Exploring Mobile Banking Adoption through Causal-Loop Diagrams

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Abstract

The increasing quest for market share and efficiency in today’s banking sector is adding to the complexity to that particular industry. This work aims to explore and model customer adoption behaviour on mobile banking using a systems thinking approach, in particular, qualitative modelling using causal loop diagrams. This method has been integrated with a grounded theory approach to identify the variables and their relationships from the literature review of relevant studies. The relationships between the variables were used to draw up causal loop diagrams. Five different perspectives were drawn from the literature to develop the diagrams through several iterations and discussions. The diagrams were brought together and analyzed to provide a proposal for effectively managing adoption in the mobile banking industry.

Keywords
Technology Adoption, Innovation, Systems Thinking, Causal-loop Diagrams and Mobile Banking.

1. Introduction

The banking industry is rapidly changing by the influence of many other industries, such as mobile technology, wireless technology and the Internet. Mobile banking technology now tends to become a mature technology and technology is mass adopted by customers in many places all over the world. The emerging new banking product like internet banking is in the early stages in the market. The current market for internet banking is relatively small because of its low level of consumer awareness. However, this new technology should not be underestimated. In many European countries, while 85% of consumers are not aware of the internet banking initiative, almost 43% would welcome the internet banking services (Mastercard 2017). The emergence of new technology is changing customer needs and customer behavior in many different ways, such as decreased customer attention, the need for personalization, and the increasing customer expectations (Mansoor 2017). Meanwhile, for every company in the market, only higher profit margins can bring profit, which needs to be gained by acquisition of greater and steadier market share (Abbasi et al. 2016). Therefore, attracting more customers are key for them to growth and profitability. The customer acceptance model, such as Technology Acceptance Model (TAM), Diffusion of Innovation (DIO), Unified Theory of Acceptance and Use of Technology (UTAUT), were used in previous research to help banking system with a new product or new function to attract the customers (Abbasi et al. 2016). However, most of the research solves the problem only form single perspective. Customer’s adoption behavior on mobile banking system is a complex system which involves many different perspectives, such as social influence, economic consideration, and mental model. A model from a single perspective is not enough to better understand the diffusion process. Therefore, it is essential to consider the problems from different perspectives. Besides, those static models only suggest how technology attract new customers and cannot guarantee a long-term profit. It is a fact that after launching the new product, the monopoly of the new product will not be long-term (Abbasi, 2016). The traditional linear thinking can only attract the first customers. Businesses need not only attracting the first customers but also keeping the customer in hand, including mobile banking. By using systems thinking approach, the causal loop diagram is helpful for the business to develop sustainably and to maintain the market share. Therefore, the study uses systems thinking approach to solve the problem in different perspectives and to sustainable develop the mobile banking adoption.
2. Method

Qualitative data represents a large amount of information obtained from analysis of documents, interview records, and notes of observations as well as researcher’s reflection notes. In system dynamics, qualitative data is an important source for formulating the dynamic hypothesis and building the simulation models (Kim and Andersen 2012). Richardson and Pugh (1981) believed that qualitative data can offer a reliable dynamic view in problem solving process. Qualitative data are used in all steps of the simulation modeling process, including conceptualization, formulation, testing and implementation (Luna-Reyes and Andersen 2003).

In order to identify problems, variables, and the causal link between variables from the purposive document, the method developed in this work applies the grounded theory approach. Different from the research design that derives the hypothesis deductively from the existing theories and tested, grounded theory generates a theory inductively from the raw qualitative data (Kim and Andersen 2012). They also mentioned that the aim of grounded theory is theory generation rather than theory testing.

Grounded theory is also used in systems thinking to support the development of dynamic hypothesis, i.e. causal loop diagram (Agnew et al. 2018). According to Kim and Andersen (2012), grounded theory and systems thinking approach can be integrated to develop the causal loop diagrams. In systems thinking approach, grounded theory is helpful to identify problems, key variables and their structural relationships from the document, which is the key elements to develop the causal loop diagrams (Corbin and Strauss, 2008). This method enhances user’s and modeler’s confidence in the resulting model through providing the connection between each data segment and the causal structures generated form the data segment, which is vital to build simulation model (Kim and Andersen 2012). This method can be used to perform a thorough and theoretically related analysis of the extant technology literature to identify and synthesize the factors that affect customers’ adoption of the technology, which is used in this research to investigate the factors affecting mobile banking. Montazemi and Qahri-Saremi (2015) also used the Grounded Theory literature review method to conduct a thorough relevant analysis of the existing online banking literature to identify the factors that affect consumers’ pre-adoption and post-adoption of online banking. The findings found the significance of the system quality, the information quality and the services quality on pre-adoption and post-adoption.

The grounded theory uses the qualitative data analysis process. The coding process includes discovering variables and relationship from the purposive documents and working with the variables and relationships to allow theories to emerge from the data (Kim and Andersen 2012). There are three types of coding, which include open coding, axial coding, and selective coding. During the open coding, purposive documents are broken down into phrases, sentences and paragraphs. In this study, open coding is used to set the system boundary and to identify the relevant variables. Axial coding is the process of reassembling variables in different ways by establishing a connection between categories after open coding. During this process, axial coding is used to merge variables and causal relationship to generate the causal loop diagrams. Selective coding is the last step used to generate the theory by integrating the categories. This work generated the causal loop diagrams from qualitative data that applies to the problems.

To achieve the aim and the objectives of this paper, specific steps were listed to create causal loop diagrams based on the research of Kim and Andersen (2012) that indicated the processes by using grounded theory to code qualitative data in systems thinking. The first step is problem articulation, which defines and identify of the system boundary. The purposive documents were founded to provide the source of variables. After that, the variables are identified from the purposive document. Then, the variables are grouped and the causal link between the variables are identified. The causal loop diagrams are developed based on previous steps. Last but not least, all feedback loops are assembled into the causal loop diagram to create a visual model (Richardson 2013). The technology was used to build the causal loop diagrams, which is Vensim PLE.

This is the summary of the process:

1) Problem articulation
2) Identify variables that are important to the problem
3) Group the variables and find their causal relationship
4) Draw causal loop diagrams for each group
5) Integrate the causal loop diagrams

Step 1: Problem articulation
The first stage begins with problem articulation. Problem articulation involves defining the problem, and it is a very important step in the system dynamic approach. The system consists of many sub-systems, and sub-system is also based on sub-systems, and it is impossible to solve all problems within confined observation vicinity (Haraldsson 2000). Therefore, in order to better understand the system and the problem, it is important to understand what system boundary is and how the system behaves. As it is impossible to solve all the problems, when identifying the system
boundary, finding the main sub-system and then identify the interacting variables of each sub-system providing the way of structure the problem.

Step 2: Identify variables that are important to the problem
After defining the problem, the system boundaries are specified. Based on the system boundaries, all key variables that are relevant for the topic, i.e. mobile banking is identified. Considering that there are many research related to customer adoption on mobile banking, it is accurate and efficient to identify the variables from the purposive document that are relevant to the topic and discuss the problem at hand. Therefore, finding the appropriate purposive document is the first process in this stage. According to Kim and Andersen (2012), the purposive data should fulfill the following criteria. First, the author in the document has a sophisticated knowledge about the topic. Second, purposive documents need to focus discussion on the problem at hand. Third, the discussion captured in the data should reflect a frank and unfeigned conversation of the decision-making group (Kim & Andersen 2012).

Therefore, based on the Kim and Andersen (2012) discussion on the purposive document used for generating causal structure, this work also developed the criteria specific for the problem at hand. To find the purposive document, online database, such as Google Scholar, Science Direct, EBSCOhost, IEEE, ProQuest, were searched. Several variations of mobile banking adoption terms were used (i.e. “online banking”, “retail banking”, “cell phone banking”, “mobile payment”, “internet banking”, “adoption”, “acceptance”, “pre-adoption”). Not all of the studies searched were appropriate for this research. In order to ensure the credibility, the documents used to identify variables in this study need to be chosen. The strategy of choosing purposive document specific for this research is developed. Considering the topic of this study, the documents were evaluated based on the following criteria:

1) The aim of the study was customer adoption on mobile banking (O’Leary 2014).
2) Because of the rapid change in the mobile payment industry, the document needs to be published within the recent 20 years.
3) The documents must have genuine, complete, reliable and of unquestioned authorship (Heffernan n.d.). The number of the documents be cited was also considered, and all of the documents need to be scholarly work.
4) If the document uses a quantitative method to analyze, it needs to provide correlations, sample size, and reliabilities, or sufficient data to compute these effect sizes. (Bowen 2009).
5) The document is free from error and distortion.
6) It is important to evaluate and investigate the subjectivity of documents. Therefore, the document needs to be free from bias in terms of political, social, economic, religious, cultural, personal and environment (O’Leary 2014).

Based on the above criteria, purposive documents were identified. After that, according to all the purposive document, all of the variables that are appropriate for the system were listed in the result section.

Step 3: Group the variables and find their causal relationship
As we mentioned about the system boundary and system behavior in step 1, how the system interacts with its sub-system was reveal. Therefore, all the variables acquire from step 2 is grouped to different aspect based on the system boundary and system behavior investigated in step 1. After that, within the group, the causal links between the variables are identified. This is where axial coding comes into play because the data was reassembled into groups. Most of previous research that investigates mobile banking adoption is event-oriented thinking. The relationship the research suggested between the factors is linear viewpoint, which sounds very logical but very straightforward and missing some steps and only tells half the story. However, systems thinking see things in circles rather than straight lines. Therefore, in the next chapter, the causal links between the variables were reformed to more specific and tell most of the story rather than only half the story. However, one thing needs to be clarified that the whole story cannot be presented as it is too complex to do that. According to Haraldsson (2000), when creating the mental models, the whole reality is not intended to be captured in one model as such models are as complex as reality. We can only map part of the reality that gives us a basic understanding of a complex issue. As a result, the tables are created for every group that shows the causal link between variables and reveals the mental model of the system.

The causal link then transforms to the word-and-arrow diagram. In regard to the notation used in causal loop diagrams, it consists of variables and arrows between the variables. A variable is a condition, situation, action or decision that can influence, or be influenced by other variables, and they can be quantitative, such as profit, population, temperature, or qualitative such as motivation, trust, burnout (Walters et al. 2016). The variable at the end of the arrow causes the variable at the top of the arrow to change (Roberts et at 1983). There are two types of polarity between variables. The “+” sign next to the arrow indicates that the item at the tail and the head of the arrow change in the same direction. An increase or decrease of tail cause an increase or decrease of the head variable. The “-” sign represents that the two
items changes in the opposite direction. An increase or decrease of tail variable cause a decrease or increase of head variable.

Step 4: Draw causal loop diagrams for each group
This step is to draw the causal loop diagrams so that the information generated from different data segment can be grouped into diagrams. Causal loop diagrams are used to qualitatively model the causal relationship among a set of variables with a system, which captures the dynamic hypothesis, capture the mental models of individuals and teams, and communicate important feedback loops (Kiani et al. 2009). In step 3, the variables and their causal links are identified. The hypothesis is made to help to understand the process to form a loop. Here is an example to show how the variables and their causal link works in the loop. There are three variables A, B, and C. There are causal links between A and B, B and C, and C and A. A has a positive effect on B and B has a positive effect on C and C has a negative effect on A. The diagram of this loop is shown below (Figure 1).

![Figure 1 Example of Causal Loop Diagram](image)

When variables are linked circularly, feedback loops occur. The types of feedback loop need to be identified. There are two types of feedback loops: Reinforcing loops and Balancing loops. According to (Pinho, 2015), if all the arrows in the loop are “+” or if there is even number of “-” sign next to the arrows, it is reinforcing loops, and if there is odd number of “-” sign, it is balancing loops. The reinforcing feedback loops amplify change which represents the exponential growth, identified with little ‘R’ loop in the middle. The balancing feedback loops counteract change, identified with little ‘B’ loop in the middle(Walters et al. 2016).

After defined the problems and system boundaries and generated the necessary information, including variables and causal links between variables, the causal loop diagrams were designed. The following points helped to draw the diagrams. Firstly, the variables should be nouns or nouns phrases in causal loop diagrams. It also needs to be clear to say a variable increase or decrease. Secondly, disaggregating the links if the causal links need extra explanation. Third, the causal loop diagram should be open loops (Haraldsson 2000).

All systems have delays. Delays represent the response time from taking the action to have effects on other factors and it shows as small parallel lines on the causal links (Haraldsson 2000). The article also gives us the rule to assign the delay in the system, the harder we push the system, the harder it pushes back. Identifying these delays is important because they are the source of the imbalances that accumulate in the system (Pinho, 2015).

Step 5: Integrate the causal loop diagrams
Last but not least, the causal loop diagrams integrate into one diagram. In order to put several diagrams into one diagram, the whole map needs to share the common variables. According to Kim and Andersen (2012), causal links could be decomposed further when the structure try to merge with other structures. For example, a causal link between variable a to variable c may be decomposed to variable a to variable b to variable c if the context implies the existence of intermediate variable. It can lead to bias because the modeler needs to make interpretation of causal arguments to identify intermedia variables. Therefore, in order to avoid the bias, the links between variables should be detailed and intuitive (Kim and Andersen 2012).

3. Results
Based on the six criteria in the second step in the methodology part, the detailed variables in purposive documents are shown in Table 1. Each topic of the selected document is listed in the first column. The second column contains the...
variables that influence the customer’s intention to use mobile banking technology. The last column is the source of the document.

Table 1 Variables identified from the purposive documents.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Variables</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicting the determinants of mobile payment acceptance</td>
<td>Perceived ease of use, perceived usefulness, perceived compatibility,</td>
<td>(Liébana-Cabanillas et al. 2018)</td>
</tr>
<tr>
<td></td>
<td>perceived security, subjective norms, individual mobility, personal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>innovativeness, intention to use</td>
<td></td>
</tr>
<tr>
<td>The adoption of online banking in Malaysia</td>
<td>Social influence, trust</td>
<td>(Tan et al. 2010)</td>
</tr>
<tr>
<td>Consumer acceptance and use of information technology:</td>
<td>Performance expectancy, effort expectancy, social influence, facilitating</td>
<td>(Venkatesh et al. 2012)</td>
</tr>
<tr>
<td>extending the Unified Theory of Acceptance and use of Technology</td>
<td>conditions, hedonic motivation, price value, habit.</td>
<td></td>
</tr>
<tr>
<td>Measuring the Post-Adoption customer perception of Mobile Banking</td>
<td>Security service, Interactivity, Relative advantage, Ease of use, Interface</td>
<td>(Yu and Fang 2008)</td>
</tr>
<tr>
<td>Services</td>
<td>creativity, customer satisfaction.</td>
<td></td>
</tr>
<tr>
<td>Subjective norms and customer adoption of Mobile Banking: Taiwan and</td>
<td>Subjective norms, effort expectancy, performance expectancy, facilitating</td>
<td>(Liang 2016)</td>
</tr>
<tr>
<td>Vietnam</td>
<td>conditions, attitude of use</td>
<td></td>
</tr>
<tr>
<td>Mobile banking adoption of the youth market</td>
<td>Perceived usefulness, perceived ease of use, perceived benefit, perceived</td>
<td>(Akturan and Tezcan 2012)</td>
</tr>
<tr>
<td>A multi-analytical approach to understand and predict the mobile</td>
<td>Social influence, variety of services, perceived cost, perceived trust,</td>
<td>(Yadav et al. 2016)</td>
</tr>
<tr>
<td>commerce adoption</td>
<td>perceived usefulness, perceived ease of use.</td>
<td></td>
</tr>
<tr>
<td>Cell phone banking: predictors of adoption in South Africa</td>
<td>Relative advantage, Compatibility, Trialability, Banking needs, perceived</td>
<td>(Brown et al. 2003)</td>
</tr>
<tr>
<td></td>
<td>risk, internet experience, self-efficacy</td>
<td></td>
</tr>
<tr>
<td>Consumer use of mobile banking in Saudi Arabia</td>
<td>Facilitating conditions, hedonic motivation, price value, habit, system</td>
<td>(Baabdallah et al. 2019)</td>
</tr>
<tr>
<td></td>
<td>quality, service quality, information quality, usage, satisfaction,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>loyalty</td>
<td></td>
</tr>
<tr>
<td>Factors influencing adoption of mobile banking by Jordanian bank</td>
<td>Performance expectancy, effort expectancy, facilitating conditions,</td>
<td>(Alalwan et al. 2017)</td>
</tr>
<tr>
<td>customers</td>
<td>hedonic motivation, price value, trust, behavioral intention</td>
<td></td>
</tr>
<tr>
<td>A system dynamics model for mobile banking adoption</td>
<td>System quality, attitude to use, trust, perceived cost, variety of services,</td>
<td>(Abbasi et al. 2016)</td>
</tr>
<tr>
<td></td>
<td>face to face interaction, risk, compatibility</td>
<td></td>
</tr>
<tr>
<td>Promotion, Word-of-Mouth Effect, customer satisfaction, financial</td>
<td>Four-scenario analysis for mobile banking</td>
<td>(Liou 2008)</td>
</tr>
<tr>
<td>restriction, service quality</td>
<td>development contextualized to Taiwan</td>
<td></td>
</tr>
<tr>
<td>Understand factors affecting trust in and satisfaction with mobile</td>
<td>Trust, System quality, Information quality, interface design, trust &amp;</td>
<td>(Lee and Chung 2009)</td>
</tr>
<tr>
<td>banking in Korea: A modified DeLone and McLean’s model perspective</td>
<td>customer satisfaction</td>
<td></td>
</tr>
<tr>
<td>Determinants of users’ intention to adopt m-commerce: an empirical</td>
<td>Social influence, Personal innovativeness, Customization, Personal</td>
<td>(Kalinic and Marinkovic 2016)</td>
</tr>
<tr>
<td>analysis</td>
<td>Mobility, Intention to use</td>
<td></td>
</tr>
</tbody>
</table>

In the table above, all the variables were proved to have either a positive or negative effect on the usage of the technology. Most purposive documents had developed the conceptual framework to state the relationship between different factors and customer’s usage intention of the technology. After that, the questionnaire had conducted to collect the attitude. Then, the data had been analyzed to modify the conceptual framework. One thing needs to be noticed that all most all of the documents only investigated the relationship between different variables and customer usage intention. Some other relationships were not be considered, such as the relationship between the variables, and
the relationship between the variables and other factors that might influence the customer behavior. Therefore, this study only collected the variables form the purposive document and made the assumption of the relationship of the whole picture. Instead of giving the single linear relationship between variable and usage intention, the whole picture and feedback loops were investigated in this study.

In the purposive documents, there are many different variables in each document. It can be discovered that many variables are repeated. Based on the system boundary, the variables were selected and grouped from the purposive documents.

1.1 Integration of causal loop diagrams and its discussion

The five causal loop diagrams can be integrated as in Figure 2. The diagram for each perspective was grouped by different colors. It explains how different factors affect mobile banking business.

![Figure 2 Integrated Causal Loop Diagram](image)

Causal loop diagrams on different perspectives provide many ways to attract customers adoption behavior on mobile banking service. Several methods are available for business to apply. However, each company is developing at different stages. For the companies that have just entered the mobile banking market, attracting first customers plays an important role in the company. For the company that already have a certain number of customers and want to expand, a small number of customers are not enough for the company to get more market share. Also, the resources that can be used for development are limited. Companies need to consider the appropriate time to assign the resources and to better use of it.

4. Discussion

Rogers’ bell curve of Technology Adoption Lifecycle can be used to provide guidance and suggestion. The technology adoption lifecycle is a model that describes the adoption of a new technology based on the psychological and demographic characteristics (Rogers, E. M. 1962). According to Innovation Adoption Lifecycle (Figure 3), customers
are divided into the different group in adopting new technology, including, innovators, early adopters, early majority, late majority and laggards (Rogers 1962). The model indicates that innovators are the first customers to try a new product, accounting for 2.5% of the total customers, followed by early adopters, which account for 13.5% of society. Next come the early majority and late majority, accounting for 34% respectively. And the last group to adopt a product are Laggards, which account for 16% of total customers.

In the Technology Adoption Lifecycle, customers in the different group have a different characteristic and different point of view in adoption behavior, which gives the suggestion to this study about how to assign the limited resources at different stages of business. Also, causal loop diagrams developed in this work gives the suggestion in different customer perspectives on mobile banking adoption. When companies want to attract different groups to adopt their mobile banking product, the strategy should focus on attracting the specific group. In order to give the suggestion to the mobile banking companies, the following discussion analyses the different conditions based on the casual loop diagrams and Innovation Adoption Lifecycle.

**Figure 3  Innovation adoption lifecycle (Rogers 1962)**

Innovators are the first customers to try new technology and product. They are risk takers and are easily attracted by new ideas and new functions in the product (Interaction Design Foundation 2019). As Figure 3 suggests, the innovators are only 2.5% of society, and this segment consists of young people who have higher social class, income, and have some connection with the related discipline of the technology (Bugajenko n.d.). Even given that the mobile banking industry is already mature and have a lot of customers in many countries, a new product like internet banking is trying to enter the mobile banking market in recent years. It is very popular in the UK among young people but not many people know this new banking product except in some European countries. This market is still relatively new and there are many gaps that could be plug by internet banks (Fong 2018). Therefore, if internet banking companies try to attract the first customers, which are innovators, the companies need to pay more attention and assign more resources on developing new features. In the Innovative perspective causal loop diagram suggests that innovation gives the company a competitive advantage to survive from many other competitors by providing a variety of services and customization services to customers. It is important for a company who just enters the market and requires market share to follow the innovative perspective causal loop diagram.

Early adopters are the second phase of adopting the new products. Those people have a positive attitude to innovation and tend to be the opinion leaders for the market (Bugajenko n.d.). They always influence the potential adopters in social media by creating reviews and other materials about the new product. Therefore, in this stage, banks can pay their attention to early adopters and try to use them to attract more customers. The early majority segment is risk averse and wants to be sure that their money is spent wisely on the product (Interaction Design Foundation 2019). Therefore, instead of new functions, they are more interested in the technical aspect. The perceived usefulness and perceived ease of use of the product are extremely important. For this reason, technical causal loop diagram provides that suggestion to the company.

For the late majority, they have low disposable income and low social status (Bugajenko n.d.). Their adoption behavior tends to focus more on perceived cost and value. In order to attract this customer segment, the company needs to consider more the economic perspectives. For example, relatively lowering the cost of the product to attract the late majority to acquire more market share. Laggards are last to adopt the product and their behavior is based on traditional
attitudes. It is worth saying that in many cases, laggards are older people who are not familiar with technology, but they may still have a mid-level of socio-economic status (Interaction Design Foundation 2019). Providing more information to increase their understanding change their mental model and change the way they think. The psychological perspective causal loop diagram provides the suggestion of attracting more customers given that perspective. Therefore, to attract laggards to adopt the technology, the company can focus on the psychological perspective causal loop diagram.

If the company wants to attract early adopters, paying attention to the perspectives causal loop diagrams can bring and investing resources into innovations may pay off. For the segment of early adopters, actions to increase social influence is essential. The early majority and late majority are usually 34% of society for each segment. It is crucial to think about the technical perspective causal loop diagram and economic consideration causal loop diagram to attract those two segments. For laggards, focusing more on the psychological perspective causal loop diagram rather than economic considerations helps the company reach the laggards.

This discussion is helpful for business in mobile banking industry to attract their customers. Before using these suggestions, companies need to consider which stages they are in and what segment of customers they need to attract. In addition, the discussion can also give suggestions to the new product in the banking industry like internet banking. Companies can follow each step to attract different customer segments. To enhance understanding of the mobile banking market situation, it is worth exploring different system perspective (Emes et al. 2012). Especially for a complex system like Mobile banking, customer purchasing attention is affected by factors from different aspects, including culture, technology, social influence, market competitor, customer psychology and so on. A model from a single perspective is not enough to understand the problem. Especially in the context of new product development, it is not enough to better understand the product diffusion process (Liou 2008). In addition, a model uses the traditional linear approach (as illustrated in Figure 1) can only attract first customers and cannot keep the customer in hand. Therefore, analysing system form different perspective, dividing system into interacting system element and understanding the effect of those elements, their interaction and how the elements cooperate with others is essential (Emes et al. 2012).

In order to help new mobile banking product to develop in a more sustainable way, this study uses the causal loop diagram to solve the problems. The causal loop diagram adds significant value to mobile banking research. Firstly, the causal loop diagram in Figure 2 enables the mobile banking business to inspect the process in a holistic way. A different aspect that influences customer intention and actual use of product is shown in the causal loop diagrams. Secondly, different perspectives in mobile banking adoption were mapped in a holistic context. It helps the business to examine the effect of different aspect during the adoption process. In the traditional research of mobile banking adoption, the variables were not be grouped and the variables from economic perspective and innovation perspective are often ignored. This study collected all the related factors and grouped them to different perspectives.

Innovation Adoption Lifecycle also offer the way to interpret the causal loop diagram. In Innovation Adoption Lifecycle, early majority shows more interests for the quality of the product. Therefore, in order to attract more first customers, the business should consider invest to improve the quality of their product rather than paying the dividend. The power of social influence in attracting customers should not be underestimated as well. In addition to traditional promotion method like advertising, making the current customers feel satisfied with the product is also essential as they are potential advertiser that may recommend the product to their friends and family. Nowadays, people use the internet and social media more than any era. Those tools are efficient to spread information. Therefore, apart from making the current customer satisfied, companies also need to take advantages of the internet and social media to make their product more popular among consumers. They could invite influential people who have thought leadership for other potential adopters to use the product. Most of them are very active in social media and give reviews and feedbacks about the product.

Form the economic perspective, the customer perception of benefit and cost of the product decides whether they adopt the product or not. If the customers believe that the product benefit is overweight the product cost, they will tend to use the product. If customers believe that product is not worth that amount, they will not use the product. Therefore, balancing the perceived benefit and perceived cost is essential for companies.

5. Conclusions
Every business or industry wants to have a sustainable development for the future. They do not want to only solve the problem at hand. This study and the causal loop diagram serve as a reference that providing the research methodology and framework for future research that hopes to investigate any problem in a sustainable way and from a systemic perspective. For example, the beef industry, energy industry, agricultural industry, and health system already have broken the traditional linear thinking and use systems thinking to explore their problems. The causal loop diagram also serves as a reference for future investigation to identify the customer adoption behavior on different technologies.
or product. More specifically, for the research in new banking product adoption, this study is a valuable framework that suggests that the problem should be considered in different perspective, including customer psychological, economic, social, innovation and technical perspective. New factors in different perspective can be added in the causal loop diagram to see how the factors affect the whole systems.

The causal loop diagrams can be further developed into a quantitative system dynamics model to builds and runs simulation model to analyze system performance under different scenarios (Hjorth and Bagheri 2006). The research also indicates that in most situations, drawing a CLDs is enough for identify a system, however, to see how the basic reference modes of the system vary through time, the research can go further and build up a simulation model and run it in a virtual environment.

The methodology part also needs to be fully considered in future work. It is important to note that this work uses the integration of two approaches, which are grounded theory and systems thinking. According to Kim and Andersen (2012), by using grounded theory, systems thinking models integrate elements of the worldview embedded in the method. However, these two research methods have their theoretical perspectives. The integration in this study did not fully consider the theoretical implications. Future work can identify the possible conflicts in integrating these two methods.

The System thinking methodology however does not come without some challenges. One of the challenges is that it is difficult for model validation based on how model outputs and behaviour accurately represent the real world (Walters et al. 2016). In particular, the causal loop diagram on mobile banking adoption is the integration of mental model or mind maps of customer. The cause and effect relationships between variables are justified with findings or previous literature on mobile banking and online banking. These proposed relationships require empirical evidence to be entirely justifiable.

However, there are also statements that the causal loop diagrams do not need to be justified. According to Barlas (1996), assessing the true validity of model structures is not feasible. He believes that the model should be validated based on its usefulness with respect to some purpose. That is to say, the actual benefits of system modelling are reflected in the form of useful information that can be obtained by participating in the modelling process itself, where the knowledge about how the system structure affects behaviour is far more important than getting the “right” (Bossel 2007).

Besides, another key limitation is that the causal loop diagrams do not discriminate between stocks and flows so they cannot be used to quantitatively model systems. If doing so, more suggestion can be given to the business, and the leverage points can be identified to generate the different scenario to predict the behavior of mobile banking development. it can also be the suggestion for future work. Also, in grounded theory, the coding process cannot eliminate the subjective influence of this work as the modeler’s perspective and assumption play a part in the coding process.

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