite all Emiratis to Adopt FinTech Solutions

As the world keeps on progressing in innovation and availability through web and versatile systems, there is no uncertainty that the eventual fate of the financial segment exists in FinTech arrangements. As it has been settled by this thesis, innovation development is the spine and the main thrust for FinTech organization. as seen, the United Arab Emirates has made it simpler for FinTech organizations to develop and grow their client reach. Some of these plans open doors and remember improving versatile and web infiltration for the nation.

As mentioned in part two of this proposition, developing the need and dependence on FinTech plans have brought about the end of traditional banking. As a result, traditional banks are showing eagerness to effectively search out developments by FinTech organizations that could help in improving their administrations. A stage forward for banks in

digitalizing their foundation is improving their center banking frameworks by the utilization of innovation, for example, distributed computing, man-made brainpower, and information investigation.

The UAE government through the supervision of the Central Bank have the option to control and improve the association of the nation's financial sector. The Central Bank assumes a significant job in bank supervision and the foundation of administrative systems that screens and aides the exercises in the financial division through laws, for example.

FinTech additionally need to set objectives that will convey the degree of personalization, straightforwardness, speed and consistent support of their customers while relieving potential dangers from contenders.

The UAE government join the nation in embracing FinTech progression is through mindfulness a component that the administration is at present doing effectively. A dominant part of the populace in the UAE has a place with the best of the world and knows about FinTech and advanced banking arrangements. For example, mobile applications and shared loaning and others. The greater part of the populace has a cell phone and internet. In this manner, improved financial transactions come simply for the populace. FinTech organizations are broadly utilized for cash transfers. An additional bit of leeway that the legislature can use in empowering the reception of FinTech arrangements is its omnichannel trademark that enables clients to get to all administrations in a single stage.

6.2 Testing the Thesis Hypotheses

The research is driven by five hypotheses which are described below.

6.2.1 Testing Hypothesis H2 and H3

Hypothesis H2 stated that '*A significant, positive correlation exists between the satisfaction of people who own an active checking account and digital banking solution outcomes*.'

This was investigated in Chapter 3 by conducting a survey which has analysed the correlation between user satisfaction and digital banking solutions and calculated the value of 0.64 that was implying that the two variables were fairly related. In addition, the positive value further indicated that there was a positive association between the two variables; hence, an increase in one caused an increase in the other. The probability value (significant value) was equal to 0.000. The value was less than 0.05, the set level of significance implying that the correlation was significant. In this regard, the study accepts the second hypothesis H2 which means that a significant, positive correlation exists between the satisfaction of people who own an active checking account and digital banking solution outcomes. As such evidence was found to support for hypothesis H3.

Hypothesis H3 stated that' *There is negative correlation between the number of digital, mobile or online bankers and those who own active checking accounts*.'

This was also investigated in chapter 3 where the researcher conducted a survey which illustrated that the study used regression analysis technique to test hypothesis related to the second research question. The hypothesis was:

Hypothesis H3: There is negative correlation between the number of digital, mobile or online bankers and those who own active checking accounts.

6.2.2 Testing Hypothesis H1

Hypothesis H1 stated that '*An increase in the customer interaction touch points through an omnichannel banking model will significantly increase the number banked customer and impact the UAEs government's objectives to transform traditional banking.'*

This was investigated in Chapter 5, where the research illustrated and described a new omnichannel banking model. The objective of the omnichannel banking platforms is to avail customers a seamless and real-time banking experience such as real-time data synchronisation and access to a wide range of services all in one platform. Omnichannel platforms offer different services or products in one system such as smart banking and online payments and integral multiple channels. The omnichannel banking design, as discussed under Chapter Four of this research, focuses on retaining and gaining loyalty for the consumer through integrating various channels, services, and products such that they are made more accessible, convenient, and easy for the customer.

From the simulation report, the study is trying to integrate all the offline channels with online channel of digital banking services by using ATM and Kiosk application module to not only meet the customer needs and demand for more ATM services, but also increase bank transactions for the customer. In responding to this observation, this omnichannel banking solution integrates all consumer ATMs with other traditional and digital channels. In doing so, this channel or platform allows the offering of more services which will, in turn, attract more customers due to the seamless experience that the platform has to offer – no matter which banking services they want. The model has been verified by using AHP tool and determine the consistency of AHP.

6.2.3 Testing Hypothesis H4 -H5

Hypothesis 4, H4, suggested *implementation of standardization and regulatory policies by the UAE government will positively impact the growth of FinTech and drive the successful transition from traditional banking to omnichannel banking model.*

On the other hand, H5 proposes that *there is positive correlation between the UAE government strategy to transform to smart cities and omnichannel banking services across all the self-service channels.*

Both hypotheses have been analysed in depth throughout chapter 4, where both hypothesis 4 and 5 sought to understand how various stockholders in the interoperability of banking in the UAE collaborate in ensuring an efficient omnichannel banking system. H4 sought to explore the implementation of standardisation and regulatory policies by the UAE government while H5 sought to understand the positive correlation exists between UAE government strategy to transform for smart cities and omnichannel banking service with seamless access across all self-service channels. However, the method described above addresses hypothesis H4 and H5, the effectiveness of the method cannot be tested at this point. This method was tested and analysed in Chapter 5, which is used an integrating simulator model in illustrating and describing the omnichannel digital platform in the UAE.

6.3 Summary

This chapter summarises the work reported in this thesis and presents the benefits of the approach taken in providing solutions to the current digital banking system in the United Arab Emirates (UAE). The research proposed an alternative digital banking solution that delivers frictionless omnichannel banking experience and allows customers to enjoy seamless, secure, smart lifestyle and personalised service across every touch point by smart device at any channel and anywhere in the UAE. It also proposed that the use of omnichannel, models and situations as a means of providing the evaluation team with process guidance. This chapter also describes some limitations of the method developed in this thesis and proposes future work that is needed to improve it. Particularly, the proposed method needs to be improved to address issues regulation. The chapter

concludes by identifying future research directions on digital banking approaches. The deliverables of the research are:

- Frictionless omnichannel banking experience allows customers to enjoy the seamless, secure, smart lifestyle and personalised service across every touch point by the smart device by any channel and anywhere in the UAE.
- Personalised conversations thereby fulfilling the explicit needs of the customers and products then anticipate the customers want.
- Fill the service gaps in current digital banking services.
- Supporting the UAE 2021 vision in united in knowledge' innovation in technology is considered as the pillar of knowledge that is driven; while, competitive economy is promoted by entrepreneurs who value the private and public partnerships.
- Introduce a smart financial service for smart cities in the UAE more specifically in Abu Dhabi and Dubai.

In chapter one, the aims and approaches of this thesis were outlined. The objective was to develop a method to address the problems that current digital banking sector is facing. To structure and drive the research, five hypotheses were identified. Chapter two summarised previous and current trends into two main research areas. Research on digital banking has focused on methods, techniques, and tools for the transformation to digitalisation by omnichannel banking strategy. On the other hand, research on digital banking systems within this thesis focused on the architecture, design and integration; however, it did not include the security requirement and product selection phases that must be preceded design and integration.

6.4 Contributions to Research on Digital Banking

This chapter summarises the work reported in this thesis and presents the benefits of the approach taken in providing solutions to the current digital banking system in the United Arab Emirates (UAE). The research proposed an alternative digital banking solution that delivers frictionless omnichannel banking experience and allows customers to enjoy seamless, secure, smart lifestyle and personalised service across every touch point by smart device at any channel and anywhere in the UAE. It also proposed that the use of omnichannel, models and situations as a means of providing the evaluation team with process guidance. This chapter also describes some limitations of the method developed in this thesis and proposes future work that is needed to improve it. Particularly, the proposed method needs to be improved to address issues regulation. The chapter concludes by identifying future research directions on digital banking approaches. The deliverables of the research are:

- Frictionless omnichannel banking experience allows customers to enjoy the seamless, secure, smart lifestyle and personalised service across every touch point by the smart device by any channel and anywhere in the UAE.
- Introduce a smart financial service for smart cities in the UAE more specifically in Abu Dhabi and Dubai.
- Personalised conversations thereby fulfilling the explicit needs of the customers and products then anticipate the customers want.
- Fill the service gaps in current digital banking services.
- Supporting the UAE 2021 vision in united in knowledge' innovation in technology is considered as the pillar of knowledge that is driven; while, competitive economy is promoted by entrepreneurs who value the private and public partnerships.

In chapter one, the aims and approaches of this thesis were outlined. The objective was to develop a method to address the problems that current digital banking sector is facing. To structure and drive the research, five hypotheses were identified. Chapter two summarised previous and current trends into two main research areas. Research on digital banking has focused on methods, techniques, and tools for the transformation to digitalisation by omnichannel banking strategy. On the other hand, research on digital banking systems within this thesis focused on the architecture, design and integration; however, it did not include the security requirement and product selection phases that must be preceded design and integration.

6.5 Limitation of the research

The research into the success bit of omnichannel in the UAE was largely thorough. The proposal of the purely mobile banking and the promotion of the shift to a digital platform for the improvement of the customer interactions and the development of a realistic approach towards the implementation of the omnichannel missed on some of the fundamental basics of a proper thesis. For instance, there was no adequate data backed up with evidence from the field coupled with real-time analysis of the consumer feedback. Though the thesis mentions such statistical analysis methods such as ANOVA and correlation, there is lacking a strong yet evidentially backed analysis that proves this beyond any reasonable doubt. The development of Fintech is on the rise from outside and within the UAE. However, the thesis, save for the sample questionnaire did not provide real data proof from the financial sectors within the UAE. There was not enough time to ensure that the statistical backing for the information given is examined for credibility. The thesis, therefore, is a candidate for further examination with further research proposed to ensure that such areas are addressed amicably to avert any doubts that may arise from the same. This thesis has discussed some of the divisions of omnichannel banking including email and mobile applications. However, there is no mention of the most effective digital banking that uses USSD technology and

the mobile platform all the same. It remains to be seen how far this technology can be used to ensure that it raises the threshold for implementation in the UAE. Due to space and time constraints, the thesis majorly focused on the UAE and its constituent countries, such Dubai. There is little comparison with other continents that have also geared towards the omnichannel business. The research questions failed to effectively nail some of the comparison approaches that have been used in other continents and countries

6.6 Future Work

As stated in the beginning of this chapter, this thesis focused on investigating and exploring the current state of digital banking solutions in the UAE and potential for adopting a unified omnichannel baking platform that deliver frictionless omnichannel banking experience as well as allows customers to enjoy seamless, secure, smart lifestyle and personalised service across every touch point by smart device through any channel and anywhere in the UAE. The research also proposed the use of omnichannel models and situations as a means of providing the evaluation team with process guidance. This model was developed to illustrate the omnichannel platform's ability to integrate customers, banks, FinTech companies and the UAE Government.

However, the thesis was not able to address the role of blockchain technology in omnichannel banking as well as how the omnichannel banking model implementation in the real world including how the UAE government will unite all Emiratis to adopt FinTech. The scope of the thesis also did not investigate the type of cybersecurity technology used in omnichannel banking. Although, some of these elements were mentioned in this thesis, there is a need for future research on each of them that will give readers a deeper and more specific understanding. The conclusions made in this thesis can also form a basis through which further studies can be done on the financial industry in other countries or regions. As an emerging trend in the digital financial sector, further study should also be

done to address issues related to cybersecurity, blockchain, cryptocurrency, and customer trust within an omnichannel platform.

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APPENDICES

Appendix A

Frequency Table

Table 3.1: Customers data observation

Table 3.2: Research Timeline

Table 3.3: Company strong differentiation from competitors

The company that I work for has strong differentiation from competitors:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	3	15.0	15.0	15.0
	Agree	11	55.0	55.0	70.0
	Strongly agree	6	30.0	30.0	100.0
	Total	20	100.0	100.0	

Table 3.4: Relatonship between the local population and global population

The company that I work for targets the local population within the UAE rather than a global population.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	3	15.0	15.0	15.0
	Agree	13	65.0	65.0	80.0
	Strongly agree	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

Table 3.5 Progress of FinTech sector in UAE

The FinTech sector in the UAE is developing rapidly:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	12	60.0	60.0	90.0
	Strongly agree	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 3.6: Progress of FinTech sector outside UAE

The FinTech sector is developing more rapidly outside of the UAE and the region:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	5.0	5.0	5.0
	Neutral	7	35.0	35.0	40.0
	Agree	9	45.0	45.0	85.0
	Strongly agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.7: Dubai Expo 2020 and FinTech products and services

Attendees at Dubai Expo 2020 would benefit from the FinTech products and services offered by [company name].

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	10.0	10.0	10.0
	Neutral	3	15.0	15.0	25.0
	Agree	12	60.0	60.0	85.0
	Strongly agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.8: FinTech in UAE and traditional banks from the products and services

FinTech in UAE is growing because many people are excluded by traditional banks from the products and services that they need.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	10.0	10.0	10.0
	Neutral	9	45.0	45.0	55.0
	Agree	9	45.0	45.0	100.0
	Total	20	100.0	100.0	

Table 3.9: Growth of FinTech in the UAE with relation to foreign visiting workers and international tourists and business persons

The growth of FinTech in the UAE is largely due to the international and cosmopolitan nature of many of its cities, such as Dubai, with a high percentage of foreign visiting workers as well as international tourists and business persons:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	9	45.0	45.0	45.0
	Agree	10	50.0	50.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.10: UAE FinTech hub

The UAE is the main FinTech hub for the GCC/Middle East:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	10.0	10.0	10.0
	Neutral	3	15.0	15.0	25.0
	Agree	15	75.0	75.0	100.0
	Total	20	100.0	100.0	

Table 3.11: Banks as partner rather than FinTech products and services

In the UAE, it is likely that banks will partner with, rather than compete with, FinTech products and services:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	5.0	5.0	5.0
	Neutral	6	30.0	30.0	35.0
	Agree	10	50.0	50.0	85.0
	Strongly agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.1: Issues of regulatory compliance

The issues of regulatory compliance are a burden for FinTech companies:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	20.0	20.0	20.0
	Neutral	11	55.0	55.0	75.0
	Agree	4	20.0	20.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.2: Products and services geared to businesses

The products and services offered by the company that I work for are primarily geared to businesses.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	10	50.0	50.0	80.0
	Strongly agree	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

Table 3.3: Targeting or attracting new customers

Targeting or attracting new customers is a major objective of the company that I work for:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	4	20.0	20.0	20.0
	Agree	14	70.0	70.0	90.0
	Strongly agree	2	10.0	10.0	100.0

	Total	20	100.0	100.0	

Table 3.4: Demand for the company products and services

There is considerable demand for the company products and services among UAE residents:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	5	25.0	25.0	25.0
	Agree	13	65.0	65.0	90.0
	Strongly agree	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 3.5: UAE residents and challenges with international banking

UAE residents are the ideal customers because of challenges with international banking:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	5	25.0	25.0	25.0
	Agree	12	60.0	60.0	85.0
	Strongly agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.6: FinTech market segment

FinTech has a very narrow market segment in terms of demographics:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	13	65.0	65.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.7: Expansion of products and services beyond UAE

Expansion of products and services beyond the UAE would not make sense at this time:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	10.0	10.0	10.0
	Neutral	6	30.0	30.0	40.0
	Agree	12	60.0	60.0	100.0
	Total	20	100.0	100.0	

Table 3.8: Products and services and traditional bank

The company I work for currently provides products and services that are marketed towards underserved or marginalised groups which have historically had little access to traditional banking, such as the poor:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	13	65.0	65.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.20: Partnerships in between FinTech firms or banks

The company that I work for has partnerships with other FinTech firms or banks:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	7	35.0	35.0	35.0
	Agree	8	40.0	40.0	75.0
	Strongly agree	5	25.0	25.0	100.0
	Total	20	100.0	100.0	

Table 3.21: Traditional banking products and services with FinTech

Traditional banking products and services are still needed, as the state of FinTech in the UAE has not reached maturity:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	5	25.0	25.0	25.0
	Agree	7	35.0	35.0	60.0
	Strongly agree	8	40.0	40.0	100.0
	Total	20	100.0	100.0	

Table 3.9: Traditional banking disadvantages then FinTech products and services

Traditional banking has major disadvantages in comparison to FinTech products and services available in the UAE:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	5.0	5.0	5.0
	Neutral	4	20.0	20.0	25.0
	Agree	13	65.0	65.0	90.0
	Strongly agree	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 3.10: Financial illiteracy of customers or clients

Financial illiteracy is a problem for the customers or clients of the company that I work for:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	5.0	5.0	5.0
	Disagree	6	30.0	30.0	35.0
	Neutral	8	40.0	40.0	75.0
	Agree	4	20.0	20.0	95.0
	Strongly agree	1	5.0	5.0	100.0

	Total	20	100.0	100.0	

Table 3.11: Problem with FinTech products and services

One problem with FinTech products and services in the UAE is the negative impact they can have on an individual credit score:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	15.0	15.0	15.0
	Disagree	7	35.0	35.0	50.0
	Neutral	7	35.0	35.0	85.0
	Agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.12: Products and services offered towards urban professionals

The products and services offered by the company that I work for are geared towards urban professionals:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	10	50.0	50.0	80.0
	Strongly agree	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

Table 3.13: Barriers to further growth

The barriers to further growth are regulatory and structural:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	11	55.0	55.0	55.0
	Agree	8	40.0	40.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.14: Products and services banks and companies

Banks cannot easily offer the same products and services as the company that I work for:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	15.0	15.0	15.0
	Neutral	7	35.0	35.0	50.0
	Agree	9	45.0	45.0	95.0
	Strongly agree	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Table 3.15: Competition as biggest problem

The biggest problem facing the company that I work for is competition:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	5.0	5.0	5.0
	Neutral	5	25.0	25.0	30.0
	Agree	12	60.0	60.0	90.0
	Strongly agree	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 3.16: Competition in FinTech drives

Competition in FinTech drives further innovations:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	6	30.0	30.0	30.0
	Agree	12	60.0	60.0	90.0
	Strongly agree	2	10.0	10.0	100.0
	Total	20	100.0	100.0	

Table 3.17: Regulation facilitate FinTech growth

Additional regulation could facilitate FinTech growth in the UAE:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	5.0	5.0	5.0
	Neutral	1	5.0	5.0	10.0
	Agree	10	50.0	50.0	60.0
	Strongly agree	8	40.0	40.0	100.0
	Total	20	100.0	100.0	

Table 3.18: Models of FinTech

Models of FinTech in other countries could serve the UAE as well:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	3	15.0	15.0	15.0
	Agree	12	60.0	60.0	75.0
	Strongly agree	5	25.0	25.0	100.0
	Total	20	100.0	100.0	

Table 3.19: Challenges to attracting an international market

There are considerable challenges to attracting an international market for UAE based FinTech companies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	5.0	5.0	5.0
	Neutral	4	20.0	20.0	25.0
	Agree	12	60.0	60.0	85.0
	Strongly agree	3	15.0	15.0	100.0
	Total	20	100.0	100.0	

Table 3.20: Barriers to start FinTech company

There are few barriers to starting a FinTech company in the UAE:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	15.0	15.0	15.0
	Neutral	9	45.0	45.0	60.0
	Agree	8	40.0	40.0	100.0
	Total	20	100.0	100.0	

Table 3.21: UAE market satisfy the ambitions

The UAE market is sufficient to satisfy the ambitions of the company I work for.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	25.0	25.0	25.0
	Disagree	11	55.0	55.0	80.0
	Neutral	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

Table 3.22: Investor's interest towards FinTech

Investors are interested in FinTech in the UAE:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	3	15.0	15.0	15.0
	Agree	11	55.0	55.0	70.0
	Strongly agree	6	30.0	30.0	100.0
	Total	20	100.0	100.0	

Table 3.23: FinTech companies unfair treatment

FinTech companies are treated unfairly in comparison to banks in the UAE:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	5.0	5.0	5.0
	Disagree	3	15.0	15.0	20.0
	Neutral	3	15.0	15.0	35.0
	Agree	8	40.0	40.0	75.0
	Strongly agree	5	25.0	25.0	100.0
	Total	20	100.0	100.0	

Table 3.24: Satisfaction level of digital banking solutions

Are you satisfied with your banks overall digital banking solutions?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		14	6.8	6.8	6.8
	1	9	4.4	4.4	11.2
	2	6	2.9	2.9	14.1
	3	5	2.4	2.4	16.5
	4	6	2.9	2.9	19.4
	5	18	8.7	8.7	28.2
	6	37	18.0	18.0	46.1
	7	19	9.2	9.2	55.3
	8	46	22.3	22.3	77.7
	9	20	9.7	9.7	87.4
	10	26	12.6	12.6	100.0
	Total	206	100.0	100.0	

Correlations Analysis

Table 3.25: Correlations between satisfaction and quality of services

Correlations

		Are you satisfied with your banks overall digital banking solutions?	Quality of services.
Are you satisfied with your bank€™s overall digital banking solutions?	Pearson Correlation	1	.640**
	Sig. (2-tailed)		.000
	N	192	192
Quality of services.	Pearson Correlation	.640**	1
	Sig. (2-tailed)	.000	
	N	192	206

**. Correlation is significant at the 0.01 level (2-tailed).

Model Summary

Table 3.26: Model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.687[a]	.473	.458	1.743

a. Predictors: (Constant), Easy to use (finger touch), Availability, Seamless access. , Quality of services, Functionality speed.

ANOVA & Regression Analysis

Table 3.27: Anova and regression analysis

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	506.649	5	101.330	33.338	.000[b]
	Residual	565.346	186	3.039		
	Total	1071.995	191			

a. Dependent Variable: Are you satisfied with your banks overall digital banking solutions?

b. Predictors: (Constant), Easy to use (finger touch), Availability., Seamless access Quality of services., Functionality speed.

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.756	.473		1.597	.112
	Seamless access.	.401	.094	.437	4.248	.000
	Quality of services.	.321	.117	.329	2.748	.007
	Availability.	.024	.115	.025	.212	.832
	Functionality speed.	-.141	.127	-.147	-1.111	.268
	Easy to use (finger touch)	.077	.076	.078	1.006	.316

a. Dependent Variable: Are you satisfied with your Bank overall digital banking solutions?

Appendix B

Table 4. 4 Technologies and Standards for multi-channel banking (Pavlovski, 2013)

ICT	Description
Internet Technologies	Internet technologies such as web servers, on-line chat, authentication servers, messaging gateways and proxies, enable on-line banking access to customers over the Internet.
Mobile Networks	Traditional cellular 3G and 4G mobile networks and wireless technologies to support mobility. These systems are largely used to extend Internet accessibility.
RFID and NFC	Near Field Computing (NFC) wireless communication based on Radio Frequency Identification (RFID), used for contactless payment by major credit card institutions.
SOA	Service Oriented Architecture is an approach for defining services consumed by IT applications; which can be internally shared or extemally accessed over the Internet.
TOGAF	The Open Group Architecture Framework specifies both a process and framework for defining enterprise and system architectures.
BIAN	Banking Industry Architecture Network defines a set of IT services based upon a Service Oriented Architecture.
NLU / NLP	Natural Language Understanding & Processing technologies extend conventional voice recognition with natural speech. Traditional IVR is directed speech and restrictive, whilst NLU technology supports unrestricted (human-like) conversational interaction.
eWallet	Emerging use of mobile phones as a payment device, leveraging the embedded SIM (subscriber identity module) smart card chip, where the eWallet application is deployed.

Table 4. 5: Applying Performance Criteria to Decompose Business Objective

A Decomposed Business Objective Performance Criteria	**A Decomposed Business Objective Performance Criteria**
Provide an efficient response to basic interactions of the customer with a platform	Response time—less than 2 seconds online Response accuracy—99%
1. Smart Banking 1.1. Core Banking	99% of all inquiry (informative) transactions and 100% of all core banking transactions should be accurate; anomalies to be automatically flagged and reported by the system.
2. Non-Bank customer maintenance 2.1. Payments 2.2. Cash Optimization	Managing the details of the non-bank customer to occur on a daily transaction; payment, refilling e-Walt, transfer money locally and international, check cash flow;
3. Customer maintenance 3.1. Shipping address and user profiles. 3.2. Banks 3.3. Payment method	99% of address changes/updates should be right the first time when undertaken by the system, 90% accuracy when by the customer on their own devices; format flagging and redressing of inaccuracies.

Table 4. 6: Display making payment and cash optimizing (Peer-to-Peer) services

Make Payments services	**Cash Optimizing services (P2P)**

Risk management services for card and bank-based payments.	**Bill Payments (**Utility, Credit Card, Subscriptions, Loan Instalments, Insurance Premium and **Air Ticket and Tour Package Payments)**
Transaction payment matching.	Wealth management
Reporting.	Foreign Exchange
Fund remittance and fraud protection in addition to multi-currency functionality and service.	Seamless Money Transfer. Safe and Secure.
Cash payments.	Bank Account Transfer.
E-wallets.	Instant Money Transfer.
Prepaid cards or vouchers.	International Money Express (IME).
Paper or e-check processing.	**Cash to Card Transfer.**

Appendix C

Figure 4. 8: The division of omnichannel platforms (Digital Banking Report, 2018)

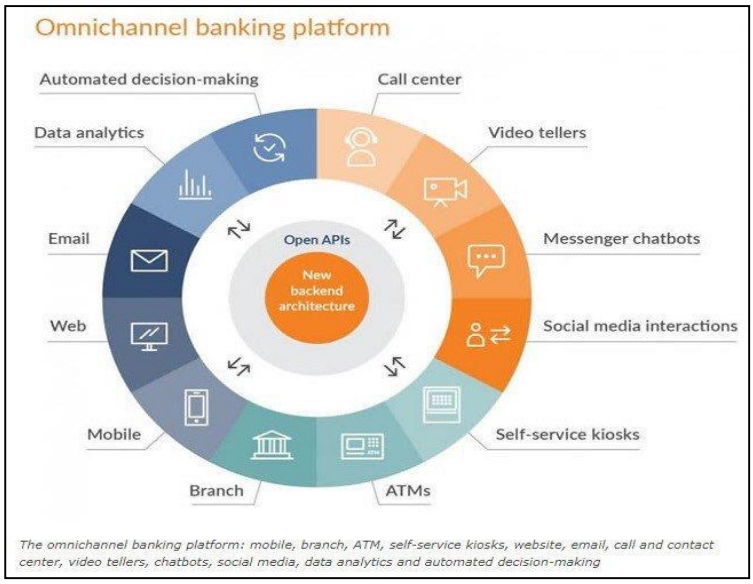


Figure 4. 9: Breaking down a project into subparts to enable controlled execution and monitoring of the project.

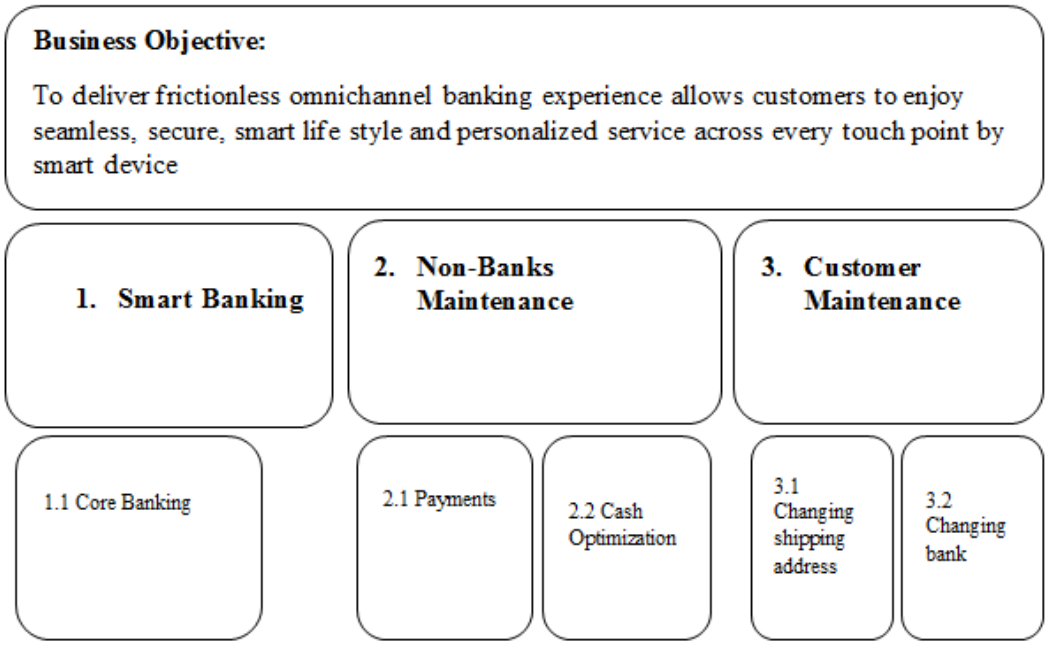


Figure 4. 10: The System Main Function Use Case Diagram

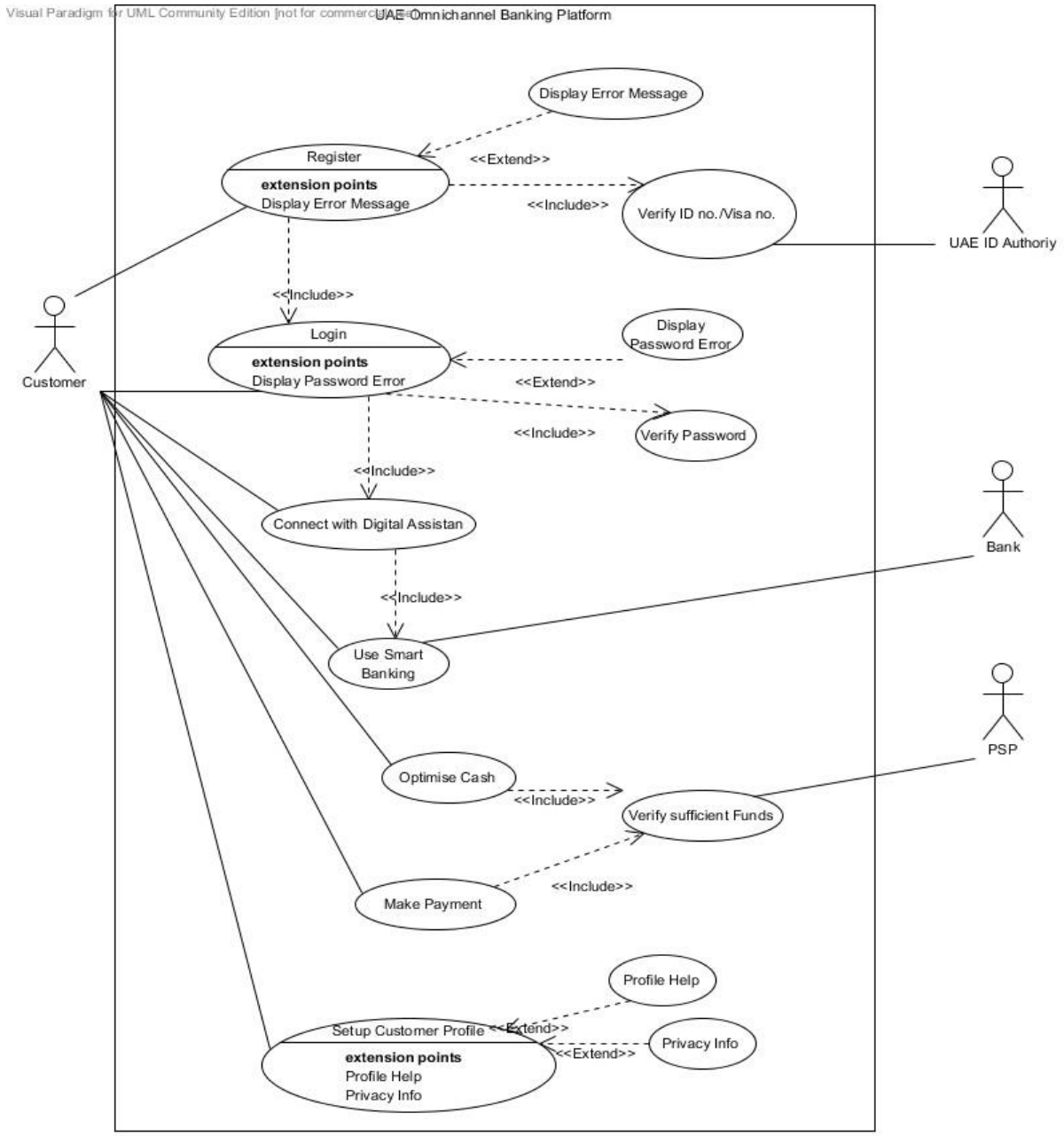


Figure 4. 11: Bank customer transaction with the system

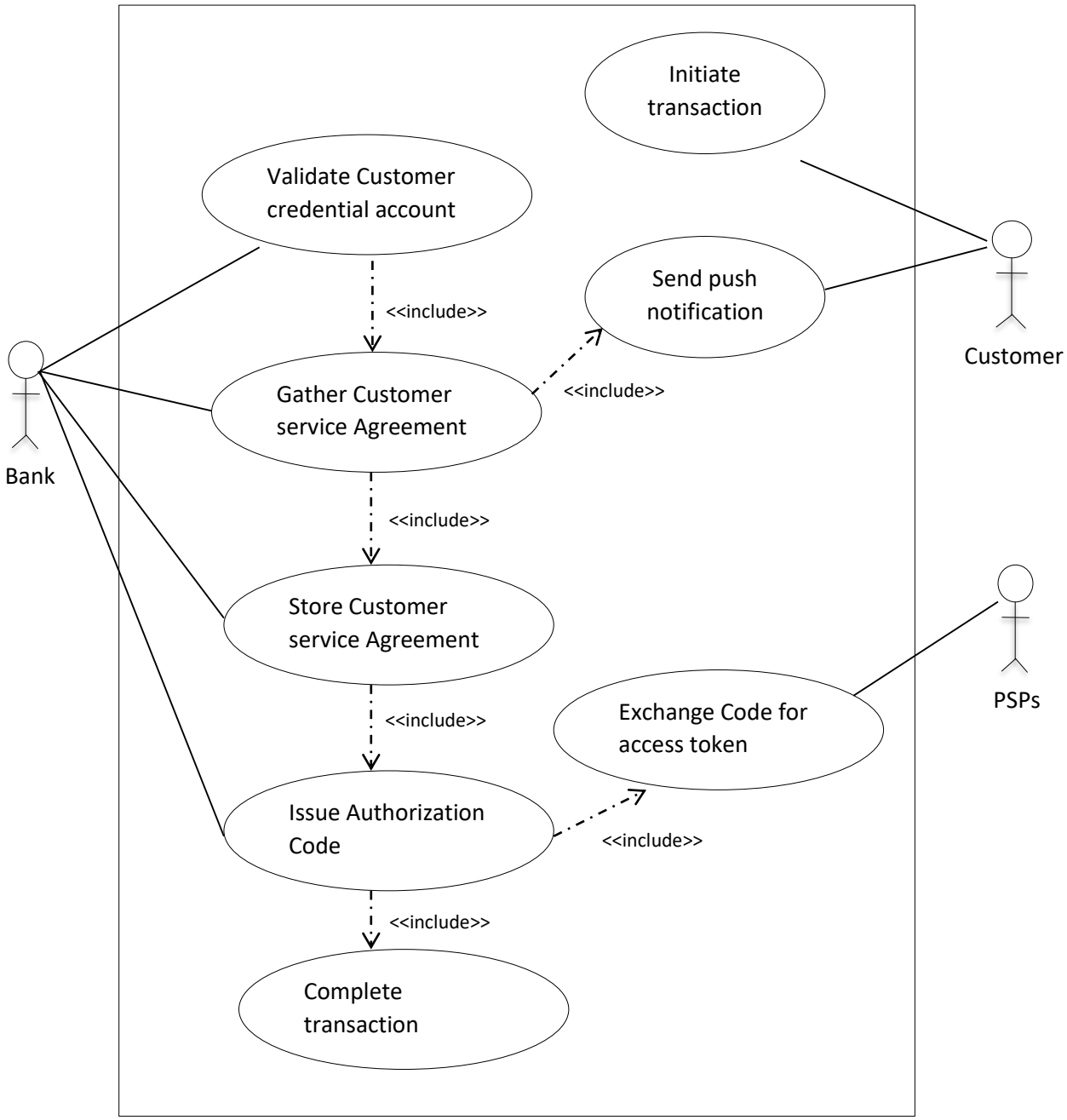
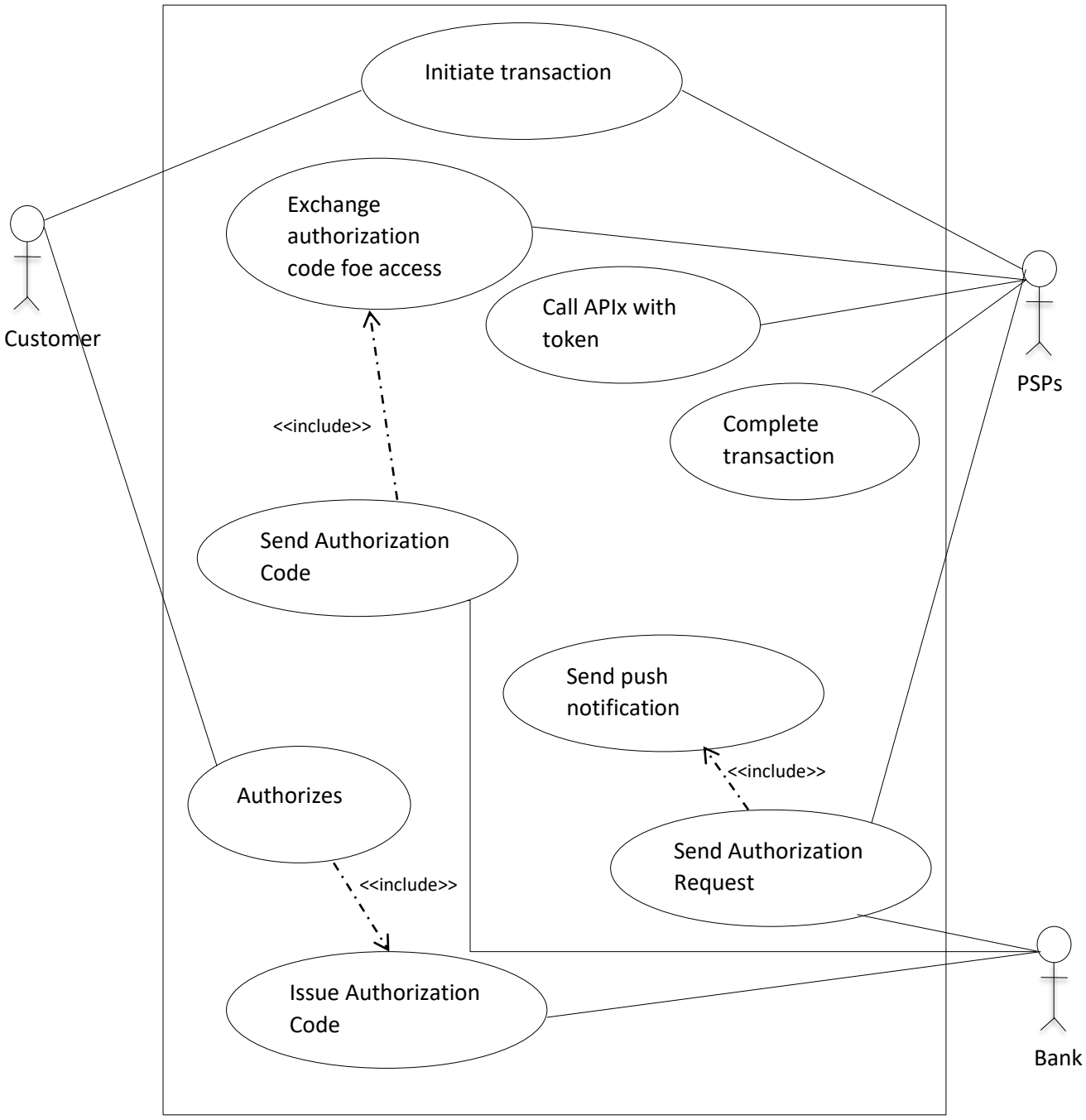


Figure 4. 12: Non-bank customer transactions with the system



Actor and Use Case Documentations

1. Actors Documentations

1.1. Actor Documentation for "***A10-Customer***"

Actor Thumbnail Actor: A10-Customer
Actor Type & stereotype

This is an abstract actor representing all types of Customers in the UAE omni-channel Banking Platform
Actor Description The actor customer is the primary role interacting with the UAE omni-channel Banking Platform in order to carry out all functions related to the customer. This actor will primarily use the system to for smart banking services, make payment, optimizing cash and update customer details. In order to carry out these functions, this actor will have to register and also identify him/herself every time the system is accessed. This actor can be a resident customer or a visitor. This resident versus visitor distinction is made only during the registration process by the customer providing either Emirates ID details using SmartPass or credit card details.
Actor Relationships Two different types of concrete actors are derived from this actor: • A20-ResidentCustomer • A30-VisitorCustomer The actor will interface with the following use case (examples): • UC01-LogsIn • UC10-RegistersCustomerDetails • UC00-ConnectWithDigitalAssistan • UC00-SmartBanking • UC00-MakePayment. • UC00-OptimizingCash • UC00-SetupCustomerProfile. • UC00-VefiyAuthorisation,
Interface Specifications UI010-LogIn UI020-CustomertDetails I900-CardsSystem
Author & History Maitha AlNuaimi
Reference Material

1.2. Actor Documentation for "***A40-PSPs***"

Actor Thumbnail Actor: A40-PSPs
Actor Type & stereotype This is an abstract actor representing all types of PSPs in the UAE omni-channel Banking Platform
Actor Description The actor PSPs is the primary role interacting with the UAE omni-channel Banking Platform in order to carry out all functions related to the PSPs. This actor will primarily help the system to provide the p2p services and make payment services This actor can be a Retail PSPs, Non-issuing PSP, Government PSP and Micropayment PSP. .
Actor Relationships Four different types of concrete actors are derived from this actor:

• A45-RetailPSP • A50-MicropaymentPSP • A55-GovernmentPSP • A60-Non-IssuingPSP The actor will interface with the following use case (examples): • UC00-VerifySufficientFunds • UC00-ExchangAuthorisationCode • UC00-CallAPIxWithToken • UC00-SendPushNotifcation • UC00-CompleteTrasaction
Interface Specifications UI010-InitiatTranacation UI020-CompleteTrasaction
Author & History Maitha AlNuaimi
Reference Material

1.3. Actor Documentation for "***A70-Bank***"

Actor Thumbnail Actor: A70-Bank
Actor Type & stereotype This is an abstract actor representing all types of Banks in the UAE or International
Actor Description The actor Bank is the primary role interacting with the UAE omni-channel Banking System in order to carry out all functions related to the Bank. This actor will primarily help the system to provide smart banking service. This actor can be a local bank or external bank. This local versus external distinction is made only during the registration process by the customer providing either her ID details or her Visa details.
Actor Relationships Two different types of concrete actors are derived from this actor: • A75-LocalBank • A80-ExternalBank The actor will interface with the following use case (examples): • UC00-UseSmartBanking • UC00-ValidateCustomer. • UC00-GatherCustomerServiceAgreement. • UC00-StoreCustomerServiceAgreement. • UC00-SendPushNotifcation • UC00-IssueAutorizationCode • UC00-ExchangeCode
Interface Specifications • UI000-SmartBanking
Author & History Maitha AlNuaimi
Reference Material

1.4. Actor Documentation for "***A90-Emrites ID Authority***"

Actor Thumbnail Actor: A90-Emirate ID Authority
Actor Type & stereotype This is an abstract actor representing Federal Authority of UAE in the UAE omni-channel Banking Platform
Actor Description The actor EmiratesIDAuthority is the primary role interacting with the UAE omni-channel Banking platform in order to carry out all functions related to the authorisation and authentication. This actor will primarily use the system to check the customer authorisation and authentication. This actor main role during the registration process by the customer providing either her ID details or her Visa details.
Actor Relationships The actor will interface with the following use case (examples): • UC01-LogsIn • UC10-RegistersCustomerDetails • UC00-UseSmartBanking. • UC00-MakePayment. • UC00-OptimizingCash.
Interface Specifications UI010-LogIn and Registration
Author & History Maitha AlNuaimi
Reference Material

2. Use Case Documentation for UAE omni-channel Banking Platform

Use Case Thumbnail*: *UC01-Register ***Actors*:** A10-Customer, A90-Emirate ID Authority ***Use Case Description****:* This use case deals with the registration of new customer in the system. These registration details include name, emirates ID, SmartPass account and related details of the customer credit card. A10-Customer provides all the details and A90-Emirate ID Authority provided by the state of customer account, to verify the visa card details of visitor customer. A95-Bank is an interface to an external system for insure customer account, share customer balance and transaction history. PSPs, to verify the details of customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A90-Emirate ID Authority **Use Case Relationships**: Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy **Constraints**: None.

User Interface Specifications:
UI10-CustomertRegistrationForm
Metrics: Complex Priority: **High** **Status**: Major
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC02-Login*
Actors: A90-EmirateIDFederalAuthoriy, A10-Customer
Use Case Description This use case describes how customer login to the system. This process is done by A90-Emirate ID Authority with input from A10-Customer.
Stereotype and Package:
Preconditions: Customer is registered in the system.
Postconditions: -
Actors: A10-Customer, A90-EmirateIDFederalAuthoriy.
Use Case Relationships: Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Author and History:
Maitha AlNuaimi
Reference Material:
Details of customer

Use Case Thumbnail: *UC07-SetupCustomerProfile*
Actors: A90-EmirateIDFederalAuthoriy, A10-Customer
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer is registered in the system.
Postconditions: -
Actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Use Case Relationships:
Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy,
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC04-UseSmartBanking*
Actors: A10-Customer, A95-Bank
Use Case Description This use case describes how the customer use the smart banking services. This service is provided by the system with output from A95-Bank
Stereotype and Package: ≪Customer≫
Preconditions: Customer is registered in the system.
Postconditions: Customer is login in the system using Emirate ID or SmartPass.
Actors: A10-Customer, A95-Bank.
Use Case Relationships: Associated with actors: A10-Customer, A95-Bank
Author and History:
Maitha AlNuaimi
Reference Material:

Details of Omnichannel services
Use Case Thumbnail: *UC06-MakePayment* **Actors:** A10-Customer, A10-PSPs **Use Case Description** This use case describes how the customer use the make payment service. This transaction is done by A10-PSPs with input from A10-Customer. **Stereotype and Package**: **Preconditions**: Customer must have been already registered with the system. **Postconditions**: **Actors**: A10-Customer, A10-PSPs **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of Omnichannel services
Use Case Thumbnail: *UC05-OptimizingCash* **Actors:** A10-Customer, A10-PSPs **Use Case Description** This use case describes how the customer used optimizing cash (p2p). This transaction is done by A60-PSPs with input from A10-Customer. **Stereotype and Package**: - **Preconditions**: Customer must have been already registered with the system. **Postconditions**: - **Actors**: A10-Customer, A10-PSPs **Use Case Relationships**: Associated with actors: A10-Customer, A10-PSPs **Author and History**: Maitha AlNuaimi **Reference Material**: Details of Omnichannel services
Use Case Thumbnail: *UC07-SetupCustomerProfile* **Actors:** A10-Customer **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have been already registered with the system. **Postconditions**: - **Actors**: A10-Customer, **Use Case Relationships**: Associated with actors: A10-Customer. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of customer
Use Case Thumbnail: *UC09-VerifyIDNo/CreditCardNo* **Actors:** A90-EmirateIDFederalAuthoriy, A10-Customer, A95-Bank **Use Case Description** This use case describes how the system verify emirates ID of a resident customer or credit card no for visitor customer. the This modification is done by A90-EmirateIDFederalAuthoriy with input from A10-Customer. **Stereotype and Package**: - **Preconditions**: Customer must have been already registered with the system. **Postconditions**: -

Actors: A90-EmiratesIDAuthority, A10-Customer, A95-Bank
Use Case Relationships: Associated with actors: A90-EmirateIDFederalAuthoriy, A10-Customer, A95-Bank
Author and History:
Maitha AlNuaimi
Reference Material:
Details of customer

Use Case Thumbnail: *UC08-DisplayErrorMessage*
Actors: A90-EmirateIDFederalAuthoriy, A10-Customer.
Use Case Description This use case describes how the process of check the customer authorisation.
Stereotype and Package: -
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Use Case Relationships: Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Author and History:
Maitha AlNuaimi
Reference Material:
Details of customer

Use Case Thumbnail: *UC10-DisplayPasswordErrorMessage*
Actors: A90-EmirateIDFederalAuthoriy, A10-Customer.
Use Case Description This use case describes how the process of check the customer authentication .
Stereotype and Package: -
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Use Case Relationships: Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Author and History:
Maitha AlNuaimi
Reference Material:
Details of customer

Use Case Thumbnail: *UC11-VerifyPassword*
Actors: -
Use Case Description This use case describes how the process of check the customer authorisation to access platform with smartPass.
Stereotype and Package: -
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: -
Use Case Relationships: Associated with actors: A10-Customer, A90-EmirateIDFederalAuthoriy
Author and History:

Maitha AlNuaimi
Reference Material:
Details of customer

Use Case Thumbnail: *UC12-VerifySufficientFunds*
Actors: A95-Bank
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC13-ProfileHelp*
Actors: A10-Customer.
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC17-PrivacyInfo*
Actors: A10-Customer.
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC16-ValidateCustomerCredentialAccount*
Actors: A95-Bank

Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Use Case Thumbnail: *UC17-GatherCustomerServiceAgreement* **Actors:** A10-Customer, A95-Bank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC20-IssueAuthorisationCode* **Actors:** A60-ADSandbox, A10-Customer, A95-CentralBank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC15-InitiateTransaction* **Actors:** A60-ADSandbox, A10-Customer, A95-CentralBank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC03-ConnectToDigitalAssistan* **Actors:** A60-ADSandbox, A10-Customer, A95-CentralBank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫

Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC19-StoreCustomerService*
Actors: A60-ADSandbox, A10-Customer, A95-CentralBank
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC18-SendPushNotification*
Actors: A60-ADSandbox, A20-PSPs, A95-CentralBank
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Use Case Thumbnail: *UC21-ExchangeCodeForAccessToken*
Actors: A60-ADSandbox, A10-Customer, A95-CentralBank
Use Case Description This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer.
Stereotype and Package: ≪Customer≫
Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:

Details of cutomer
Use Case Thumbnail: *UC22-CompleteTransaction* **Actors:** A60-ADSandbox, A10-PSPs, A95-CentralBank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC23-SendAuthorisationCode* **Actors:** A95-Bank **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC24-CallAPIxwithToken* **Actors:** A10-PSPs **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫ **Preconditions**: Customer must have not been already registered with the system. **Postconditions**: Customer is registered in the system. **Actors**: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank. **Use Case Relationships**: Associated with actors: A10-Customer, A80-Administrator. **Author and History**: Maitha AlNuaimi **Reference Material**: Details of cutomer
Use Case Thumbnail: *UC25-Authorises* **Actors:** A10-Customer **Use Case Description** This use case describes how the profile of a customer is updated. This modification is done by A60-ADSandBox with input from A10-Customer. **Stereotype and Package**: ≪Customer≫

Preconditions: Customer must have not been already registered with the system.
Postconditions: Customer is registered in the system.
Actors: A10-Customer, A80-Administrator, A90-ADSandBox, A95-CentralBank.
Use Case Relationships: Associated with actors: A10-Customer, A80-Administrator.
Author and History:
Maitha AlNuaimi
Reference Material:
Details of cutomer

Appendix D

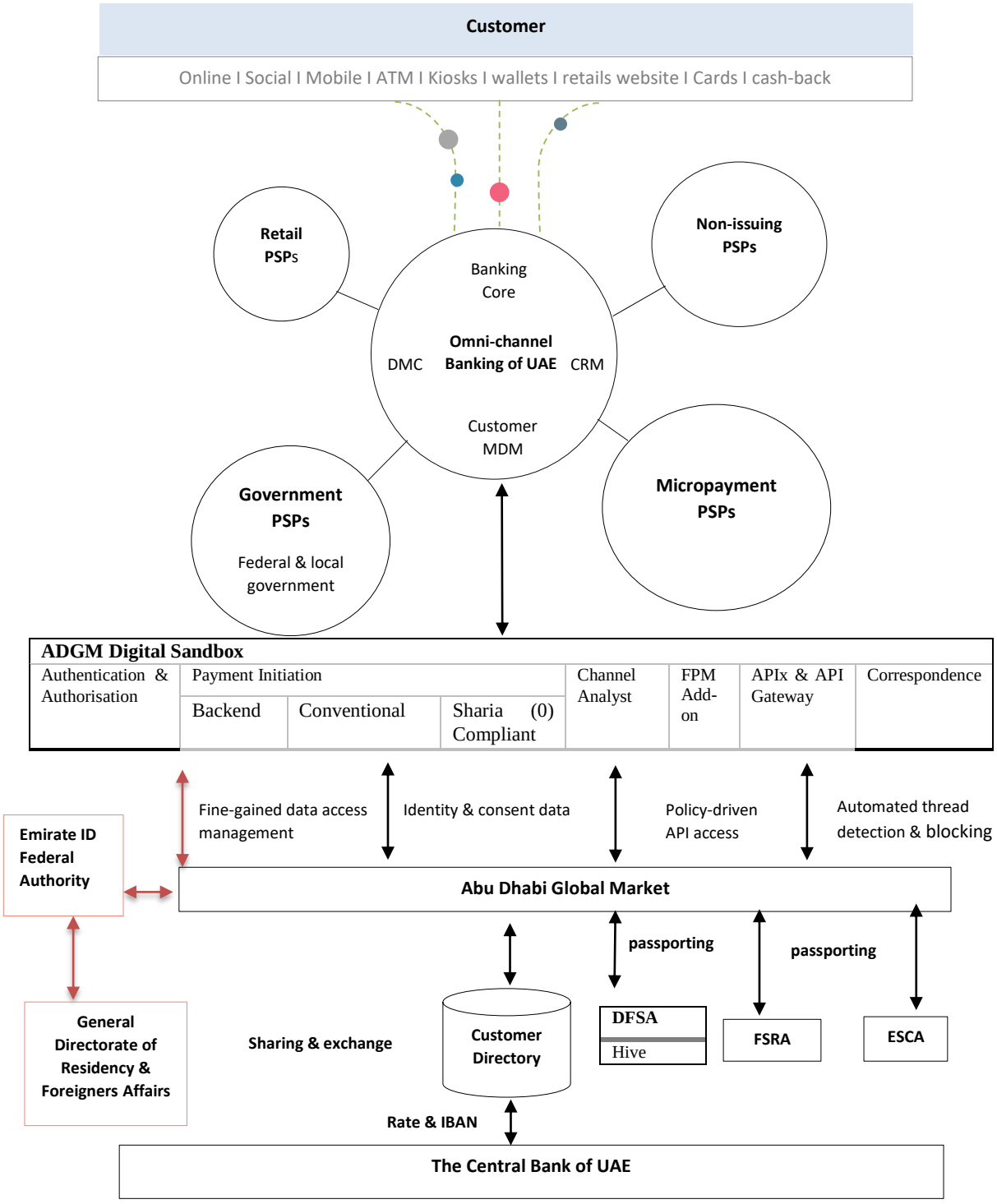


Chart 4. 4: The Theoretical Framework: show interoperation between the government department and system.

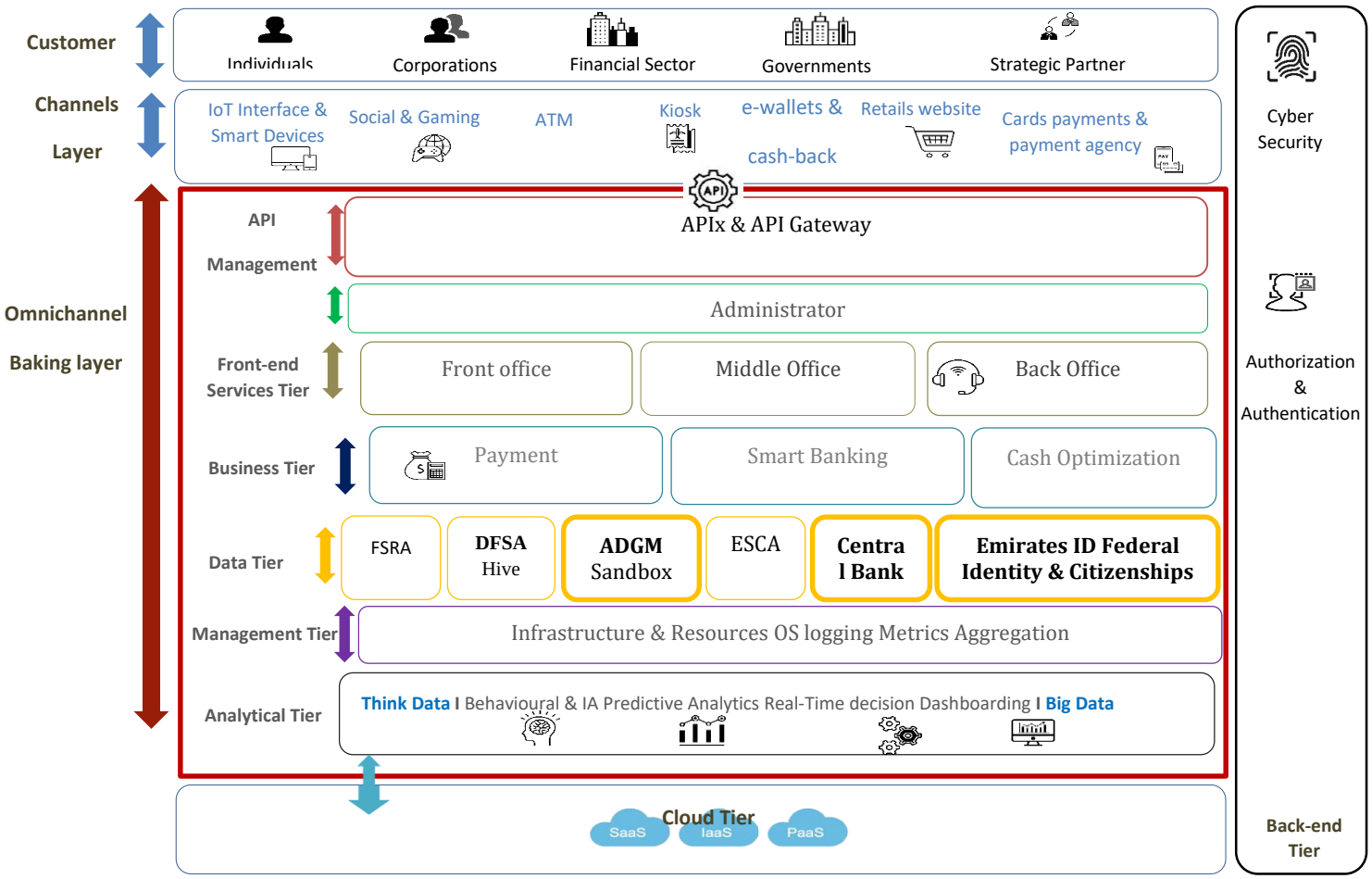
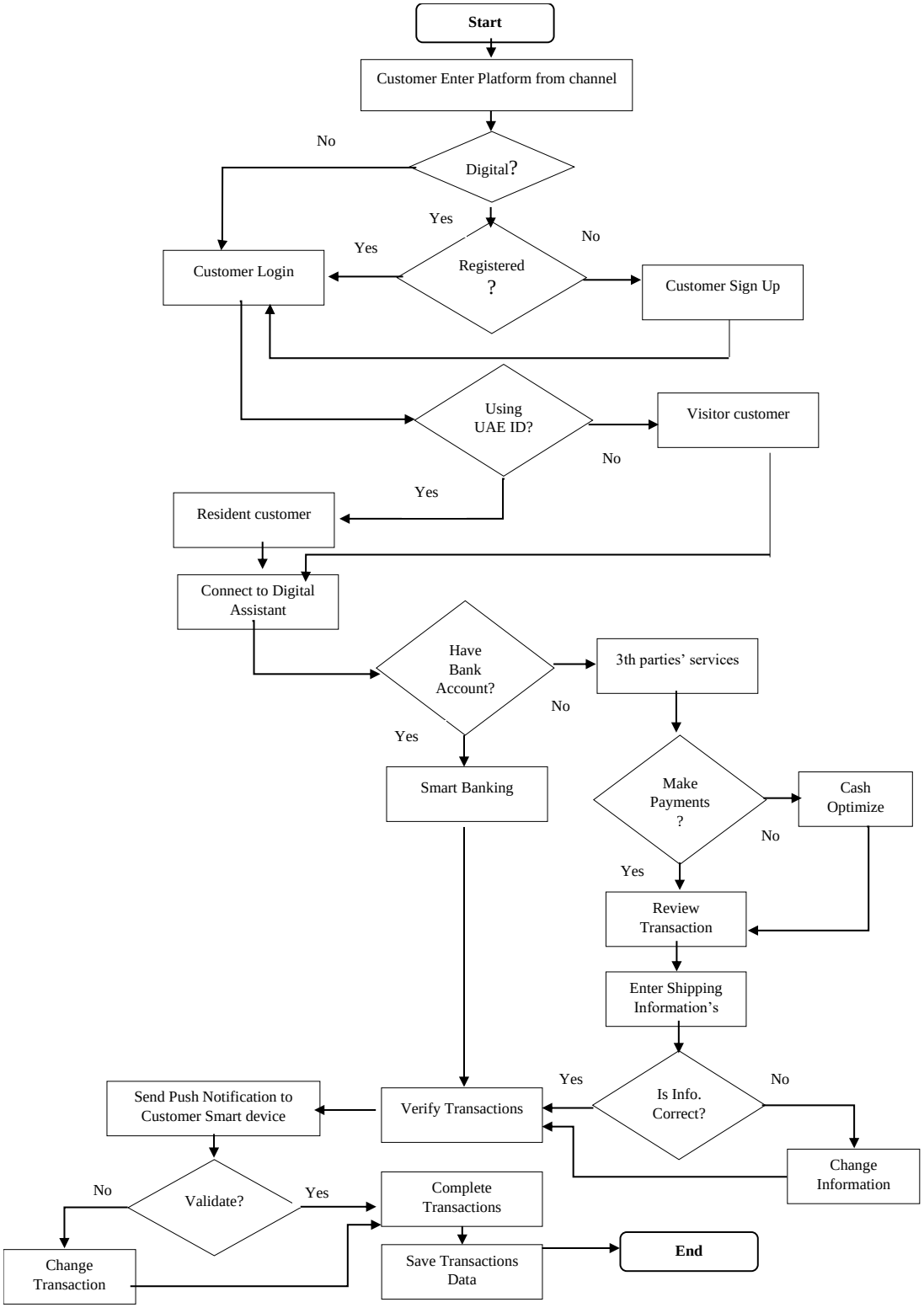


Chart 4. 5: The Proposed Conceptual Architecture Framework for the UAE omnichannel Digital Banking Platform



4.3 Flow Diagram of the Omnichannel Digital Banking Platform

Appendix E

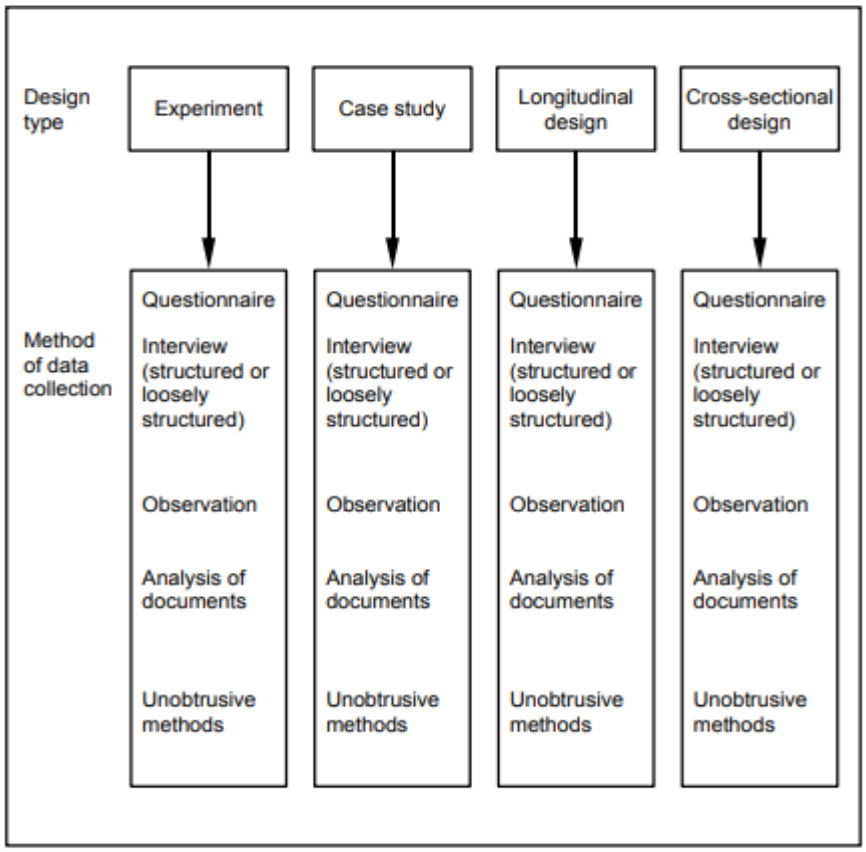


Figure 5. 12: Types of research designs and methods of data collection (Vaus 2001, 10)

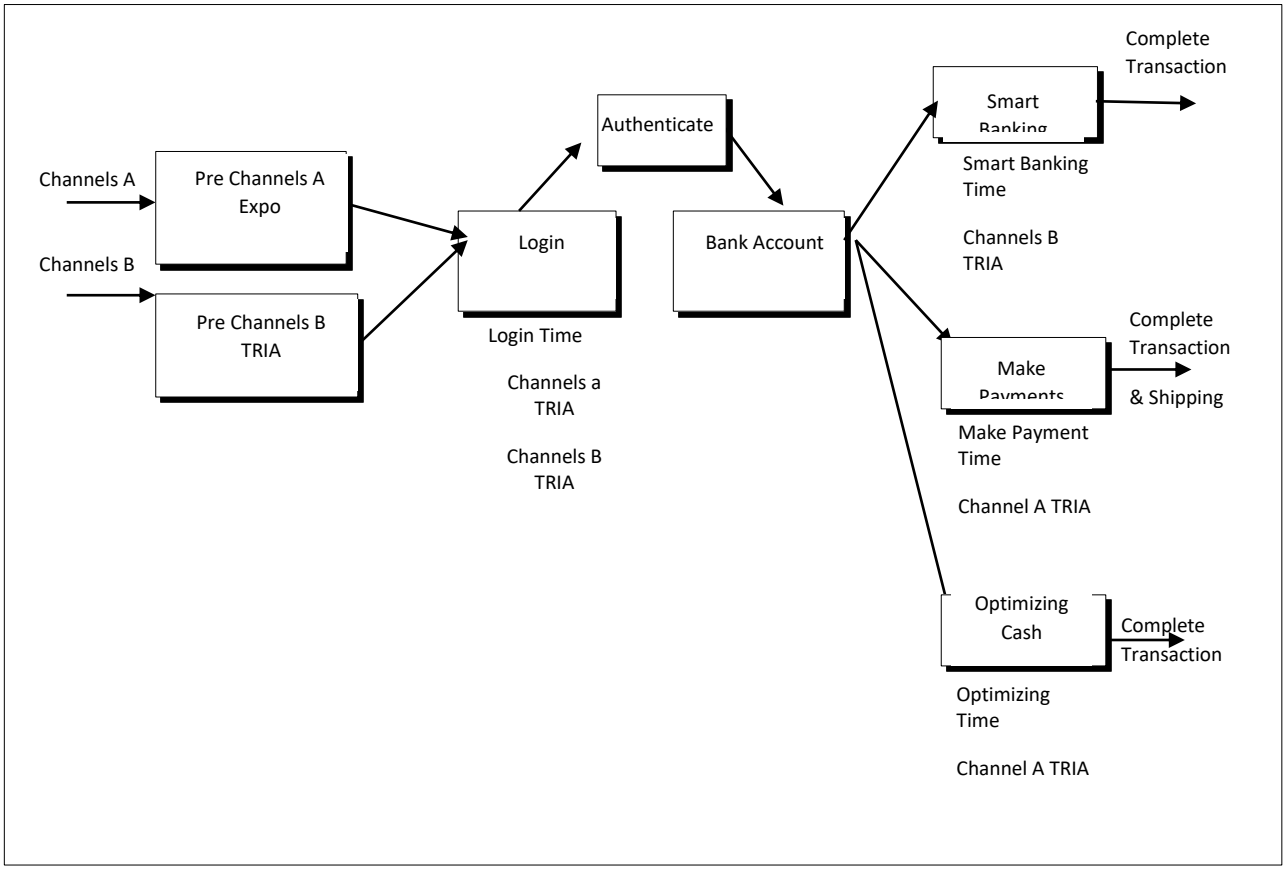


Figure 5. 13: Description of the operational function of the omnichannel banking platform

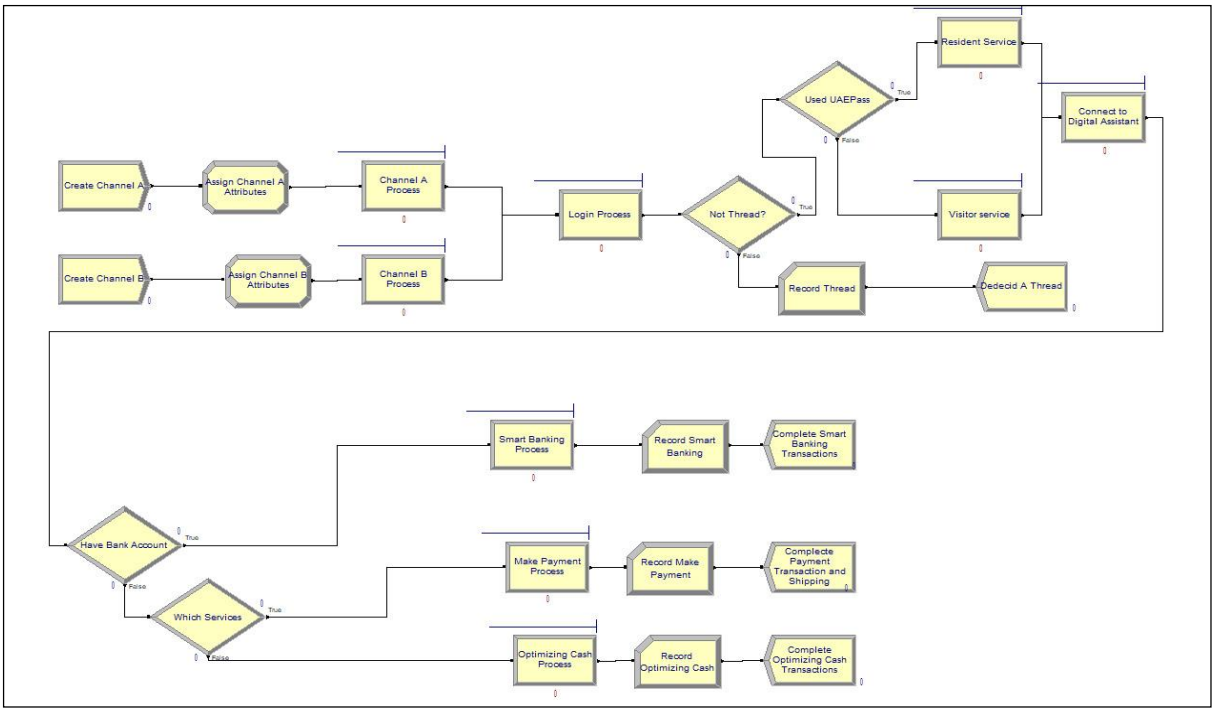


Figure 5. 14: The complete operational model of UAE omnichannel Banking Platform in Arena

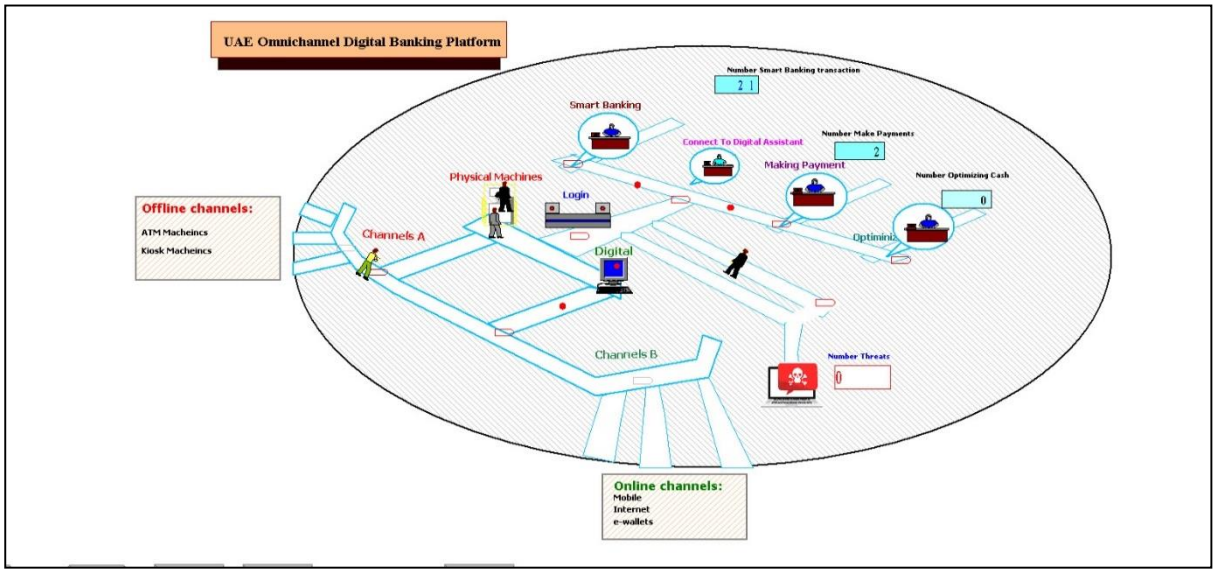


Figure 5. 15: The UAE Omnichannel Digital Banking Platform Animation

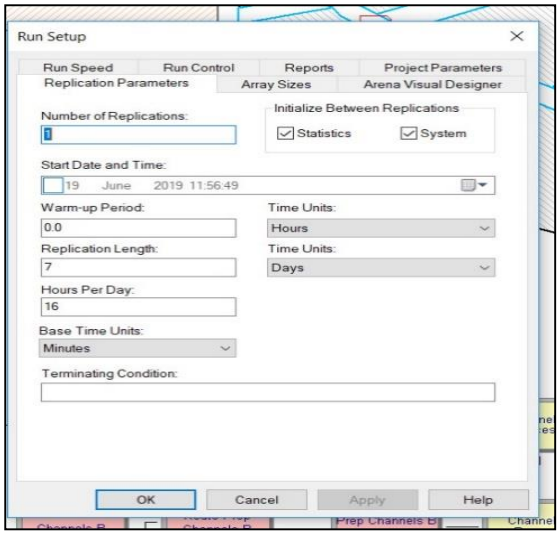
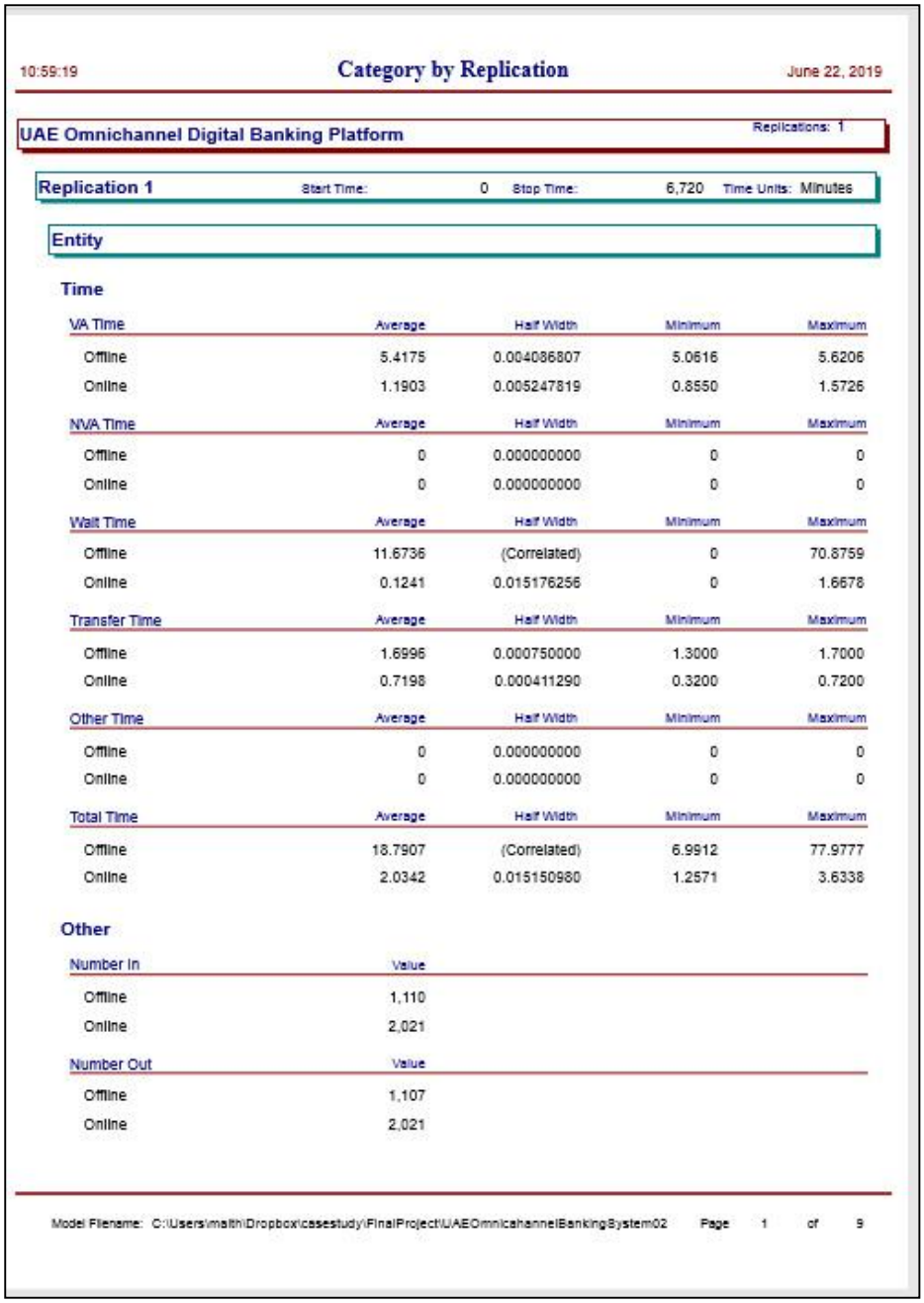


Figure 5. 16: The Run Setup



10:59:19 **Category by Replication** June 22, 2019

UAE Omnichannel Digital Banking Platform Replications: 1

Replication 1 Start Time: 0 Stop Time: 6,720 Time Units: Minutes

Entity

Time

VA Time	Average	Half Width	Minimum	Maximum
Offline	5.4175	0.004086807	5.0616	5.6206
Online	1.1903	0.005247819	0.8550	1.5726

NVA Time	Average	Half Width	Minimum	Maximum
Offline	0	0.000000000	0	0
Online	0	0.000000000	0	0

Wait Time	Average	Half Width	Minimum	Maximum
Offline	11.6736	(Correlated)	0	70.8759
Online	0.1241	0.015176256	0	1.6678

Transfer Time	Average	Half Width	Minimum	Maximum
Offline	1.6996	0.000750000	1.3000	1.7000
Online	0.7198	0.000411290	0.3200	0.7200

Other Time	Average	Half Width	Minimum	Maximum
Offline	0	0.000000000	0	0
Online	0	0.000000000	0	0

Total Time	Average	Half Width	Minimum	Maximum
Offline	18.7907	(Correlated)	6.9912	77.9777
Online	2.0342	0.015150980	1.2571	3.6338

Other

Number In	Value
Offline	1,110
Online	2,021

Number Out	Value
Offline	1,107
Online	2,021

Model Filename: C:\Users\malth\Dropbox\casestudy\FinalProject\UAEOmnichannelBankingSystem02 Page 1 of 9

Figure 5. 17: Simulation report displaying the result for each operation chart

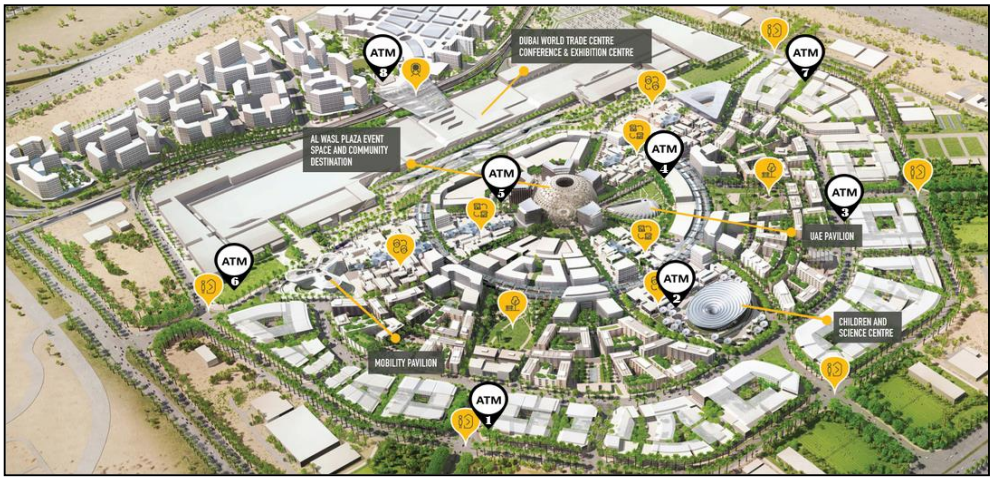


Figure 5. 18: The distribution of ATM and Kiosk machines in each zone of the expo 2020. (Expo 2020 Dubai 2019)

Preference Level	**Numeric Value**
Equally preferred	1
Equally to moderately preferred	2
Moderately preferred	3
Moderately to strongly preferred	4
Strongly preferred	5
Strongly to very strongly preferred	6
Very strongly preferred	7
Very strongly to extremely preferred	8
Extremely preferred	9

Table 5. 14: Preference scale for pairwise comparisons (W.Taylor 2013, 440-449)

System	**Seamless access**	
	CDB	ODB
CDB	1	$\frac{1}{4}$
ODB	4	1

Table 5. 15

Seamless access

$$\begin{bmatrix} 1 & \frac{1}{4} \\ 4 & 1 \end{bmatrix}$$

Table 5. 16

Service Time	Quality	Availability	Functionality	Acceptance needs	Sharia
$\begin{bmatrix} 1 & \frac{1}{9} \\ 9 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{6} \\ 6 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{4} \\ 4 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{6} \\ 6 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{7} \\ 7 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{8} \\ 8 & 1 \end{bmatrix}$

Table 5. 17

System	**Seamless access**	
	CDB	ODB
CDB	1	$\frac{1}{4}$
ODB	4	1
	5	$\frac{5}{4}$

Table 5. 18

System	**Seamless access**	
	CDB	ODB
CDB	$\frac{1}{5}$	$\frac{1}{5}$
ODB	$\frac{4}{5}$	$\frac{4}{5}$

Table 5. 19

System	**Seamless access**		
	CDB	ODB	**Row Average**
CDB	0.2	0.2	0.2
ODB	0.8	0.8	0.8
			1.0

Table 5. 20

Criterion / **System**	**Seamless Access**	**Service Time**	**Quality**	**Availability**	**Functionality**	**Acceptance needs**	**Sharia**
CDB	0.2	0.1	0.1429	0.2	0.1429	0.125	0.1111
ODB	0.8	0.9	0.8571	0.8	0.8571	0.875	0.8889

Table 5. 21

Criterion	Seamless Access	Quality	Availability	Functionality	Service Time	Acceptance needs	Sharia
Seamless Access	1	1/2	1/3	1/2	3	2	2
Quality	2	1	1/2	1/2	4	2	4
Availability	3	2	1	2	6	4	5
Service Time	1/3	1/4	1/6	1/5	1	1/2	1/2
Acceptance needs	1/2	1/2	1/4	1/3	2	1	2
Sharia	1/2	1/4	1/5	1/4	2	1/2	1

Table 5. 22

Criterion	Seamless Access	Quality	Availability	Functionality	Service Time	Acceptance needs	Sharia	Row Average
Seamless Access	0.10714	0.077	0.113	0.1045	0.13043	0.1538	0.1081	**0.1134256**
Quality	0.21429	0.154	0.169	0.1045	0.17391	0.1538	0.2162	**0.1694692**
Availability	0.32143	0.308	0.339	0.4181	0.26087	0.3077	0.2703	**0.3178649**
Functionality	0.21429	0.308	0.169	0.2091	0.21739	0.2308	0.2162	**0.2235579**
Service Time	0.03571	0.038	0.056	0.0418	0.04348	0.0385	0.027	**0.0402073**
Acceptance needs	0.05357	0.077	0.085	0.0697	0.08696	0.0769	0.1081	**0.0795592**
Sharia	0.05357	0.038	0.068	0.0523	0.08696	0.0385	0.0541	**0.0559380**
								1.0000000

Table 5. 23

System	score
Current Digital Banking	0.1625534
Omnichannel Digital Banking	0.8371466
	1.000000

Table 5. 24

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Table 5. 25: RI values for n items being compared (W.Taylor 2013, 440-449)

Appendix F

Survey Participation Consent Form

Survey Consent Form

UAE omnichannel digital banking platform Survey Questionnaire

Survey Participation Consent Form

Dear Participant:

I would like to enlist your help. I am a student at the British University in Dubai with an interest in the current, disruptive transformation of the omnichannel banking system. I am conducting a survey on the subject of UAE Omnichannel Digital banking Platform as Smart service for smart cities. The purpose of the study is to investigate and explore the current state of Digital Banking in the UAE, and the potential for adopting unified omnichannel baking platform that allows access at any time, any channel and anywhere in the UAE.

If you would, please support the study by completing this survey. The survey should only take about 5-7 minutes of your time. Your answers are anonymous so you are not required to put your name on the survey. All answers will be kept confidential and only group results will be presented or documented.

Your help with this research is strictly voluntary. You do not have to answer the questions. The return of an answered survey will indicate your consent to participate in this study.

If you have questions or concerns, please contact me at 2016132043@student.buid.ac.ae **. You may also contact my faculty advisor,**

Cornelius.ncube@buid.ac.ae . **If you have any questions regarding your rights as a research participant, please contact the University's Student Administrator department at** Christine.salvador@buid.ac.ae.

Thank your for your time and consideration.

Sincerely,

Maitha AlShaiba Al Nuaimi

Customer Survey

Dear Sir / Madam: Many thanks for finding time to participate in this study. My name is Maitha AlNuaimi, a PhD student in British University in Dubai. The objectives of my research are to investigate and explore the current state of Digital Banking in the UAE, and the potential for adopting unified omnichannel baking platform that allows access at any time, any channel and anywhere in the UAE. This survey is targeted UAE residents and visitors who own a smart device.

Your participation is highly appreciated. Please note that all the information provided by you will be treated with strict confidentiality.

1. **What is your gender**

- ○ Male
- ○ Female

2. **What is your age group?**

- ○ 14-17 years
- ○ 18-24 years
- ○ 25-31 years
- ○ 32-38 years
- ◉ 39-45 years
- ○ 46 years and above

3. **What is your place of residence?**

- ○ Abu Dhabi
- ○ Dubai
- ○ Sharjah
- ○ Ajman
- ○ Umm Quwain
- ○ Fujairah
- ○ Ras Al-Khaimah
- ○ Other (please specify)

4. **What is your highest level of education?**

- ○ Primary/Secondary
- ○ Bachelor Degree
- ○ Master Degree

- Doctor of Philosophy
- Professional Qualification (e.g. Diploma)
- Other (please specify)

5. What is your marital status?

- Single
- Married
- Divorced
- Widow
- Widower

6. Are you employed?

If no, please answer question 7. If yes, please skip to question 8

- No
- Yes

7. What is your status?

- Student
- Job seeker
- Unable to work
- Retired
- Homemaker
- Other (please specify)

8. What is your occupation?

- Accountant
- Teacher/lecturer
- Marketer
- Data analyst
- Administrator
- Doctor
- Journalist
- Public relations officer
- Banker
- Consultant

- Self-employed (e.g Businessman or businesswoman)
- Other (please specify)

9. What is your average monthly expenditure in UAE Dirham (AED)?

- Below 10,000
- 10,000-15,000
- 16,000-20,000
- 21,000-25,000
- Above 25,000

10. Are you a client of any banks in UAE?
If (Yes), please go to question 11 , if (No) go to question 12

- Yes
- No

11. How many banks are you a client to?

- One (1)
- Two (2)
- Three (3)
- More than three (3)

12. Select the non-bank digital finance service that you use to deal with your financial transactions?

- Prepaid cards (e-dirham or others)
- Exchange centres
- Cash-back cards
- Mobile e-wallet

13. What do you understand by the term Digital Banking? Please select all that apply.

- Monitoring account balances, transferring funds between accounts, bill payment and locating an ATM using your smartphone
- Digital lending service, digital wealth solution, open bank account from home, Robo-advisors that provide financial advice and e-payment, all that done by your smart device from anywhere.
- A service provided by banks so that people can find out information about their bank account, pay bills etc using the Internet
- Making client life easier and smarter by developing smart banking applications
- Other (please specify)

14. Are you aware of your bank's offering digital banking service solutions? If Yes, go to Q14

- Yes
- No
- Customer of non-bank financial service

15. Are you satisfied with the financial services offered by your non-banking centre or fintech?

- Very Satisfied
- Satisfied
- Neither satisfied or dissatisfied
- Dissatisfied
- Very dissatisfied

16. Are you satisfied with your bank's overall digital banking solutions?

- Very satisfied
- Satisfied
- Neither satisfied or dissatisfied
- Dissatisfied
- Very dissatisfied

17. please rate how important the following elements are in achieving satisfaction?

	Strongly agree	**agree**	**Nether agree nor disagree**	**Disagree**	**Strongly disagree**
Seamless access					
Quality of services					
Availability					
functionality					
Speed					
Easy to use (figure touch)					

18. Which digital service does your bank(s) engage in? Please select all that apply.

- Chat bot service
- Robo finance adviser
- Wealth life style management

- ☐ Dashboard analysis
- ☐ loan management
- ☐ Perform uniquely fast international fund transfers
- ☐ Manage your profile settings (email, mobile, e-PIN and more)
- ☐ Don't know
- ☐ Other (please specify)

19. Does your bank (s) offer environmentally friendly products and services (paperless)?

- ○ Yes
- ○ No
- ○ Don't know

20. **Are you satisfied with the customer support services?**

- ○ Very satisfied
- ○ Satisfied
- ○ Neither satisfied or dissatisfied
- ○ Dissatisfied
- ○ Very dissatisfied

21. Are you thinking of switching to other bank(s) or fintech services? If Yes, go to Q22

- ○ Yes
- ○ No
- ○ Not decided

22. What is the reason (s). Please select all that apply.

	Extremely bad	**Bad**	**Somehow bad**
Slow digital services			
High prices of products and services			
Impersonal approach			
Poor quality digital banking services			
Poor accessibility of digital service			
Low acceptance of my needs			

23. If there is another unified digital banking solution in UAE that providing an omnichannel experience allows customers to enjoy seamless, secure, smart life style and personalized service across every touch point by smart device, would you like to use it?

- Yes
- No

24.Would you like to receive a copy of the research findings via email? If Yes, go to Q24

- Yes
- No

25. What is your email address?

25. Finally, is there any other information you would like to share?

Appendix G

Fintech and Bank Entrepreneur Survey

This survey instrument is adapted from the interview guide which was originally used by Blythin and Van Cooten (2017) in their *The Development of FinTech in Nairobi: Contributions to Financial Inclusion and Barriers to Growth*, a dissertation published by Lund University.

General Questions and Introduction

1. What is the name of the company that you are representing in this survey?

_____

2. Do you have the necessary authorisation to participate in this survey on behalf of your company?
   YES ___
   NO ___

3. What was the first year that [company name] was in operation?

_____

4. What does the company do, in terms of the products or services that it offers? Please check all that apply:
   ___ Financial services such as insurance or investment
   ___ Financial services that includes payments and savings
   ___ Third party payment services
   ___ Currency conversion services
   ___ Banking
   ___ Something else

5. What differentiates your company from a formal financial institution?
   ___ the targeted market
   ___ other

6. How many staff work for [company name]?
   ___ less than 10
   ___ 50 – 100
   ___ 101 – 1000
   ___ 1000+

7. What have been the biggest successes so far?
   ___ raising capital
   ___ innovating on current products and business models
   ___ implementation of solutions

8. Who are your target customers? (Check all that apply)
   ___ other fintech businesses
   ___ online businesses
   ___ traditional firms
   ___ young single adults

___ young families
___ mature investors
___ marginalised groups
___ young professionals
___ foreign tourists
___ foreign businesses

9. Where are your target customers?
___ in the UAE
___ in countries in the Arabian Gulf region
___ in countries in the Middle East
___ in countries in Asia

Likert-Based Questions

For these statements:
1 indicates strong disagreement,
2 indicates disagreement,
3 indicates that you do not feel strongly,
4 indicates agreement, and
5 indicates strong agreement.

1. The company that I work for has strong differentiation from competitors:
___ 1
___ 2
___ 3
___ 4
___ 5

2. The company that I work for targets the local population within the UAE rather than a global population.
___ 1
___ 2
___ 3
___ 4
___ 5

3. My personal professional background is related to fintech.
___ 1
___ 2
___ 3
___ 4
___ 5

4. My personal professional background is related to Bank.
___ 1
___ 2
___ 3
___ 4

___ 5

5. I have always been interest in fintech and digital finance.
   ___ 1
   ___ 2
   ___ 3
   ___ 4
   ___ 5

The Growth of FinTech

6. The fintech sector in the UAE is developing rapidly:
   ___ 1
   ___ 2
   ___ 3
   ___ 4
   ___ 5

   Would you like to elaborate?

7. The fintech sector is developing more rapidly outside of the UAE and the region:
   ___ 1
   ___ 2
   ___ 3
   ___ 4
   ___ 5

   Would you like to elaborate?

8. Attendees at Dubai Expo 2020 would benefit from the fintech products and services offered by [company name].
   ___ 1
   ___ 2
   ___ 3
   ___ 4
   ___ 5

   Would you like to elaborate?

9. Fintech in UAE is growing because many people are excluded by traditional banks from the products and services that they need.
   ___ 1
   ___ 2
   ___ 3
   ___ 4
   ___ 5

   Would you like to elaborate?

10. The growth of fintech in the UAE is largely due to the international and cosmopolitan nature of many of its cities, such as Dubai, with a high percentage of foreign visiting workers as well as international tourists and business persons:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5

    Would you like to elaborate?

11. The UAE is the main fintech hub for the GCC/Middle East:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

12. In the UAE, it is likely that banks will partner with, rather than compete with, fintech products and services:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

13. The issues of regulatory compliance are a burden for fintech companies:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

Global Inclusion

14. The products and services offered by the company that I work for are primarily geared to businesses.
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

15. Targeting or attracting new customers is a major objective of the company that I work for:
    ___ 1

___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

16. There is considerable demand for the company's products and services among UAE residents:
___ 1
___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

17. UAE residents are the ideal customers because of challenges with international banking:
___ 1
___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

18. Fintech has a very narrow market segment in terms of demographics:
___ 1
___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

19. Expansion of products and services beyond the UAE would not make sense at this time:
___ 1
___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

20. The company I work for currently provides products and services that are marketed towards underserved or marginalised groups which have historically had little access to traditional banking, such as the poor:
___ 1
___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?

21. The company that I work for has partnerships with other fintech firms or banks:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

22. Traditional banking products and services are still needed, as the state of fintech in the UAE has not reached maturity:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

23. Traditional banking has major disadvantages in comparison to fintech products and services available in the UAE:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

24. Financial illiteracy is a problem for the customers or clients of the company that I work for:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

25. One problem with fintech products and services in the UAE is the negative impact they can have on an individual's credit score:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

26. The products and services offered by the company that I work for are geared towards urban professionals:
    ___ 1
    ___ 2
    ___ 3
    ___ 4

___ 5
Would you like to elaborate?

Barriers to Further Growth

27. The barriers to further growth are regulatory and structural:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

This Interview Guide is adapted from the interview guide which was originally used by Blythin and Van Cooten (2017) in their *The Development of FinTech in Nairobi: Contributions to Financial Inclusion and Barriers to Growth* a dissertation published by Lund University.
This Interview Guide is adapted from the interview guide which was originally used by Blythin and Van Cooten (2017) in their *The Development of FinTech in Nairobi: Contributions to Financial Inclusion and Barriers to Growth*

28. Banks cannot easily offer the same products and services as the company that I work for:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

29. The biggest problem facing the company that I work for is competition:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

30. Competition in fintech drives further innovations:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

31. Additional regulation could facilitate fintech growth in the UAE:
    ___ 1
    ___ 2
    ___ 3
    ___ 4

___ 5
Would you like to elaborate?

32. Models of fintech in other countries could serve the UAE as well:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

This Interview Guide is adapted from the interview guide which was originally used by Blythin and Van Cooten (2017) in their *The Development of FinTech in Nairobi: Contributions to Financial Inclusion and Barriers to Growth* a dissertation published by Lund University.

33. There are considerable challenges to attracting an international market for UAE based fintech companies.
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

34. There are few barriers to starting a fintech company in the UAE:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

35. The UAE market is sufficient to satisfy the ambitions of the company I work for.
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

36. Investors are interested in fintech in the UAE:
    ___ 1
    ___ 2
    ___ 3
    ___ 4
    ___ 5
    Would you like to elaborate?

37. Fintech companies are treated unfairly in comparison to banks in the UAE:
    ___ 1

___ 2
___ 3
___ 4
___ 5
Would you like to elaborate?