## THE UNIVERSITY OF HULL

# Online AI algorithmic purchase decision pathways: shopping via mobile application

Being a Thesis submitted for the degree of Doctor of Philosophy in the University of Hull

By

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#### Abstract

In recent years, online shopping has become a popular option for buying goods and services. Accordingly, this study was conducted in order to observe consumers' decisionmaking behaviour in an online buying environment via phone applications. The study focused on students, young people with a high potential for learning and using online shopping systems. This study looked at a number of outstanding factors selected for customer decision-making processes using the Throughput model.

In order to understand the different decision-making paths of customers in the range of online shopping on mobile applications in this study, the author has applied quantitative methods with convenient sampling combined with online surveys to investigate respondents of the study and introduce the importance of the study to respondents. In addition, quantitative data were analysed by SmartPLS software (version 3.0) which explains the structural equation model (SEM).

The findings of the study help to facilitate the development of the proposed model to explain the routes for the online consumers to make a decision when shop in the internet environment. It can be noticed that the flux model is not only good for marketing, management or financial areas, but it is also an effective decision-making model applied in the field of consumer behaviour judgement. Also, the study also proves that different buying decision-making routes for consumers in the online shopping environment are completely real. These findings contribute to the theoretical and practical aspects of finding online customer decision-making pathways depending on different products on mobile applications not only in Danang, Vietnam but also in other areas in the world. The findings from this study could be useful for e-commerce researchers, businesses, and online retailers to understand the consumer decision paths in particular and the customer behaviour in general, thereby guiding solid steps in producing, introducing products and persuading consumers.

**Keywords:** *online purchase decision, algorithmic purchase decision pathways, mobile shopping, online shopping, Throughput Model.* 

### **Dedications**

I would like to take this valuable opportunity to thank many individuals, without whose assistance, this research would not have been completed:

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### **Author's Declaration**

I, Thi Minh Tam Nguyen, declare that the work, research analyses and conclusions reported in my PhD Thesis "Online AI algorithmic purchase decision pathways: shopping via mobile application" are entirely my efforts, except where otherwise acknowledged. I also declare that I have followed the academic rules and ethical conduct in presenting all information in this document.

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## List of Abbreviations

TPM Throughput Model

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#### **CHAPTER 1 INTRODUCTION**

The aim of this chapter generalizes the introduction to this study. It is to review the critical background that is relevant to the problems set up for this study. Then this chapter continues to discuss the context of the research, research aims and research questions before exploring the outline of the whole research at the end of this chapter.

#### **1.1 Background and research rationale**

Nowadays, consumer behaviour covers broad scope indicates а and comprehensiveness (Belch and Belch, 1998). This identifies the important role of consumer behaviour in our daily life, including in economics, marketing and behavioural sciences (Engel et al., 1995). According to Belch and Belch (1998), consumer behaviour refers to "the process and activities people engage in when searching for, selecting, purchasing, using, evaluating, and disposing of products and services so as to satisfy their needs and desires" and "including the decision processes that precede and follow these actions" (Engel et al., 1995).

When the Internet was applied to economics, it influenced and changed the ways consumers perform in an online marketplace and the distribution of purchases on different products and retailers also transformed (Brynjolfsson et al., 2010). Based on lower search costs, offering an opportunity to visit various retailers at the same time or compare different alternatives instantaneously, the Internet helps consumers get all information and market players easily (Daniel et al., 1999; McGaughey et al., 1998). In other words, customers have already accessed all suppliers (Daniel et al., 1999). It increases the power of buyers and reduces the power of sellers while the competition in the market becomes higher by optimal allocation of resources (Bakos, 1991; 1997; Hinz, et al., 2011).

It is no doubt that gaining more and more customers as well as increasing the market share is the first and unique goal of online retailers (Tih et al., 2006).

One of the most significant actions of customers is making a decision. Customer decisions are decisions customers make in the marketplaces as buyers, payers and users (Sheth, et al., 1999). What to purchase, whether to purchase, whom to purchase, when to purchase and how to pay are the most popular questions for customers, and they have to face every day.

The impact of the Internet on each stage of the consumer decision-making process is very clearly (Zeng et al., 2003). In a study, Zeng et al., (2003) found the role of the Internet to support the search stage and almost neglected to help consumers during evaluation. Similarly, evidence for incomplete support of the Internet was found during the purchase process by Kohli, et al., (2004). The more the Internet develops over the past decade, the more decision aid tools and recommender systems the customers support.

Because of the nature of online purchase activities, the online purchase process is different from the traditional one. It can be said that the Internet influences all stages of the purchase process followed by consumers (McGaughey et al., 1998). Consumer behaviour was changed by the Internet. It offered consumers various types of access to search for information, weigh different options, and make a purchasing decision (Moon, 2004; Constantinides, 2004).

When mobile commerce appeared and developed rapidly, there were relevant previous studies which showed the relationship between mobile shopping and customer behaviour, especially customer purchase decisions (Wang et al., 2015; Bigne et al., 2005; Holmes et al., 2013).

However, even though mobile shopping had become gradually prevalent amongst online clients, there was still a lack of strong evidence regarding its influence (Wang et al., 2015) and there were a few pieces of research that study the relationship between mobile shopping and customer purchase decision (Lu et al., 2009; Holmes et al., 2013; Bigne et al., 2005; Hooi et al., 2011).

Furthermore, the world nowadays has to face "smartphone culture" (Page et al., 2013) or the age of smartphones (Watkins et al., 2012). In the economic sector, the more smartphone we have the more mobile commerce applications the businesses provide (Holzer et al., 2009; 2011).

It is said that there is no doubt about the important role of mobile shopping, including mobile applications in business (Natarajan et al., 2017). Mobile shopping is a new and emerging paradigm and has huge potential in the world of business (Natarajan et al., 2017). Besides, this is also the "new ways to attract customers, to develop marketing strategies and improve customer experience" (Natarajan et al., 2017).

When smartphones become more and more popular all over the world, mobile applications (mobile apps) increase more and more quickly (Statista, 2018a). The number of mobile app downloads worldwide in 2017 is 178.1 billion. It forecasts the number of mobile app downloads worldwide in 2018 will be 205.4 billion. In 2022, this number is projected to

grow to 258.2 billion app downloads (Statista, 2018b). In another report, among huge mobile apps, Statista (2017) presents the smartphone content categories with the highest share of mobile app minutes as of June 2017. Based on these figures, retail sites accessed through mobile apps reach 47 per cent of the time.

Nowadays, the more mobiles people have the more transactions via mobile devices (mobile shopping or M-shopping) customers make. Global retail electronic commerce (ecommerce) sales increase rapidly (Emarketer, 2018). According to Emarketer (2018), global retail e-commerce sales touched £1.77 trillion in 2017, increasing 24.8% over the previous year. Among many areas in the world, retail e-commerce sales in Asia-Pacific grew 31.1% in 2017 to £1.04 trillion in comparison with total retail sales in Asia-Pacific of £7.13 trillion which increased by 7.7%. In digital sales, mobile commerce (m-commerce) accounted for 58.9%, reaching an estimated £1.03 trillion. This pointed out the key role of mobile. In 2017, worldwide m-commerce sales increased 40.3% to £1.03 trillion, demonstrating 6.0% of total retail expenditures (Emarketer, 2018). As can be seen from these above impressive figures, m-commerce, including mobile applications, becomes more and more important in retail expenditures.

However, the relationship between mobile applications and customer purchase decisions which is one of the most significant actions of customers still is not filled in an academic area. While the more mobile applications the customers download, the more retail revenue the business gets. Therefore, this study tries to research this relationship to help the business to understand clearly their customers and the ways they shop online via mobile applications. By investigating pathways that lead customers to purchase online via mobile shopping application, this study attempt to understand and describe how customers use mobile applications to purchase products online. In this paper, purchase decision-making theories and mobile application literature will be combined to develop a purchase decision pathway theory. This theory will illustrate how online consumers purchase online via mobile applications and what are the different pathways when they shop for different products.

As can be seen from the previous studies, purchase decision-making was researched in the traditional process through the purchase decision-making process model without considering the pathways people usually do when they purchase each type of product (Brassington and Pettitt, 2006; Sheth et al., 1999). It is clear that the key issue of this classic model of purchase decision-making is a step-by-step serial structure while this is not focused on every time. Customers usually skip some stages based on their characteristics and type of product (Armstrong et al., 2014). In other studies, researchers consider the relationship between customer purchase decisions in their behaviour relations (theory of reasoned action – TRA model) (Fishbein, M., 1979). Even though when researching in a technology environment, the technology acceptance model (TAM) offers a connection between consumers' acceptance of a specific technology and the usage behaviours in our perspective (Davis et al., 1989).

These models are related to the components of intended behaviours through customer attitude (Ajzen, 1991; Fishbein, 1979; Davis, 1989) or purchase decision stages (Brassington and Pettitt, 2006; Sheth et al., 1999). However, these models just take notice of how these elements affect customer intention and do not consider in a case-by-case the general model for customers when they shop for various types of products (Sheth et al., 1999). They did not study the ways to lead people to those attitudes and intentions. It means that we will not know the ways people sum up the information, perception and analyse then lead customers to different decision choices.

Therefore, this study will consider the pathways that lead online customers to purchase each type of product based on researching the ways people focus when they shop via mobile applications.

Furthermore, it is clear that when Kotler et al., (2010) developed the type of product, the internet and mobile technology was not exploded strongly like today. This research will modify the type of traditional product making by Kotler et al., (2010) into a 2x2 matrix. Thus this study aims to re-category in another way by putting four types of products into a 2x2 matrix. And of course, this arrangement will be based on technological factors in the online environment. This expects to identify more clearly about types of products in the online environment.

#### **1.2 Positioning the study**

There are three different literature streams, including online shopping, purchase decision-making and a Throughput model. In order to address these literature streams clearly, the author has included the following:

To address the pathways that lead consumers to make purchase decisions via mobile shopping applications, this study employs a combination of three literature streams including online shopping, purchase decision-making and a Throughput model.

The first one is based on online shopping, including the concept of online shopping. The other stream is customer behaviour including purchase decision-making. More specifically, purchase decision-making is considered the primary framework to investigate pathways people use to purchase. Third, this research aims to analyse the pathways customers go through when they purchase a product based on their genders, ages, occupations and the type of products they shop for. Furthermore, the Throughput model also plays a key role for people to lead them to end purchase decision-making.

The study, therefore, involves different schools of literature: online shopping, purchase decision-making literature, and the Throughput model. The study problems are solved by linking these above streams of literature together. In fact, in dealing with these issues, the research focus might be the overlap among these literature streams.





#### **1.3** Research problem

Nowadays, consumer behaviour covers a broad scope and indicates comprehensiveness (Belch and Belch, 1998). This identifies the important role of consumer behaviour in our daily life, including in economics, marketing and behavioural sciences (Engel, Blackwell and Miniard, 1995). According to Belch and Belch (1998), consumer behaviour refers to "the process and activities people engage in when searching for, selecting, purchasing, using, evaluating, and disposing of products and services so as to satisfy their needs and desires" and "including the decision processes that precede and follow these actions" (Engel, Blackwell and Miniard, 1995).

When the Internet was applied to economics, it influenced and changed the ways consumers perform in an online marketplace and the distribution of purchases on different products and retailers also transformed (Brynjolfsson, Dick and Smith, 2010). Based on lower search costs, offering an opportunity to visit various retailers at the same time or compare different alternatives instantaneously, the Internet helps consumers get all information and market players easily (Daniel and Klimis, 1999; McGaughey and Mason, 1998). In other words, customers have already accessed all suppliers (Daniel and Klimis, 1999). This increases the power of buyers and reduces the power of sellers while the competition in the market becomes higher by optimal allocation of resources (Bakos, 1991; 1997; Hinz, Hann and Spann, 2011). Therefore the market structure was changed (Bakos, 1997; Koufaris, 2003).

It is no doubt that gaining more and more customers as well as increasing the market share is the first and unique goal of online retailers (Tih and Ennis, 2006). In the first study to explore the electronic market nature, Malone, Yates and Benjamin (1987) argued that customer is capable of searching numerous retailers for a product or service. Moreover, the cost of searching is low and "proportionately more use of markets" will be detected (Daniel and Klimis, 1999). Thus the Internet market supports customers to visit all online retailers by creating more changes and reducing the concentration of the market. Besides, the impact of recommendation networking on a flatter delivery of both income and demand was found by Oestreicher-Singer and Sundararajan (2012). So the customers empower more and more base on the development of the Internet in the online market.

One of the most significant actions of customers is making a decision. "Customer decisions are decisions customers make in the marketplaces as buyers, payers and users" (Sheth, Jagdish N., Banwari Mittal, and Bruce I. Newman, 1999). What to purchase, whether to purchase, whom to purchase, when to purchase and how to pay are the most popular questions for customers, and they have to face every day.

According to Moon (2004), the way consumers adopt, develop and practise decisionmaking strategies is one of the necessary issues in consumer behaviour. Consumer decisionmaking refers to the "behaviour patterns of consumers, that precede, determine and follow on the decision process for the acquisition of need satisfying products, ideas or services" (Du Plessis et al., 1991).

The impact of the Internet on each stage of the consumer decision-making process is very clearly (Zeng and Reinartz, 2003). In a study, Zeng and Reinartz (2003) found the role of the Internet to support the search stage and almost neglect helping consumers during evaluation. Similarly, evidence for incomplete support of the Internet was found during the purchase process by Kohli, Devaraj and Mahmood (2004). The more the Internet develop over the past decade, the more decision aid tools and recommender systems the customers support.

On the one hand, the first step in supporting customers understands their decisionmaking stages. This was done by providing the required information and simplifying customers' choices to reduce intangible and perceptive costs (Kohli, Devaraj and Mahmood, 2004). On the other hand, changing channel choices may be the result of failure to maintenance some stages of the decision process.

Because of the nature of online purchase activities, the online purchase process is different from the traditional one. It can be said that the Internet influences all stages of the purchase process followed by consumers (McGaughey and Mason, 1998). Consumer behaviour was changed by the Internet. It offered consumers various types of access to search for information, weigh different options, and make a purchasing decision (Moon, 2004; Constantinides, 2004). For example, according to Moon (2004) and Constantinides (2004), every stage of purchase decision including examining alternatives, collecting necessary information, simultaneous assessment of diverse retailers, providing individual information and a payment process are all dissimilar in the online environment. Xia and Sudharshan (2002) argued that "this environment could have a profound effect on how customers construct their decision-making processes to adjust appropriately to the new decision-making environment". Many stages of the purchase decision process may take place via the Internet channel or physical shops based on the customers. This means that cross-channel purchases are allowed by using the Internet (Choudhury and Karahanna, 2008).

However, online purchase decisions have their issues, and one of the key underlying ones is information overload which was decision addressed in previous studies. The type and amount of online information are definitely different (Bakos, 1997). One of the principal reasons for an alteration in behaviour is information overload which is related to the bounded

rationality theory. The fact that customers get overloaded by the massive amount of data on products has been proved earlier (Jacoby, 1984; Malhotra, 1982; 1984). Because a massive amount of information is available on the Internet, a customer is not able to assess all the alternatives in seriousness before making a choice.

From another viewpoint, it is clear that the impact of new supporting features in the online environment such as communicating decision aids (Wang and Benbasat, 2009), recommender systems and comparison engines on consumer behaviour is understandable based on the Internet's characteristics. According to Terpsidis et al. (1997), customers could be helped in information search and problem recognition by a recommender system.

It might suggest possibly suitable products and decrease external searching by using reviews or feedback from other clients who have similar interests. It may help customers in the frequently overwhelming task of finding products as a reply to the significant choices number and its frustration at a low level of specialized support existing (Schafer, Konstan and Riedl, 2001). Besides, a countless impact on information searching behaviour might come from comparison engines (Peterson and Merino, 2003) and might create an updated trend in purchase behaviour. Furthermore, purchase decisions could be affected by comparison tools (Haubl and Trifts, 2000). In addition, many researchers confirmed in their studies that there was an impact of online buyer reviews on customers' purchase decisions (Li and Hitt, 2010; Mudambi and Schuff, 2010).

It is no doubt that Internet purchasing behaviour does not need to follow traditional customer purchasing behaviour (Koufaris, 2003). Because the customers who have more "powerful, demanding and utilitarian in their shopping expeditions" (Koufaris, 2003) are so different in an online environment. Clients could control their situations and dynamically pull the information they need rather than waiting for sellers to "push" it (Court et al., 2009).

These researches above argued the important role of customer decision-making as well as the impact of the Internet on changing customer behaviour (including decisionmaking). Therefore research on customer decision-making in an online environment is always necessary and updated.

From the previous studies, there was a group of models and theories which aim to investigate customer behaviour and decision-making. These theories focus on the main factors which detect an adoption of customer shopping behaviour in the online environment. In a few last decades, considerable literature developed rapidly from exploring the following models, namely the Technology Acceptance Model (TAM) (Davis, Bagozzi and Warshaw, 1989), the Theory of Planned Behaviour (Ajzen, 1985; 1991) and the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980). Although in the beginning, these theories were explored for other contexts, they have also been applied to online purchase research to investigate the adoption and use of online shopping. These models can show the way personal characteristics, such as perceived behavioural control and attitude, impact an intentional and real behaviour of online clients; then similarly how these characteristics might be formed by their beliefs themselves. They focus on attitudes, feelings, norms and beliefs. Despite their differences, these models propose that personal beliefs might be experiences of intention to have behaviours in a specific way. These similarities and different characteristics of these models are mentioned in detail as follows.

On the one hand, TAM pays attention to a connection between consumer technology acceptance and customer behaviours. It is also to say that TAM explores the way people apply and accept new technology in their behaviours (Davis, 1989). On the other hand, in TRA and TPB models, people consider the activity's implications to decide whether to be involved in or not be involved in a specific behaviour (Ajzen and Fishbein, 1980).

Three models are related to the components of intended behaviours through customer attitude (Ajzen and Fishbein, 1980; Davis, 1989). However, these models just take notice of how these elements affect customer intention. They did not study the ways to lead people to that attitude and intention. It means that we will not know the ways people sum up the information, perception and analysis then lead customers to different decision choices.

On the contrary, the Throughput Model gives four powerful, essential concepts arranged into six pathways that affect our decisions. It explores these essential elements to help people make better decisions which are challenging to make as people misunderstand the process of decision-making (Rodgers, W., 2006).

Furthermore, it can apply in the mobile commerce environment (Rodgers, W., 2010). The Throughput Model might help the business to understand, forecast and close to changing online client preferences and needs. It is no doubt that understanding and applying the Throughput Model for the e-commerce environment will support improving decision choices. The four conceptions are associated in different ways to provide buyers with six different pathways to make a choice. Consequently, the Throughput Model allows us to study information and practical process in several stages before making a decision. This model

which assists people to understand useful knowledge offers an in-depth analysis of the fluctuating stages touching decisions (Rodgers, W., 2010).

The Throughput Model can help to design a conceptual structure, suggest a series of connections and relationships, or improve an equation system (Rodgers, W., 2010).

Therefore, it is necessary for this research to study the pathways that lead customers to make purchase decisions via mobile shopping applications because the pathways to lead the customer to make an online purchase intention remain unclear in the literature. It is to say that there were not any studies that fill this gap. Thus the current study seeks to address this gap.

Besides, gender differences can lead to different attitudes of customers toward online shopping and customer behaviours (Chen et al., 2015) because women and men are different (Lin, X., Featherman, M., Brooks, S. L., & Hajli, N., 2018). Furthermore, gender was shown to have a relationship with customer decision-making (Bakewell and Mitchell 2003, 2004; Mitchell and Walsh 2004), purchasing processes (Pahl 1990), and online consumer behaviour (Ndubisi and Nelson 2006; Kim et al. 2007). It is said that "gender moderates the influences of interactivity, vividness, diagnostics, and perceived risk on customer's attitude as well as the impacts of attitude on purchase intention" (Lin, X., Featherman, M., Brooks, S. L., & Hajli, N., 2018). Therefore this factor should be clarified to make the relationship between gender and online purchase decision via mobile applications in this study.

Finally, when customer shops online, the way people make a purchase intention is based on product type (Kotler, P. and Armstrong, G., 2010). Thus it is not enough to analyze the pathways people lead to online shopping intention without considering the product type they buy. This is also the moderating factor that should be explored in this study.

#### 1.4 Research objectives and research questions

This study will undertake an analytical review of the purchase decision-making pathways of customers via mobile shopping applications. In particular, the research will focus on the ways people do when they shop online via a mobile shopping application. This could help producers, marketers, suppliers or other partners understand the stages customers usually spend when they make purchase decisions so that they can develop their business as well as understand their customers more clearly. This study is guided by the following fundamental research question:

#### "What are customer purchase decision pathways when they shop online?"

In responding to the research questions above on the purchase decision pathways to the customer when they do shopping via mobile shopping applications, the primary purpose of this research is to take an in-depth look at the purchase decision pathways in Throughput Model in Vietnam. The following research objectives are proposed:

(i) Examining theoretically and empirically the purchase decision pathways when customers purchase products via mobile shopping applications.

#### 1.5 Research method

Because this study regards the purchase decision pathways which lead the customers to make a decision online via mobile shopping applications which occur in reality external to social actors this current research will apply objectivism aspects of an ontology. As mentioned in the research objectives, this research is exploring both the theoretically and empirically nature of consumer purchase decision pathways in Vietnam. These paths are affected by consumer behaviours and the relationship between consumer purchase behaviours and the decision-making process when using mobile shopping applications.

In addition, this study belongs to a positivist paradigm because a number of researchers believed that the research topic related to e-commerce, mobile commerce and marketing area had been mostly appropriate to this paradigm (Kuo et al., 2009; Beverland & Lindgreen, 2010; Galalae & Voicu, 2013; Wang et al., 2015).

This research methodology consists of both secondary and primary data. Where, secondary data will be carried out through different journals, books, magazines, organisation papers, media reports or theses. On the other hand, primary data will be collected from Vietnamese customers who use mobile applications to purchase products online. Mobile users in two big cities (Ho Chi Minh and Da Nang) in Vietnam were respondents of this study because the shopping buyers in these two big cities usually use mobile applications to purchase online so their idea is valuable for this research. The Throughput Model will be used as the major theory.

Vietnam was chosen for this study because its e-commerce revenue increases rapidly in recent years. In 2020, with a growth rate of 36 per cent, Vietnam became one of the fastestgrowing internet economies in Southeast Asian (Nguyen, 2022b). In 2021, the revenue of ecommerce amounted to around 13.7 billion U.S. dollars (Nguyen, 2022a). This figure was forecast to reach 39 billion U.S. dollars by 2025, ranking second only after Indonesia within the Southeast Asian region (Nguyen, 2022b) while Southeast Asia's growth was forecasted to be the highest in the world (with a 20.6% expansion in 2022) (Flood, 2022). In this region, five countries, including the Philippines, Indonesia, Vietnam, Malaysia, and Thailand—will rank among the top 10 markets measured by retail e-commerce sales growth (Flood, 2022).

To start a study, the research approach should be the first thing to consider. The research approach, according to Spens and Kovacs (2006), should be understood as a process of hypothesis testing. It includes the inductive research approach and the deductive research approach. The two types of research approaches need to be clarified to support the process of methodology description. Hence, the study would be more efficient. The inductive research approach is the process of observing and then developing without testing. While the deductive approach researches the literature, and analyse the data collected to make the conclusion. The literature is described via information, data and facts collected which are reaching a hypothesis by the researcher (Johnson, 1996, cited by Spens, K.M. and Kovacs, G., 2006).

After reviewing research deductive and inductive approaches, it could be concluded deductive approaches might need to combine with the research. Based on the Throughput Model, the deductive approach will be conducted to find out the data on current pathways that lead Vietnamese customers to purchase online.

Research Methodology is stated as "a plan structure and strategy of investigation used to obtain answers to research questions or problems" (Mingers, 2001). The research methodology involves two main kinds which are quantitative methodology and qualitative methodology. When analysing the problems of culture, activities or behaviours, the qualitative methodology usually is used to make the research. The significant feature of these problems is that they often are influenced by other factors. Qualitative information and data are collected and then used to explain an event and its consequence (Mingers, 2001). In qualitative methodology research, people mostly use interviews and questionnaires to collect data (Myers, 1997). According to Myers (1997), the inductive research approach possesses the nature of qualitative research methodology.

In another hand, the data collected when using quantitative research methodology must be accurate, well-defined and clear. According to Kaplan and Duchon (1998), to formulate the hypothesis, researchers test statistical analysis and controlled experiments. This is the main feature of quantitative research methodology. Different to the qualitative methodology, quantitative research methodology uses not only interviews and questionnaires to collect data but also measures and observations. Among them, a questionnaire is the most popular method used in quantitative research methodology (Smith, Thorpe and Lowe, 2002).

The two methodologies above could be mixed to become a third research methodology called the mixed approach. According to Zina O'Leary (2010), the researcher could capitalize on the best traditions and overcome many of their shortcomings by using the mixed approach.

By considering the research qualitative and quantitative methodologies, the quantitative methodology will be used in this project based on what happened in the fact. This could be needed to help the author understand the current situation of pathways that lead customers to buy online products via mobile applications. Besides, it is strongly believed that the quantitative methodology could explain more specifically what different pathways of customers when purchasing online based on their characteristics and the different type of products.

After comparing some key research techniques which are used popular in the world, it is said that the structured interview (standardized interview) with a closed question is the most suitable technique to conduct this research. It could allow the author to follow an appropriate list of questions that are put in a suitable order to revolve around the research aims and objectives.

In conclusion, this research is designed by a quantitative research method and also follows a structured interview (standardized interview) with a closed question. The empirical research will reflect on the experiences of local users of mobile shopping applications and understand their behaviour when shopping online via mobile shopping applications. These will be accomplished with appropriate academic theories to address the gap which mentions in the problem statement above.

#### 1.6 Overview of study findings

Although it has been widely advanced in developed countries around the world, the field of online shopping, in general, is still a new field in Vietnam so theoretical studies are so essential to promoting direction for practical actions. This research has contributed a further scientific document in the field of online shopping, through the construction of a theoretical model that proposes different decision-making paths for consumers who buy online through mobile applications in Vietnam.

Algorithms are stepwise representations of a solution to a given problem, which makes it straightforward to apprehend. The suggested algorithms in this paper implemented a definite procedure. Moreover, it is not dependent on any programming language, so it is uncomplicated to understand for anyone even without programming knowledge. While AI algorithms are hardly a novel discovery, they are nevertheless exceedingly involved in systems used to support decision-making. This study examined the opportunities and nuances related to the use of AI algorithmic pathways. It presented different algorithms to identify and recognize purchase behaviour. We operationalize several algorithmic pathways to benefit from the tremendous AI possibilities by employing a TPM for individual and organizational use.

Building up a theoretical model based on the TPM (Rodgers, 1984) and referring to a series of theories from previous studies to explain the different decision-making pathways of online customers has demonstrated that the model application is quite consistent with the survey data in Da Nang. These data can contribute to the theoretical and practical scale, thereby helping academic and applied researchers to understand the online shopping market in Vietnam better.

By identifying the factors and pathways that influence the intention of using online shopping services, the study has provided online sales service providers with a more detailed view of consumers in using online shopping services. At the same time, service providers can refer to the recommendations of the research to increase competitiveness as well as meet the needs of consumers. In general, the findings from this study could be useful for e-commerce researchers, businesses, and online retailers to understand customer behaviour, thereby guiding solid steps in producing, introducing products and persuading consumers.

#### 1.7 Research contribution

There are several methods to investigate research contribution. In this case, the theoretical contribution model of Corley and Gioia (2011) is applied to identify the expected contribution of this study. This contribution model consists of a 2\*2 matrix including two key dimensions namely utility and originality. Utility defines the scientifically and practical usefulness of research while the originality dimension describes an incremental or revelatory understanding of the research.

#### **Figure 1.2 Current dimensions for theoretical contribution**



Source: Corley and Gioia, 2011

This study makes three contributions to empirical, theoretical and methodological levels.

First, in the experimental stage, the pathways that lead customers to shop online via mobile shopping applications are unfolded. These purchase decision paths remain underresearched in the context of anywhere in the world. Thus, this study plays an important role to find the routes for online purchase decisions. Next, in theoretical achievement, the research explores the customers' purchase decision-making pathways literature and enhances the key critique of the Throughput model of online purchase decision-making via mobile shopping applications. Moreover, the pathways of customers' purchase decision-making are underresearched in the online environment, mainly via mobile applications. Finally, at the methodology level, the research methodology is focused on the pathways of customers' purchase decision-making model which are under research although there are many theories related to customer decision-making.

To analyse these contributions, this study is incremental from an initial perspective and practically useful (quadrant 3) from a utility perspective (Corley and Gioia, 2011).

#### **1.8** Practical implications

First, this paper provides suggestions for marketing system designers to understand the significant dominant algorithmic purchase decision pathways of the consumer used in the online environment. Second, supported by statistics and AI-enhanced machine learning, neural networks and deep learning apparatuses, this proposed model can help organisations in predicting their consumer purchase decision paths based on available data on their customers' behaviour. Third, changing influence factors can assist organisations to identify and change their consumer decision routes. Organisations may change their consumer decision paths from two or three-step pathways to one-step pathways by limiting the time of promotion (such as a flash sale). This implies that time pressure is used to change/ skip their consumer's purchase paths in this case. This is one of the most imperative applications of this algorithmic model in the business world.

In conclusion, it can be said that the TPM algorithms can improve artificial intelligence applications so that they can support access and enhance decision-makers research skills in order to democratize market research. Making market research can be assisted more broadly, especially using cases beyond strategic decisions to notify psychological choices. For these above-mentioned reasons, TPM's algorithms are able to improve marketing research.

#### **1.10** Structure of the thesis

The main parts of this study are divided into seven chapters.

Chapter 1: Introduction

This chapter introduces a general background, a concept of the research and the updated situation of mobile commerce and mobile application in Vietnam. Then a clear research gap, research objectives and research aims are explored to help the readers might understand correctly about the study. After that, a clear outline of content is introduced.

#### Chapter 2: Literature review

This chapter summarises the essential contribution of the literature streams which may be relevant to the issues set up for research. The chapter begins with the purchasemaking decision The chapter goes on with a review of online shopping, including online shopping behaviour in general, factors that affect online shopping behaviour, online buying decision-making and current online decision-making models. Online shopping is the most widely reviewed because they are much more relevant to this discussion. A black box in the purchase decision-making process and decision-making process theories and models are also discussed in this section. Finally, this chapter ends with literature about the Throughput Model.

#### Chapter 3: Conceptual framework

In this chapter, indicators of purchase decision-making pathways are debated. Then chapter 3 continues to provide theoretical discussion leading to the development of the conceptual framework. Next, the hypotheses are presented after definitions relating to key concepts of the research are discussed.

#### Chapter 4: Research methodology

This chapter presents the methodology employed to test the hypotheses built-in in chapter three. The chapter begins with a presentation of the methodology approach and methodology design including a research method, tools and techniques. Furthermore, the chapter identifies measurement procedures where variables are operationalized. Besides, the chapter will continue with issues relating to data collection including method, sampling, process and response rate. Then, the validity and reliability of the data are analysed in the next section. Finally, the chapter ends with ethical considerations and research limitations.

#### Chapter 5: Result of data analysis

This chapter provides the results of the data analysis. It starts with the description of data screening which includes data missing, and outliers. The chapter continues with the other testing for regression, the testing for the validity of the measurements, etc. After that, descriptive statistics which provide an overview of the frequency, mean, etc., of the variables measured from the sample are followed. Then, it proceeds with the results of hypothesis testing and stops short of summarizing the testing results.

#### Chapter 6: Discussion and conclusion

This chapter provides discussions on and implications of the hypothesis testing results. The chapter begins by reviewing all main research issues and findings of the research, pointing out the contributions including both theoretical and managerial aspects presented and stops at the limitations of the research and suggests future research directions.

#### **CHAPTER 2 LITERATURE REVIEW**

#### 2.1 Introduction

By reviewing the relevant literature and clarifying the current understanding of online consumers, their purchase decision process and mobile applications, this chapter aims to put the research issue into perspective.

This chapter begins by presenting the three areas of research which are used in this study, including mobile shopping applications, consumer behaviour and consumer decision-making. The first section mentions fundamental concepts of electronic commerce in general, mobile commerce and mobile shopping application, in particular.

In the second section, important perceptions of consumer behaviour and consumer decision-making, in particular, are introduced as well as the evolution of decision-making is discussed in detail to provide the essential background for this study.

Moreover, this study explores the online environment so that understanding the online consumer behaviour and the impact of the Internet on user's behaviour and consumer decision-making need to discuss in the next section. This study considers the effect of the Internet on consumer behaviour and the purchase decision-making process, in particular, to show how different they are from them in an offline environment. It is followed by the discussion of characteristics of consumer behaviour and decision-making in the Internet environment.

The next section, it analyses and emphasizes the main models of consumer behaviour and decision-making as well as their limitations of current knowledge of this area. This part is also illustrated some basic related models.

This chapter ends with a critique of theories studies in our understanding of consumer behaviour and decision-making process as well as a discussion about the importance of new approaches in online consumer decision-making studying.

#### 2.2. Purchase decision-making

Today, managers dedicate their true efforts to making decisions appropriate to the organization (Fischhoff & Broomell, 2020). Accordingly, many theorists and practitioners take to consider decision-making as the most critical, core managerial function (Al-Tarawneh, 2012). In a complex and constantly changing business environment, managers

face countless decisions every day. Pearce and II (1989) have pointed out that decisionmaking is inevitable because they showed that avoiding decision-making is clearly to decide by yourself. Not surprisingly, the decision-making process has been studied a lot (Amason, 1996) because decisions affect not only the organization but also society as well as individuals (Colignon, Cray, Colignon, & Cray, 1980). Therefore, today, it is important for managers to realize their research obligations and improve their knowledge of decisionmaking processes.

Next, definitions, customer decision-making and theoretical models of decisionmaking will be discussed below

#### 2.2.1. Definitions

According to historical literature, there are many different definitions of decisionmaking. Accordingly, defined decision-making as the "conscious and human process, involving both individual and social phenomenon based upon factual and value premises (Miller & Fremount, 1970), which concludes with a choice of one behavioural activity from among one or more alternatives with the intention of moving toward some desired state of affairs". To explain this view, Varshney (1997) has pointed out that a decision-maker, as an individual, or as a member of the formal organization with his own philosophy and perception of the organization, would select for optimizing values within the constraints imposed by the organization; in which, the organization is considered as a social aspect

On the other hand, in 1976, Mann expressed that decision-making referred to the heart of the management process because he thought that decisions were long, complex, unstructured and risky, which had a huge impact on the future of the organization so that a manager needed to be cautious about (Mann, 1976). In the same view, Panpatte and Takale (2019) reaffirmed that decision-making should be considered the backbone of business management because without taking the right decision at right time, nothing can be performed. In the following years, Montagna and Carlisle (1979); Stoner and Fry (1982); Trewatha and Newport ; Bedeian (1986); Turban, Campion, and Eyring (1995); P. J. Harrison (1999) argued that decision-making was the process of bidding among alternative courses of action to solve a problem or attain better situation regarding the opportunities that exist.

In summary, after reviewing the kinds of literature on decision-making at a certain limit, the author concludes including:

Most of the definitions of decision-making are very similar to each other.

- The decision-maker has several alternatives for evaluation and selection. Thus, if there is only one choice, the manager is not involved in decision-making.

- Decision-making involves conscious choices and acts.
- Managers must constantly make decisions even if they are not willing to.

- Decision-making like any other organizational activity does not take place in a vacuum (P. J. Harrison, 1999)

For an overview of concepts so far, the Table below will summarize in detail the definitions of decision-making over the timeline.

The authors and time	Definitions and findings
Drucker (1967)	Decision-making is only one of the tasks of an executive; it
	usually takes time but a small fraction of the manager's time
M. Harrison (1980)	Decision-making is an integral part of the management of any
	organization.
Mann (1976).	Decision-making is often referred to as the heart of the
	management process
Varshney (1997)	Decision-making is considered a process synonymous with the
	whole management.
Qlueck (1977)	Decision-making is the process of thought and deliberation
	that leads to a decision
Trewatha and Newport	Decision-making is so important that none of the managerial
	functions can be performed without it
Stoner and Fry (1982)	decision-making is the process of choosing among alternative
	courses of action for the purpose of solving a problem or
	attaining a better situation regarding the opportunities that
	exist
Pearce and II (1989)	Pearce II & Robinson (1989) indicated that decision-making is
	inevitable because to explicitly avoid making a decision is in

Table 2.1 Development of decision-making definitions

Kriger and Barnes (1992)	The problem can be more complicated by differentiating	
	decision-maker into individual, group, multi-group or	
	organizational (Kriger & Barnes, 1992)	
L 1 (1000)		
Lambert (1998)	These decisions may be related to planning, organizing,	
	staffing, leading or controlling and can be straightforward or	
	complex	
Hammond, Keeney, and	Making decisions is the most important job of any manager or	
Raiffa (1998)	executive (Hammond et al., 1998)	
Depue and Collins (1999)	Depue and Collins (1999) define decision as the act of making	
	up one's mind by collecting, sharing and gathering significant	
	ideas from different sources.	
Dictionary (2000)	He defines that "decision as a choice or judgement that you	
	make after a period of discussion or thought".	
Simons, van den Pangaart,	Decision-making is not the end of the process. It extends	
Aerts, and Boon (2007)	through to achieving results and is a continuous process.	
Al-Tarawneh (2012)	Decision-making is the process of identifying and selecting	
	from among possible solutions to a problem according to the	
	demands of the situation.	
Kidane (2012)	Decision-making is a fundamental part of management.	
Carlson, Tanner, Meloy, and	Decision-making is the process whereby an individual, group	
Russo (2014)	or organization reaches conclusions about what future actions	
	to pursue given a set of objectives and limits on available	
	resources.	

#### 2.2.2. Customer decision-making

Consumer decision-making can consider as a process of consumer behaviour; in which, decision-makers (customers) will have to identify and follow the decision-making process to get products, ideas or services to meet their needs (Du Plessis, Kerley, & Winter, 1991). Accordingly, (Loudon David & Della, 1993) suggest that previous studies on decision-making soon focused on understanding consumer purchasing behaviour. For greater

certainty, (Newman & Sheth, 1985) argued that consumer's purchase behaviour was the study of individuals, groups or organizations and all activities related to the purchase, use and disposal of goods and services. In addition, consumer behaviour involves all aspects of purchasing behaviour from pre-purchase activities to consumer activities, after-purchase reviews and reviews(Fullerton, 2013). Moreover, it is also relevant to all those who have influence, directly or indirectly on purchasing decisions and consumer activities (J. King, Kahle, & Close, 2011).

From an individual perspective, the author generally finds that consumer behaviour is an interdisciplinary social science, combining elements from psychology, sociology, anthropology, ethnography, marketing and economics, especially behavioural economics (Armstrong, 1991). It examines how emotional, attitudinal, and interest effects affect purchasing behaviour (Newman & Sheth, 1985). In addition, the characteristics of individual consumers such as demographics, personality lifestyles and behavioural variables such as usage rates, usage opportunities, loyalty, brand advocacy, and willingness to provide referrals in an effort to understand people's desires and consumption are also studied in the formal study of consumer behaviour (Armstrong, 1991). Moreover, the study of consumer behaviour also investigates the effects on consumers from groups such as family, friends, sports, reference groups and society (Armstrong, 1991). In summary, previous studies have shown that consumer behaviour is difficult to predict, even for experts in this field. However, new research methods such as consumer ethnography and neuroscience are shedding light on how consumers make decisions (Newman & Sheth, 1985).

Next, researchers always recognize that understanding purchasing and consumption behaviour is a major challenge (Bagozzi, Gurhan-Canli, & Priester, 2002). Consumer behaviour, in its broadest sense, involves understanding both how purchasing decisions are made and how products or services are consumed or experienced (Bagozzi et al., 2002). Consumers are positive decision-makers (Armstrong, 1991). In summary, previous studies have shown that consumer behaviour is difficult to predict, even for experts in this field. However, new research methods such as consumer ethnography and neuroscience are shedding light on how consumers make a decision. They decide what to buy, usually based on disposable income or a budget (Cai & Xu, 2006). However, they can change preferences related to their budget and a range of other factors (Armstrong, 1991). Therefore, in order to understand the buying behaviour of consumers better, the buying decision-making process is gradually born according to behavioural studies. In the next section, the author will introduce
and synthesize a few theoretical models indicating consumer purchasing decision-making processes.

#### 2.2.3. The black box in the purchase decision-making process

According to Kotler (1968), buyers' behaviour seems to be complex to analyse although once consumer behaviour can be understood, a prediction of the ways consumers might respond to numerous environmental and informational signs will be possible to express. In the past, there were many well-known studies of buyer theoretical perspectives, such as the Freudian buyer, Marshallian buyer, Hobbesian buyer, Veblenian buyer and Pavlovian buyer (Kotler, 1965). However, although they were recognised, they did not paint the complete picture (Kotler, 1968). Thus, many researchers have argued that it is challenging to understand consumers' behaviour (Aday & Yener, 2014; Ares et al., 2008; Tiu Wright et al., 2006).

Kotler's Input-Output view of the buying process contains four concepts: inputs, channels, processors and outputs (Kotler, 1965; Markham et al., 2006). As seen in Figure 1, inputs are subdivided into the product, price, place, and promotion of the four P's of the marketing mix. On the other hand, marketing strategies are influenced by price, quality, availability, service, style, options, and images. Channels mean networks for sending promotional information, which covers advertising media, salespeople, acquaintances, family and personal observation. The processor (so-called the buyer's black box) is the buyer's psyche, containing buyers' perceptions, wants, needs, attitudes, lifestyles, interests, opinions and knowledge that affect decisions and choices. Outputs include product choice, brand choice, dealer choice, quantities and frequency (Markham et al., 2006).

The buyer's black box is a metaphor for the consumer's mindset in the buying process, which is one of the most critical parts that affect directly the choices of consumers or their final decisions. Nonetheless, researchers or marketers may approximate or guess what customers think based on the "black box" (Kotler & Armstrong, 2012).

# Figure 2.1 Kotler's buying process



Source: Adapted from Kotler (1965) and Markham et al. (2006)

The buyers' black box contains consumer characteristics and the consumer's decision process (Kotler, 1999). The buyer's characteristics include attitudes, motivation, perception, personality, lifestyle and knowledge. The decision process of the customer comprises five stages namely: (1) problem/ need recognition, (2) information search, (3) alternative evaluation, (4) purchase decision and (5) post-purchase decision (Kotler & Armstrong, 2012). Based on their characteristics, customers might employ a different decision process when they shop. Based on the buyer's situation, different sets of consumer mechanisms and marketing factors might influence directly the purchase decision-making of consumers (Kotler, 1968).

The roles of the customer's decision play in a transaction in the marketplace as buyers, payers and users (Sheth et al., 1999). The primary goal of most businesses is getting inside the head of a customer to discover how customers make decisions and how to get them to make a quick decision to purchase. Figure 2 illustrates the five stages of buying decision process which is the decision-making process used by consumers regarding the market transactions before, during, and after the purchase of a product or service (Dewey, 1910; Engel et al., 1968).

Figure 2.2 Classical purchase behaviour model



Source: Blackwell & Engel (2001)

According to Brassington and Pettitt (2006), there are five stages of consumer purchase decision-making, which include (1) problem recognition, (2) information search, (3) information evaluation, (4) decision and (5) post-purchase evaluation (figure 2). Dewey (1910) first introduced the aforementioned five stages in 1910. It was further developed by Brassington & Pettitt (2006), Engel et al. (1995), Kotler et al. (2009), and Solomon et al. (2014).

The classical purchase behaviour model is a sequential model, which has been developed from the grand models. This model is also identified as a traditional model, that is, a fundamental process model. It focuses on the process and removes the interrelations of elements (Brassington & Pettitt, 2006; Engel et al., 1995; Kotler et al., 2009 Solomon et al., 2014).

The critical problem of this classical model is that a customer does not necessarily follow the sequential "step by step" to reach the final stage (Papamichail & Robertson, 2008) because each customer has his/her characteristics and other factors to influence the decision (Karimi, et al., 2018). The customers might make final choices based on following several different paths (Karimi, & Holland, 2015). Moreover, customers may go back to previous

stages, iterate among stages (Langley, 1999) or move among stages without a clear structure or appear chaotic (Karimi, & Holland, 2013). On the other hand, decision-making is a psychological construct. Some of these stages may be skipped depending on the individual characteristics (Darley et al., 2010), motivation and personality traits (Morrison et al., 2013; Payne et al., 1993) and demographic factors (Hall et al., 2017).

In conclusion, the classical decision model may not correctly signify the real decisionmaking process complexity of individuals as these traditional stages' concepts may be too basic, and simple and cannot stand for the differences in the decision-making process flow (Karimi, et al., 2018), because the purchase decision-making process might influence by consumer's characteristics, motivation and personality traits. Besides, there are other features (such as technology) that have substantial impacts on the consumer decision-making process (Huang & Benyoucef, 2017; Sadovykh & Piramuthu, 2015). The next section debates the effect of the Internet on consumer decision-making.

#### 2.2.4. Decision-making process theories and models

The present literature on decision science stresses that the decision-making progress is not a sequent process and cannot be categorized into a set of predefined stages (Karimi, 2013), decision-makers themselves ought to be taken into consideration as they head the progress. Simon (1960) argued that decision-making was more than just a result, and involved many different stages. He introduced a decision-making model that consisted of various stages. Later, other researchers advanced this discipline by investigating the stages in the process. Decision-making models are structured models that depict the progress that the decision-maker follows (Karimi, 2013).

#### 2.2.4.1. "Grand" consumer decision-making models

There are three of the principal consumer decision-making models known as "grand models" represented in Figures 2.3,2.4 and 2.5. They are Nicosia's model (1966), Howard and Sheth's model (1969) and Engel-Kollat-Blackwell's model (1968). As can be seen clearly from the figures, a large number of boxes which related to each other with the aim of demonstrating how these actions are derived from perceptual features and external features internalised by the consumer was listed and considered. Despite the differences, these models all followed similar stages of the decision-making process which remain highlighted by circles. Firstly, there is a start that brings consumers' attention to the decision problem. Then

consumer searches and evaluates the information or gets the alternatives. Lastly, they make decisions as well as complete purchase choices.



Figure 2.3 Nicosia model of the consumer decision process

Source: Nicosia, 1966





Source: Howard and Sheth, 1969



Figure 2.5 The Engel-Kollat-Blackwell Model of Consumer Behaviour (1968)

Source: Engel, Blackwell and Miniard, 1995, p. 95

As can be seen from these grand models, they have some limitations as follows (Erasmus, Boshoff and Rousseau, 2001):

(i) The restrictions in the theoretical background of consumer behaviour at the time of their development; too much importance given to details as well as a statement of rational consumer decision-making behaviour while the customer might spend very little time making a purchasing and does not involve in those sequential stages.

(ii) The development positivistic approach is the underlying limitation of these grand models. They did not look at consumer decision-making from the perspective of the consumers who are related to the process. The limitation is that they just considered the consumer decision-making process as a logical problemsolving approach.

## 2.2.4.2. Classical Purchase Behaviour Process

The classical purchase behaviour model which has been developed from the grand models is a sequential model. This model is also identified as a traditional model which is a basic process model. It focuses on the process and removes the interrelations of elements. It clarifies the main five stages of the purchasing process namely problem recognition, information search, evaluation of alternatives, purchase decision, and post-purchase behaviour (Figure 5).





Source: adapted from Butler and Peppard, 1998

The key problem of this classical model is its "step-by-step" sequential structure because this is not followed every time. It means that every consumer might not follow all these steps and some of these stages could be skipped depending on the type of purchase and the customer. Customers may go back to previous stages. However, this model was based on consumer behaviour research for more than half a century.

#### 2.2.4.3. Sequential models of decision-making

There are four models which represented sequential models of decision-making as follows:

## a. Simon's model

One of the original efforts in decision-making modelling is the model of Simon (1960). In his work, the decision-making process has been theorized into three stages of activities including intelligence activity, design activity, and choice activity (Simon, 1960; Wally and Baum, 1994) (Figure 6).





Source: Simon, 1960

#### b. Keeney's model

The four-stage model of Keeney (1982) is another important decision-making model. These stages structure the decision problem (generation of alternatives and specification of objectives), assess possible impacts of each alternative, determine preferences (values) of decision-makers, and evaluate and compare alternatives. This model shows the estimated complications at each stage. Taking into account the individual preferences of decisionmakers is considered one of the advantages of the model. Besides, the inter-relation of concepts may also be more developed than in Simon's model. Nevertheless, the sequential structure might still be seen in this model.



Figure 2.8 Four-stage decision-making model of Keeney

# Source: Keeney, 1982

# c. Holtzman's model

Holtzman (1989) presented a model which became one of the most common models used in decision-making. It contains decision analysis phases, including formulating, evaluation and appraisal.

# Figure 2.9 Holtzman's model



Source: Regan and Holtzman, 1995

# d. Shim's model

Shim et al. (2002) explored a similar conventional decision-making process model which was based on the model of Simon for Decision Support Systems (DSS). While established for the DSS environment, it might be a detailed model of decision-making that is more widely applied. At first, the problem is recognized. Next, a model can be generated. Then, alternative solutions are created as well as the model which is based on the problem definition to analyse the different replacements is developed. Finally, the choice is made and implemented.



Figure 2.10 Shim et al.'s (2002) models of DSS decision-making process

Source: Shim et al., 2001

The above-decision research has been criticized for different reasons. However, their drawbacks go beyond the serial steps which could not explain real-world decisions. Langley et al. (1995) addressed that their shortcomings stem from limitations of the decision, decision-maker and decision-making process concepts. These limitations and the ways they can be spoken are seeing sequential stages, describing a decision as something that exists and can be defined and excluding the influences of emotions, memories from the process and individual differences.

#### 2.2.4.4. Non-sequential models of decision-making

Other researchers have explored non-sequential models. These core non-sequential models in decision purchase decisions are reviewed in this section.

#### a. Mintzberg's model

One of the first models to have developed the sequential decision-making process is Mintzberg's model. Mintzberg's model is based on Simon's model (1960). It defines the three stages of intelligence, design and choice which might be inevitable in decision-making.

# Figure 2.11 Mintzberg's model



Source: Mintzberg, 1976

# b. Papamichail and Robertson's model

D2P (decision for decision support in processes) is a non-sequential process model which was announced by Papamichail and Robertson (2003). It is based on the work of Holtzman (1989). Its improvement is gathering more information on decision actors, their activities, roles, and the way they follow the process.





Source: Papamichail and Robertson (2003)

The main problem of these models is too much emphasis is given to details and they do not consider the pathways people do when they purchase a product.

# 2.3. Online shopping

Online shopping is defined as an e-commerce form that allows consumers to purchase goods and services via the internet using a web browser or mobile application (Kawaf &

Tagg, 2017). By accessing shopping search engines, consumers can find products of interest offered by e-retailers at almost the same prices (Fu et al., 2020). In recent years, as information technology has grown, customers can shop online with a variety of support devices such as desktops, laptops, tablets and smartphones (Frizzo-Barker et al., 2020).

In addition, Lui (2012) has argued that the diversity of options, ease of use, saving cost and increasing value for money are useful factors to encourage customers when conducting procedures about online shopping. Besides, with the rapid separation of digital device environments, people are more likely to use mobile phones, laptops, tablets and different digital devices to collect information (Kawaf & Tagg, 2017). In other words, consumers' minds and purchasing behaviours are strongly influenced by the development of the digital environment (Pappas, 2016). Moreover, according to Li, Kannan, Viswanathan, and Pani (2017), multi-interaction can have an influence on customer support decision-making in an online shopping environment. Each customer is becoming more interactive and through online reviews, customers can influence the behaviour of other potential buyers (Li et al., 2017). Overall, online shopping is growing and more complex thanks to the constant change of Internet and Information Technology. This is the impetus for promoting online consumer behaviour studies.

# 2.3.1. Online shopping behaviour

In the past few decades, definitions of online buying behaviour have begun to appear with the advancement of computers and the Internet. According to Häubl and Trifts (2000), online shopping is a transaction made by consumers through a computer interface, where the consumer's computer is connected and can be compatible with the digital retailer via the internet. Meanwhile, (y Monsuwé, Dellaert, y Monsuwé, & de Ruyter, 2004) have argued that online shopping is defined as consumer behaviour in shopping through online stores or websites used for online purchases. In the same opinion field, C. H. Park and Kim (2003) also said that the online shopping behaviour of consumers is mainly based on the interface of websites and images of products posted on the internet. In general, the views of researchers in the early 2000s about online shopping behaviour were relatively straightforward since the internet was not well developed at that time.

However, over time, thanks to the development of information technology, especially the growth of e-commerce, online shopping behaviour have changed drastically. Specifically, Kawaf and Tagg (2017) stated that online shopping behaviour is the purchase of goods and services via the internet with a web browser or mobile application, thanks to the permission of the e-commerce platform. Meanwhile, according to Soopramanien and Robertson (2007), the rapid growth of the internet and e-commerce has strongly influenced the way consumers surf the web and gather product information. There are many factors influencing customers' online buying behaviour but the most important and prominent factor is still information. According to Thapliyal and Pathak (2019), technology and the internet have brought a huge amount of information, and every purchase decision-making behaviour needs to be carefully evaluated to make the best choice in a series of alternatives. On the other hand, Kavitha and Kannan (2020) stated that e-commerce is making it easy for customers to access products, but buying behaviour becomes more complicated. This presents both opportunities as well as challenges for researchers, retailers, and economists. They need to promote research on online buying behaviour to keep up with market trends. That is the reason why the author conducted this study to improve the understanding of consumer decision-making behaviour in the online environment.

In the next section, the author will discuss online shopping intention and the factors affecting online shopping intention.

# 2.3.2. The factors affect online shopping behaviour

Previous studies provided useful information on the diverse factors that influence consumers' online buying behaviour, including four main areas: consumer characteristics, consumer perceptions, product features and merchant characteristics (Lui, 2012). Consumer characteristics include demographic, internet usage, and consumer purchases. Meanwhile, attitude and motivation are mentioned in consumer awareness. Next, the product/service characteristics relate to the amount of customer knowledge about the product/service. Finally, the supplied features and quality are included in merchant characteristics. Table 2.2 summarizes the domain areas and key factors used to explain customer behaviour on the Internet and related sources.

Domain Area	Key elements	Sub Elements	Findings	Supporting literature		
Consumer	Demographics	Gender	Mixed	(Bhatnagar, Misra, &		
Characteristics		Age	Results	Rao, 2000a);		

# Table 2.2 Summary of Factors Influencing Online Shoppers

		Marital Status	(Positive;	(Brown, Pope, &
		Incomo	Negative;	Voges, 2003);
		meome	No	(D1-1-1-) 0
		Education	influence)	
			,	$(D_{1}) = (D_{1}) = (D_{$
				(Donthu & Garcia,
				1999); (Dunckley &
				Kuldip, 2004)
				(Joines, Scherer, &
				Scheufele, 2003)
	Internet	Internet Usage	Positive	(Dillon & Reif,
	Experience	Experience	Influence	2004)
		Drior Durchaso		(Dillon & Reif,
		r noi r urchase		2004)
		Experience		$(H_{2} \approx D_{2})$
				(Ha & Perks, 2005)
				(Kuhlmeier &
				Knight, 2005)
				(Mourali, Laroche,
				& Pons, 2005)
				(Inysveen &
				Pedersen, 2004)
				(J. Park & Stoel,
				2005)
				(Pavlou, 2003)
				(=====,====)
Consumer	Perceived	Product Risk	Negative	(J. L. Baker, 2000)
Perception	Risks		Influence	(Bhatnagar, Misra, &
				Rao 2000b)
				1
				(Childers, Carr,

			Peck, & Carson,
			2001)
			(Forsythe & Shi
			2003)
			(Huang & Oppewal,
			2006)
			)
	Security risk	Negative	(Bhatnagar et al.,
		Influence	2000a)
			(Dillon & Reif
			2004)
			(Elliot & Fowell,
			2000)
			(Jarvenpaa & Todd,
			1997)
			(Liebermann &
			Stashevsky, 2009)
Convenience	Convenience	Positive	(Bhatnagar et al.,
		Influence	2000a)
			(Delefreez Paim
			Haron, Sidin, &
			Khatibi, 2009)
			(Delafrooz, Paim, &
			Khatibi, 2010)
			(Lui. 2012)
			(Doolin Dillon
			There a
			Thompson, &
			Corner, 2005)
Information	Information	Positive	(Dennis, King,
search	search	Influence	Jayawardhena, &
		-	Wright 2007)
			(Districtle Maar
			(Birtwistle, Moore,

				Kim, & Stoel, 2005)
				(Wolfinbarger &
				Gilly, 2001)
	Social	Recommendati	Positive	(Chevalier &
	influence	ons Reviews	Influence	Mayzlin, 2006)
				(Foucault &
				Scheufele, 2002)
				(Ganesh & Li, 2010)
				(Limayem, Khalifa,
				& Frini, 2000)
				(Harridge-March &
				Quinton, 2010)
				(Randall, Ulrich, &
				Reibstein, 1998)
	Hedonic	Enjoyment	Positive	(Suganthan et al.,
	motivations		Influence	2005)
				(Wright,
				Jayawardhena, &
				Dennis, 2008)
				(Dennis, King, Kim,
				& Forsythe, 2007)
				(E. J. Park, Kim, &
				Forney, 2006)
				(Sorce, Perotti, &
				Widrick, 2005)
Product/services	Product price	Product	Positive	(Devaraj, Fan, &
Characteristics		Pricing	influence	Kohli, 2002)
				(Delafrooz et al.,
				2009)
				(Delafrooz et al.,

				2010)
				(Brynjolfsson &
				Smith, 2000)
				(Brown et al., 2003)
Merchant	Product	Product	Positive	(Bakos, 1997)
Characteristics	Information	Information	influence	(Cao, Zhang, & Seydel, 2005)
				(Peterson
				Balasubramanian &
				Bronnenberg, 1997)
				(Ranganathan &
				Ganapathy, 2002)
				(Zhang, Keeling, &
				Pavur, 2000)
	Reputation	Reputation	Positive	(De Ruyter, Wetzels,
			influence	& Kleijnen, 2001)
				(Gefen, Straub, &
				Boudreau, 2000)
				(Gosschalk & Hyde,
				2005)
				(Jarvenpaa,
				Tractinsky, & Vitale,
				2000)
				(Jun & Jaafar, 2011)
	Customer	Service quality	Positive	(Jarvenpaa & Todd,
	Service	Communicatio	influence	1997)
		n		(Lennon & Harris,
		Responsivenes		2002)
		s		(Prasad & Aryasri,
				2009)

		(Wolfinb	r &	
		Gilly, 20	01)	
		(Lohse	&	Spiller,
		1998)		

Source: Lui (2012).

# 2.3.2.1. Consumer characteristics

According to Lui (2012), buying characteristics have a strong influence on the buying behaviour of customers via the internet. Demographics and internet experience are the two main factors of customer characteristics.

## a. Demographics

There have been many previous studies on demographic factors influencing online purchasing behaviour. Bhatnagar, Misra and Rao (2000) found mixed results when studying age and sex. Meanwhile, studies by Donthu and Garcia (1999) and Susskind (2004) have suggested that the trend of online shoppers is affected by their income. Besides, the education level also has mixed results when affecting online buying behaviour reported by Li, Kuo and Russell (1999) and Susskind (2004). On the other hand, another cultural demographic was also approached by Hall (2000) and has left positive effects.

However, many authors have now come up with different theories against demographic factors (Lui, 2012). They argued that demographics may be less likely to impact online buying behaviour if the growth of the Internet population continues and becomes more diverse. In our research, the demographic factor is still one of the key factors that we retain to research affecting the decision-making path of online consumers.

## **b.** Internet Experience

According to Lui (2012), as the Internet becomes increasingly essential to everyday life, studies show that online shopping will have a positive impact on customers when they interact on social networks, webpages or other platforms. The more users have experience with the Internet, the more experience they will have with online shopping, which will lead to a more positive attitude towards online purchases (Dillon and Reif, 2004; Doolin et al., 2005; Kuhlmeier and Knight, 2005; Xu and Paulins, 2005). Also, Venkatesh and Agarwal (2006) argue that the more experienced consumers are, the better their ability to perform product-related tasks because they already have prior knowledge. Buying online is often considered

riskier than buying from a retailer because it is a new form for many people, so online shoppers will rely on their experience (Laroche et al. ., 2005). Elsewhere, Jayawardhena, Wright and Dennis (2007) suggested that the frequency of online purchases was positively correlated with the first time after online shopping. In summary, the shopping experience is a very important factor in the purchasing characteristic that any research on online shopping cannot be ignored; our study is not an exception.

#### **2.3.2.2.** Consumer perception

To predict consumers' intention to buy online, consumer perception is a factor not to be missed. In this section, we discuss the main elements of consumer perception: cognitive risk, convenience, information search, social influences and motivation for pleasure.

# a. Perceive risks

Perceived risks are defined as the uncertainty of the buying environment that consumers consider, which is related to the adverse results that occur when making inappropriate decisions (Hunter et al., 2004). Customers will have less incentive to buy from a specific supplier or at another online address if their perceived risk increases when buying from that site (Spake and Finney, 201 0). Liebermann and Stashevsky (2002) and Pavlou (2003) stated that perceived risk comes from several mistakes such as web retailers misrepresenting products; leaking personal information, and providing misleading advertisements. A series of studies also indicate that consumer satisfaction is negatively impacted by cognitive risks (Bhatnagar et al. 2000; Jarvenpaa et al. 1999; Liao and Cheung 2001; Park et al. 2004; Pavlou 2003). In general, the main areas of concern for consumer perceptions are product risks, security risks and privacy risks (Forsythe et al., 2006; Shergill and Chen, 2005).

# **b.** Product risk

According to Lui (2012), product risk is seen as a poor or inappropriate purchase decision. Making poor decisions from not comparing prices, not being able to return products or not receiving purchased products are common risks in an online shopping environment (Bhatnagar and Ghosh, 2004; Bhatnagar, Misra and Rao, 2000; Jarvenpaa and Todd, 1997; (Sarkar, 2011). Product performance is also the calculated risk for failure to meet expectations because of the related failure to test the product before purchase and concerns about defective delivery (Baker, 2000; Childers et al., 2001; Tan, 1999). According to Bhatnagar and Ghosh (2004) and Jarvenpaa and Todd (1997), customers prefer to check

product quality before buying but it is difficult to achieve in an online environment, so there is a risk of buying an item that doesn't suit the original purpose. On the other hand, online shopping is also related to another problem sometimes customers receive goods on time (Huang and Oppewal, 2006; Sarkar, 2011).

#### c. Security risk

Policies on reliability, payment security and privacy are factors that consumers are interested in online shops (Gefen and Straub, 2000). Bhatnagar, Misra and Rao (2000) argue that financial risk is a concern for the privacy of financial information of consumers online. Ranganathan and Ganapathy (2002) found that security is a top concern and influences whether consumers intend to buy high or low. To increase consumer confidence online, websites can take steps to minimize environmental risks or enhance security (Warrington, Abgrab and Caldwell, 2000). Nowadays, although websites use a variety of security measures to protect consumers, online customers still prefer to check legality before purchasing (Lui, 2012). For that reason, financial institution banks have been introducing a series of new technologies to alleviate consumer security risks.

## d. Convenience

Convenience is one of the important factors influencing online buying behaviour (Wolfinbarger and Gilly, 2001). According to Huang and Oppewal (2006), convenience is defined as reducing the opportunity cost of effort and time related to procurement activities. Many consumers prefer online shopping because it is ready anywhere, which opposes traditional shopping where buyers need to plan, move, find out parking or wait for purchasing (Childers et al., 2001). Dholakia and Uusitalo (2002) have suggested that online shopping would help customers save time and effort searching more than visiting actual stores. Online consumer satisfaction is strongly influenced by purchasing convenience, which in turn improves the buying opportunity. (Lee and Tan, 2003). Also, when buying online, customers can choose the desired colour and size immediately, thereby reducing unnecessary purchase time (Bhatnagar, Misra and Rao, 2000).

Although there are some restrictions when shopping online because consumers must have access to the internet to be allowed to make online purchases; with the increase in mobile connectivity each year, this issue is no longer so important (Lui, 2012). According to Huang and Oppewal (2006), the advantages of online shopping are still better than the disadvantages, especially meaningful to those who have difficulties in time.

## e. Information search

Finding information that occurs when the need is recognized, consumers will assess all possible sources to address specific issues and meet their needs (Oumayma, 2019). According to Wolfinbarger and Gilly (2001), the search for online information of consumers and their intention to shop online are closely linked. Online information comparisons provide opportunities for consumers to choose the lowest prices (Choi and Park, 2006). When there are many choices about products and retailers, prices may be lower than in traditional stores, which explains why customers choose to shop online (Jayawardhena et al., 2007). However, according to Lui (2012) retailers not only focus on providing low prices, but they also consider other important drivers that influence customers' decision-making to buy online.

#### f. Social influences

Social influence is influenced by friends, relatives, colleagues, articles, reviews or advertisements (Lui, 2012). According to Vanchon (2011), people often imitate the buying behaviour of other individuals around them to comply with social standards. Randall, Ulrich and Reibstein, (1998) suggest that people monitor other people's purchases to gain useful information, which helps them make more informed purchasing decisions. For example, when there is a need to purchase a product, which was also purchased from other individuals in the same community earlier, this will positively influence the prospect's purchase decision.

Societal influence can be fully applied in the online environment. Ganesh et al., (2010) have demonstrated that social networking is an excellent update technology, which can be used to encourage social influence. To reach a large number of people, products and services can be shared via social networks through methods such as recommendations, reviews and viral marketing (Lui, 2012). Moreover, recommendations from other shoppers have a positive impact on shoppers' buying decisions at online stores (Chevalier and Mayzlin, 2006). In addition, some reports suggest that famous reviewers or bloggers have a great influence on online purchasing behaviour (eMarketer, 2008). Also, as we learn, online forums for shopping are also places where buyers can interact with each other to ask for ideas and make suggestions. All of the above comments show that social influence has a decisive influence on the online purchasing behaviour of consumers

# g. Hedonic motivations

Hedonic motivation is defined as the aspects of enjoyment and entertainment while the attitude and behaviour of online shopping individuals are formed (Kim and Forsythe, 2007; Moon and Kim, 2001). Highly hedonic motivated consumers are usually interested in some fun through purchases and experiences (Wolfinbarger and Gilly, 2001). Their behaviour often includes finding information on the Internet that has been browsed, then seeking bargaining opportunities and having interests related to certain products or interests. Childers et al. (2001) and Hansen (2005) stated that in determining online purchasing intent, hedonic dynamics should be considered in addition to common pragmatic motivations. With online shopping becoming increasingly complex, online stores are constantly striving to serve the different needs of their customers. In many previous studies, hedonic motivation is not paid much attention but with the advancement of social networks, this is a factor deserving of consideration (Lui, 2012).

## 2.3.2.3. Product/service characteristics

The main factors we learn in the product characteristics section are price and product information. The price difference between online and offline channels is an important significance for channel satisfaction (Donthu and Garcia, 1999).

# a. Product price

The price is considered to be the full cost of money to consumers upon purchase (Lui, 2012). Jarvenpaa and Todd (1996) and Liao and Cheung (2001) have argued that online purchasing decisions are significantly influenced by price. According to Lui (2012), the price of a product and service purchased on an online platform is lower than that of an official store. Lower prices between online and offline channels have a strong impact on consumer purchasing decisions (Devaraj, Fan and Kohli, 2002). Today, many price comparison websites appear on the internet to allow consumers to easily compare the prices of products. Online customers only need to take a few minutes to find the cheapest prices for the products of their choice on price comparison websites.

#### **b.** Product information

Product information is information distributed by online stores about the products they sell (Park and Kim, 2003), including product attributes, reviews, recommendations, etc. Bakos (1997), Bellman, Lohse and Johnson, (1999) stated that in order to reduce customer search costs, online sellers should provide adequate information regarding fake products and products. The uncertainty about the quality of the information will negatively affect customer perception and reliability of the supplier, which in turn affects the decision to buy online (Ranganathan and Ganapathy, 2002). To increase consumer satisfaction, online sellers should

provide product insights that help customers make better purchasing decisions (Peterson, Balasubramanian and Bronnenberg, 1997). Therefore, the product information must be constantly updated to help consumers make easy choices in the way they understand (Park and Kim, 2003; Zhang, Keeling and Pavur, 2000).

#### 2.3.2.4. Merchant characteristics

We refer to merchant reputation and customer service facilities as two important elements in merchant Characteristics.

#### a. Reputation

Consumers put their trust in suppliers that are closely related to their reputation (Hyde and Gosschalk, 2005). Jun and Jaafar (2011) have shown that consumer buying decisions are positively influenced by the reputation of the seller. In addition, deRuyter, Wetzels and Kleijnen (2001) have argued that better reputation companies will have a greater opportunity to capture the belief of online consumers. Retailers today should be wary of negative feedback from online information and rating systems. They should work hard to keep the trust of customers because it is an important factor in promoting online shopping behaviour (Lui, 2012).

# **b.** Customer Service

Customer service covers responses to payment and returns policies and commonly asked questions (Lui, 2012). Customers are interested in assistance with product selection, gift services or transportation costs (Park and Kim, 2003). Prasad and Aryasri, (2009) and Shen et al (2006) have also demonstrated the importance of customer service and its influence on online shopping behaviour. Consumers will feel comfortable if the online seller clearly specifies the payment methods, delivery time and costs of the online store (Lui, 2012). In addition, Wolfinbarger and Gilly (2001) have stated that if the information is relatively easy to find, consumers will be willing to serve themselves. The authors also stated that customer loyalty increased significantly when online buyers knew that a customer service representative was available online and ready to solve the situation immediately. In summary, customers are more likely to make a decision if they feel it is easy to contact customer service for solving related questions and issues.

## 2.3.3. Online buying decision-making

It is assumed that online consumer behaviours are different from traditional behaviours (Van den Poel & Buckinx, 2005. For example, according to Bucklin et al. (2002), online choice behaviour is more flexible and contains a series of related choices (Bucklin et al., 2002). In the online environment, businesses and customers might shape the context of monitoring choice events based on the result of earlier events experience. In other words, these significant characteristics can contribute to the complexity of this decision-making process.

The online purchasing process is different from the traditional one as the Internet influences all stages of the purchase-making process (Gupta et al., 2004; McGaughey & Mason, 1998). In the online environment, customers have many differences in searching for alternatives, evaluating various retailers, collecting required information, personal information security as well as providing a payment process (Butler & Peppard, 1998). The mechanisms of the Internet can change consumer behaviour because it provides for customers the means to search for relevant information, and evaluate the alternatives or options to purchase (Constantinides, 2004; Moon, 2004). The Internet allows customers not only to make their online decision process to adapt to a new decision environment (Xia & Sudharshan, 2002) but also to purchase via cross channels such as Internet networks or physical stores (Choudhury & Karahanna, 2008). Karimi, & Holland (2015) have argued that the online environment can contribute to the complexity of this decision-making process, as the businesses and customers might shape the context of monitoring choice based on the result of earlier experience. . For example, online choice behaviour is more flexible and contains a series of related choices (Bucklin et al., 2002).

Different from the traditional decision-making process, the online one is more flexible (Bucklin et al., 2002) because all stages of the purchase-making process are influenced by the Internet (Butler and Peppard, 1998, Gupta et al., 2004). In particular, online customers might have many dissimilarities in collecting required information, alternative searching, evaluation of alternatives, purchase options and so forth (Butler and Peppard, 1998, Moon, 2004, Constantinides, 2004). Furthermore, the customers can be assisted to make their decision process to adjust to the new decision environment (Xia and Sudharshan, 2002) and buy via cross channels (Choudhury and Karahanna, 2008). It can be argued that the Internet can promote the complexity of the online decision-making process (Karimi et al., 2015).

Moreover, the customers might track numerous decision routes to make their final choices based on the ways of adapting and replying to their decision duties (Pavlou et al., 2007). Online customers might add, skip or reorder the steps of their decision-making process (Dorn et al., 2010). Thus, online purchase decision-making can be a tremendously self-motivated adaptable path (Karimi et al., 2015).

In comparison with the traditional purchase decision journey, during the online shopping process, the customers might be more forceful, utilitarian and demanding (Koufaris, 2002). They can, according to Court et al. (2009), be in charge of their situations, get valuable and appropriate information dynamically and not wait for available information which is provided by organizations. Besides, buyer's characteristics and decision-making perspectives are different based on their various educations, social status, philosophical viewpoints (Rodgers, 2006), motivation, attitudes, personality, perception, lifestyle and knowledge (Kotler et al., 2018), which influence the customer's cognitive thinking and guide the assorted purchase decision journeys of each online customer. It can be said that the actual purchase decision paths of each customer might be overseen (Karimi et al., 2018). As a result, a better way of exploring and analysing online purchase decision pathways should be discovered.

The Internet might cause some critical fundamental issues for the consumer purchase decision process. For instance, information overload is a critical issue which affects decision-making (Soto-Acosta et al., 2014). These influences might be not only positive effects (Huang, 2000; Huang et al., 2013) but also adverse effects (Chen et al., 2009; Sicilia and Ruiz, 2010). In order to reduce this drawback, Häubl and Trifts (2000) advocated that consumers implement a two-step decision process. First, online customers can examine a massive amount of products/services and select a set of suitable options which may appear to have a great deal of potential in terms of problem-solving (Häubl & Trifts, 2000). In the second stage, this set of alternatives may be evaluated more deeply and compared to other options depending on the required criteria to make the final choice (Häubl & Trifts, 2000).

Moreover, online consumers are more demanding, forceful and utilitarian during their shopping journeys compared with traditional purchase decision-making (Koufaris, 2002). Online customers can control their situation and extract useful and relevant information actively rather than waiting for organisations to provide it for them (Court et al., 2009) which can influence the online consumer decision-making process. It can be said that the Internet

affects all stages of purchase decision-making (McGaughey & Mason, 1998) in a variety of ways.

Furthermore, each online consumer may have a different decision-making perspective based on their different philosophical viewpoints, education, social status, etc. (Rodgers, 2006). In addition, the buyer's characteristics include attitudes, motivation, perception, personality, lifestyle and knowledge (Kotler & Armstrong, 2012) that may have an impact on their cognitive thinking that guides the purchase decision-making of online consumers.

Next, the purchase decision-making of online customers might be an extremely dynamic and flexible route (Karimi, & Holland, 2015). Based on the ways that consumers adapt and reply to their decision tasks, they may follow various routes to make the final choices (Pavlou et al., 2007). These adaptive abilities can help online consumers to skip, add or reorder the decision-making process steps (Dorn, 2010).

Nonetheless, the actual purchase decision-making paths of each online consumer are overlooked (Karimi, et al., 2018). Therefore, it is worth discovering another better way in order to model and analyse the purchase decision pathways of the consumers.

A critical argument of purchase decision-making pathways for online consumers from the Throughput Model perspective is discussed to represent how the buyer characteristics are processed through a black box channelling to a decision choice.

#### 2.3.4. Current online decision-making models

# 2.3.4.1. Theory of reasoned action (TRA)

The theory of Reasoned Action was developed by Ajzen and Fishbein in the late 1960s and expanded in the 1970s (Doswell, Braxter, Cha, & Kim, 2011). The Theory of Reasoned Action assumes that the intention of the behaviour leads to the behaviour and the intention is determined by the individual's attitude towards the behaviour, along with the influence of the subjective standard surrounding the implementation of those acts (Fishbein, 1981). In particular, Attitude and Subjective Standard are important in intent to act.

This is one of the various important theories that explain the relationship between behaviours and attitude. The TRA concentrates on the effects of an individual's attitude toward their actions. In a later study, Ajzen and Fishbein (1980) stated that the subjective belief of an individual about the importance of a particular behaviour would influence that person's intention of acting. The Theory of Reasoned Action identifies the customer's attitude as the centre of the behavioural process. Moreover, the attitude of a customer about behaviours, actions, ideas or objects could be satisfied or unsatisfied, agreed or disagreed. The TRA only considers the evaluative aspect of a customer's attitude (Bajaj and Nidumolu, 1998).

According to Ajzen and Fishbein (1980), the Theory of Reasoned Action is a particular theory that is related to the elements of intention behaviours. Via the TRA model, people might be assumed to be regularly somewhat rational and create systematic use of information which is available to them. An individual can consider the implications of the activities before deciding to participate or not participate in a particular behaviour (Ajzen and Fishbein, 1980).





Source: Fishbein and Ajzen (1975)

According to Colman (2015), the Theory of Reasoned Action takes care of consumers' behaviour as well as determines their behavioural tendencies, in which behavioural tendencies are part of an attitude toward behaviour ( for example the general feeling of their liking or dislike will lead to behaviour) and partly the subjective standards (the impact of others also leads to their attitudes). In addition, this model predicts and explains trends to conduct behaviour by attitudes toward consumer behaviour rather than consumers' attitudes towards products or services (Karami, 2006).

Like the three-component attitude model, the Theory of Reasoned Action model combines three components: Awareness, Emotions and trend components are arranged in a different order from the three-component attitude model. The way of measuring attitudes in the Theory of Reasoned Action is similar to that in multi-attribute attitudes. In this model, however, the subjective standard component must be measured further, as this component also influences the trend leading to consumer behaviour. According to previous studies, the Theory of Reasoned Action has been used in many areas of research such as communication behaviour, consumer behaviour and health behaviour. Accordingly, many researchers use the theory to study behaviours related to high risk and danger, as well as deviant behaviour.

However, this model also has limitations in predicting highly controlled behaviour. Furthermore, TRA does not take into account certain conditions that allow the conduct of behaviour not available to individuals because TRA focuses on behaviours that people decide to enact.





Source: Fishbein (1975)

# 2.3.4.2. Theory of planned behaviour (TPB)

The theory of planned behaviour is a theory that expresses the relationship between one's beliefs and one's behaviour (Sanne & Wiese, 2018). It states that attitude, subject norms, and perceived behavioural control, together shape an individual's behavioural intentions and behaviours.

The Theory of Planned Behaviour has been developed from the TRA (Ajzen and Fishbein, 1980). As discussed above, this theory concerns the three factors which affect an individual's behaviours. These are the attitude, the subjective norms and the perceived behaviour control. In an economic aspect, the three elements influence the customer's intention of purchasing and then decide the purchasing behaviour.

#### Figure 2.15 Theory of planned behaviour (TPB)



## Source: Ajzen, 1991

The Theory of Planned Behaviour as a foundation model of the relationship between beliefs and behaviours was referent by many later researchers to make a framework or literature in their studies (Mathieson, 1991; Harrison et al., 1997). However, it is not concerned with any particular beliefs and also related behaviours. The Theory of Planned Behaviour is a general model, and like the Theory of Reasoned Action, be used in several behaviour pieces of research about e-commerce (Jarvenpaa and Todd, 1997, b; Tan and Teo, 2000; Limayem et al., 2000; Song and Zahedi, 2001; Pavlou, 2002; George, 2002; Khalifa and Limayen, 2003; Suh and Han, 2003; Celik, 2008).

As be clear from the three above models, they just describe a straight-line process which leads consumers to purchase decisions. They do not consider the routes people do when they make a decision. Besides, these models do not reflect the role of information factor to purchase a product or service.

This theory was initiated by Ajzen (1991), which aims to improve the predictability of the Theory of Reasoned Action by adding to the cognitive behavioural awareness model, which offers many advantages in predicting and interpreting an individual's behaviour in a given context (Sanne & Wiese, 2018). It is considered one of the most widely applied and cited theories of behaviour theory (Cooke & Sheeran, 2004)

The advantage of TPB is that it can encompass the non-willful behaviour of people that cannot be explained by the Theory of rational action (TRA). The TPB model is considered to be more optimal than the TRA model in predicting and explaining consumer

behaviour in the same content and case studies because the TPB overcomes the disadvantages of the TRA model by adding behavioural control awareness factors. Moreover, this theory can explain an individual's social behaviour by treating "social norms" as an important variable.

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Figure 2.16 Theory of planned behaviour (TPB)

Source: Bauer, 1960

# 2.3.4.3. The technology acceptance model (TAM)

In 1989, Davis developed the technology acceptance model (TAM) to explain the intended behaviour of potential users when using an improved technology (W. R. King & He, 2006). This model is based on the theory of theoretical action (TRA), a psychological theory that seeks to explain behaviour. TAM involves two main factors including perceived ease of use (EU) and perceived usefulness (U) and the dependent variable behavioural intention (BI), which is thought to be closely related to TRA swimming practice behaviour.

Davis (1989) established a new usage model of information technology called TAM. And according to a number of researchers such as Arning and Ziefle (2007); Djamasbi et al. (2010); Li and Bai (2011); Agrebi and Jallais (2015), the TAM is more powerful than any information technology usage model which has been established.

Figure 2.17 Technology Acceptance Model (TAM)



Source: Davis (1989)

The Technology Acceptance Model states that the intention of users to use a technological product depends on their belief level in the usefulness and the ease of the technology. The usefulness and the ease are to assist users in using the product effectively and efficiently (Chen, Y.M., Hsu, T.H. and Lu, Y.J., 2017).

Davis, Bagozzi and Warshaw (1989) and Igbaria (1993) argued that initially, the Technology Acceptance Model was established to describe the use of computer products. Then, accompanying the development of the Internet, TAM is being used to explain other usages of Internet applications (Atkinson and Kydd, 1997; Fenech and O'Cass, 2001). TAM, later, is used by several researchers such as Shim et al. (2001); Fenech and O'Cass (2001); Gillenson and Sherrell (2002); Grazioli and Jarvenpaa (2002); Koufaris (2003); Vijayasarathy (2004); George (2004); Kim, Ferrin and Rao (2008) to apply on e-commerce and then m-commerce. These theories described a connection between the customer's sequence of beliefs, attitude and intention to the actual behaviour of purchasing (Verhagen and Dolen, 2009).

According to W. R. King and He (2006), this model has become popular because it is easy and legible to apply in behavioural research. However, it is not perfect because not all relationships in TAM are borne out in all studies and there is a big difference between the effects predicted in different studies.

# 2.3.4.4. Online pre-purchase intention model

The Online Pre-purchase Intentions Model is an instance of the application of the TRA and TPB models mentioned above. To gain a deeper understanding of online consumer behaviour, (S. Shim, Eastlick, Lotz, & Warrington, 2001) invented this model, which is based on the theories the Theory of Reasoned Action and the Theory of Planned Behaviour. (S. Shim et al., 2001) found a relationship between information retrieval and online buying behaviour. The authors also believe that the attitude of online consumers and previous purchasing experience affects their intention to search for information online. This is because consumers' perceived risk levels, related to online information search and purchases, may decrease as they gain more buying experience. Besides, internet experience, awareness of behaviour control and attitudes towards online shopping also influence customers' intention to buy online. Moreover, they also argue that a safe online shopping environment and good return policies will increase consumers' ability to buy online. However, besides the advantages, the model that Shim et al. (2001) refer having drawbacks such as the lack of notable areas in their research including items such as demographic characteristics and determinants and motivation for online shopping.





Source: Shim et al. (2001)

## 2.3.4.5. Model of E-customer's relational purchasing behaviour

The Model of E-customers Relational Purchasing Behaviour is also a specific example based on the TRA and TPB models. (C. H. Park & Kim, 2003) proposed this model to better understand online shopping behaviour. The attributes of the online stores have consisted of the model and their influence on information satisfaction and relational benefit are tested (Lui, 2012).

Park and Kim (2013) have suggested that information satisfaction and relational benefits are strongly influenced by consumer perceptions of an online store. Quality of user interface; quality of product and service information; and security awareness are cognitive attributes of online stores. The authors have stated that consumers' commitment to the site is strongly influenced by information satisfaction and the relational benefit that relates to customer acquisition.



#### **Figure 2.19 Relational Purchasing Behaviour Model**

## 2.3.4.6. Conceptual model of the online purchase decision-making process

This is an online buying decision-making model proposed by Karimi (2013). The factors from the two different areas of consumer behaviour and decision science are

Source: Park and Kim (2003)

summarized by Karimi (2013) to combine the advantages and solve the disadvantages of each. According to Karimi (2016), the focus of this model is the customer decision-making process that leads to the choice and use of electronic services.

Karimi's model is based on a classic 5-step decision-making model that includes demand awareness, information search, reviews, purchase and post-purchase behaviour. However, Karimi (2016) added two important phases: formation of the decision problem and appraisal. In addition to ensuring the dynamism of the decision-making cycle, this model also recommends decisions that can be skipped or repeated in different steps. Besides, the study takes into account consumer decisions about process flow and emphasizes their individual role. This model synthesizes the classical model with elements from decision-making process models and includes construction and appraisal stages (Karimi, Papamichail, & Holland, 2010). According to Karimi (2013), these two stages directly related to the positive role of consumers, have been overlooked in consumer research. The influencing factors in the model are referred to in our research.

#### Figure 2.20 Conceptual model of the online purchase decision-making process



Source: Karimi (2013)

#### 2.3.5. Limitation of the previous decision-making models

Although previous reference models for decision-making behaviour provide insight into the decision-making process as well as the factors that influence decision-making, these models still leave significant limitations.

First, Erasmus et al. (2001) have argued that models are overly emphasizing in detail and an assumption about consumer decision-making, while consumers spend very little time making purchases and do not participate in these sequential stages. The fundamental drawback of these models is a positive approach to their development, instead of looking at consumer decision-making from the perspective of the consumers involved in the process (Erasmus et al., 2001). They see consumer decision-making as a logical problem-solving approach, which limits the accuracy of the models (Karimi, 2013).

The traditional 5-stage buyer's decision process (need recognition, information search, evaluation of alternatives, purchase decision, and post-purchase decision) in consumer buying behaviour pertains to what customers undergo before, during, and after they buy a product or service (Engel et al., 1968). This traditional model is established by a number of studies including the research of Engel et al. (1968), Engel et al. (1990); Howard and Sheth (1969b) and Karimi et al. (2018). It is a linear model, which might be used as the standard model for research of consumer behaviour and demonstrates the main five stages of the consumer purchase decision process (Karimi et al., 2015).

As reported by Karimi et al. (2015), this classical model can be adapted to the online environment. In agreement with Rodgers (2006), online consumers might have various decision-making depending on their diverse education, social status, viewpoints, etc. Besides, other characteristics such as motivation, attitudes, personality, perception, knowledge and lifestyle (Kotler et al., 2018) can influence the online users' purchase decision-making.

Moreover, the consumer decision-making process might be more complex and flexible in the online environment (Karimi et al., 2015). As claimed by Bucklin et al. (2002), online choice options might be more flexible and consist of a series of concerning selections.

There is no doubt that the Internet can make several essential issues for the process of decision-making in both negatives (Chen et al., 2009, Sicilia and Ruiz, 2010) and positive effects (Huang, 2000, Huang et al., 2013). For example, information overload may delay the
final decision (Soto-Acosta et al., 2014) or change the consumer's behaviour (Mick et al., 2004).

Online consumers maybe make the purchase decision by following different paths (Pavlou et al., 2007). In regard to the consumers' adaptive abilities, they can add, skip or reorder the stages of the decision-making process (Dorn et al., 2010). As a result, the Internet can be able to impact every stage of the online decision-making process (McGaughey and Mason, 1998).

In this traditional decision-making model, the customers are considered to move from one stage to the next, and finally make a purchase decision (Karimi et al., 2018). However, in the real world, consumers make their decision processes flexibly based on their adaption and response to decision tasks (Bettman et al., 1998, Payne et al., 1988). This would mean that this traditional model cannot illustrate the complexity of the consumer decision-making processes in the real world because the consumers might move, skip or reorder among stages (Dorn et al., 2010, Karimi et al., 2013, Langley, 1999).

On the other hand, several prior theories on predicting behavioural intention have been studied intensively depicting individuals' decision-making. The Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB) address individuals' motivational factors as predictors of behavioural intention. Moreover, the processes of TRA and TPB depend on attitude toward the behaviour and social normative perceptions (Fishbein, 1980, Ajzen and Fishbein, 1980). From an information systems theory perspective, the Technology Acceptance Model (TAM) explains how a consumer accepts and uses a technology (Davis, 1989). The operationalization of TRA has been rooted in the concept that attitudes are subject to expectations or beliefs related to attributes of the object or action and evaluations of those attributes (Fishbein, 1967). This expectancy value is widely applied in psychology, including attitude theories and decision-making theories for decades (e.g., (Edwards, 1954, Rosenberg, 1956).

Despite their differences, these theories and models suggest that personal beliefs may be reinforced by intentional experiences, thereby shaping behaviours in a particular way. These differences and similarities characteristics between these theories and models are described in detail below.

On the one hand, TAM was explored in order to examine customers' behaviours and their connection with consumers' technology acceptance (Davis et al., 1989). TAM

represents the process by which people apply and accept new technology in their behaviours (Davis et al., 1989). On the other hand, in the TRA and TPB models, decision-makers might consider the activity's implications reflecting on being involved in or not being involved in a specific behaviour (Ajzen, 1991, Fishbein, 1980).

Taylor and Todd (1995) compared the TAM and TPB and found the similar explanatory power of both, as well as their differences. While the Technology Acceptance Model proves its strength in predicting usage, the Theory of Planned Behaviour suggests a more specific process of behaviours. Shim et al. (2001), Limayem et al. (2000), George (2004), Vijayasarathy (2004), Kim and Park (2005) in different studies have shown that the two theories emphasise the same element that influences customers' behaviours, that is the attitude towards e-commerce.

According to Ajzen (1991), Davis (1989), Fishbein (1980), these models explored the elements of planned activities based on consumer attitude and how they impact customer intention. However, the pathways that lead a customer to a particular attitude and intention were not considered in the models. In other words, the way people collect their perceptions and information and evaluate their leading clients to various decision choices may not be recognised. Moreover, these models explored customers' perceptions, such as perceived usefulness and perceived ease of use in TAM; attitude and subjective norm in the TRA model; attitude, subjective norm and perceived behaviour control in the TPB model. These models help to understand customers' behaviours when examining perceptions and to evaluate (judging) before making a decision choice (behaviour intention). Nevertheless, they fail to consider the role of information before judgement and making a final decision.

Scholars have developed the above models aiming to explore consumer behaviour and decision-making, which identify critical factors that affect a customer's shopping behaviour in the online environment, especially in a mobile environment (Cho and Sagynov, 2015, Wang and Yu, 2017, Chen et al., 2018). TRA, TPB and TAM have been examined in different online shopping studies for decades (Rehman et al., 2019, Tandon and Kiran, 2019, Paul et al., 2016, Gupta and Arora, 2017). These theories and models can display the influence of individual characteristics, such as perceived behavioural attitude and control, on online clients' behaviour (Lee et al., 2007). Further, these characteristics may be shaped by an individual's beliefs (Gefen et al., 2003, Hsu et al., 2006, Lee et al., 2007); which can be grounded on feelings, norms, attitudes, and beliefs (Davis et al., 1989, Ajzen, 1991, Fishbein, 1980, Ajzen, 1985).

However, the above models do not consider the stages that online consumers might follow during their shopping journey. Besides, these models assume the decision-making processes, which seem not to examine the different routes that customers may go through to reach their final decisions.

As a consequence, the pathways that lead the customer to make an online purchase intention using previous decision models in the literature are unclear. That is to say, previous studies did not fill this information gap. Thus, this paper applies another decision model – Throughput Model in order to demonstrate the different routes that customers might go shopping for different products/services by investigating algorithmic purchase decision pathways.

As be clear from the three above models, they just describe a straight-line process which leads consumers to purchase decisions. They do not consider the routes people do when they make a decision. Besides, these models do not reflect the role of information factor to purchase a product or service.

Moreover, the rigid structure of these generic models is another issue that needs to be addressed. They do not allow diversity in the decision-making process. A model that wants to be meaningful must be proved in many different situations and trusted by users (Karimi, 2013).

In addition, with the rapid development of information technology, especially the growth of e-commerce, it is challenging for researchers to continuously propose new behavioural studies to meet the needs of the customer (Kawaf & Tagg, 2017).

Finally, the goal of proposing a new model is a dynamic and flexible structure. This structure illustrates the processes for making online purchase decisions through mobile applications. To accomplish this goal, the author refers to the pathway model developed by Waymond Rodgers. This model has been applied effectively in the fields of finance, taxation and auditing in order to test different decisions of related people (W. Rodgers, Guiral, & Gonzalo, 2009). Accordingly, in this study, the author wishes to propose a new insight into the prediction of customers' online purchasing decisions through this link model. In the next section, the author will go into detail about the Throughput Model.

# 2.4. The Throughput Model and applying in online decision-making

# 2.4.1. The Throughput Model

The Throughput Model (TPM) was explored by Rodgers (1997), Rodgers (2006) in order to clarify six dominant pathways that an individual might follow during the decision-making process. Because the customers have various viewpoints, education or social status, the decision pathway of each customer might be different from others based on the relationship and weight of influent factors (Rodgers, 1997). The customers can also modify or move their decision-making through their understanding and considering the benefit of the six dominant routes (Rodgers, 2006).

#### Figure 2.21 The Throughput Model

Where P = perception, I = information, J = judgement, and D = decision choice.



Source: Rodgers, 1997; 2006

#### 2.4.1.1. Introduce the TPM

The TPM is considered a model covering six special algorithmic strategies to build and calculate individual or organizational decision-making assessments (R. Rodgers, 1997). The advantage of this model is that it distributes a structure of various factors that influence the decision-making of individuals (Rodgers, 1997). According to Rodgers, the important characteristic of this model is to conceptualize how individuals and organizations implement different algorithm paths, representing interactions between the four elements of information (I), perception (P), judgement (J), decision (D) and then make final decisions. Moreover, a significant contribution of this model is to describe the link between perception and information, which denotes the triple bottom line components of environmental, economic and social, concepts (Rodgers & Gago, 2006). It means that the interaction between awareness and information can strongly influence the six algorithmic paths that relate to the corporate social responsibility features.

Previously, the TPM was applied to investigate various issues assessed by commercial lenders (Rodgers & Gago, 2001). Moreover, a range of other issues that have been studied by previous authors has applied the TPM such as business ethics (Rodgers & Gago, 2001), auditing (Rodgers, 2011), organizational behaviour (Foss & Rodgers, 2011), sexual harassment (Guiral, Ruiz, Rodgers, & Gonzalo, 2008) or tax compliance (O'shaughnessy, 2014). Also, this model also provides a new perspective to test customer decision-making behaviour in circumstances relating to conflict of interest (Ishaque, 2020). To sum up, to promote our understanding of the impact of six different algorithmic pathways on overall decision-making, the TPM should be used (Rodgers, 1997). That is also the reason why we refer the throughput model as the main model for our research framework in making consumer's online purchasing decisions via mobile applications.

# Figure 2.22 The TPM



Where: P = Perception, I = Information, J = Judgement, D = Decision. Source: Edited from(Rodgers & Gago, 2006)

# 2.4.1.2. Four dominant concepts

According to Rodgers, individual and organizational daily decision-making processes form activities relating different algorithmic paths among four distinct factors: perception (P), information (I), judgement (J) and decision choice (D). These four elements manage the individual cognitive processes connected by six algorithmic paths, which rely on each person's individual reasoning regime to make decisions.

The cognitive factor of the six-path algorithm model represents the analysis and classification of information, including framing (Rodgers, Guiral, & Gonzalo, 2019). The perceptions framework mentioned above describes how decision-makers consider issues based on their previous experience, knowledge and education level. On the other hand, Rodger also argued that this also involves explaining the issues that this process affects and making decisions. This framing process requires decision-makers to have a piece of solid knowledge in order to provide guidance in reviewing, rejecting, or accepting available information (Rodgers et al., 2019).

The information element of the TPM includes available and relevant information for individuals to use to make decisions (Rodgers, 1997). Information is taken from different sources of individuals for building judgement processes or choosing between different decision-making pathways in the TPM (Rodgers, 2011). Moreover, Rodger has argued that information can be judged by reliability and relevance based on the source that decision-makers feel confident. Information, on the other hand, can strongly influence a pre-cognitive framework, especially when it is in conflict with awareness or when there is no available awareness (Rodgers, 1997). From this, we can easily deduce that information and perceptions can be interdependent (Rodgers et al., 2019), the information available to decision-makers influencing cognitive framing.

Judgements are defined as factors related to the act of analysing and evaluating factors based on available information and perception so that individuals compare and choose alternatives (Rodgers, 1997). According to Rodgers (1997), the judging process is seen as a method of compensation, which is used to handle conflicts of interest by assisting decisionmakers in the selection process. This technique can save time to make a decision when evaluating a given perception and information.

The decision choice is the final sector in the TPM. At this stage, the decision-maker will choose the best options after evaluating the divergent or distinct relationship connections.

## 2.4.1.3. The six pathways symbolize decision-making paths of online customers

This TPM has different algorithmic routes, which describe elements of knowledge level, information availability or time pressure (Rodgers et al., 2019). There are all four different factors mentioned earlier for individuals to evaluate and implement an appropriate process before making a decision (Rodgers & Gago, 2001).

These algorithmic pathways are the following (Rodgers, 1997); (Rodgers & McFarlin, 2016), where "perception (P)", "information (I)", "judgement (J)" and "decision choice (D)":

- (1)  $P \rightarrow D$ : Expedient pathway
- (2)  $P \rightarrow J \rightarrow D$ : Ruling guide pathway
- (3)  $I \rightarrow P \rightarrow D$ : Revisionist pathway
- (4)  $I \rightarrow J \rightarrow D$ : Analytical pathway
- (5)  $P \rightarrow I \rightarrow J \rightarrow D$ : Value-driven pathway
- (6)  $I \rightarrow P \rightarrow J \rightarrow D$ : Global perspective pathway

 $P \rightarrow D$ : displays psychological egoism that tensions individuals who are always motivated to act in their self-conscious thoughts (Bowie, 1991). It is pointed out that people are always motivated to act because of their perceived personal benefit (Rodgers, 1997). This theory is an important part of the Teleological theory of ethics, also known as the consequence theory (Rodgers et al., 2019). The moral value of an action or practice is only determined by the result of those actions or practices themselves, this theory has argued. In this way of making decisions, we believe that in an online environment customers will buy goods that they do not want to review information and reviews to make judgements because they have a firm belief and a perfect experience of what they bought and wanted to experience again. These products will often be in the areas of essential goods or favourite products (brands, designers, fashion lovers).

 $P \rightarrow J \rightarrow D$ : presents the deontology standpoint that underlines the validity of people and the judgements related to a special decision process instead of its alternatives (Rodgers, 1997). The pathway implies that information is not appreciated, and a decision is taken through judgement (Rodgers, 1997). This means that a person constructs awareness without using any information, balances the possible consequences before making any judgement, and then takes a conclusion by a decision. In this study, we believe that online customers do not need to rediscover information for a new product but rather from their basic perception; they will make judgements based on the rules before making a decision.

 $I \rightarrow P \rightarrow D$ : spotlights the relativist perspective which believes that decision-makers utilize themselves or the people around them as their foundation for set ethical standards (Rodgers, 1997). Rodgers stated that these decision-makers have tried to identify the consensus of the relevant group as certain behaviour after a careful observation process. In an online shopping environment, this route will describe when customers receive product information from any source (advertising, newspaper reading, web surfing, reference groups); this information appears and awakens their needs, making them find this product interesting and very useful for themselves.

 $I \rightarrow J \rightarrow D$ : depicts the utilitarian role which is related to result, or the largest goods for the largest number of individuals (Rodgers et al., 2019). According to Rodgers (2019), this pathway is like psychological egoism because it is concerned with consequences. In the online environment, we assume that this route will be useful if customers make decisions under time pressure in certain situations. Decision-makers are forced to make judgements based on searching information, ignoring perceptions necessary. Motivational activities are also a way to help customers make decisions faster. It may include free samples, gift vouchers, sign displays, live shows and online supportive sales staff (Amos, Holmes, & Keneson, 2014).

 $P \rightarrow I \rightarrow J \rightarrow D$ : emphasizes that role-based beliefs are tied to recognized social profiles, depending on the specific social capital feature of a person or organization (Rodgers, 1997). According to Rodgers (2019), this prominent pathway recommends that framing one's cognitive problem will inspire assembly and the type of information that will be made in the analysis (judgement). It means that a person who is encouraged to act tactfully (perception) has an impact on the summary of information made to be evaluated (judgement) before making informed dependable decisions (Rodgers et al., 2019). In an online situation, there will be a number of products that customers need to buy so they start looking for relevant information, and then continue to evaluate before making a buying decision.

 $I \rightarrow P \rightarrow J \rightarrow D$ : describes the ethics of care philosophy which focuses on a set of character traits that are profoundly evaluated in close private kinships, such as compassion, loyalty, love, friendship, and the like (Rodgers et al., 2019). In this progression, a person will research the given information, frame the issue, and then progresses to analyse this issue

before making a decision (Rodgers, 1997). It is possible to deduce from the online environment based on this assumption: that at a given time, customers will receive some information about the product (source of information); they feel that they need it and then make a decision before making a buying decision.

#### 2.4.2. TPM value in the online environment

Previous literature has shown that the TPM can be applied in the mobile commerce environment (Rodgers, 2010). The TPM might support businesses in understanding, forecasting, and modifying online consumer purchase decisions through the six different algorithmic pathways. This model, which assists people in understanding useful knowledge, offers an in-depth analysis of the various stages affecting decisions (Rodgers, 2010) so that it consents marketers and organizations to study information and efficient processes in several stages before making a decision choice. The TPM can assist to create a conceptual structure, recommend a series of connections and relationships, or develop an algorithmic equation system (Rodgers, 2010).

In addition, the consumers can be shopping for the same products, and the route of each customer can be different from others (Pavlou et al., 2007) because of their adaptive abilities for decision tasks (Dorn et al., 2010, Bettman et al., 1998, Payne et al., 1988). Thus, the customers might have various paths to making final decisions when shopping online (Lian and Lin, 2008, Liu and Wei, 2003, Pascual-Miguel et al., 2015). While the TPM may be used to create enabled robust algorithms of purchase decisions in the online environment, it can explore the purchase algorithmic pathways for online customers when they shop for products/ goods.

The next section investigates the online purchase algorithmic pathways based on the TPM.

#### 2.4.3. TPM in online algorithmic purchase decisions

Rodgers (1997, 2006) explored the TPM with four main concepts (including perception, information, judgement and decision choice) in the decision-making process (see Figure 3). The TPM illustrates six dominant pathways that lead an individual to a decision based on her/his different philosophical viewpoint, education, social status, etc. These differences might influence the relative weight of each path when making a decision (Rodgers, 1997). In the TPM, decision-makers can benefit by explaining and acknowledging the pathways which may affect or modify their decisions.

The combination of perception (P), information (I), judgement (J) and decision choice (D) relates to machine learning and deep learning in the following manner.

In the TPM, the four core conceptions were found to be instrumental in the decision process (Foss & Rodgers, 2011; Rodgers, Alhendi, & Xie, 2019). First, perception (P) refers to a situation that involves categorising and classifying information (Rodgers, 1997). Second, Information (I) depicts incoming data from the five senses, namely tasting, hearing, seeing, smelling and touching. The higher-level human processes transfer the data into relevant and reliable information. Then, judgement (J) is a process of arranging and classifying the "perception" and "information" features of the decision-making process by employing two different methods. These methods are (1) compensatory (choosing the highest value choice between two choices) and (2) non-compensatory (modifying the general compensatory method by way of adding and summing the criteria value). Finally, decision choice (D) refers to the highest expected value solution, which can be a result of a selection dependent on individual ability and intended plans (Rodgers, 2006).

The perception  $\leftarrow \rightarrow$  information relationship refers to a general neural network. That is, perception influences the types of information to be selected for further processing in the judgement stage (i.e., analysis). Also, information influences perception, which is similar to Bayesian statistics displaying a revision or updating of perception.

# Figure 2.23 The TPM and pathways





Source: Rodgers, 1997; 2006

The TPM illustrates six algorithmic pathways to the process of making a decision (Rodgers & McFarlin, 2017).

(1)  $P \rightarrow D$  depicts the expedient pathway, where an individual with a certain level of expertise or knowledge makes a decision choice without the aid of information.

(2)  $P \rightarrow J \rightarrow D$  describes the ruling guide pathway, which accentuates an individual's perceived understanding of rules, even if the present information may be contradictory.

(3)  $I \rightarrow P \rightarrow D$  focuses on the analytical pathway that embraces a systematic and programmatic approach to utilising information.

(4)  $I \rightarrow J \rightarrow D$  indicates the revisionist pathway, which is exceedingly dependent on changing information.

(5)  $P \rightarrow I \rightarrow J \rightarrow D$  stresses the value-driven pathway, which specifies how a person's perception helps to channel and select specific types of information.

(6)  $I \rightarrow P \rightarrow J \rightarrow D$  symbolises the global perspective pathway, which adopts the available information, and influences a person's perception.

These algorithmic pathways can be operationalized by machine learning techniques. Further, neural networks and deep learning procedures can aid these algorithms in assembling knowledge from data sets and learning unsupervised from data that is unstructured or unlabelled.

Nevertheless, several famous theories and models related to consumer decisionmaking can assist in machine learning techniques based on an understanding of acceptance of technologies (Cabrera-Sánchez, 2020). These include the Theory of Reasoned Action (TRA) (Fishbein, 1980), the Theory of Planned Behaviour (TPB) (Ajzen, 1991, Schifter and Ajzen, 1985) and the Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989), which are the most popular models focusing on feelings, norms, attitudes, and beliefs. Although these models are developed in different situations based on various concepts, they emphasise that personal beliefs might influence intention experiences in order to behave in a particular way (Ajzen, 1985, 1991; Davis et al., 1989; Fishbein, 1980). For example, Ajzen (1991), Davis et al. (1989), Fishbein (1980) proposed the emergence of several main elements of planned actions based on consumer attitude and how consumer behaviour impacted their intention. In recent years, machine learning aided by neural networks and deep learning has provided many pieces of evidence (Cabrera-Sánchez, 2020), which show how these models can be adopted in the online environment to identify online customer shopping behaviour (Gefen et al., 2003; Hsu et al., 2006). In addition, these models might be applied to the aforementioned algorithms in order to study online shopping adoption, purchase decision or individual characteristics that influence online buyers' behaviour (Lee et al., 2007, Rehman et al., 2019; Tandon & Kiran, 2019; Paul et al., 2016; Gupta & Arora, 2017).

Nonetheless, these models do not explicitly consider the algorithmic pathways, which describe how people behave when they would like to purchase, based on their attitude and intention. Moreover, a traditional decision process that includes how consumers recognise their needs search the related information, and evaluate selected options to make the final decision might be not reflected in previous theories and models. Moreover, previous theories assume that consumers' perceptions through evaluation actions (judgement) influence decision choices (e.g., perceived usefulness and perceived ease of use in TAM; attitude and subjective norm in the TRA model; attitude, subjective norm and perceived behaviour control in the TPB model) (Davis et al., 1989; Ajzen, 1991; Fishbein, 1980; Ajzen, 1985). Nevertheless, theories do not consider related information, which may influence the final purchase decision based on the evaluation of alternatives. Thus, it is necessary to make clear the algorithmic pathways online consumers utilize when they shop online, primarily, due to the unclearness in the academic literature.

The TPM describes six dominant algorithmic pathways, which influence consumer decisions through the four main concepts (Rodgers, 2006, 2010). Furthermore, in the TPM model, Rodgers also studied the role of related information that contributes to the ways people make the final purchase decision (Rodgers, 2006, 2010).

Moreover, this model can be applied in the online environment (Rodgers, 2010). This paper attempt to adopt the TPM to support marketers in order to assist forecasting activities by an understanding of the online consumer purchase decisions through the six different algorithmic pathways for AI use in machine learning, neural networks, and deep learning applications (Rodgers, 2010). Although consumers might be shopping for the same products, the pathway of each customer might be different from others (Pavlou et al., 2007) Because of the consumers' adaptive abilities (Dorn, 2010), adaption and response to decision tasks (Bettman et al., 1998; Payne et al., 1988), they make their decision processes flexibly, move, skip or reorder among stages (Dorn, 2010; Karimi et al., 2013, Langley, 1999). On the other

hand, a customer might have various routes to making decisions when shopping online, because he/she buys different types of products (Lian and Lin, 2008; Liu and Wei, 2003 Pascual-Miguel et al., 2015).

Thus, these algorithmic purchase decision pathways may aid marketers to understand their consumers more profoundly in the different pathways they go through when shopping online. This, in part, is similar to the neural networks aided by deep learning. Further, this support, nowadays, becomes more and more critical when we come to the AI age. The TPM may be used to create enabled robust algorithms for purchase decisions in the online environment in the future. The next section explores the purchase algorithmic pathways and their adaption for machine learning as applied to neural networks and deep learning in the AI world.

# 2.4.4. Modelling the purchase decision pathways

Constructed on the two cognitive aspects of buyer's decision-making processes between analytical and prescriptive models in section 2, we propose to integrate the 5-stage of buyer's decision processes into the TPM to examine the six algorithmic pathways in mobile shopping decision-making behaviour via mobile apps (see Figure 2.24).

Perception in the TPM refers to "framing the decision – guiding the process" and "defining the problem" (Rodgers, 1997: 68). This concept in the purchase decision-making process can be depicted as the "need recognition" step. In other words, perception might refer to the need for recognition of the customer, which has to be satisfied with products/ services.

Need recognition can be viewed as a perception in the TPM. Bruner et al. (1988) identify that the need recognition (problem recognition) reflects a difference between a consumer's actual state (what situations might be really like) and a consumer's ideal state (what an individual desires the situations to be like). In another way, need recognition occurs when a consumer identifies a problem (need a product/service)

Bhattacharyya and Rahman (2004) argued that consumer needs and wants are so fundamental in nature. However, it is difficult to understand what customers really "need" or "want" because they are unconscious, implicit, unclear, and undefined (Hatton et al., 2017). Thus, it is supposed that recognizing the consumer's needs is very difficult, although they usually wish to buy only what they actually need and want (Baumeister et al., 2017). Nowadays, researchers start to predict customers' needs and want based on Industry 4.0 and the Internet of Things (IoT) (Saldivar et al., 2016).

Information signifies reliable and relevant transformed data in the TPM (Rodgers, 1997). This information represents the searching process related to the product(s) from several various resources (Kulandairaj, 2013, Rana and Jha, 2019, Rahman and Kharb, 2018), that customers are interested in purchasing. This information can fulfil their desires or need (Sachdeva, 2015). Thus, the information may refer to "product-related information" which influences the choices of the consumers when they would like to purchase products.

Both shopping beginners and experts are involved in searching for product-related information (Bettman and Park, 1980, Herr, 1989, Lee, 2014), while the shopping novices might look for information on products to improve their narrow awareness, the experts could seek for detailed knowledge to develop their current understanding of the product (Bettman and Park, 1980, Herr, 1989, Rahman and Kharb, 2018).

Product-related information might consist of external sources (including personal and impersonal sources) (Punj and Staelin, 1983) and internal sources (such as consumers' memory and prior experience of the product) (Cant et al., 2006, Rahman and Kharb, 2018). These information sources can influence the consumer decision differently based on the type of product and consumer's characteristics (Hyde, 2008; Sachdeva, 2015). When customers gather related information, they can learn about the product's features and competing brands (Sachdeva, 2015).

Judgement concept represents the "evaluation of alternatives" and selecting the brands or products to purchase based on a set of considerations (sometimes called the evoked set or awareness set) (Solomon, 2006; Campbell, 1969; Howard and Sheth, 1969). It is defined as the set of "brands that the buyer considers acceptable for his next purchase" (Howard and Sheth, 1969). This consideration set is the brands or products, which are alternatives narrowed down from many to a few, depending on many personal criteria such as brand awareness, previous exposure, price, quality and more (Roberts and Lattin, 1991; Campbell, 1969; Howard and Sheth, 1969; Brown and Wildt, 1992(LeBlanc and Herndon Jr, 2001)). There are two different choice levels, including an attribute level (which is based on a satisfactory level on each criterion) and an alternative level (which is related to a choice decision plan among potential alternatives) (Park et al., 1981). The consumer decision is made by considering these restricted brands and products (Erdem and Swait, 2004). Decision choice concept refers to "purchase intention". After evaluating these alternatives, the buyers will intend to purchase the products/services, which they think are best for them.

On the one hand, Ajzen (1991) argued that purchase intention could be presumed as a vital indicator of the extent to which people are willing to approach convinced behaviour. Purchase intention also illustrates the attempts of customers when they try to perform convinced behaviours (Ajzen, 1991). On the other hand, in the online environment, Laohapensang (2009) showed that online shopping intention might lead to real action. Similarly, many researchers express the same ideas in their research, such as He et al. (2008), Pavlou and Fygenson (2006), Carlos Roca et al. (2009), Wang et al., (2017), Wang and Somogyi, (2018). Moreover, Jamil (2011) also confirmed that purchase intention might have a positive impact on the original online purchase decision. Therefore, in this study, purchase intention is measured, instead of a purchase decision, when considering the deciding factor when customers shop via a mobile shopping application.

The post-purchase decision is captured by the TPM interdependent relationship of perception and information (i.e.,  $P \leftarrow \rightarrow I$ ). That is, similar to Bayesian statistics (Bolstad and Curran, 2016), the "information" construct is constantly updating a consumer's perception. In other words, prior purchasing decisions (i.e., post-purchase decisions) are captured by the "information" construct. In addition, consumers' previous decisions are incorporated by information sources, which are highlighted by a purchased product or service. Therefore, the  $P \leftarrow \rightarrow I$  relationship serves in part as a post-purchase decision framework, which is similar to a neural network.

A neural network is a category of computer software, which is motivated by humans' biological neurons (Barnett and Cerf, 2017). Further, neural networks can assist with machine learning in that they can simulate pattern recognition or match similar to the  $P \leftarrow \rightarrow I$  relationship as it learns to solve a problem (Rodgers, 2020). In sum, this approach can afford a machine learning mechanism (supervisory or non-supervisory) for consumers' purchasing behaviour. The AI machine learning aspect of the TPM affords the algorithmic pathways the capability to automatically learn and improve from experience (i.e.,  $P \leftarrow \rightarrow I$ ) without being explicitly programmed. Machine learning highlights that the TPM can access data and uses it in order to learn from consumers' purchasing behaviour (Rodgers, 2020).





Where: P = need recognition, I = information searching, J = evaluation of alternatives, D = purchase decision Arrows = The hypothesised pathways from one construct to another

Source: Adapted from Rodgers, 2006

The six algorithmic pathways demonstrate how customers' decision-making affects by different possible routes. Furthermore, the six pathways can be grouped into three different steps in the decision-making process. The proposition of each algorithmic pathway is explained as follows.

One-step decision-making pathway:

1.  $P \rightarrow D$ , quick buying pathway

Two-step decision-making pathways:

2.  $P \rightarrow J \rightarrow D$ , selected buying pathway

3.  $I \rightarrow J \rightarrow D$ , casual buying pathway

4.  $I \rightarrow P \rightarrow D$ , impressionable buying pathway

Three-step decision-making pathways:

5.  $P \rightarrow I \rightarrow J \rightarrow D$ , traditional buying pathway

6.  $I \rightarrow P \rightarrow J \rightarrow D$ , modern formal buying pathway

The above-mentioned algorithms can be viewed as a machine learning apparatus for training how consumers may approach a decision problem by employing one of six different pathways. Therefore, in order for individuals/organisations to appreciate wholly the power of machine learning and neural network algorithms, we must first come to the realization of the different types of pathways consumers may implement in their decision-making processes.

# 2.4.4.1. One-step decision-making pathway (simple algorithmic pathway)

 $P \rightarrow D$ : need recognition  $\rightarrow$  purchase decision (*quick buying pathway*). This simple algorithmic pathway relates to a purchase decision made based on need recognition. It implies that when a customer recognises a need to buy, he/she decides to purchase without considering any other information and/or is confronted with time pressures. Typically, this process is recommended for common repeat products based on habitual purchase and brand loyalty (Hoyer, 1984). In addition, customer experience might affect to customer's journey (Lemon and Verhoef, 2016) to make the decision, and this may bring the customer comes to the final choice after realising the need. Furthermore, purchasing expensive items is also moderated by one's wealth, assets or income that produces ability. That is, more time may be required before spending a considerable amount of money.

#### Figure 2.25 P→D Quick buying pathway



# 2.4.4.2 Two-step decision-making pathways (intermediate algorithmic pathways)

 $\mathbf{P} \rightarrow \mathbf{J} \rightarrow \mathbf{D}$  implies the need recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*selected buying pathway*). Customers in this decision pathway have no time pressure, and they can be confronted with changing environments. Further, misunderstanding of information or inconsistent signalling of information may be ignored due to a rule-based type of decision-making propensity. Thus, based upon a rule-based structure, they tend to evaluate alternatives after recognising their needs and then make a purchase decision.





 $I \rightarrow J \rightarrow D$  depicts information searching  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*casual buying pathway*). This algorithmic pathway highlights the importance of information, which may be the characteristics or attributes of an individual, place or thing. This information could assist people in identifying the issue, specifying all factors and weight all relevant alternatives in order to select the best option.





 $I \rightarrow P \rightarrow D$  indicates information searching  $\rightarrow$  need recognition  $\rightarrow$  purchase decision (*impressionable buying pathway*). This algorithm generally relates to the way people use the information to affect their need recognition before making a decision. Time pressure should not be an influence since the guiding principle is reliance on a trusted person, place or thing. Any environmental changes will be off-set by the person, place or thing that influences the "perceptual" processes.



Figure 2.28 I  $\rightarrow$  P  $\rightarrow$  D Impressionable buying pathway

## 2.4.4.3. Three-step decision-making pathways (Multi-intermediate pathways)

 $P \rightarrow I \rightarrow J \rightarrow D$  relates to need recognition  $\rightarrow$  information searching  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*traditional formal buying pathway*). This algorithm signifies how customers use their need recognition to select and modify the available information to analyse the alternatives and then decide the best options to buy.



Figure 2.29  $P \rightarrow I \rightarrow J \rightarrow D$  Traditional formal buying pathway

 $I \rightarrow P \rightarrow J \rightarrow D$  indicates that information searching  $\rightarrow$  need recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*modern formal buying pathway*). This algorithmic indicates how the available information influences the customer's need recognition, and then he/she analyses the alternative options before making a final decision choice.

Similar to the "*traditional formal buying pathway*" ( $P \rightarrow I \rightarrow J \rightarrow D$ ) this process of decision-making is based on enough time to consider options. Nonetheless, if the buyer is confronted with time limitations or changing environments that prevent consideration of other options then the buyer may have to consider a different algorithmic pathway (e.g., step one or step two decision-making algorithms).

Figure 2.30 I $\rightarrow$ P $\rightarrow$ J $\rightarrow$ D Modern formal buying pathway)



Depicting the algorithmic decision-making pathways is essential for a better understanding of online purchasing buyers' habits and considerations. Each step pathway is differentially affected by (1) the reliability and relevance of information, (2) changing environmental conditions, (3) the expertise level of the buyer, and (4) time pressures (Rodgers, 1997). Based on the influence of these factors, consumers focus on different algorithmic decision-making pathways (See Figure 9).

Pathway	Information		Changing environment		Time pressure		Expertise level of buyer	
	Influence	Not influence	High	Low	High	Low	High	Low
One-step		Х		Х	Х		х	Х
P→D								
Two-step								
P→J→D		х		х		х	х	х
I→J→D	х		х			x	х	x
P→I→D	Х		Х	х		x	х	х
Three-step								
P→I→J→D	х		х			х	х	х
I→ P→J→D	х		Х			х	х	х

Figure 2.31 The factors that influence algorithmic decision-making pathways

Source: Authors generated

## 2.4.5. Transferring among algorithmic purchase decision pathways

Depending on the effect and weight of these factors, customers might transfer their purchase decision pathway to another one. For instance, a consumer recognises a need for a product (a pair of shoes). He/she searches the related information for it and then decides the best option (two-step pathway-  $P \rightarrow I \rightarrow D$ ). However, when the environment changes (he/she has a chance to go to the big shopping mall) and/or the availability of the related information (promotion campaign, the review from close friends) is available, then he/she might evaluate an alternatives brand which has a good offer or a favourable review from his/her friends before making the final decision. In other words, he/she changes his/her purchase decision pathway to a three-step path ( $P \rightarrow I \rightarrow J \rightarrow D$ ). On the other hand, he/she might skip the information searching step if he/she does not have enough time (has to leave after 10 minutes) and/or limited information (knows only two brand names) and/or the environment changing (this area has one shoe shop with one brand name). It means that he/she will follow the simple pathway ( $P \rightarrow D$ ).

# Figure 2.32 Transferring among algorithmic purchase decision pathways



Source: Authors generated

As can be seen from the six propositions above, there are many paths, that the consumers might follow when they buy a product. Based on various factors, the purchase decision routes may be different from one case to another.

These above-mentioned algorithms may be viewed as a machine learning mechanism for training how consumers might approach a decision obstacle by spending one of six different purchase pathways. Consequently, it, firstly, must be to realize the different types of pathways which consumers may implement in their decision-making processes in order for individuals/organisations to appreciate wholly the power of machine learning and neural network algorithms.

There is no doubt that these purchase decision algorithms can support powerfully intelligent advertising through machine learning and deep learning by capturing consumer insights in real-time and personality. The next section discusses the literature review and points out why it is required to explore a new purchase model that clarified the real purchase decision process flows in the online environment.

#### 2.5. Literature review discussion

Although the critical role of the electronic consumer is confirmed in today's marketplace, this area has been not yet fully understood (Terpsidis et al., 1997; Peterson & Merino, 2003; Dennis et al., 2009). Despite the fact that a large number of researches related to the Internet have been carried out over a few decades, there are several issues which have kept on unaddressed. Furthermore, the online environment and its factors also change quickly and extensively day by day and this outdates some previous studies.

This theoretical foundation exposed that online consumer behaviour is different from the traditional one (Koufaris, 2002; Van den Poel & Buckinx, 2005). Many researchers have pointed out that the Internet impacts not only the natural cognitive flow, satisfaction and decision-making process of consumer behaviour (Xia & Sudharshan, 2002; Constantinides & Fountain, 2008; Jarrett, 2008) but also various stages of the decision-making process (Wikström, 2005; Tih & Ennis, 2006).

On the one hand, consumers might be adaptive and flexible with limited competencies to construct a decision as a process flow (Payne et al., 1993). Besides, there are a considerable amount of significant factors which impact consumer behaviour. Therefore, it is essential to identify the key factors which influence consumer behaviour (Court et al., 2009) not only in traditional but also in the online environment.

On the other hand, the online purchase decision process is dynamic, complex and unstructured (Bucklin & Sismeiro, 2009) while the best way to understand complex and magnetic phenomena is modelling that is reality simplification (Caine & Robson, 1993). Nevertheless, according to Van den Poel and Buckinx (2005), the dynamic situation makes some difficulties in modelling online consumer behaviour. This chapter delivers some conceptual models which might enhance our current knowledge of purchase decisions in the online environment. However, most of the existing models are developed from traditional models and the online purchase decision complexities are not considered (Louvieris et al., 2003). Therefore, it is required to explore a new purchase model which might clarify the real purchase decision process flows in the Internet environment (Constantinides, 2004; Rickwood & White, 2009).

In conclusion, due to the lack of a specific purchase decision model which is able to explain the online purchase process complexities in the real world, a conceptual model of the online purchase decision-making process is required. Based on reviewing different models from different researches in this chapter, the next chapter suggests a model which is able to explain the purchase decision- making process that customers follow in the Internet environment.

# 2.7. Conclusion

In conclusion, due to the lack of a specific purchase decision model which is able to explain the online purchase process complexities in the real world, a conceptual model of the online purchase decision-making process is required. Based on reviewing different models from different researches in this chapter, the next chapter suggests a model which is able to explain the purchase decision- making process that customers follow in the Internet environment.

# **CHAPTER 3 CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES**

# 3.1. Overview

Based on the above review and analysis, this chapter aims to develop the conceptual framework of this research and set the research settings. A new model which can explain the online current purchase decision is developed in detail. This model is advanced from other related purchase decision and consumer behaviour models which combines fundamentals from the literature and is proposed in order to address the limitations identified to perform the online purchase decision pathways.

This dynamic model can explain the complexities of purchase decision-making pathways in online environments. It is persuaded suitable for the online decision-making process. This model structure is flexible. It allows adaptive and complex processes to justify their variations.

It is clear that there is a huge amount of psychology literature which studies how decision-makers evaluate different alternatives. However, depending on the scope of this study, the stages of the process and influenced factors are concerned rather than all the mental information processing. Besides, the purchase process dimensions are also identified. These dimensions can explain the process's characteristics. Furthermore, the process variations can be measured according to these mentioned dimensions.

As outlined in the literature review, the overall model is modified by each individual for each detailed context. A meaningful explanation of behaviour can be provided by accounting for individual and contextual variations. The expected variations of the purchase process are highlighted. By expressing the conceptual framework, this chapter leads to the research design.

# 3.2. Proposed Model

The main objective of this study is to examine the factors that influence customer purchase decision-making behaviour through mobile apps. To meet this goal, the author developed a proposed model based on the TPM.

Past studies have suggested that the TPM (2009) has been successfully applied to explain human behaviour in various fields. As a result, the proposed model of this study will be outlined from the TPM to test customer decision-making behaviour via mobile applications. The TPM proposes that the decision-making behaviour of people is directly affected by the perceptions and information they receive (Rodgers et al., 2009). Similarly, consumers use their perceptions and information to improve judgement and decision-making (Lui, 2012).

The TPM clarifies the six general pathways which might influence the individual decision (Rodgers, 2010). Based on the concept of TPM and the customer decision-making process, the TPM of purchase decision-making and concepts might be understood as follows:

**Perception** in original TPM refers to framing the decision-making process and defining the problem (Rodgers, 1997). In this purchase decision-making process, this is *need recognition* step. In other words, perception might be understood as *need recognition* which has to be satisfied. Customers could recognize that they need products or goods.

**Information** is the data which is "reliable and relevant" (Rodgers, 1997). Human five senses namely seeing, tasting, smelling, hearing and touching could help us to collect useful data for decision-making. Information might be political, economic, social, financial and management elements. In this process, it is *information searching*. After determining the need, a customer will try to find the *information searching* which might influence the products/ goods that they plan to purchase. The information may come from their own experience or their references such as friends, relatives, or colleagues or public knowledge or advertising, etc.

**Judgement** is analysing perception and information (Rodgers, 1997) by identifying the weight of each criterion/option and making a comparison among these alternatives. It can be said that judgement is *evaluation of alternatives* to choose the best option to purchase.

**Decision** is "the highest expected value solution" which people choose (Rodgers, 1997). In this case, customers decide the best one to purchase. Decision refers to *purchase decision*. This step comes after evaluating these alternatives. The buyers will purchase the products/ goods which they think are the best for them.

Based on these six paths, the author has proposed a model as below:





Source: Edit from Rodgers Waymond, 2006

Where: P = consumer's need I = information J = evaluation of alternatives D = purchase decision

The conceptual model is illustrated in figure 3.1. The hypothesized causal relationships might be present from one construct to other constructs by arrows.

# 3.3. Indicators of purchase decision-making pathways

Different indicators can be used to measure different aspects of the process. In this section, each dimension of purchase decision-making pathways will be discussed in detail.

# **3.3.1.** Dimensions of need recognition

**Perception** in the TPM refers to "framing the decision – guiding the process" and "defining the problem" (Rodgers, 1997). This concept in the purchase decision-making process can be depicted as the "*need recognition*" step. In other words, perception might refer to the need recognition of the customers, which has to be satisfied by products or goods.

According to Engel et al. (1968), Bruner et al. (1988), and Venkatesakumar et al. (2008), the need recognition (problem recognition) can be able to reflect a difference among consumers' actual states (what situations might really like) and consumers' ideal states (what consumers desire the situations to be like). In another way, need recognition occurs when a consumer identifies a problem (need a product/ goods) (Bruner et al., 1998) so that it can be defined as a perception in the TPM.

Evans et al. (2006) argued that understanding consumer needs and wants is one of the critical underpinning constructs of consumer behaviour. However, it is difficult to understand what customers really "need" or "want" (Evans et al., 2006). Individuals may have the same need structure but different specific needs, which might be to the fore in various individuals at different points in time and according to various cultural and social contexts (Evans et al., 2006). Therefore, there are many ways to satisfy a basic need and a person chooses a specific path based on the individual's unique set of experiences, religious, ethnic, cultural or national background (Solomon, 2006).

The first stage when consumers are going to make a purchase decision is needed recognition (problem recognition) (Workman & Studak, 2006). Need recognition indicates a difference between an ideal state of a consumer (the desired situation) and the actual state of the consumer (a real situation) (Engel, 1968; Bruner, 1987; Belch & Belch, 2004; Workman & Studak, 2006). In other words, need recognition occurs when the customers recognize the gap between their current situations and their desires/needs (ideal situations) (Taylor, 2018). However, when researchers studied this stage, they usually investigate other perceptions such as internal and external factors which influence this stage (Furaiji et al., 2012; Sofia Neves Gomes & Jeive, 2018) or individual characteristics, social influences, situational economic factors and the online environment when applying for online consumers (Darley et al., 2010). Another while, Sirgy (1987) tried to measure problem recognition based on congruity theory while others did not consider it. However, this study only measured the need recognition by only one question "How do you feel about your present car, compared to your ideal car? The ideal car is what you hope for, considering the amount of money you are willing to spend (Sirgy, 1987: 57). Thus, in his study, Sirgy (1987) also suggested finding a better research measurement for need recognition. In the same year, Bruner (1987) also give the scale of problem recognition style for a fashion product. However, it related more style of need recognition than need recognition of consumers. Later, when researching consumer behaviour in the internet environment, Zhang and Benyoucef (2016b) explored another scale to measure

the five stages of the consumer decision-making process. Nonetheless, they focused on consumer attention instead of problem recognition which confirmed its important role in social commerce. Similarly, in a car purchase decision process study, Dahiya and Gayatri (2018) estimate the need recognition by the statement "digital marketing leads to awareness of buying a new car" (p.80). Besides, another construct can be used to measure this item such as attention attraction in a research of a consumer decision-making process in social commerce (Zhang & Benyoucef, 2016b). To conclude, there is still a lack of scale to measure the real need recognition of online consumers when they start to purchase the product(s).

Based on the definition and analysis of need recognition in previous studies, there is a number of internal and external factors which might trigger the consumer's need recognition (Butler & Peppard, 1998; Sofia Neves Gomes & Jeive, 2018). It can be summarised that need recognition happens because of the following reasons. Firstly, a positive change in an individual financial situation could activate a consumption of customer; restocking after running out of stock (Butler & Peppard, 1998); a changing physical including losing or gaining weight could cause the need to buy new things (Workman & Studak, 2006) are the internal reasons. Then, the influence of marketing including online and offline (Butler & Peppard, 1998), as well as other people (for example when someone sees the new television of his/her neighbour, that makes his/her need for television) (Bruner, 1987), are the external factors which affect the consumer's need recognition.

Punj and Srinivasan (1992) suggested four groups of the reason that lead the consumer to think about purchasing a new car namely, higher expected satisfaction, current dissatisfaction, product depletion, and new need. These reason categories also applied to measure the need recognition in other studies such as Frutos et al. (2014); Taylor (2018). Furthermore, in his study about the relationship between social media engagement and the activation of the consumer's purchase process, Frutos et al. (2014) confirmed that this measurement scale for need recognition can be applied in the online environment.

# 3.3.2. Dimensions of information

**Information** is the data which is "reliable and relevant" (Rodgers, 1997). Human five senses namely seeing, tasting, smelling, hearing and touching could help us to collect useful data for decision-making. Information might be political, economic, social, financial and management elements. In this process, it is *information searching*. After determining the need, the customer will try to find the information which might influence the products/ goods

that they plan to purchase. The information may come from their own experience or their references such as friends, relatives, or colleagues or public knowledge or advertising, etc. This information search relates to the product(s) in which customers are interested.

In the next action after exploring the need for a product, consumers might search for related information from a number of various resources (Kulandairaj, 2013; Rahman & Kharb, 2018; Rana & Jha, 2019). This information can fulfil their desires or need (Sachdeva, 2015).

In fact, both shopping beginners and experts are involved in searching for productrelated information (Bettman & Park, 1980; Herr, 1989; Lee, 2014). While the shopping novices might look for information on products to improve their narrow awareness, the experts could seek detailed knowledge to develop their current understanding of the product (Bettman & Park, 1980; Herr, 1989; Rahman & Kharb, 2018).

Product information might consist of external sources (including personal and impersonal sources) and internal sources (such as consumers' memory and prior experience of the product) (Cant et al., 2006; Rahman & Kharb, 2018). On the one hand, the external information source might be separated into two categories, namely non-marketer/ personal dominated and marketer/ impersonal dominated (Barber et al., 2009; Seock & Bailey, 2009). Non-market/personal sources can contain "word-of-mouth" (WOM) endorsements or recommendations by family, friends or other relatives whereas the market/non-personal sources might involve in both digital media (e.g. blogs or e-retailers website) as well as traditional media (e.g. billboard, TV and magazines advertisements) (Rahman & Kharb, 2018). On the other hand, the experimental source may include the memories or previous experiences of customers when handling, examining and using the product (Kulandairaj, 2013; Sachdeva, 2015; Rahman & Kharb, 2018).

Generally speaking, these information sources can influence the consumer decision differently based on the type of product and consumer's characteristics (Sachdeva, 2015). When customers gather the related information, they can learn about the product's features and competing brands (Sachdeva, 2015).

# 3.3.3. Dimensions of alternative selection

**Judgement** is analysing perception and information (Rodgers, 1997) by identifying the weight of each criterion/option and making a comparison among these alternatives. It can

be said that judgement in shopping is *evaluation of alternatives* to choose the best opportunity to purchase.

After collecting the related information, the consumers continue to evaluate all alternatives (Sachdeva, 2015). They might use different rules for making a set of possible products (consideration set/ evoke set) which can be considered to buy (Sachdeva, 2015). It can be said that there is no single process to create an evoke set for one consumer or all consumers in all purchasing situations (Meenakshi & Arun, 2009; Philip et al., 2009).

Choice criteria in retailing applications combine choice criteria between retailing and mobile shopping apps. In other words, when consumers shop on mobile apps that means they shop on an electronic store (e-store). They have to evaluate and select the alternative options in the online application when they do the evaluation of alternative stage. Therefore, in this research, the criteria for selecting the product in a mobile store are explored to measure how shoppers choose alternatives.

When consumers shop via mobile applications (apps), they have to evaluate the alternatives of not only products but also apps store. Based on the previous research, a summary of e-shopping mall/ site selecting criteria was explored as follows.

Type of shopping mall/ site	Selecting criteria	Source	
E-store (electronic store)	product perceptions,	Jarvenpaa and Todd (1996)	
	shopping experience,		
	customer service, and		
	perceived consumer risk		
E-store (electronic store)	merchandise, service,	Lohse and Spiller (1998)	
	promotion, convenience,		
	checkout, and navigation		
E-store (electronic store)	merchandise, convenience,	Lim and Dubinsky (2005)	
	interactivity, reliability,		
	promotions, and navigation		
Mobile shopping site	merchandise, service,	Wu and Wang (2006)	
	promotion, convenience, and		
	assurance		

Figure 3.2 E-shopping mall/ site selecting criteria

Wu and Wang (2006) reviewed the earlier studies in both traditional and electronic stores (Jarvenpaa & Todd, 1996; Lee, 1998; Lohse & Spiller, 1998; Miles et al., 2000; Pavlou, 2001; Silverman et al., 2001; Barnes, 2002; Barnes & Vidgen, 2002; Shih & Shim, 2002; Varshney & Vetter, 2002; Wolfinbarger & Gilly, 2002). In their research, Wu and Wang (2006) suppose five consumer criteria dimensions (including merchandise, service, promotion, convenience, and assurance) with 35 items for the mobile shopping environment. Then, after collecting and analysing the data, a new criterion for selecting mobile site was created which including merchandise (with 4 items), enabling functions (combining service, promotion, and convenience with 3 items) and assurance (4 items).

In this study, these products and app selection criteria are applied when considering the consumer evoke set for the consumer who uses mobile applications to purchase the product.

Item	Code	Question	Dimension	Source
Needed product	EA 1	This app provides the	Merchandise	Wu and Wang
		product that I need		(2006)
Attractive	EA 2	This app provides the		
product		attractive product		
A function for	EA 3	This app provides a		
product		function for product-		
information		information search		
search				
A function for	EA 4	This app provides a		
product preview		function for product		
		preview		
Comparison	EA 5	This app provides	Enabling	
information		comparison	functions	
about shopping		information about		
		shopping		
Promotional	EA 6	This app provides		
activities		promotional activities		
Online help	EA 7	This app provides an		

**Figure 3.3 Indicators of alternative evaluation** 

function		online help function		
Transaction EA 8		This app is able to	Assurance	
security		assure transaction		
		security		
A commitment	EA 9	This app has a		
to privacy		commitment to privacy		
protection		protection		
A flawed-	EA 10	This app has a flawed-		
product return		product return		
guarantee		guarantee		
A refund	EA 11	This app has a refund		
guarantee		guarantee		

Source: Adapted from Wu and Wang (2006), Baltas and Papastathopoulou (2003), Rigopoulou et al. (2008)

# 3.3.4. Dimensions of decision

**Decision** is "the highest expected value solution" which people choose (Rodgers, 1997). In this case, customers decide the best one to purchase. Decision refers to *purchase decision*. After evaluating these alternatives, the buyers will purchase the products/ goods which they think are the best for them.

On the one hand, Ajzen (1991) argued that purchase intention could be presumed as a key indicator of the extent that which people are willing to approach convinced behaviour. Purchase intention also illustrates the attempts of customers when they try to perform convinced behaviours (Ajzen, 1991). On the other hand, in an online environment, Laohapensang (2009) showed that online shopping intention might lead to actual action. Similar, many researchers got the same ideas in their research such as Pavlou and Fygenson (2006); He et al. (2008); Carlos Roca et al. (2009); Laohapensang (2009). Moreover, Jamil (2011) also confirmed that purchase intention might have a positive impact on the actual online purchase decision. Therefore, in this study, purchase intention is measured instead of purchase decision when considering the decision factor when customers shop via mobile shopping application.

The consumer makes a final purchase decision after scanning and searching for all various alternatives (Sachdeva, 2015). The consumer might be purchased their product offline, online store, telephone (Kumar & Meenakshi, 2011).

Items for measuring purchase intention via mobile app were adapted from Hsu and Lin (2016). In this study, Hsu and Lin (2016) show the scale to measure in-app purchase intention. In other words, this scale illustrates the items to evaluate the purchase intention of buyers via mobile applications. Thus, it is suitable for this study.

#### **3.4. Hypotheses development**

To develop the theory for the study, the relationships between the four main factors Perception (P), Information (I), Judgement (J), Decision (D), will represent specific theoretical bases. Based on the proposed theoretical model above, there will be all 5 dependent relationships including Perception -> Information, Perception -> Judgement, Perception -> Decision, Information -> Judgement and Judgement -> Decision. In the following, the author will summarize theories based on literature references from previous studies.

# 3.4.1. The relationship between need recognition and decision-making

According to Vermeir and Verbeke (2006), recognition of personal importance is a driving force to accelerate the decision-making process of consumers. Recognition is triggered when the object (a product, service or advertising message) is considered a tool to meet important needs, goals and values (Vermeir & Verbeke, 2006). Accordingly, people are motivated to invest cognitive efforts in decision-making processes because important needs are not satisfied, while habitual behaviour occurs when consumers have low motivation by satisfying their needs (Jager, 2000). From the above observations, the author realizes that there is a certain correlation between demand perception and decision-making, thereby developing the first theory for research.

# H1: Customer need recognition has a positive influence on purchasing intention

# **3.4.2.** The close relationships between need recognition, information searching and evaluation of alternatives

According to Nicosia (1966), information searching will be performed after consumers identify a particular problem or need. Which, information is divided into two sources: internal information and external information (Kotler & Armstrong, 2012). Specifically, inside information is referred to as consumer memory or recall of a product, sometimes triggered or guided by personal experience (Kotler & Armstrong, 2012). This is when customers try to search their memory to see if they recall past experiences with a product, brand or service. On the contrary, external information is considered as the customer's previous knowledge about the product or service, and then leads them to search for information from personal sources (such as word of mouth from friends/family), or public sources (e.g., online forums, consumer reports) or marketers of dominant sources (such as salespeople, advertisers) especially when the past experience of a person who is restricted or considered ineffective (Kotler & Armstrong, 2012). From the above assumptions, the author has hypothesized whether there is a correlation between Need recognition and Information searching.

# H2: Need recognition has a positive influence on information searching

Next, according to Oumayma (2019), once customers have enough information after the search process, it's time for them to evaluate different options based on their personal perceptions about the degree of satisfaction, the quality of the product, and the reputation of the brand or other outstanding features. Similarly, Kotler and Keller (2005) consider the evaluation of alternatives as a stage not to be missed because it involves factors such as price, quality and size, which are listed and filtered in the previous stages of perception and information searching. Because of the necessity and interaction between these three factors before the final activity is to make a decision, the author has strongly proposed the next two important hypotheses that need to be proved as follows.

# H3: Need recognition has a positive impact on evaluating alternatives.

# H4: Information searching has a positive impact on evaluating alternatives.

# 3.4.3. The relationship between evaluating alternatives and decision-making

Decision-making is research that determines and evaluates alternatives based on the values and preferences of decision-makers (Al-Tarawneh, 2012). Accordingly, making a decision implies that there are alternatives to consider, which means that we not only want to identify as many alternatives as possible but also want to choose the best one which is appropriate to the goals, desires and values we set (Harris, 1998). Also, after referring to previous studies on strategic decision-making processes, Nutt (1999) formulated a firm hypothesis that "decision-making is more successful if the judgement is used to assess alternatives". It is clear that a few decades ago, researchers came up with theories about the significant relationship between evaluating options and making decisions. More specifically,

Mintzberg et al. (1976) also provided a decision cycle model and identified three main phases: recognition identification, development and selection. In particular, at the selection stage, alternatives will be analyzed and scanned before a final alternative is chosen to make a decision. Moreover, according to S. Baker and Cooke (2001), the evaluation of alternatives will help decision-makers make better decisions by analyzing and measuring the criteria collected after the process of awareness and information acquisition. From the literature referenced above, we would like to suggest a remarkable hypothesis:

# H5: Evaluate alternatives that positively influence purchase intention

Figure 3.4 The proposed research hypotheses

Number	Hypotheses
	H1: Customer need recognition has a positive influence on purchasing
1	intention
	H2: Need recognition has a positive influence on information
2	searching
3	H3: Need recognition has a positive impact on evaluating alternatives.
_	
	H4: Information searching has a positive impact on evaluating
4	alternatives.
	H5: Evaluate alternatives that positively influence purchase intention
5	

The relationships between need recognition, information searching, evaluation of alternatives and purchase intention in the online environment are confirmed in many studies such as Ozarslan and Eren (2018);. Gómez-Díaz (2016); Zhang and Benyoucef (2016a);

Karimi et al. (2018). Regarding these above relationships, this study might be discovered by these above hypotheses (see Figure 3.4).

# 3.5. Expected model based on dimensions

As can be realised from analysing above, the TPM of the purchase decision might be explored as follows:

# Figure 3.5 The online purchase decision-making model

## **NEED RECOGNITION**



Source: Edit from Rodgers, 2006

Where: P = need recognition

- I = information searching
- J = evaluation of alternatives in retailing application
- D = purchase intention via mobile shopping applications

# 3.6. Summary

As explained in chapter 2 – theoretical foundation, the purchase decision process in the online environment is too complex and not fully understood. In order to discover the way this process unfolds, a suitable model which can explain the dynamic nature and complexities of purchase decisions in real-life should be developed.

Although there is a huge number of research on the consumer purchase decision process, it still has some limitations. Early models such as grand models or classical models
were simplified to a few sequential stages. In the real world, all consumers do not follow these step-by-step structures in all situations. They seem to ignore the important role of consumers in creating the purchase decision-making process.

Since the Internet appeared and become one of the noticeable purchase channels, a few online purchase decision-making models have been explored. However, these models seem to adopt the sequential models of the traditional purchase decision process and concentrate on influential factors rather than the stages of the purchase decision process. They do not consider how a dynamic and different process is constructed in different conditions. Therefore, there is a need for additional explanation and development of a suitable model for the online purchase decision-making process. Thus this study tried to provide an appropriate model which illustrates the main stage of the online purchase decision process while considering the role of pathways consumers follow to make the final choices.

In this chapter, in order to address the shortcomings of consumer purchase models, these core improvements were implemented in the proposed model.

- The TPM was applied to investigate the routes of purchase decision-making that consumers perform when they buy a product. In all situations, there are six paths which lead online users to the final choice.

- The information concept was considered to assess the influential factors which affect customers' decision-making process. This concept seems to be lacking in other previous studies.

The conceptual framework of this study, in terms of the proposed model, segmentation and the context of research including consumer's need recognition, information searching, evaluation of alternatives in a retailing application and purchase intention via the mobile application, was determined in this chapter. The design of the research methodology is explained in the next chapter.

### **CHAPTER 4 RESEARCH METHODOLOGY**

#### 4.1. Overview

After exploring the proposed model in the previous chapter, this chapter discusses the research framework and perspective that has been utilised in designing the methodology and in constructing the procedures that the research requires. Based on the literature reviewed in the preceding chapter, a conceptual model was formed; this was used to formulate the research design that has been adopted in the entire procedure of the research. While the conceptual model has already been discussed in the previous chapter, the research design will be presented in this chapter. The section below also describes the choices available to the researcher in designing the research and the rationale behind the selection of the chosen methodology. The study has been developed based on the research onion suggested by Saunders et al. (2009) where the authors have provided a systematic mechanism through which the research can be designed to include all the elements of research design in a matter that also aligns the research choices.

The research has been carried out with the objective of understanding the purchase pathways that lead consumers to the final decision-making process via mobile shopping applications in Vietnam. The study will be designed as quantitative research to enable the researcher to utilise the existing theoretical frameworks in carrying out consumer research in a structured manner and at the same time enable an in-depth enquiry into understanding the factors that influence the online consumer purchase decision-making process in Vietnam.

There are six main parts of this selection. The first part focuses on the research philosophy, approach and methodology which are considered to be the most suitable for addressing the research questions. Secondly, the technique and samples use for collecting research data and further analysis will be discussed to describe the population and samples from where the data will be collected. The format of the data collection instruments to create a framework for the information being collected from the research participants is also reflected. The reliability and validity of the instruments and procedures used in obtaining the data will be followed. Next, the data analysis, ethical considerations and research limitations will be introduced, enumerated and discussed in the last part of this chapter. Finally, all the details of this methodology chapter will be summarized in the previous section of this chapter.

### 4.2. Research philosophy

The research paradigm or the philosophical frame is used to conduct the study. Based on the knowledge source and nature, the research assumptions are launched by the research paradigm. Then, these assumptions would be applied to guess the research phenomenon (Collis & Hussey, 2013). Moreover, research paradigms provide the research framework. The researcher can base on this framework to define and structure the data which needs for the research (Hussey & Hussey, 1997).

There are two main contrasting paradigms which are available to the researchers, including positivism and interpretivism (Byrne et al., 2008). The positivism paradigm is based on natural sciences while interpretivism has been adopted from the human belief which is too complicated and hard to understand by approving natural science principles (Collis & Hussey, 2013).

Furthermore, according to Saunders et al. (2009), ontology can be reflected in two aspects, containing subjectivism and objectivism. Firstly, subjectivism argued that perceptions and consequent actions of social actors create social phenomena (Holden & Lynch, 2004; Saunders et al., 2009). Subjective perspective is believed to concern reality. This is one of the socially constructed factors in the context of humanity (Saunders et al., 2009). The researchers can focus on supplementary interpret participants' perspectives in order to clarify new awareness or opinions in particular situations. Secondly, the view of an independent relationship between social beings and social actors is supported by objectivism (Saunders et al., 2009).

As mentioned in the research objectives, this research is exploring both the theoretically and empirically nature of consumer purchase decision pathways in Vietnam. These paths are affected by consumer behaviours and the relationship between consumer purchase behaviours and the decision-making process when using mobile shopping applications. As a result, the current research will apply objectivism aspects of an ontology because this study regards the purchase decision pathways which lead the customers to make a decision online via mobile shopping applications which occur in reality external to social actors.

In addition, a number of researchers believed that the research topic related to ecommerce, mobile commerce and marketing area had been posited mostly belonging to a positivist paradigm (Kuo et al., 2009; Beverland & Lindgreen, 2010; Galalae & Voicu, 2013; Wang et al., 2015).

In this study, the researcher will consider the existing shopping decision pathways of customers who make a decision online via mobile applications in Vietnam without their own feeling during the research process and collect large data via surveys with reliability and credibility to investigate how online purchasing via mobile applications affect to customer behaviours in Vietnam. Therefore positivism is appropriate for this research. The researcher will consider the existing mobile shopping pathways situation as a fact during the process. It means that there will have no author's idea which influences the result of the study. All real cases of mobile shopping applications and shopping pathways will be respected and described precisely in the research. This guarantees that trust data will be analysed objectively without the researcher's feelings. The collected data will be observable and measurable base on Vietnamese customers and the researchers will not affect their viewpoints.

As a result, the methodological position of this research can be quantitative research which is based on a deductive approach. According to Saunders et al. (2009), deductive approaches are often related to positivism and quantitative analysis. It is associated with testing theory (theories) via theoretical hypotheses which might be built up through literature review and many constructed variables. It is noted that this method often applies questionnaires and surveys (Collis & Hussey, 2013).

As can be seen from the objectives of this research, "to identify influential factors that affect customer's purchasing different products through decision-making pathways; and to examine the impact of demographic factors on the buyer's purchasing different products in the decision-making pathways" are the aims of this study. It means that the researcher needs to understand customer behaviours when using mobile shopping applications. Therefore the best choice for this case is to collect data by taking a survey. In other words, asking the customers is the perfect method to aware of and considers their behaviours. Furthermore, there are many kinds of customers so it needs a large size of samples to understand this point. That is a nomothetic approach which is one of two different methodological approaches supporting various sampling bases. Following the quantitative technique, the nomothetic approach focus on containing a larger sample size via surveys, manifold, questionnaire or personality test (Burnell & Morgan, 1979).

Besides, there are two more philosophies including realism and pragmatism which need to be considered. In this study, as mentioned above, realism which refers to objects related to exits independently to the human mind (Saunders et al., 2009) is the best.

In summary, philosophical stances and paradigms should be considered carefully and could be demonstrated briefly as above. This research applies the two chosen ontological assumptions (realism) and epistemological assumption (positivism) with a methodological assumption (nomothetic approach).

### 4.3. Research approach

As can be seen from other studies, the first thing for starting research should be to consider a research approach. According to Spens and Kovács (2006), the research approach might be referred to as a hypothesis testing process. Deductive and inductive research approaches are included. These two types of research approaches must be made clear to support a process of methodology description. Therefore, this research would be more effective. On the one hand, the deductive approach explores the literature; investigates the data collected to make a conclusion. The literature might be described via collected data, information and facts which are reaching a hypothesis by the researcher. On the other hand, the inductive research approach is the observing process and then developing without testing (Johnson, 1996).

In conclusion, after looking over both research approaches, it could be decided deductive approaches might need to apply to this research. The deductive approach will be conducted to find out the data on current pathways that lead Vietnamese customers to purchase online based on the TPM.

#### 4.4. Research methodology

Research methodology, according to Mingers (2001), is referred to as a planning strategy and structure of investigation which use to find proposed answers for research problems or questions. There are two main types of research methodology, namely qualitative and quantitative methods.

On the one hand, the qualitative methodology is often used to analyse the problems of culture, activities or behaviours. The common significant characteristics of these problems are that they are usually influenced by other factors. Then, qualitative data and information should be collected to expound on events and their consequence (Mingers, 2001). Based on the study of Myers and Avison (2002), interviews and questionnaires are usually used to

collect the data in qualitative methodology research. This research also emphasises that the inductive research approach is considered the nature of qualitative research methodology (Myers & Avison, 2002).

On the other hand, the main feature of quantitative research methodology is the collected data must be well-defined, accurate, and precise. Besides, statistical analysis and controlled experiments have to be tested for formulating the hypothesis (Kaplan & Duchon, 1988). Quantitative research methodology is able to use not only questionnaires and interviews to collect data but also observations and measures. This is a different critical thing from the qualitative methodology. Among these above methods, the questionnaire is the most popular one (Easterby-Smith et al., 2002).

Moreover, these two methodologies above could be mixed to become a third research methodology namely the mixed methodology approach. By using this mixed approach, all the best traditions could be capitalized on, and many shortcomings might be overcome (O'Leary, 2017).

After considering both the research qualitative and quantitative methodologies, the quantitative methodology will be applied in this research based on what happened in fact. The quantitative method could support the researcher to understand the current situation of purchase decision pathways that leads customers to buy online products via mobile applications. Further, it is strongly believed that the quantitative methodology could explain more specifically what different paths of customers when purchasing online based on their characteristics and the different type of products.

From the analysis above, after considering a list of key strengths and weaknesses of three approaches when using as a methodology to study purchase decision-making, this study will use the quantitative method.

### 4.5. Research technique and procedures

The research technique and procedures which can use to collect the information from the chosen samples are discussed in this section. This current research uses a questionnaire for collecting quantitative data.

The research needs to conduct the survey in a specific location. Therefore, the researcher travels to Vietnam in order to control the survey via the sampled participants.

On the other hand, in order to obtain the informed consent of the participants, a prepared consent form and invitation letter (presented in Appendix 1 and 2) are delivered to the respondents before conducting a survey.

### 4.5.1. Instruments for data collection

As mentioned above, this research conducts a survey which is carried out through a structured questionnaire. This questionnaire is designed and focused on reviewing related literature.

A pre-test and pilot study were accompanied with the purpose of testing the variety of measurement scales, improving the questionnaire and recognising various problems, which might be challenged in the final study. A structured questionnaire was prepared in both English and Vietnamese. The pre-test and pilot study was done to validate the online purchase decision-making measurement scale. Data was collected from twenties students selected and ten young experts (aged 22-35) in marketing research for a period from July 2019 to August 2019. They are chosen for two main reasons. Firstly, it was very significant to select educated respondents and young marketing experts who could understand the concept of online consumer decision-making. Second, they are able to play a dynamic role in online purchase decision-making. The pre-test and pilot study helped the researcher to identify specific unexpected problems. Many respondents find the language of many items should be simplified. Then, the gender must be two options which are simpler for respondents to answer. Then the questionnaire was edited based on the pilot test.

The final study was done after the results were obtained from the pre-test and pilot study. A structured questionnaire was prepared in both English (presented in appendix 3) and Vietnamese for data collection. The scale with various items was deleted after the pilot study was administered to the respondents with the left-over items. It takes around 15 minutes to 20 minutes to complete this questionnaire.

There are four main sections of the questionnaire. Section A of the questionnaire is aimed to collect the background or biographical information regarding the respondent's demographics. This section requires the participants to provide relevant information about their genders and ages. Next, the second section collects the general data related to the online experience via using a mobile shopping application. In this section, the basic information to categorise the targeted respondents such as the smartphones they owned, the mobile apps they installed is collected or the product(s) they bought. Then, in the last part of this section, general information about the frequency of buying and the types of products that online users purchase via mobile shopping applications is gathered. Following, section C, namely actions to purchase the products via mobile shopping application is divided into four parts. These parts include need recognition, information searching, evaluation of alternatives and purchase intention which represents the conceptual framework in the previous chapter. Finally, the pathway to purchase the product via mobile application is delivered in the last section to understand to route(s) online users follow when they shop through mobile applications. These answers have been collected through a five-point Likert scale which is one of the most popular scales for information collection (Sekaran & Bougie, 2016). The scale is imposed to range from "strongly disagree" to "strongly agree".

### 4.5.2. Validity and reliability of the questionnaire

The two key quality concerns of the research instruments such as a questionnaire are validity and reliability. Validity refers to the ability of the researcher to measure the required aspects to be measured while reliability could generate the same result at different times to confirm correct measurement (Creswell & Plano Clark, 2003). These primary research qualities are emphasized and essential for situations in which the researcher collates the potential information based on the attitudes and perceptions of respondents while the changes in the environmental factors are not able to vary the research findings (Saunders et al., 2009).

On the one hand, according to Saunders et al. (2009), the validity of a questionnaire is able to improve by certifying that these questions in the survey match well to the theoretical conceptions. In this research, the questionnaire is built by breaking down all related factors in the conceptual framework into statements. These statements are represented in sections B and C of the survey (see Appendix 3). To aim for this goal, several previous pieces of research which link to measure adoption among online consumers have been used as references (Gefen & Straub, 2000; Howcroft et al., 2002; Huang et al., 2007; Lin, 2011). However, one of the main backs drawn of validity is it is only based on the assumptions of researchers to estimate and is not able to measure accurately.

On the other hand, the reliability of the research could be assured over and done with a questionnaire design. Good close-ended questions should be easy to understand as well as neutral as much as possible. One of the ways to improve the reliability of the questionnaire is by using a pilot study. This pilot study might support the researcher to not only evaluate whether the questionnaire is easy to understand precisely by potential respondents but also certify that the length and sequencing of the survey are suitable as well as would not prevent the process of data collection (Creswell, 2003). The questionnaire and initial guide for the survey are presented to 34 respondents, including undergraduate students (aged 18-22), people aged 22-37 who shop online via mobile applications and the researcher's peers to test the reliability of the study design. This pilot test helps the researcher to evaluate the quality and clarity of the questionnaire statements. Then, the opinions and comments of respondents would be noted to amend the final questionnaire. Guidance, a cover letter, as well as the researcher's email, are provided to the target respondents which are expected to increase the study's reliability. These documents might support respondents' understanding better of the questions being asked because the research aims and context are explained clearly (Saunders et al., 2009). Furthermore, the reliability of the research can be measured through Cronbach's alpha which is referred to as the internal scale consistency used in the instrument of the research (Saunders & Lee, 2005). This Cronbach's alpha index is found to assess effectively the reliability of multi-item scales in consumer research (Saunders & Lee, 2005). Thus, Cronbach's alpha is undertaken to evaluate the instruments' reliability.

Besides, exploratory and confirmatory factor analysis (EFA & CFA) are used to estimate the instruments' validity. In addition, other metrics including composite reliability (CR), average loadings (AL) or average variance extracted (AVE) might be considered to check for both the instrument validity and reliability when conducting research related to consumer intentions via mobile shopping application (Natarajan et al., 2017).

### 4.6. Scale construction and question design

Next, after identifying appropriate research methods, developing scales and questionnaires are the tasks that researchers must perform to support the survey and data collection (Creswell, John W., 2014).

In particular, building a scale refers to the creation of empirical measures for theoretical works; the measurement usually includes several specific items and indicators (Stangor, 1998). With the objective of measurement to discover online consumer purchase decision pathways in Danang, the study is based on the algorithmic model developed by Waymond Rodgers. Specific indicators of the scale will be based on four main latent constructs: Perception (Need Recognition), Information Searching, Judgement (Evaluation of Alternatives), Decision (Purchase Intention). Specifically, the author will interpret in the following sections

On the other hand, building a questionnaire relates to the design of a questionnaire to collect statistically useful information on a given topic (Dillman, Don A., Smyth, Jolene D., Christian, Leah Melani., 2014). When properly constructed and responsibly managed, the questionnaire can provide valuable data on the selected topic. In this study, the author uses the Likert scale to assess the answers of the respondents. Therefore, validity and reliability will be performed to check the quality of the questionnaire in this study, which is considered a multi-item scale (Robinson, M. A., 2018). In particular, the validity of a questionnaire can be improved by confirming that these questions in the survey are consistent with theoretical concepts (Saunders et al., 2009). In this study, the questionnaire was constructed by breaking down all the relevant elements in the conceptual framework into statements. On the other hand, the reliability of the research can be guaranteed and carried out with the questionnaire design. The questions should be as easy to understand and neutral as possible (Saunders et al., 2009). In addition, the author also uses refinement questions to remove samples that are not suitable for research. Furthermore, to improve the reliability of the questionnaire, the study also uses a pilot survey because it can assist researchers not only in assessing whether the question is easily understood by potential respondents but also in confirming that the length and sequence of the survey are appropriate and does not prevent the data collection process (Creswell, 2003).

### 4.6.1. The scale construction

#### 4.6.1.1. Need recognition

According to Karimi (2013), to start a decision-making process, decision-makers must be aware of the needs. To understand it, Silverman (2001) has defined that needs recognition is considered as perceiving customer satisfaction about market products and services, which establishes a desirable state to have these products and services. On the other hand, some researchers such as Belch and Belch (2004), Workman and Studak (2006), Engel (1968), Bruner (1987) have suggested that cognitive needs show the difference between the ideal state and actual state of consumers. However, when beginning to enter this stage, researchers often investigate perceptions under the influence of various factors such as environmental stimulation, personal experience, and internal or external motivations of the customer (Liang, TP, & Lai, HJ, 2002) or the impacts of the social and economic situation and even the impacts of the online environment (Darley et al., 2010). For example, in 1987, Sirgy measured problem awareness based on appropriate theory but only by a single question "How do you feel about your current car, compared to your ideal car?" Oumayma, B. (2019, October), meanwhile, measures customer awareness through the impact of social media. In this study, he suggested that the biggest stimulus to customer demand was advertising (external impact) but he ignored the other effects. In addition, Zhang and Benyoucef (2016) explored another scale to measure five stages of consumer decision-making. However, they focus on consumers' attention instead of recognising the issue that affirms its important role in social commerce.

After a personal learning and refining process, the author summarizes several reasons to enable customer needs recognition to be activated. First, in terms of internal forces, which include a positive change in personal financial situation, refilling after stocking out or the need for physical changes, are factors that drive demand awareness (Butler and Peppard, (1998); Workman and Studak, (2006)). Next, external factors that influence customer perceptions are also included, such as online and offline marketing (Butler and Peppard, 1998) or influences from other people (family, friends, relatives or neighbours) (Bruner, 1987).

Finally, a scale with four items that can make consumers realise their needs for products based on the theory of Punj and Srinivasan (1992) was proposed in the author's study. These include higher expected satisfaction, current dissatisfaction, product exhaustion and new needs.

Item	Code	Question	Source
Higher	NR1	I had an old product but wanted one more	Punj and Srinivasan
satisfaction	NR2	I had an old product ran fairly well, but the	(1992) Easternatical (2014)
		new models had better styling	Frutos et al. $(2014)$
	NR3	I had an old product ran fairly well but could get better with a new product	1 aylor (2018)
Current	NR4	I had an old product needed repairs too	Punj and Srinivasan
dissatisfaction		often and was not reliable	(1992)
	NR5	I had an old product ran fairly well, but if	Frutos et al. (2014)
		it broke down, it would not be worth fixing	Taylor (2018)
Product	NR6	I had an old product stopped running and	Punj and Srinivasan

Table 4.1 The scale of need recognition

		-	
depletion		had to be replaced	(1992)
	NR7	I had an old product ran fairly well but it	Frutos et al. (2014)
	111(/	i had an old product fan fanty wen, out it	
		is best to trade every two or three years	Taylor (2018)
New need	NR8	I had an old product ran fairly well but	Punj and Srinivasan
		wanted a product for a different purpose	(1992)
	NR9	I did not have a product and wanted to get	Frutos et al. (2014)
		one	

### 4.6.1.2. Product information searching

Next, after the needs are identified, consumers will assess all possible different sources so that they can solve problems and meet current needs (Oumayma, B. 2019). To do this, consumers will have to search for more information on products or services that meet their needs.

Also according to Oumayma, B. (2019), information about potential product/service choices is collected from various sources such as personal sources (friends, family, acquaintances, so on), commerce sources (advertising, agencies, sellers), public sources (social media like Facebook, Zalo, Youtube ...). More specifically, Rahman and Kharb (2018) have argued that product information may include internal and external sources. In particular, internal sources of information include "word of mouth" (WOM), recommendations by family, friends or other relatives and even sources related to digital media as well as traditional media (Barber et al., 2009; Seock and Bailey , 2009; Rahman and Kharb, 2018). On the other hand, internal sources relate to customers' inherent experience and knowledge about the product (Rahman and Kharb, 2018, Sachdeva, 2015, Kulandairaj, 2013).

In short, according to Sachdeva (2015), sources of information influence consumers' decisions in diverse degrees depending on the type of product and the characteristics of consumers. Once relevant information is collected, customers can learn about product features and competing brands (Sachdeva, 2015).

The following is a scale table showing the sources of information that the author has studied and analysed above

### Table 4.2 The scale of information searching

Item	Code	Question	Source
Personal sources	IS 1	Do personal sources (family, friends,	Sachdeva (2015)
		neighbours, colleagues and acquaintances)	Kulandairaj (2013)
		help you in searching for information about	
		the product	
Traditional media	IS 2	Do traditional media sources (magazines and	Sachdeva (2015)
sources		TV, billboard advertisements, salespersons,	Kulandairaj (2013)
		dealers, display, demonstration, exhibition,	Rahman and Kharb (2018)
		etc.) help you in searching for information	
		about the product?	
Digital media	IS 3	Do digital media sources (Internet e-retailers	Sachdeva (2015)
source		website, blogs, social media, etc.) help you	Kulandairaj (2013)
		in searching for information about the product?	Rahman and Kharb (2018)
Experimental	IS 4	Do experimental sources (handling,	Sachdeva (2015)
sources		examining and using the product) help you	Kulandairaj (2013)
		in searching for information about the	
		product?	

### 4.6.1.3. Evaluation of alternatives

After having gathered enough information, it's time for consumers to value all the different alternatives (Oumayma, B. 2019). Typically, customers will evaluate alternatives based on the various attributes of potential products. They set up assessments based on satisfaction, quality, reputation, and features ...Overall, according to Philip et al. (2009) Meenakshi and Arun (2009), there is no single process to create a set of suggestions for consumers in all buying situations.

In this study, there are 3 dimensions set by the author for the selection criteria, which need to be measured including product criteria, merchandise, and enabling functions. In particular, based on the studies of Hirschman and Holbrook (1982), Ahtola (1985), Havlena and Holbrook (1986), Childers et al. (2001), Dhar and Wertenbroch (2000), the author will use product quality, product brand, product price, payment and product delivery, returns and

changes as scales for measuring product evaluation criteria. The rest, based on research by Wu and Wang (2006), criteria for merchandise (with 4 items), enabling functions (combining service, promotion, and convenience with 3 items) and assurance (4 items) were reapplied as measuring mobile store choice criteria in online retailing

The following is a scale table showing the product and app selection criteria compiled by the author after reviewing and analysing a series of previously stated studies.

Item	Code	Question	Dimension	Source
Product quality	EA 1	I pay attention to	Product criteria	Baltas and
		product quality		Papastathopoulo
		(country of origin,		u (2003)
		product features,		Rigopoulou et al.
		packaging, etc)		(2008)
Product brand	EA 2	I pay attention to the		Baltas and
		product brand (Many		Papastathopoulo
		and new models by		u (2003)
		brand, a variety of		Rigopoulou et al.
		known brands)		(2008)
Product price	EA 3	I pay attention to		Baltas and
		product price (lowest		Papastathopoulo
		price or comparison		u (2003)
		price)		Rigopoulou et al.
				(2008)
Payment	EA 4	I pay attention to		Baltas and
		product payment		Papastathopoulo
		(accept a variety of		u (2003)
		payment methods)		Rigopoulou et al.
				(2008)
Product delivery,	EA 5	I pay attention to		Baltas and
returns and		product delivery,		Papastathopoulo

Table 4.3 The scale of evaluation of alternatives

changes		returns and changes		u (2003)
				Rigopoulou et al.
				(2008)
Needed product	EA 6	This app provides the	Merchandise	Wu and Wang
		product that I need		(2006)
Attractive product	EA 7	This app provides an		
		attractive product		
A function for	EA 8	This app provides a		
product		function for product-		
information search		information search		
A function for	EA 9	This app provides a		
product preview		function for product		
		preview		
Comparison of	EA 10	This app provides	Enabling	
information about		comparison	functions	
shopping		information about		
		shopping		
Promotional	EA 11	This app provide		
activities		promotional activities		
Attractive productAfunctionproductinformation searchAfunctionforproduct previewComparisonofinformationaboutshoppingPromotionalactivities	EA 7 EA 8 EA 9 EA 10	This app provides an attractive product This app provides a function for product- information search This app provides a function for product preview This app provides comparison information about shopping This app provide promotional activities	Enabling functions	

Source: Adapted from Wu and Wang (2006), Baltas and Papastathopoulou (2003), Rigopoulou et al. (2008)

### 4.6.1.4. Purchase decision

According to Oumayma, B. (2019), customers' purchasing decisions will be the final choice made about what products they will buy related to the store, packaging and purchase methods. Customers can choose to buy the products they want via the offline, online store or phone (Kumar and Meenakshi, 2011)

In this study, the author references and records the scale of Hsu and Lin (2016) because it has items that measure purchase intent via mobile applications that have been adjusted. In which, Hsu and Lin (2016) depicts the scale to measure in-app purchase intention. In other words, this scale demonstrates the items to assess the purchase intention of consumers via mobile applications. Thus, it is appropriate for this study.

Item	Code	Question	Source	
Purchase	PI 1	I intend to continue purchasing products and services	Hsu and Lin	n
intention		via mobile applications	(2016)	
	PI 2	I strongly recommend others to purchase products and services via mobile applications		
	PT 3	I find purchasing products and services to be worthwhile via mobile applications		
	PI 4	I will frequently purchase products and services in the future via mobile applications		

 Table 4.4 The scale of Purchase Intention

Source: Hsu and Lin (2016)

# 4.6.2. The questionnaire structure

There are 33 questions for this study. Questions are closed. This makes it easy for respondents, as well as the convenience of collecting, coding and analysis of information.

The question structure is divided into 4 sections corresponding to the following specific objectives:

- Section 1: The objective is to collect background or biographical information related to the demographics of the respondents. Here, respondents will provide information about gender, age, occupation, place of residence or nationality
- Section 2: The online shopping experience through mobile applications is surveyed. In this section, questions related to respondents are specifically collected, such as: What smartphones do they own? What are the mobile apps they install? Or which product did they buy? Then, at the end of this questionnaire group, the author will survey respondents about the frequency and type of products they buy through online shopping apps.

- Section 3: Questions about recognizing needs, seeking information, evaluating replacement intent and purchasing are surveyed. These responses were collected through the five-point Likert scale, which is one of the most common scales for collecting information (Sekaran & Bougie, 2016). The scale is imposed to range from "strongly disagree" to "strongly disagree".
- Section 4: Questions about online customer decision-making paths are formed. Here, the author will know which roads will be used by customers to make decisions corresponding to the products they want to buy.

A detailed questionnaire will be described in Appendix 3. This questionnaire is designed and focused on reviewing relevant documents.

### 4.6.3. Pilot survey

According to Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, LP, ... & Goldsmith, CH (2010), pilot survey, which is also called some other names such as pilot project or pilot test, is a small scale preliminary study. This survey is done to assess the feasibility, reliability, time, cost or other adverse events aiming at improving research design before undertaking comprehensive research projects. In the same opinion, Creswell (2003) has suggested that pilot research is one way to improve questionnaire reliability, it not only helps researchers evaluate whether the question is easy to understand and correct but it also confirms the length and the appropriate survey sequence as well it does not prevent the data collection process.

After referring to these above views, an initial questionnaire and guidelines for the survey were presented to 30 university students and 5 fellow researchers to test the reliability of the study design. It helps researchers assess the quality and clarity of questions. Next, there will be some final revisions of the questionnaire after collecting positive comments. In addition, guidance, a cover letter as well as the researcher's email will be provided to increase research reliability.

In addition, Cronbach's alpha is also tested to measure the reliability of research, which refers to the internal scale consistency used in the study (Saunders & Lee, 2005). Besides, exploratory factor analysis and validation (EFA & CFA) or other important data including composite reliability (CR), average load (AL), or average variance extracted (AVE) is checked to consider the validity and reliability of the tool when researching consumer intent through a mobile shopping application (Natarajan et al., 2017).

### 4.7. Research sample

### 4.7.1. Sample technique

Sample techniques, according to Saunders et al. (2009), offer necessary methods to assist researchers to decrease the overload of information based on concentrating on subgroup as a replacement for the whole situation. It is claimed that there are two sampling method types including probability and non-probability (Hair et al., 2010). First, probability samples are selected from the population, which is possible to answer research questions. It achieves objectives that require researchers to estimate the characteristics of the population of the sample statistically. Next, non-probability samples are selected from a total population that is not mentioned and hard to respond to investigative questions or accomplish objectives. Investigators are required to conjecture numerical data about the characteristic of the people. In the scope of research, there is no absolute quantity of the population or customer database of mobile shopping applications in Vietnam. Thus, the non-probability sampling method is suitable to apply for this research.

On the other hand, convenience sampling is a sampling technique of non-probability sampling methods (Hair et al., 2010). It involves selecting haphazardly those cases that are easy to obtain for the research sample. Samples of convenience sampling are usually chosen at the appliance of the research. The convenience sampling method cannot be calculated so its limitation is the low accuracy of the sample. Hence, collected data cannot be trustworthy for a larger target population of research and cannot perform the target population (Hair et al., 2010). Nevertheless, this sampling method supports researchers to gain a considerable quantity of respondents in a short time and with a fit budget. Consequently, the convenience sampling technique is applied to gather information in this research because of the limited time and financial plan.

### 4.7.2. Sample characteristics

Sample characteristic is the most vital requirement of the research because the researcher must understand customer information, to have the ability to achieve research objectives (Saunders et al., 2009). This research primarily concentrates on online customers who have experienced mobile shopping applications and used mobile applications or mobile applications to purchase online.

According to GSO (2018), the population of Vietnam in 2017 was around 94.67 million. Among this huge community, there is 42 per cent of them have at least one

smartphone (Thông, 2018). This figure points out the important role of smartphones in the daily life of Vietnamese people. Besides, 90 per cent of people said that they have purchased at least one time per month via mobile applications after they installed them (Thông, 2018). According to Criteo's report about online Vietnamese consumers, people aged 18-24 and aged 25-34 are the most frequent customers who are willing to buy via mobile applications (94% and 93%) (Thông, 2018). This impressive figure shows the main group of online customers who have purchased products via mobile devices in Vietnam.

Most people aged 18-22 are usually undergraduate students. Văn (2017) identifies that 77 per cent of high school students (at age 18 -19) continue to study at a university or college. Normally, Vietnamese students will spend four years at the university, excluded medical universities. Thus, when they graduate, they are at 22 or 23. It is said that between the age of 18-24, most people are students at university. Therefore, this is one of the main reasons that the sample will focus on the students in Vietnam in this research. They are called generation Z (Shatto & Erwin, 2016).

Moreover, people who are at aged 22-37 also one of the most frequent groups to shop via mobile applications (Thông, 2018). They have usually worked from one to more than ten years after graduation. Thus, another respondent group of this study is individuals aged 22-37. They are represented by millennials (Shatto & Erwin, 2016).

On the one hand, the age of the two above groups is over 16 years old and, from this age, people have knowledge about daily technology and usually spend time using the Internet (Jones, 2008). Besides, the Vietnam government provides Identity Card for civilians when they are 14 years old. Moreover, people aged 15 and over can register bank accounts and have the ability to pay for a transaction, including online shopping payments.

On the other hand, they also accept new technology, like going travelling booking, and purchasing online. At this age, in Vietnam, people can own their smartphones. They also have money based on earning themselves or their parents give them, and they can decide on the things they buy without permission from their parents.

Therefore, students and people aged 22- 37 who purchase products/ goods via mobile applications are the samples of this study.

In conclusion, this research is designed with a quantitative research method and also follows a questionnaire. The empirical analysis will reflect on the experiences of local users of mobile shopping applications and understand their behaviour when shopping online via mobile shopping application(s). These will be accomplished with appropriate academic theories to address the gap which mentions in the problem statement above.

### 4.7.3. Sample size

The sample size should be decided based on the requirement of empirical precedence, study objectives researcher's judgement as well as analytical tools although there are some dissimilar arguments related to the sample size of consumer behaviour research (Miaoulis & Michener, 1976; Jankowicz, 2005).

It is clear that the larger sample the study conducts, the more valuable the research achieves. However, most of the research has the main limitation of time and cost. Therefore, the researcher should pay attention to the minimum required sample to achieve statistically meaningful conclusions.

There are a huge number of theories which suggests different sample size when doing research (Hulland et al., 1996). There is a lot of different theoretical guidance for sample size (Baumgartner & Homburg, 1996). In particular, the sample size of research could be recommended from 50 plus the number of parameters to be estimated (Bagozzi, 1980), to 100 (Bollen, 1989), to 200 and more ((Kelloway, 1998).

On the other hand, other flexible ways to determine the sample size are suggested by different researchers. For instance, Tabachnick et al. (2007) advise that the sample size should be  $N \ge 104 + m$  (where m = the number of independent variables). Differently, in a previous study, Nunnally (1978) believes that a suitable sample size for each research is equivalent to 10 observations per model variable. In addition, an item-to-response ratio range is suggested among 1:4 (Hinkin, 1995), 1:5 as a minimum ratio and 10:1 as the highest one (Hair, 2006).

In the current research, a sample size between 300 and 500 cases is required for most studies and seems to be deemed adequate depending on precedence for the sample sizes of structural equation modelling (Smith, 2009). Besides, the large sample might make a disadvantage to the research because it could magnify the statistical significance of the research results (Sekaran, 2016).

Based on the argument for sample size above, in this research, a 716 sample of students and people aged 22-37 who have smartphones, install mobile shopping apps and purchase products via apps will be collected for analysis further. It is suitable for the viewpoint of Hair (2006), Smith (2009) and Sekaran (2016).

Furthermore, because of the limitation of time and the cost, the research could only collect data from the two main cities of Vietnam. Da Nang city symbolised the Central and Highland and Ho Chi Minh City is stood for the South Area.

As can be seen from the statistics of the General Statistics Office, the number of people divided by city, and the number of people in three central cities in Vietnam show in the following table (GSO, 2017).

Table 4.5 The number of people in Vietnam

City	Number of people	Percentage
Total	9,343,700	100
Da Nang	1,046,200	11.20
Ho Chi Minh	8,297,500	88.80

Source: GSO (2017)

Based on the proportion of the people in the three biggest cities in Vietnam, the sample would be deliver depended on the geography as below:

Table 4.6 The number of samples in different cities

City	Number of people	Percentage
Da Nang	80	11.20
Ho Chi Minh	636	88.80
Total	716	100.0

In conclusion, the research would conduct a survey of 716 people who purchase goods via mobile applications in the three biggest cities of Vietnam (Da Nang and Ho Chi Minh). The non-probability sampling methods and the convenience sampling technique would be applied to gather information.

### 4.8. Data analysis

As a result of the methodology for this research, a comprehensive analysis will be carried out for survey data. The quantitative data which is collected from close-ended questions will be encoded using Statistical Package for the Social Sciences (SPSS) and smart PLS for statistical analysis. Structural Equation Modeling (SEM) is used to examine the model fits and hypothesis testing. Because SEM has the ability to evaluate multiple interrelated dependent relationships (Hair Jr et al., 1995). The statistical software tool used to carry out the various analysis of this research is SPSS 23.0 and smart PLS 3. Before conducting the SEM analysis, the measurement model will be tested for validity and reliability.

On the one hand, demographic variables would be carried out through descriptive statistics to evaluate the sample distribution and composition as well as whether this sample is represented the desired population. Then, the collected data which corresponds to the study variables from the theoretical variables such as the need recognition, information searching, evaluation of alternatives and online purchase intention would be exposed to analysis in depth. This will then be followed by an associative analysis which would be analysed to identify whether the correlations among these research variables might be as predictable as the literature. After that, a regression analysis is able to include factors analysis and would be expected to help the researcher to evaluate the research variables' impacts (Collis & Hussey, 2013). The findings from the quantitative survey would be analysed in combination to identify the relationship between the need recognition, information searching, evaluation of alternatives and purchase intention of online consumers towards using mobile shopping applications to buy products as well as address the research questions of this study.

The choice of methods and techniques for data analysis depends on whether the collected data are quantitative or qualitative (Collis & Hussey, 2013). This is quantitative research. Therefore, the use of such survey questions and quantitative analysis methods is suitable for analyzing collected data. The data will be entered and analysed to cover the information of the sample and descriptive statistics of all indicators (items). Covariance is based on the SEM technique. SEM is a common method used in the marketing literature (Baumgartner & Steenkamp, 2006) that allows researchers to clearly and simultaneously measure errors, combining both observed and unrelated variables in the analysis (Grace & Bollen, 2008). Testing separate measurement models and model structures is a commonly used technique (Baumgartner & Homburg, 1996). This is due to the presence of deviation parameters, the normal situation in practice, and the one-step method, in which at the same time, the measurement and sub-model structure are estimated will be significantly skewed (Anderson & Gerbing, 1988).

With the research objectives set out to test and compare research models, a rigorous scientific data analysis strategy is needed. Moreover, the research model is a path model. To carry out the research objectives, Smart PLS 3.2.9 software was used as the main tool for analysing the collected data. This section details data analysis methods applied for hypothetical testing.

### 4.8.1. Descriptive statistical analysis

Descriptive statistical analysis was performed to describe the sample as well as to describe the collected results for the observed variables of the main model. Statistical analysis of descriptive samples helps the researcher to make initial judgements about the suitability of the research samples. Moreover, statistical analysis of the main observed variables helps the researcher better identify the characteristics of observed variables in the research model. The frequency index, frequency-based on samples with appropriate values will be surveyed in the statistical analysis of the sample description, while the average value corresponding to the conversion evaluation interval will be focused on in the survey.

### 4.8.2. Preliminary assessment of each scale

This study applies the recommendations of Joseph F Hair Jr, Hult, Ringle, and Sarstedt (2016) including intrinsic consistency Cronbach's alpha, convergence and discriminant values to test the reliability of the scales research.

By measuring the reliability coefficient, the reliability test of the scale can assess the consistency of the entire scale. The requirements of reliability analysis using Cronbach's alpha coefficient:

- Consider Cronbach's alpha coefficient: According to (Garson, 2016), Cronbach's alpha coefficient if in the range from 0,8 to 1 is a good scale, from 0,7 to 0,8 is an acceptable scale, and Cronbach's alpha coefficient is recommended from 0,6 and above is usable in case the research concept is new or new to the respondents in the research context. According to the meaning of the values Cronbach's alpha (CA) is determined as follows (Joe F Hair, Sarstedt, Ringle, & Mena, 2012):
- $0,6 = \langle CA \langle 0,7 \rangle$ : Acceptable
- 0,7 = <CA <0,8: Fair
- 0,8 = <CA <0,9 Good
- $0,9 = \langle CA \langle 1 \rangle$  Very good

 However, Cronbach's alpha does not indicate which variable should be removed and which should be kept. Therefore, besides the alpha coefficient, it is also used item-total correlation coefficient (Item-total correlation) and those with a total correlation variable <0,3 will be removed (Nunnally, 1994).

The convergent value represents the measurement value of a concept that is closely related to each other after repeated measurements. To check the convergence value of the outer loading scale, the average variance extracted (AVE) and the combined reliability of the conceptual variable (CR). Used as suggested by Joseph F Hair Jr et al. (2016). Accordingly, the researchers also suggested that the estimated standardized factor load factor should be greater than or equal to 0,5 and ideally greater than or equal to 0,7. The reliability of a concept variable greater than or equal to 0,7 suggests good reliability while a confidence level between 0,6 and 0,7 is acceptable. Also, an average deduction variance of greater than or equal to 0,5 is required to obtain a satisfactory convergence level.

For discriminant values, Joseph F Hair Jr et al. (2016) also suggest that to have sufficient evidence of discriminatory values, the average extracted variance of any two conceptual variables should be larger than average. The correlation value between the two concept variables. In other words, the square root of the average of the variance of the two concept variables should be greater than the correlation value between the two concept variables. Besides, for the test area condition of Fornell-Lacker, all square root AVE must have a value greater than 0,5.

### 4.8.3. Test models and research hypotheses

After a preliminary evaluation of each scale, it is necessary to establish a measurement model that includes all the scales in the research model to look at their validity closely.

To estimate the specific relationship between potential variables, the internal model (also called the structural model) was analyzed after the external model analysis was performed. Specifically, path values (Path Coefficient) for potential endogenous variables and R-square with a significance level of 5% (p-value <0,05) are used. Also, to assess whether multi-collinear phenomena between independent variables (Which often occur in regression models) can influence the testing of research hypotheses, the magnification factor Variance (VIF) was applied. According to Garson (2016), multi-collinear phenomena can exist (with the indication of multi-collinearity) when the VIF index > 4.

To evaluate the results of the study, a non-parametric Bootstrap analysis (Bootstrap test) was performed because sampling, according to many researchers, was a suitable strategy to test the model in practice. This study implements a Bootstrap procedure with 5000 samples.

#### 4.8.4. Assessment of mediation effect

To test the intermediate effect, this study is interested in the proposal of (Preacher & Hayes, 2008). Specifically, Zhao, Lynch Jr, and Chen (2010) stated that if the value of 0 does not appear in the results of the Bootstrap confidence interval and the specific indirect effects are statistically significant (with p-value values reached) meaning the level is less than 5%).

### 4.9. Ethical considerations

Concentrating on the research objectives, and questions as well as considering philosophy, and paradigms carefully and understanding comprehensively ethical issues, the current research focuses on the character viewpoint of the own activities themselves as well as using considerable methods in the whole research process. As a consequence, Kantian ethics related to a deontological perspective are mentioned as the best ethical position in this study (Kant, 1979).

As can be seen from the aims of this study and discussion in the philosophy section above, the researcher takes an in-depth look at the purchase decision pathways of consumers when they shop online via mobile shopping applications in Vietnam and respects its facts whether its situation is good or bad. The study will not pay attention to the functional outcomes of finding data. It just focuses on what is the real situation of the purchase pathway via mobile shopping applications in Vietnam and the consumer behaviours when using the mobile shopping application. Therefore, this research is related to deontology.

According to the ethical paradigms (Kant, 1979; Reynolds & Bowie, 2004; Saunders et al., 2009; Wood & Hilton, 2012; Gotsis & Kortezi, 2013), the proposed research might follow Kantian ethical standpoint. The study will examine theoretically and empirically the purchase decision paths when Vietnamese consumers purchase different types of products via mobile shopping applications in Vietnam. This means it focuses on the character of using mobile shopping applications of consumers and makes clear the main pathways related to consumer purchase behaviours as well as a consumer decision-making process. The researcher, in this case, will not change the data and analysis and even the result which

applied many means to achieve the expected outcome. All the real facts will be described analysis and explained based on the actual collected data. Obviously, the researcher's view will not consider a central stance which decides whether actions are right or wrong (virtue ethics).

After setting the research topic, some ethical issues might involve clarifying the topic and research design. Firstly, it is better to explore, and design in a suitable way focused on a literature review based on previous published good-quality papers on mobile commerce applications, mobile shopping applications, consumer behaviours as well as the consumer decision-making process. In this stage, there are a significant influence and strong relationship between philosophy, paradigms and ethical issue (Wells, 1994). Otherwise, the research must be designed harmless to Vietnamese customers who participate in the survey. Moreover, the researcher has to inform prospective participants of their rights, privacy agreement, and the purpose of the study.

When it comes to the collecting data stage of this research, some issues related to ethics should be considered. As mentioned above, this research attempts to use primary data which involved directly human participants. The design questionnaire would be piloted within a small sample of respondents and researcher peers. It will be edited if there are any problems with improper expression, hard feelings to respond to, confusing emotions, etc. On the other hand, the researcher aims to conduct a survey both online and offline. Therefore ethical considerations should be paid attention to when the internet involves in the process. It is necessary to provide s statement of respondents' privacy and information confidence of Vietnamese customers who use mobile shopping applications. Besides, the researcher has to make sure that all prospective participants know that they have the right to refuse the research anytime without a researcher's permission.

In storing and analysing the data, the most important ethical consideration is that the information has to be stored confidentially and securely. Of course, the researcher could not use the data of Vietnamese customers in this research for other research without the respondent's agreement. In a typical case, an electronic database might be deleted after finishing the research (S Frankel & Siang, 1999). Otherwise, the researcher seems to need to set strict standards to avoid bias-occurring and subjective selectivity during the whole research collection process. This action will keep the validity and reliability of the study. Besides, when applying analysis tools such as SPSS software, exploring exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation modelling (SEM) which are expected to suit this study might break a law of Kantian ethics because many

various statistic methods and technique will use to get the best findings (Saunders & Savulescu, 2008). Apparently, this issue will be considered in the research process.

Finally, in writing up the research findings, a result of the study might report from the writer's viewpoint or select which data will be reported or misrepresent statistical accuracy (Saunders et al., 2009). In order to solve this issue, the researcher has to follow the philosophy and paradigms and focus on the code of ethical principles for research.

### 4.11. Summary

The research methodology is introduced based on the research process 'onion' (Saunders et al., 2016) in this chapter. The research philosophy, approach and methodology are discussed. Then the research technique and procedure are mentioned in the next section. The scale construction, question structure and research sample are presented in the following section. Finally, by discussing the data analysis technique and the ethical considerations, this chapter focus on the details of the research methodology. The next chapter delivers more specifics about the data findings and the statistical results.

### **CHAPTER 5 EVALUATION OF PLS-SEM RESULTS**

#### 5.1. Chapter overview

This chapter begins with the introduction of the Structural Equation Model (SEM) and advocates the use of Partial Least Squares (PLS). Next, the results of the research analysis will be presented. The analysis begins with a descriptive statistical evaluation of the collected sample. In particular, the characteristics of gender, income, occupation and frequency of online purchases are checked. In addition, descriptive statistics about the measurement are also presented.

After a preliminary evaluation of the sample and a description of the measurement, the main analytical sections are presented. The study will evaluate the value of the research model by using indicators for evaluating reliability and validity such as Cronbach's alpha, Outer loading, Composite reliability (CR), and Average Variance Extracted (AVE). Next, the testing hypothesis will be presented through the evaluation of the Path Coefficients, and R-square (R2) indicators after performing the Boostrap operation with 5000 samples through SmartPLS 3.0 software. Finally, a discussion of the research results will be presented after analytical results are obtained.

#### **5.2. Introduce Structural Equation Modeling (SEM)**

According to Joe F Hair Jr, Sarstedt, Hopkins, and Kuppelwieser (2014), using Structural Equation Modeling (SEM) has gained considerable credibility for decades in behavioural and social sciences research. It is considered one of the most important statistical models in social science recently. The method encourages researchers to combine unobservable variables calculated indirectly by indicator variables as well as allow the calculation of measurement errors in observed variables (Chin, 1998).

One of the reasons why the author uses the SEM model in the study is that it is a powerful technique, which can combine complex path models with underlying structures (Urbach & Ahlemann, 2010). This means that SEM undertakes a multivariate analysis of multi-causal relationships among different, independent phenomena grounded in reality. This technique is an appropriate method to help the author evaluate and explain complex related dependencies or include measurement errors on structural factors (Joseph F Hair, Ringle, & Sarstedt, 2012).

In addition, an SEM model consists of two interrelated models, the external model (measurement) and the internal model (structure) (Urbach & Ahlemann, 2010). According to Joseph F Hair et al. (2012), the ability of SEM to evaluate latent variables (factors) at the observed level (external or measured level) and the test relationship between the underlying variables in theory (internal model) or structure) made it a popular choice for researchers. The internal model or structure examines the relationship between independent variables, also called exogenous variables in SEM and dependent variables, also known as endogenous variables. These correlations describe all causal relationships between structures, exogenous as well as endogenous variables, used in the analysis (Joseph F Hair et al., 2012). In addition, in the same analysis, SEM also assessed the measurement model. This combined analysis allows measurement errors of observed variables to be analyzed as an integral part of the model, which makes the estimates provided by SEM better than the linearity regression models created (Reinartz, Haenlein, & Henseler, 2009)

According to Joseph F Hair Jr et al. (2016), there are two types of SEM. Firstly, SEM based on covariance (CB-SEM) is primarily used to validate (or refute) theories (that is, a set of systematic relationships between many variables can be tested by experience) (Joseph F Hair Jr et al., 2016). It does this by determining how well a proposed theoretical model can estimate covariance matrices for a sample dataset.

In contrast, PLS-SEM (also known as PLS path modelling) is primarily used to develop theory in exploratory research (Joseph F Hair Jr et al., 2016). It does this by focusing on explaining the variance in the dependent variables when examining the model. The author will explain this difference in more detail later.

### 5.3. Covariance-based and PLS-SEM

In the previous section, the author mentioned that CB-SEM and PLS-SEM are two basic methods of structural equation model analysis. Accordingly, both of them have the same set of theoretical equations and measurement scales but differ in their approach to the problem of parameter estimation (Joseph F Hair Jr et al., 2016).

In particular, the CBSEM method aims to reproduce the theoretical covariance matrix, without focusing on explanatory variance. CB-SEM is often associated with software used to perform analysis such as LISREL or AMOS (Joseph F Hair et al., 2012). The origin of the CBSEM method lies in the seminal work (Jöreskog, 1969) on factor analysis of its maximum capacity and its subsequent extensions to estimate structural equation systems. CB-SEM

focuses on estimating a set of model parameters such that the theoretical covariance matrix is implied by the system of structural equations as close as possible to the experimental covariance matrix observed in the estimation sample. Therefore, CB-SEM is parametric oriented and aims to show that the null hypothesis is insignificant (Joseph F Hair et al., 2012). CB-SEM requires the completion of a series of assumptions, such as the normal distribution of observed variables and sufficient sample size, usually more than 250. Insufficient sample size can result in the elimination of models (Joe F Hair Jr et al., 2014). If these assumptions are violated, then the variance-based SEM (PLS) seems to be the more appropriate option for researchers (Reinartz et al., 2009). Moreover, CB-SEM only caters to reflective measures and applies to external model specifications only under certain conditions (Joe F Hair Jr et al., 2014).

In contrast, PLS-SEM, introduced by Wold (1985), maximizes the explained variance of the dependent structure (Henseler, Falkai, & Gruber, 2010). It expands the key components and correlates analysis (Henseler et al., 2010).PLS path modelling is based on many theoretical foundations as described by Wold-rich but theoretical data (Wold, 1985). Its goal, however, is to predict the behaviour of relationships between structures and explore basic theoretical concepts. PLS-SEM is based on the application of minimum squares using the PLS algorithm with regression-based methods and tends to maximize the variance explained (Joseph F Hair et al., 2012). For this reason, the PLS-SEM method is based on theory, but it is manipulated data to predict and provide new knowledge and theoretical background on the phenomenon being studied. Moreover, PLS-SEM, unlike CB-SEM, needs less stringent sample sizes and does not need the normal distribution of observed variables (Joseph F Hair et al., 2012). Therefore, PLS-SEM is suitable for applications where strong assumptions cannot be fully met and are often called a non-distributed soft modelling method. (Joseph F Hair et al., 2012). In addition, PLS-SEM supports both research and validation-based research (Chin, 1998) and works well even with a small number of samples (Hair et al., 2012) and with a number of indicators (Henseler et al., 2010). Although CB-SEM does not allow measures to be developed in a format, PLS analysis can handle an unlimited number of reflection and forming measures (Chin, 1998). A summary of CB-SEM and PLS is summarized in the following table.

#### Table 5.1 The difference between CB-SEM and PLS-SEM

Торіс		COVARIANCE (CB-	VARIANCE (PLS)
		SEM)	
Theory	Theory background	Strictly theory-driven	Based on the theory, data drove
	Relation to theory	Confirmatory	Predictive
	Research orientation	Parameter	Prediction
Model specification	Type of the latent measures	Reflective(andformative, if identifiedby reflective)	Reflective and/or formative
	Latent variables	Factors	Components
	Model parameters	Factor means	Component weights
	Latent variable score	Indeterminate	Determinate
	Reliability measures	Cronbach's α (and/or Guttman's λ and GLB) Covariance/correlation	a) Cohen's $f^2$ b) $\rho c$ indicator or Cronbach's $\alpha$ , Guttman's $\lambda$ and GLB (for the reflective models only) Individual-level raw
		matrix	data
Sample	Sample size	Minimal recommendations range from 200 to 800	Minimal recommendations range from 30 to 100 cases
	Data distribution	Identical (normal)	Normal distribution

	distribution	is not assumed
Model fit	<ul> <li>a) overall (absolute) fit measures</li> <li>b) comparative fit measures</li> <li>c) model parsimony</li> </ul>	<ul> <li>a) Model</li> <li>predictiveness</li> <li>(coefficient of</li> <li>determination, Q2</li> <li>predictive relevance</li> <li>and average variance</li> <li>extracted – AVE)</li> <li>b) Stability of</li> <li>estimates, applying</li> <li>the resampling</li> <li>procedures (jack-knifing and</li> <li>bootstrapping)</li> </ul>
Residual co-variance	Residual co-variances are minimized for optimal parameter fit	Residual variances are minimised to obtain the optimal prediction
Software	LISREL, AMOS, etc.	SmartPLS,SPSS(PLS module), etc.

Source: adopted from Davcik, 2014

# 5.4. Assessment of PLS-SEM

In this study, the author used PLS-SEM to serve the analysis of results for the following reasons. First, because the nature of this study is to predict customer decision-making behaviour through mobile apps based on the perceived paths of the TPM, PLS is more appropriate to use because there is prediction-oriented software. Second, structures and measures have been developed in both formative and reflective ways based on the process model of ethical thinking. While PLS can serve both formative and reflective measures, CBSEM only works with formative measures. Third, due to the nature of this study, it is

difficult to get normally distributed data. Although CB-SEM only works with normally distributed data PLS can operate with data without normal distribution. For these reasons, the use of PLS versus CB-SEM is more appropriate. The study used SmartPLS 3.0 software to perform PLS analysis.

In particular, the process of analysing the results of the research is carried out through two main stages. First, evaluation of the measurement models is done with the evaluation of both reflective and formative measurement indicators. When evaluating the measurement models, we must distinguish in measuring between reflective and formative constructs. The two approaches are based on different concepts and therefore require consideration of different evaluative measures. Reflective measurement models are assessed on their internal consistency reliability and validity. The specific measures include composite reliability (as a means to assess internal consistency reliability), convergent validity, and discriminant validity. The criteria for reflective measurement models cannot be universally applied to formative measurement models. With formative measures, the first step is to ensure content validity before collecting the data and estimating the PLS path model. After model estimation, formative measures are assessed for their convergent validity, significance and relevance and the presence of collinearity among indicators. Once the measurement model has been confirmed that the construct measures are reliable and valid, the next step addresses the assessment of the structural model. This involves examining the model's predictive capabilities and the relationships between constructs. The evaluation of the structural model in PLS could be performed based on the coefficient of determination (R-squares), effect size (f2) and path coefficients once the measurement model has been analysed. The following table briefly summarizes the analysis procedures based on the PLS-SEM method that the author applies to the study.

#### **Table 5.2 Systematic Evaluation of PLS-SEM Results**

Evaluation of the Measurement Models	
Internal consistency	Convergent validity
Indicator reliability	Collinearity among indicators
Convergent validity	Significance and relevance of outer weights
Discriminant validity	

Evaluation of the Structural Model
Coefficients of determination (R2)
Predictive relevance (Q2)
Size and significance of path coefficients
f 2 effect sizes
q2 effect sizes
Source: Hair Jr et al. (2016)

# 5.5. Analyse research results

# 5.5.1. Describe samples

After eliminating the inappropriate answers, the author finally obtained 669 valid copies (accounting for 93.44%) of the 716 copies collected from the respondents. As mentioned in the previous chapter, the age of the study is 18-37 because this is the age group with a high ability to buy online thanks to technology knowledge and frequency of regularly mobile phone use. According to the analyzed data, the majority of the survey participants are women (accounting for 64.40%), while men account for 35.60%. Regarding the income of consumers participating in the survey, there is a significant difference between the lowincome group (less than 5 million), accounting for the highest with 72.90%. In addition, the income group of 5-10 million also has a difference compared to the rest when accounting for 14%, the remaining groups fluctuate below 10%. Next, about the occupation of the respondents, most of them are students with 72.9% because of the specificity of the age group that the author wants to target, the remaining groups range from 2.3-12.5%. Addition, another notable statistic is the frequency of use of mobile shopping apps by customers in a month. The figures show that the number of times from 2-5 times accounted for the majority with 45.9%, while the frequency of one time ranked next with 39.3%; the remaining figures are below 10%. Descriptive results are presented in the following table:

# Table 5.3 Respondent's Profile

Characteristics	Frequency	Rate (%)
Gender		
Male	238	35,6
Female	431	64,4
Income		
Under 5 million	488	72,9
From 5 -10 million	94	14,0
From 10 – 15 million	45	6,8
From 15 – 20 million	29	4,3
From 20 – 30 million	6	0,9
More than 30 million	7	1,1
Occupation		
Officer	57	8,5
Business	23	3,4
Office staff	84	12,5
Student	488	72,9
Housewife	2	0,3
Others	15	2,3
Frequency		
One time 138	263	39,3
Two-five times 161	307	45,9
Six-ten times 18	34	5,1
More than ten times 34	65	9,7

### 5.5.2. Describe the measurement aspect

To assess the overall level of agreement with each statement of the sample, the average value of the total sample was calculated and used with the conversion evaluation intervals shown in Table. In particular,  $1.0 \le \text{Mean} \le 1.8$  indicates the level of "strongly agree" of the respondents to the question;  $1.8 \le \text{Mean} \le 2.6$  indicates the "agree",  $2.6 \le \text{Mean} \le 3.4$  indicates the "neutral opinion",  $3.4 \le \text{Mean} \le 4.2$  indicates the "Disagree "and  $4.2 \le \text{Mean} \le 5.0$  indicates the level of" strongly disagree ".

### Table 5.4 Conversion table of consumer rating by average range

$1,0 \le Mean \le 1,8$	$1,8 \le Mean \le 2,6$	$2,6 \leq Mean \leq 3,4$	$3,4 \leq Mean \leq 4,2$	$\begin{array}{rrr} 4,2 &\leq \text{ Mean } \leq \\ 5,0 \end{array}$
Strongly agree	Agree	Normal	Disagree	Strongly disagree

Statistical results describing the observed variables in the proposed research model are shown in the table below.

 Table 5.5 Descriptive statistical results for observed variables in the research model

	Observed variables	The average	Rating level
Code		value (mean)	
NR1	I had an old product but wanted one more	2.265	Agree
	I had an old product ran fairly well, but the		Agree
NR2	new models had better styling	2.239	
	I had an old product ran fairly well but		Agree
NR3	could get better with a new product	2.459	
	I had an old product needed repairs too		Agree
NR4	often and was not reliable	2.414	
	I had an old product ran fairly well, but if it		Agree
NR5	broke down, it would not be worth fixing	2.190	
	I had an old product stopped running and		Agree
NR6	had to be replaced	1.936	
	I had an old product ran fairly well, but it is		Normal
-----	---	-------	----------------
NR7	best to trade every two or three years	2.782	
	I had an old product ran fairly well but		Agree
NR8	wanted a product for a different purpose	2.111	
	I did not have a product and wanted to get		Agree
NR9	one	1.885	
	Do personal sources (family, friends,		Agree
	neighbours, colleagues and acquaintances)		
	help you in searching for information about		
IS1	the product?	1.804	
	Do commercial sources (advertisements,		Agree
	salespersons, dealers, displays,		
	demonstrations, exhibitions, etc.) help you		
	in searching for information about the		
IS2	product?	1.859	
	Do public sources (mass media, consumer		Agree
	rating organizations) help you in searching		
IS3	for information about the product?	2.019	
	Do experimental sources (handling,		Agree
	examining and using the product) help you		
	in searching for information about the		
IS4	product?	2.096	
EA1	The app provides the product that I need	1.544	Strongly agree
EA2	The app provides an attractive product	1.746	Strongly agree
	The app provides a function for product-		Agree
EA3	information search	1.822	
	The app provides a function for product		Agree
EA4	preview	1.801	
EA5	The app provides comparison information	1.737	Strongly agree

	about shopping		
EA6	The app provides promotional activities	1.598	Strongly agree
EA7	The app provides an online help function	1.707	Strongly agree
EA8	The app is able to assure transaction security	1.877	Agree
	The app has a commitment to privacy		Strongly agree
EA9	protection	1.709	
	The app has a flawed-product return		Strongly agree
EA10	guarantee	1.649	
EA11	The app has a refund guarantee	1.770	Strongly agree
	I intend to continue purchasing products and		Strongly agree
PI1	services via mobile applications	1.704	
	I strongly recommend others to purchase		Agree
	products and services via mobile		
PI2	applications	2.054	
	I find purchasing products and services to be		Agree
PI3	worthwhile via mobile applications	1.907	
	I will frequently purchase products and		Agree
PI4	services in the future via mobile applications	2.010	

In general, the majority of respondents expressed a degree of "agreement" with the observed variables. The average value of the mean from  $1.0 \leq \text{Mean} \leq 2.6$  shows the satisfaction of the respondents to the questionnaire.

# 5.5.3. Evaluation of the measurement model

PLS-SEM requires evaluation criteria related to the results of measurement and structural model (Hair et al. 2017)). To judge the reliability and validity of the items, model assessment must focus on the measurement models (Hair et al. 2017). In this study, the author, all four constructs including Need Recognition, Information Searching, Evaluation of Alternatives, and Purchase intention were collected by multi-item measures in both previously presented research models. The advantage of using several items to measure a

particular concept is the ability to capture all the different aspects of that concept (Hair et al. 2017).

In these models, the need recognition stage is one construct which is measured by nine formative indicators related to customer decision-making ability through retailing applications (NR1, NR2, NR3, NR4, NR5, NR6, NR7, NR8, NR9). The direction of the arrows, which is not the same as the reflective measures, is from the measures to the construct because these indicators are the cause of the construct measurement according to the scale developed in the previous chapter. However, the next stage is information searching, where a latent construct forms indicators that involve finding and accessing different sources to address a need identified in the previous stage. At this stage, the arrow direction will point in the opposite direction, from the structure to the measures (IS1, IS2, IS3, IS4). Similarly, eleven indicators (EA1, EA2, EA3, EA4, EA5, EA6, EA7, EA8, EA9, EA10, EA11) are used to measure the evaluation of options at the next stage of the model (Evaluation of alternatives in retailing application), which is measured by reflective measurement. Finally, the purchase intention stage related to the final buying decision behaviour will be measured by four indicators: PI1, PI2, PI3, PI4

PLS-SEM is the model that easily handles reflective and formative measurement models (Hair et al. 2017). According to Hair et al. 2017, PLS-SEM helps to create a specific link that has actual significance and an overall significant relationship. Since the formative and reflective measures require different assessments based on different concepts, Smart PLS 3 is used to evaluate the reliability and validity of the constructs in this research model. The following sections discuss in more detail the evaluation of reflective and formative and reflective measurements.

## 5.5.3.1. Reflective measurement models

The evaluation of reflectance measurement models involves the criteria of internal consistency, convergent validity and discriminant validity.

## a. Internal Consistency

To evaluate internal consistency reliability, which is the first evaluation criterion, we examine the parameters of both Cronbach's alpha and Composite reliability (Hair et al. 2017). According to Hair et al. (2017), Cronbach's alpha assumes that most of the outer loadings of the indicators are equal in a given structure (equally reliable) and is considered a conservative measure; while Composite reliability is an alternative metric that takes into account the

necessary difference of the outer loadings' indicators. According to table 5.6 below, both Cronbach's alpha and Composite reliability have values above 0.7, the permissible level proposed by Nunnally (1978). Therefore, the reliability of the measures is verified at an acceptable level.

#### **b.** Convergent validity

The second evaluation criterion in reflective measurement is convergent validity. According to Rodgers et al. (2013), convergent validity is established by the Average Variance Extracted (AVE) measure, which measures the degree of correlation between different measures within the same construct. Hair et al (2017) suggested that 50% of the variance of each index must be explained by a construct. In the results that Smart-PLS produces, AVE values must be above 0.5 to meet the index at a significant level (Hair et al. 2017). Table 5.6 gives a favourable result for this AVE.

Constructs	R	R Square	Avarage Variance	Composite	Cronbach's
	Square	Adjusted	Extracted (AVE)	Reliablity	Alpha
NR					
IS			0,563	0,837	0,741
EA	0,271	0,269	0,523	0,923	0,909
PI	0,418	0,417	0,689	0,898	0,85

#### Table 5.6 Quality criteria

#### c. Discriminant validity

Next, to evaluate the discriminant validity, we examine the indices of Cross loading, the Fornell-Larcker and Heterotrait-Monotrait Ratio (HTMT) (Hair et al. 2017). Accordingly, the index of outer loading in each item should exceed the index of outer loadings of other items in the same line to indicate a discriminant validity issue (Hair et al. 2017). The accepted general load is 0.70 but some scholars say 0.5 is acceptable (Joe F Hair et al., 2012). According to some scholars, 0.40 is accepted in a study involving newly developed measures (Hair et al., 2012). Table 5.7 indicates that there is no cross-loading between variables in the model. However, the load index of the variable NR7 is too low at 0.283. Therefore, NR7 should be eliminated in this model. After removing the variable NR7, the loading indexes are

all better, not affecting the evaluation indexes of the convergent validity and the internal consistency as evidenced by table 5.8 Furthermore, Chin (1998) and Chin et al. (2003) proposed that convergent and discriminant validity are accepted if the square root of the AVE belongs to each construct is greater than its correlation with the other constructs. To support this theory, the Fornell-larcker evaluation criteria were reviewed to ensure there was no violation of discriminatory validity (Hair et al. 2017). Table 5.9 proves that the indicators that represent Fornell-larcker criteria in this study are reasonable

Finally, the Heterotrait-Monotrait Ratio (HTMT) is the remaining criterion for evaluating the discriminant validity, which the confirmatory factor analysis (CFA) procedure in PLS represents (Hair et al. 2017). Table 5.10 shows that 1 is not included in the HTMT confidence interval. It is clear that the results illustrated in the research model that examine the correlations of measured loads on the construct are good; there is no higher indicator load on other constructs. Thus, from the results, it can be concluded that the reflective measurement model is reliable and valid based on the accuracy of each measured construct Discriminant Validity (Cross loading).

	EA	IS	NR	PI
EA1	0.732	0.401	0.396	0.416
EA2	0.721	0.446	0.392	0.496
EA3	0.607	0.186	0.134	0.372
EA4	0.627	0.189	0.106	0.361
EA5	0.736	0.473	0.388	0.478
EA6	0.776	0.388	0.315	0.529
EA7	0.762	0.398	0.363	0.523
EA8	0.688	0.154	0.078	0.313
EA9	0.759	0.349	0.272	0.405
EA10	0.763	0.350	0.285	0.412
EA11	0.758	0.363	0.284	0.396

 Table 5.7 Discriminant Validity - Cross Loading (Having NR7)

IS1	0.388	0.748	0.363	0.310
IS2	0.400	0.762	0.376	0.406
IS3	0.342	0.783	0.418	0.375
IS4	0.345	0.707	0.438	0.391
NR1	0.191	0.375	0.633	0.305
NR2	0.268	0.419	0.691	0.269
NR3	0.220	0.293	0.550	0.254
NR4	0.259	0.414	0.722	0.327
NR5	0.306	0.437	0.739	0.281
NR6	0.316	0.396	0.732	0.311
NR7	0.144	0.115	0.283	0.145
NR8	0.322	0.435	0.805	0.365
NR9	0.377	0.318	0.770	0.401
PI1	0.594	0.447	0.397	0.856
PI2	0.426	0.453	0.480	0.841
PI3	0.524	0.477	0.387	0.853
PI4	0.442	0.231	0.231	0.767

Table 5.8 Discriminant Validity - Cross Loading (No NR7)

	EA	IS	NR	PI
EA1	0.732	0.400	0.391	0.416
EA2	0.721	0.446	0.390	0.496
EA3	0.607	0.186	0.147	0.373
EA4	0.628	0.189	0.117	0.361
EA5	0.736	0.472	0.391	0.478

EA6	0.775	0.387	0.299	0.529
EA7	0.761	0.398	0.363	0.523
EA8	0.689	0.154	0.096	0.313
EA9	0.760	0.349	0.278	0.405
EA10	0.763	0.351	0.293	0.412
EA11	0.758	0.363	0.288	0.395
IS1	0.387	0.743	0.334	0.309
IS2	0.399	0.760	0.359	0.405
IS3	0.341	0.784	0.411	0.375
IS4	0.345	0.713	0.448	0.390
NR1	0.191	0.376	0.639	0.304
NR2	0.268	0.419	0.698	0.268
NR3	0.220	0.295	0.556	0.254
NR4	0.258	0.417	0.730	0.326
NR5	0.306	0.438	0.746	0.281
NR6	0.316	0.397	0.740	0.311
NR8	0.322	0.437	0.814	0.365
NR9	0.377	0.318	0.779	0.401
PI1	0.594	0.447	0.389	0.855
PI2	0.426	0.454	0.475	0.841
PI3	0.524	0.478	0.380	0.853
PI4	0.442	0.232	0.247	0.769

# Table 5.9 Discriminant – Fornell-Larcker

EA	IS	NR	PI

EA	0.723			
IS	0.491	0.750		
NR	0.411	0.519		
PI	0.604	0.495	0.454	0.830

## Table 5.10 Heterotrait-Monotrait Ratio (HTMT)

	EA	IS	PI
EA			
IS	0.566		
PI	0.666	0.609	

### 5.5.3.2. Formative measurement models

According to Hair et al. (2017), the formative measurement cannot be measured by the criteria used to measure the quality of the reflective measurement. Diamantopoulos (2002) and Edwards & Bagozzi (2000) explain the above statement by the assumption that there is no error related to the formative measurement, which means that the internally consistent reliability is not suitable for assessing formative measurements. In the same vein, Chin (1998) has observed that there is no significance when convergent and discriminant validity is applied to measure formation measurements. So, content validity is formulated to ensure that at least key aspects of the construct are captured by the formative measures (Hair et al. 2017). Therefore, the formative measurement models will be evaluated through convergent validity, indicators' collinearity as well as significance and relevance of outer Weights (Hair Jr, JF, Hult, GTM, Ringle, C., & Sarstedt, M., 2016)

#### a. Covergent validity

According to Hair Jr, JF, Hult, GTM, Ringle, C., & Sarstedt, M., (2016), convergent validity is the amplitude that has one measure positively correlated with another in the same construct. This means that when examining format measurement models, we should check if the reflective measure is highly correlated with other formative measures in the same construct (Hair Jr, JF, Hult, GTM, Ringle, C., & Sarstedt, M., 2016). According to Chin (2008), this analysis is also called redundancy analysis. Usually, the exogenous latent

variables (formative construct) will predict the endogenous latent variables (reflective construct) Hair et al. (2017), where convergence validity is evaluated by the magnitude of the path coefficients between the formative and reflective measures in the same construct. Unfortunately, the model in this study does not include the reflective and formative indicators in the same construct, so the researcher cannot verify convergence validity

#### **b.** Collinearity Issues

Next, we evaluate the problem of collinearity, where the variance inflation factor (VIF) is used to evaluate the collinearity of the formative indicators (Hair et al., 2017). According to Hair Jr, JF, Hult, GTM, Ringle, C., & Sarstedt, M., (2016), VIF is considered the inverse of tolerance. Accordingly, to avoid the problem of collinearity, the value of VIF must be less than 5 and the tolerance must be greater than 0.2 Hair et al. (2017). If any indicator has a VIF value higher than 5, it should be encouraged to be excluded according to Hair et al., (2017). In terms of research, the existence of the problem of collinearity increases the standard error as well as reduces the ability to determine whether the calculated weights are dramatically different from zero (Hair et al., 2017). It is a pleasure that the results from Table 5.11. Table 5.11, demonstrates no collinearity problem in the internal and external models. In addition, Table 5.12 shows no homogeneity problems among the 8 formative measurements for the NR construct.

	EA	IS	NR	PI
EA				1.203
IS	1.370			
NR	1.370	1.000		1.203
PI				

<b>Table 5.11</b>	Inner	VIF	Values
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## **Table 5.12 Outer VIF Values**

	VIF
EA1	1.929
EA10	3.226

EA11	3.016
EA2	1.927
EA3	2.196
EA4	2.224
EA5	1.942
EA6	2.123
EA7	2.092
EA8	2.505
EA9	3.081
IS1	1.414
IS2	1.491
IS3	1.545
IS4	1.284
NR1	1.873
NR2	2.252
NR3	1.827
NR4	1.835
NR5	1.970
NR6	1.944
NR8	2.026
NR9	1.539
PI1	1.975
PI2	2.031
PI3	2.071
PI4	1.668

## c. Significance and Relevance of Outer Weights

Finally, evaluating the significance of the relevance of outer weights is a follow-up analysis after checking for collinearity. It is important to consider whether the formative indicators are really significant in the formation of the structure (Hair et al., 2017). To assess the significance of each indicator, t-values were calculated and the indicator weights were used to calculate the standard errors for the estimates (Hair et al., 2017). Smart-PLS software ran Bootstrapping with 5000 alternate and repeated samples to estimate the model.

Table 5.7 has illustrated that all nine indicators give important p-values that contribute to the formation of the NR construct. However, Hair et al. (2017) suggested that researchers should test the absolute contribution of each formative indicator to its construct given by outer loading. The accepted general load is 0.70 but some scholars say 0.5 is acceptable (Joe F Hair et al., 2012). According to some scholars, 0.40 is accepted in a study involving newly developed measures (Joe F Hair et al., 2012). Table 5.8 has shown that except for NR7, all other indicators have outer loading coefficients higher than 0.4. Thus, NR7 in the NR construct is the only indicator that will be removed from this model according to the results obtained.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values
NR1 -> NR	0.132	0.128	0.081	1.617	0.106
NR2 -> NR	0.125	0.123	0.089	1.410	0.158
NR3 -> NR	0.010	0.011	0.074	0.137	0.891
NR4 -> NR	0.178	0.177	0.068	2.638	0.008
NR5 -> NR	0.144	0.143	0.071	2.038	0.042
NR6 -> NR	0.119	0.118	0.089	1.337	0.181
NR8 -> NR	0.255	0.254	0.074	3.465	0.001
NR9 -> NR	0.371	0.371	0.062	5.945	0.000

**Table 5.13 Outer Weights** 

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values
NR1 -> NR	0.639	0.632	0.047	13.691	0.000
NR2 -> NR	0.698	0.689	0.045	15.336	0.000
NR3 -> NR	0.556	0.551	0.047	11.963	0.000
NR4 -> NR	0.730	0.722	0.037	19.681	0.000
NR5 -> NR	0.746	0.737	0.036	20.950	0.000
NR6 -> NR	0.740	0.732	0.043	17.140	0.000
NR8 -> NR	0.814	0.805	0.034	24.288	0.000
NR9 -> NR	0.779	0.771	0.036	21.913	0.000

**Table 5.14 Outer Loadings** 

# 5.5.4. Evaluation of the structural model

After evaluating the formation and reflection measurements in the measurement model, we will evaluate the structural model in the next step. This means that we go to test the predictive power of the model and the relationship between the structures (Hair Jr, JF, Hult, GTM, Ringle, C., & Sarstedt, M., 2016). According to Hair et al. (2017), there are 5 main criteria to check the quality of the obtained structural models. We first check the coefficients of determination (R2 values) and the significance level of the path coefficients. We will next evaluate the effect size  $f^2$ , the predicted relevance Q<sup>2</sup>, and the final effect q2 size. The following sections will detail the evaluation process of these 5 important criteria.

### 5.5.4.1. Coefficients of determination (R2)

According to the opinion of Hair et al. (2017), R-squared will explain the variance of latent structures through accurate prediction of the model. That means that the higher the R2 value, the better the model fit. Next, adjusted R2 can be used to avoid bias for complex models according to multiple regression rules (Hair et al. 2017). However, there was not much difference between adjusted R2 and R2 values in this study. Figure 5.6 shows that Need Recognition (NR)/ Information Searching (IS) has the same judgement variance of 27%, while the judgement variance of Evaluation of Alternatives (EA) and Purchase Intention (PI) is respectively 27.4% and 41.6%. Although these values are not high enough to confirm the accuracy of a model, Hair et al. (2017) argued that a value of 20% is high in some areas of consumer behaviour measurement.

However, to evaluate the structural model measuring cognition and judge human behaviour, only one criterion R2 is not enough (Hair et al. 2017). Therefore, the significance of the path coefficients will be the next factor used to evaluate the research model

## 5.5.5.2. Significance of the path coefficient

According to Davison & Hinkley (1997) and Efron & Tibshirani (1986), PLS-SEM is based on a non-parametric bootstrap process because it does not presume the normality of the data. The way bootstrapping works is to replace a subsample from the original sample and repeat the processes several times (Hair et al. 2017). As a rule, 5000 bootstrapping samples should be used which corresponds to the estimation of 5000 PLS path models. Furthermore, for satisfaction, the confidence level (95%) is used because it represents the probability range of values that imply the true population parameters or confidence intervals Hair et al. (2017). Three accepted significant levels are presented in Table 5.15. According to Hair et al. (2017), latent signs are unknown and can vary the t value in PLS-SEM. In order to accept the negative effect of the sign change on the results in the experimental t-value, the no sign change option was clicked to run bootstrapping. In practice, the results of the three options are not significantly different, but to be sure, the no sign changes option should be encouraged (Hair et al. 2017)

Simultaneous analysis Smart-pls allows us to explain how consumers integrate information from many different perspectives, which may be motivated by their perceptions before evaluation options to make decisions depending on their behaviour at the end. Table 5.16 shows the results of the path coefficients for the total number of samples. In general, decision-makers follow a different decision-making route depending on the information they have, the perception of need, and the evaluation of options. The results of the model show that the researcher's assumptions are appropriate (hypotheses 1 to 5). We can see a significant relationship between Information Searching construct and Need recognition construct when the path coefficient is 0.519 (P <-> I presents H4 and H5). Next, the significant pathways and correlations are shown in Figure 6.1 for the model given the positive relationships of the constructs, which support the author's hypotheses in this study. Specifically, we can easily see that Need Recognition has a positive effect on Purchase Intention via mobile when the index of this path coefficient is 0.247 (i.e., H1:  $\beta 1 = 0.247$ , p < 0.01). Next, Need Recognition and Information Searching also affect the Evaluation of alternatives (the stage of identifying problems and choosing the right one) (ie, H2:  $\beta 2 = 0.213$ , p < 0.01; H3:  $\beta 3 = 0.380$ , p < 0.01). The last and most important assumption affecting decision-making is that the Evaluation of Alternatives has a positive impact on Purchase Intention (H6:  $\beta 6 = 0.503$ , p < 0.01). In the last assumption, the path coefficient is at the highest level. This proves that the Evaluation of Alternatives constructs plays an extremely important role in the process leading to consumer buying decision-making behaviour.

In addition, thanks to the concordance of the hypotheses (direct effects), the indirect effects of the model are also well represented. Specifically, Table 6.12 lists the indicators of indirect effects, which explain whether the indirect paths from Need Recognition and Information Searching constructs to Purchase Intention are profound. It is clear that Table 6.12 gives significant results with p<0.05

On the other hand, confidence intervals are also very valuable for reporting. In the context of PLS-SEM, Confidence intervals have relied on standard variances obtained from bootstrapping. Table 6.13 shows the range of confidence intervals for each pathway. For example, the population value of outer weight for EA and PI will be between 0.425 and 0.573

	Significance level $\alpha$ - two-tail		
t-value	test		
Above 2.57	1%	0.01	

 Table 5.15 The three significance levels

Above 1.96	5%	0.05
Above 1.65	10%	0.1

# Table 5.16 Path coefficients

		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values
EA PI	->	0.503	0.502	0.038	13.228	0.000
IS EA	->	0.380	0.377	0.038	10.121	0.000
IS NR	->	0.519	0.524	0.032	16.453	0.000
NR IS	->	0.519	0.523	0.032	16.067	0.000
NR EA	->	0.213	0.219	0.042	5.033	0.000
NR PI	->	0.247	0.250	0.041	6.084	0.000

Table 5.17 Specific indirect effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values
IS -> NR -> EA	0.111	0.115	0.023	4.863	0.000
IS -> EA -> PI	0.191	0.190	0.026	7.325	0.000
NR -> EA -> PI	0.107	0.110	0.022	4.798	0.000

NR -> IS -> EA	0.197	0.197	0.024	8.146	0.000
NR -> IS -> EA -> PI	0.099	0.099	0.015	6.562	0.000
IS -> NR -> EA -> PI	0.056	0.058	0.012	4.690	0.000
IS -> NR -> PI	0.129	0.131	0.024	5.344	0.000

**Table 5.18 Confidence Intervals** 

	Original Sample (O)	Sample Mean (M)	2.5%	97.5%
EA -> PI	0.503	0.501	0.425	0.573
IS -> EA	0.380	0.377	0.302	0.450
<b>NR -&gt; EA</b>	0.213	0.220	0.137	0.299
NR -> PI	0.247	0.251	0.172	0.330

### 5.5.5.3. Effect Size f2

Next, according to Al Fayi, SMA, (2017), in order to help assess whether the removed structure has a significant impact on the endogenous construct; the exogenous construct, which is specified, can be excluded from the model to determine the change in the value of R2. Accordingly, this measure refers to the effect value, which allows typing an exogenous variable.

Cohen (1988) mentioned that the index at 0.02 is representative of the small effects of the exogenous latent variable, while the large and medium effects are at 0.15 and 0.35 respectively. We can fully predict that a high R2 value can have a large impact on the endogenous structure when an exogenous structure is removed and contrary. Table 5.19 shows the small to large effects of the structures in the model.

## Table 5.19 f square

	EA	PI
IS	0.145	

NR	0.046	0.087
EA		0.36

## 5.5.5.4. Blindfolding and predictive relevance Q<sup>2</sup>

 $Q^2$  is the value that researchers should check after examining the value of R2 (Geisser, 1974; Stone, 1974). Accordingly, this measure is considered as an indicator of the model's predictive relevance (Hair et al., 2017). According to Hair et al., (2017), the path model's predictive relevance for a certain construct is significant if the values for the certain reflective endogenous latent variable are greater than the index 0, while the  $Q^2$  value is less than or equal to 0 that means a lack of predictive relevance.  $Q^2$  value is able to be calculated by the blindfolding method in Smart PLS for a certain omission distance (Hair et al. 2017). This blindfolding method is applied to endogenous single-item constructs and models of endogenous constructs.

According to Chin (1998), the value is estimated by combined between the true and predicted value as well as the mean of the remaining data. The cross-validated redundancy and cross-validated communality are methods used to determine the value of Q<sup>2</sup> (Hair et al. 2017). In this study, the author uses the cross-validated redundancy method because it is said to build on the path model estimates of both structural and measurement models, while the cross-validated commonality approach only uses the target endogenous construct aiming at predicting the omitted data points. Table 5.20 and Table 5.21 show the indexes of Q<sup>2</sup> values greater than 0 for the two exogenous constructs and their indicators (NR and PI). This means that exogenous constructs have a predictive relevance to endogenous constructs in this research model.

	SSO	SSE	Q <sup>2</sup> (=1-SSE/SSO)
EA	7359.000	6395.803	0.131
PI	2676.000	1928.218	0.279
a)			

<b>Table 5.20</b>	Construct	<b>Cross-validated</b>	Redundancy
			-/

Table 5.21 Indicator	Cross-validated	Redundancy
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SSO	SSE	Q <sup>2</sup> (=1-SSE/SSO)

EA1	100.699	91.688	0.089
EA2	100.023	74.776	0.252
EA3	88.024	83.061	0.056
EA4	98.747	97.894	0.009
EA5	99.269	74.176	0.253
EA6	86.208	69.107	0.198
EA7	74.700	57.361	0.232
EA8	118.425	123.597	-0.044
EA9	92.163	72.326	0.215
EA10	88.041	80.697	0.083
EA11	132.006	115.128	0.128
PI1	100.545	60.975	0.394
PI2	85.285	62.345	0.269
PI3	96.142	68.229	0.290
PI4	94.244	70.094	0.256

# 5.5.5.5. Effect Size q<sup>2</sup>

To explain the relative impact of the predictive relevance, the q2 effect size is used, where the small, medium and large effect levels are represented by the values 0.02, 0.15, and 0.35 (Cohen, 1988). According to Hair et al., (2017), the formula to calculate the q2 effect size is expressed as follows:

# $q^2$ effect sizes = ( $Q^2$ included - $Q^2$ excluded / (1 - $Q^2$ included)

*Table 5.22 below will give us the result of the corresponding*  $q^2$  *effect size.* 

# Table 5.22 q<sup>2</sup> Effect size

	NR	IS	EA	PI
PI	0.387	0.184	0.205	

EA	0.151	-0.017	-0.17

# 5.6. Verifying research hypotheses

To assess the significance and relevance of the path factors in the structural model, Bootstrap analysis with 5000 samples was performed. The results shown in Table 5.23 describe that all structural relationships are statistically significant. Specifically, the relationship between perception and decision making at a significant level with p = 0.000, <0.05, supports the acceptance of hypothesis 1 ( $\beta = 0.247$ ). Meanwhile, Perception also has a very good relationship with information when there is  $\beta = 0.519$  and p = 0.000 < 0.05, support hypothesis 2. Next, hypothesis 3 is supported when the result shows that the index of the relationship between perception and evaluation is relatively good with  $\beta = 0.3213$ , p = 0.000. In addition, H4, and H5 are also fully supported with the indexes respectively  $\beta = 0.380$ , p = 0.000;  $\beta = 0.503$ , p = 0.000 (please see Table 5.23).

	Research Model				Result
Hypotheses	Path Coefficients	Std.	T- Value	P- Value	
H1 (P -> D)	0.247	0.041	6.084	0,0000	Accepted
H2 (P -> I)	0.519	0.032	16.067	0,0000	Accepted
H3 (P -> J)	0.3213	0.042	5.033	0,0000	Accepted
H4 (I -> J)	0.380	0.038	10.121	0,0000	Accepted
H5 (J -> D)	0.503	0.038	13.228	0,0000	Accepted

#### 5.7. Discussion of the research results

This study clarifies specific buying decision-making routes for customers via mobile apps by proving the correlation of constructs including Need Recognition (P), Information (I), Evaluating alternatives (J) and Purchase Intention (D). From the empirical results presented above, the following points of interest need to be discussed below:

First, statistics show that people with a low income of less than 5 million a month are the people who are most interested in e-commerce and participate in online purchases through mobile applications. It is understandable for this result because the age group the study is targeting is between the ages of 18 and 24, most of which are students so the income is very low. However, it also reflects that young people are the most knowledgeable about information technology as well as spending time with mobile devices, which in turn will easily generate purchasing behaviour through mobile applications. This has shown positive findings for retailers, economists and researchers on reach when researching online buying behaviour. In addition, there is a statistical difference in gender when making an online purchase decision. Accordingly, from the survey results, the female overwhelmed the male in making online purchasing decisions although there has been a much shorter gap in the result compared to previous studies on buying behaviour.

In addition, this study clarifies the goal of finding specific customer decision-making paths online via mobile applications that are not consistent in a sequential process like previous studies by Simon (1960); Keeney (1982); Regan and Holtzman (1995); Shim et al. (2002) or other studies. In which, customers can make decisions based on each specific situation, under pressure on time, space and finance as well as other given resources. The decision-maker does not need to go through all the processes to make a decision. Instead, they can shorten the sequence aiming at cutting costs, saving time and delivering consistent results. From the results in the above sectors, the five decision-making paths in the authors' study gradually received good results although this was a very new research direction. Specifically, the Expedience (P -> D) ( $\beta = 0.247$ ), the Ruling guide (P-> J -> D) ( $\beta = 0.107$ ), the Analytical (I  $\rightarrow$  J  $\rightarrow$  D) ( $\beta = 0.191$ ), the Value-driven (P -> I -> J -> D) ( $\beta = 0.099$ ) and the Global perspective pathway (I -> P -> J -> D) ( $\beta = 0.056$ ). That shows that the research has high practicality, rightly hitting consumers' buying decision psychology in an online environment.

#### 5.8. Summary

In conclusion, the full evaluation of PLS-SEM result is explained in detail in this chapter. A description of the selected sample is delivered. Then, an evaluation of not only the measurement model but also the structural model is discussed. Next, the research hypothesis is analysed based on the result of PLS-SEM. Finally, by discussing the research result, this chapter responds to every purchase decision path. In the next chapter, the author will present conclusions, implications as well as limitations that the study faces.





## **CHAPTER 6 DISCUSSION AND CONCLUSION**

## **6.1 Introduction**

The summary and conclusion of the research findings will be presented in this chapter. There are 3 main sections including Introduction in Section 6.1, significant findings and practical implications in Section 6.2 and contribution, limitations of the study and future research in Section 6.3. The purpose of the study will be reiterated in the research discussion. The main purpose of this study is to identify buying decision paths by artificial intelligence (AI) algorithms, which show the main decision-making pathways that customers will choose to purchase through online mobile applications. Based on these buying decision paths, suggestions and solutions are posed to help marketers and businesses understand the different purchasing decisions of consumers, thereby improving online shopping services to meet the needs of customers according to each specific algorithmic path. Next, the TPM was applied to examine the associations between the investigated factors, which included Information, Perception (Need Recognition) and Judgement (Evaluation of Alternatives) to predict customer purchasing decisions (Purchase Intention). According to Foss & Rodgers (2011), these constructs will always appear in decision-making contexts, where the order and priority can be changed or eliminated, which directly affects decision-making results.

Relied on the research question and theoretical framework as well as literature on previous purchase decision studies considered, six research hypotheses were developed and tested. A large-scale survey of national universities in three major cities in Vietnam (including Ho Chi Minh and Da Nang) was conducted to assist in testing these hypotheses. The survey identified 669 representatives (eligible candidates) for the total sample of this study. Surveying in different regions of Vietnam is a condition that helps researchers has the opportunity to compare different decision-making behaviours of customers in each region. After surveying the sample based on basic descriptive statistics analysis, SEM, which comprised a series of multiple regression equations, was used to test the correlation of individual constructs and direct or indirect pathways leading to the customer's online purchase decision-making behaviour. As the present study consists of several variables that needed to be tested at the same time, PLS-SEM was applied.

#### 6.2 Significant findings and practical implications of the study

## 6.2.1. Significant findings

On the international scientific level, researches in the field of consumer shopping behaviour are quite diverse and dense. However, this is still a relatively new area of research in Vietnam, especially in online shopping behaviour based on mobile applications. Of course, yearly, economists as well as marketers at big brands like Tiki, Lazada, Shopee, Sendo, etc... still make research based on their revenue statistics to measure the market and improve their service. However, these studies only stop at a basic level and have not yet fully assessed the online shopping market in Vietnam. Therefore, this academic study is expected to be a breakthrough on the theoretical basis to help business planners who can apply it to deeply understand the different behaviour of customers based on specific situations.

This research has contributed a further scientific document in the field of online shopping, through the construction of a theoretical model that proposes different decision-making algorithmic pathways for consumers who buy online through mobile applications in Vietnam. Algorithms are stepwise representations of a solution to a given problem, which makes it straightforward to apprehend. The suggested algorithms in this paper implemented a definite procedure. Moreover, it is not dependent on any programming language, so it is uncomplicated to understand for anyone even without programming knowledge. While AI algorithms are hardly a novel discovery, they are nevertheless exceedingly involved in systems used to support decision-making. This study examined the opportunities and nuances related to the use of AI algorithmic pathways. It presented different algorithms to identify and recognize purchasing behaviour. We operationalize several algorithmic pathways to benefit from the tremendous AI possibilities by employing a TPM for individual and organizational use.

Different decision-making pathways of online customers have demonstrated that the model application is quite consistent with the survey data in Viet Nam. These data can contribute to the theoretical and practical scale, thereby helping academic and applied researchers to understand the online shopping market in Vietnam better. By identifying the factors and pathways that influence the intention of using online shopping services, the study has provided online sales service providers with a more detailed view of consumers in using online shopping services. At the same time, service providers can refer to the recommendations of the research to increase competitiveness as well as meet the needs of consumers. In general, the findings from this study could be useful for e-commerce researchers, businesses, and online retailers to understand customer behaviour, thereby guiding solid steps in producing, introducing products and persuading consumers.

Referring to the results chapter, we can easily withdraw that the coefficients of the paths represent two of the six hypotheses provided by the researcher and give good consequences, thus supporting these algorithmic purchase pathways that the paper has proposed in the research framework. The algorithmic pathways are the significant findings that the researcher wants to elucidate, thereby understanding the shopping psychology of online consumers through mobile applications. They are the theoretical foundations for future online shopping studies, which can be applied to capture buying decision-making behaviour. Furthermore, the results answered important sub-research questions of the research objects such as: *What purchase decision pathways lead to mobile purchases via mobile shopping applications? What are the different purchase decision pathways among customers when they purchase various types of products?* Six algorithmic paths will be discussed below.

The results from Hypothesis 1 have supported a positive relationship between need recognition and purchase decision (quick buying pathway). This algorithmic pathway relates to a purchase decision made based on need recognition. The path implies that when customers recognize a clear need, they will immediately buy without having to consider any other information or they will conduct purchase decisions when facing up time pressure. It means that when the knowledge and experience of the product are high, customers will confidently make a quick purchase decision. Typically, this process is recommended when buying common items at a low price. We are able to understand this algorithmic path deeply by following a simple example. When a guy feels hungry in the morning. He knows that he should eat a noodle bowl at a familiar restaurant (need recognition or perception). Unfortunately, because of the time of social distancing due to the Covid-19 pandemic, he decided to go to the GrabFood app on his smartphone and immediately order the noodle bowl that he wanted at his familiar restaurant (purchase decision). From the example above, we can recognize that clearly without being too fussy and taking too many factors and stages of consideration, a buying decision-making behaviour has also been given. In the future, this path will promote retailers; marketers should know how to keep their product images from the smallest things. Quality, service and image will be important factors that always make customers not abandon themselves when they have essential needs.

Next, the favourable results from the evaluation of Hypotheses 2 and 6 supported the **selected buying pathway**. In this path,  $P \rightarrow J \rightarrow D$  implies the need for recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision. This decision-making

roadmap suggests that the customer does not have any time pressure and is willing to cope with the changing environment. In addition, since this is a path that tends to rule-based decision-making, misinterpretations of information or inconsistent information signals can be ignored. In this path, the customer will skip the information searching stage. Instead, they will make decisions based on an assessment of available alternatives after an arising needs recognition. We can understand better through the following simple example. There was a guy who was travelling in a far place when he suddenly realized that he needed something to eat because of hunger (Need recognition). Unfortunately, the surrounding area where he resides is only shops selling clothes instead of food. He had to pull out his phone and type in the ShoppeeFood app. Through familiar suggestions, he saw the fast-food 3 chains of convenience food stores in a nearby area, including Lotteria, KFC and Jollibee. Then, how does he rate the food he needs now? (Taste, price, promotions, familiar products...). After a while of evaluation, he finally made the decision to choose the familiar Chicken Wing Combo from KFC, the dish he often eats. It is clear that this is a buying decision process that is very close to consumers daily. If the purchase is not under time or price pressure, the customer does not need to choose to buy quickly or look at a variety of information. Marketers need to grasp the situation and decision-making behaviour of consumers in this academic pathway to propose the necessary incentives to increase business sales.

The third path we discuss below is called **the casual buying pathway** ( $I \rightarrow J \rightarrow D$  depicts information searching  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision). The good associations between Hypothesis 3 and Hypothesis 6 support the decision-making path. In this path, the information searching stage comes first and plays an extremely important role in the whole decision-making process, which may be the criteria or attribution of an individual, place or thing. This information can help consumers identify the problem, and specify all the factors and the important alternatives, to choose the best decision. To be more evident, we can consider the following example. *During the time of social distancing because of the Covid pandemic, a customer wanted to buy a game item for his son but was not familiar with any brands. He was not under any time pressure and started searching for information. The compensatory method refers to a selection of several criteria related to the product or service that are considered important to the buyer (Rodgers, 2006). Price, colour, features, warranty period, and playing environment, ... are important information to evaluate the suitable toy for his son. By scoring these attributes from high to low scores (evaluation of* 

*alternatives), he then decided on the best item he should buy.* It should be admitted that information plays an extremely important role in this casual buying pathway, which is both an input element and criterion to help consumers to make decisions. Based on this path, economists and marketers can fully grasp consumer decision-making trends in an environment without the pressure of time as well as the absence of essential needs. Therefore, investing in information about products and services is an important factor in promoting the decision-making process of customers in this context. The information discussed above can be price, product features, product warranty period, specifications, environment, etc.

Next, Hypothesis 5 and Hypothesis 1 effectively complement the impressionable **buying pathway** (I $\rightarrow$ P $\rightarrow$ D), which indicates information searching  $\rightarrow$  need recognition  $\rightarrow$ purchase decision. This is a decision-making pathway that does not suffer the pressure of time and often involves how people use the information to influence the generation of their needs. Obviously, dependence is noted on trustworthy people, places, and things. Any change in an object, place or environment has an important effect on human cognitive processes. This buying path is compared to impulsive buying behaviour where the purchase occurs suddenly and unplanned (Beatty & Ferrell, 1998; Rook, 1987). The following example can help us better understand this decision-making route. After three years apart, a girl reunites with her childhood friend. She realizes that her friend looks much prettier than when she was in school. Through the conversation, she receives an introduction about the Innisfree skincare set that her best friend is using along with very good product reviews (information searching). Her best friend's comments influence her beauty perception and she thinks that she should have the skincare set as well (Need recognition). No need to consider other factors, just based on the beauty of her best friend, she quickly made a decision to buy and order online right on the shop's page. The example above is one of many impressive buying scenarios. In addition to human factors, the environment, objects and promotional activities also influence the buying decision process of customers. The purchases in this algorithmic pathway are completely unscheduled. It is launched when the generation of demand is instantaneous. To promote the buying advantage from this algorithmic path, marketers and retailers must constantly implement promotions, branding, and regular advertising aiming at making a good impression on customers at first sight

The next algorithmic pathway that we will discuss is **the traditional formal buying pathway** ( $P \rightarrow I \rightarrow J \rightarrow D$ ), which relates to need recognition  $\rightarrow$  information searching  $\rightarrow$ evaluation of alternatives  $\rightarrow$  purchase decision. The analytical results support Hypothesis 1, Hypothesis 3 and Hypothesis 6 representing this algorithmic decision-making path all having high indexes. This algorithm demonstrates how customers use need recognition to select and modify available information to analyze alternatives and then decide the best options to purchase. In general, this is an algorithmic process developed based on The 5-stage decision-making process model, which was formed from the research base of Engel, Blackwell, and Kollat (1978). Therefore, it is not surprising that this pathway is highly supported by the research results. This trend of decision-making has prompted retailers and marketers to pay more attention to the buying behaviour of customers when faced with important products and in complex cases, which require a lot of detailed evaluation.

Finally, modern formal buying pathway is the discussed next three-step decisionmaking process  $(I \rightarrow P \rightarrow J \rightarrow D)$ . Similar to the "traditional formal buying pathway"  $(P \rightarrow I \rightarrow J \rightarrow D)$ , this decision-making process is based on enough time to consider options. Respectively, Hypothesis 5, Hypothesis 2 and Hypothesis 6 will support this decision-making pathway, respectively. This algorithm shows how the available information affects the identification of customer needs and then analyzes the alternatives before making the final decision choice. The fact that information plays an important role in driving awareness needs reminds us of the two-step impressionable buying path. However, from the academic perspective, this process is more complicated because buyers will have to carefully consider the evaluation and selection criteria to make the final purchase decision. In fact, there are many products that excite the urge to buy by appearing with their own impressive bulletin board. Some examples such as the heavy-duty Bugatti La Voiture Noire or a noble real estate from Dubai and even high-value diamond jewellery completely conquered all buyers. It is clear that anyone who wants to own expensive items to satisfy their ambition is recognized as Maslow's hierarchy of expectations once defined five levels of expectation. The higher the level of expectation is, the higher the demand will be (Maslow, A. H., 1943). Then the consideration of spending on price, economic conditions, product quality, necessity, etc.. will be more detailed and effective. In short, this is the modern way of buying, which will represent a new style of buying, especially in the context of online shopping. Market researchers and retailers need to grasp the trend of the market to hit the right buying psychology of customers. In non-price terms, information is an important factor that marketers should invest in.

## **6.2.2.** Practical implications

From a practical perspective, this study provides insightful recommendations for information system designers in understanding the six dominant algorithmic purchase decision routes of the consumer used in the Internet environment. This proposed model may assist organisations in predicting their consumer purchase decision routines based on available data on their customer's behaviour, which can be supported by AI-enhanced machine learning, neural networks and deep learning apparatuses. Moreover, it can support organisations to understand and change their consumer decision pathways by changing influence factors. For example, the business might change its consumer decision route from a two or three-step pathway to a one-step pathway by limiting the time of promotion (such as a flash sale). That means time pressure is used to change their consumer's purchase paths in this case. This is one of the most important applications of this algorithmic model in the real business world.

In sum, TPM's algorithms can enhance artificial intelligence applications, thereby democratising market research by expanding access and enhancing decision-makers' research skills. It can assist in making market research more broadly applicable, extending use cases beyond strategic decisions to inform tactical choices. For all these reasons and more, TPM's algorithms can assist in improving marketing research.

#### 6.3 Contributions and limitations of the study

## 6.3.1. Contributions

Firstly, this study fulfils its purpose of adding to the body of knowledge by providing new contributions, fundamental theories and methodologies in the field of consumer behaviour research. The study seriously discussed previous relevant studies on consumer behaviour to answer the problems of the research question. We begin by reviewing the previous literature and the different stages of development of the research model in the past in order to identify the key factors influencing the purchasing decision. We determined that the 5-step decision-making model combined with the TPM would be valuable research bases for helping us develop our own research framework. Above all, we find unresolved problems in previous research models of the consumer decision-making process to guide our research. We find that the decision-making behaviours of customers vary greatly in each context, situation, and product they need to buy. Proposing a non-sequential model based on

the four basic stages referenced by the TPM including Information, Perception, Judgement, Decision to discover 6 different basic decision-making paths is a great contribution in terms of the theory that we want to build for the study of consumer behaviour in the context of online shopping that is very popular nowadays

By identifying the factors and pathways that influence the intention of using online shopping services, the study has provided producers, marketers, suppliers or other partners with a more detailed view of consumers in using online shopping services. At the same time, service providers can refer to the recommendations of the research to increase competitiveness as well as meet the needs of consumers. The six algorithmic pathways can be viewed as six academic theoretical frameworks that help researchers exploit customer behaviour. Here, the behaviours should be extended to the specific potential customer markets that entrepreneurs want to target. It depends on geographic location, demographics, gender disparities and also the cultural background that influence decision-making behaviour. In the online context, the decision-making environment can be more diverse because it is also influenced by technology. The diverse and powerful development of information technology resources is both an opportunity and challenge for researchers of consumer behaviour. Moreover, the Covid pandemic occurring from the end of 2019 until now will reduce the traditional shopping activity, which will be replaced by the ever-growing online shopping. In general, the findings from this study could be useful for e-commerce researchers, businesses, and online retailers to understand customer behaviour, thus guiding solid steps in producing, introducing products and persuading consumers.

This study can fill the research gap in purchase decision-making by drawing the different purchase decision paths for online customers in various situations. Based on the purchase decision pathway model, it can solve the limitation of lacking the literature to understand the consumer decision-making process which might be more complex and flexible in the online environment (Karimi et al., 2015). Furthermore, it breaks down the statement that the consumers follow the traditional 5-stage buyer's decision process (step by step by a number of studies including the research of Engel et al. (1968), Engel et al. (1990); Howard and Sheth (1969b) and Karimi et al. (2018). It contributes to an affirmation that online choice options might be more flexible and consist of a series of concerning selections (Bucklin et al., 2002) and online consumers maybe make the purchase decision by following different paths (Pavlou et al., 2007). This model supposes that purchase decision-making is not a straight-line process, it provides the different routes that customers may go through to

reach their final decisions. Thus, it is satisfied that a meaningful model must be proved in many different situations and trusted by users (Karimi, 2013) and continuously propose new behavioural studies to meet the needs of the customer in the rapid development of information technology, especially the growth of e-commerce era (Kawaf & Tagg, 2017).

#### 6.3.2. Limitations of the study and future research

Although the author makes many efforts to ensure the research quality, the topic still has some limitations:

First and foremost, because of the limitation of time, funds, human resources, support tools and some other resources, the study was forced to follow a convenient method, so the representativeness of the sample in the overall population was not high. On the other hand, the sample size is not large, so subjective assessments of the target group can skew the research results. Therefore, further research should be conducted with larger sample sizes, probabilistic sampling and subject stratification to increase the generality of the study.

Next, this research is directed in a completely new direction, which differs from previous studies on factors that influence purchasing decisions or sequential purchasing processes. Instead, this study focuses primarily on unravelling the decision-making paths that consumers often use to buy online. Therefore, it is difficult to avoid the shortcomings of theoretical reliability or authenticity of the topic. To overcome these shortcomings, subsequent studies will have to test hypotheses on a broader scale, evaluate them in many ways and apply them not only on mobile platforms but also on other online platforms such as e-commerce, social networks/forums, websites or even offline purchases to increase the persuasion of the research model.

Another limitation of this research is that has not studied the demographic factors of customers, environmental factors, and so on. These factors can have a strong impact on the results of the research. In the future, it is advisable to study the differences in demographic factors, from which it is possible to make comparisons between different groups giving different results, which can help managers find solutions for different customer groups.

Moreover, the research results show that evaluation choices have the most powerful impact on decision-making. It is also understandable that with increasingly complex information that comes from many different sources, the decision-maker (consumers) must evaluate and select to make the best decision based on the spending metrics they set.

Therefore, it is clear that this is a positive relationship that future research should focus on when investigating online buying intention.

Finally, the need for more transparency is one of the fundamental reasons for use of AI algorithmic pathways. Transparency, not only in the technical aspects of the algorithms – this is limited up to a certain point – but also more transparency about the driving force behind the algorithms. In this paper, we offer four major concepts of perception, information, judgement and decision choice that drive the TPM algorithmic pathways. Further, more transparency can be vital to building the level of trust needed to accept and integrate AI technology, especially for autonomous decision-making. For the near future, an ideal scenario would be to have hybrid decision-making systems, for example, running computer-based systems in parallel to human systems and comparing them (see Appendix 4 and 5).

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#### APPENDIX

# Appendix 1 - Consent UNIVERSITY OF Hull form used in the research

**Consent form** 

**BUSINESS SCHOOL** 

#### **RESEARCH ETHICS COMMITTEE**

## **CONSENT FORM: SURVEY**

Hereby agree to participate in this study to be undertaken

By Ms Thi Minh Tam Nguyen, a lecturer of University of Economics-The University of Danang, Vietnam and a research student of University of Hull, United Kingdom.

And I understand that the aims and purpose of the research is to explore the issues regarding the user purchase decision behaviour of mobile shopping application in Vietnam.

The reason for conducting this research is to gather more information about the perception and behaviour of Vietnamese consumers regarding mobile shopping applications as well as to provide useful recommendations in order to understand the purchase decision paths of consumer when using mobile shopping applications to buy products.

By signing this consent form are agreeing to your participation in this research process and to the collation of the material. Participants have the right to withdraw from participation in the research process at any point and materials collated from them up to that point will be removed.

### I understand that

- 1. Upon receipt, my questionnaire will be coded and my name and address kept separately from it.
- 2. Any information that I provide will not be made public in any form that could reveal my identity to an outside party i.e. that I will remain fully anonymous.
- 3. Aggregated results will be used for research purposes and may be reported in scientific and academic journals (including online publications).
- 4. Individual results **will not** be released to any person except at my request and on my authorisation.
- 5. That I am free to withdraw my consent at any time during the study in which event my participation in the research study will immediately cease and any information obtained from me will not be used.

Participant's Signature:

Date:

The contact details of the researcher are:

Ms Thi Minh Tam Nguyen

Faculty of Business, Law and Politics Business School, University of Hull Phone: (+84) 979 851 877/ (+44) (0)7713 991077 THI-MINH-TAM.NGUYEN@2017.hull.ac.uk

The contact details of the Supervisor are: Supervisor: Professor Waymond Rodgers Professor of Marketing, Faculty of Business, Law and Politics University of Hull, Hull, HU6 7RX, UK w.rodgers@hull.ac.uk

#### **Appendix 2 – Invitation letter**

Hull University Business School

The University of Hull

Hull HU6 7RX

United Kingdom

July 15<sup>th</sup> 2019

Dear participants,

I am a research student at the University of Hull. I have been given permission by Hull University Business School and my supervisor to carry out my research in Vietnam. This letter is an invitation to consider participating in my study. I would like to provide you with more information about this research and what your involvement would entail if you decide to take part.

The aim of the research is to explore the issues regarding the user purchase decision behaviour of mobile shopping application in Vietnam. The title of this research is "PATHWAYS LEAD CUSTOMERS TO PURCHASE DECISION VIA MOBILE SHOPPING APPLICATION".

The reason for conducting this research is to gather more information about the perception and behaviour of Vietnamese consumers regarding mobile shopping applications as well as to provide useful recommendations in order to understand the purchase decision paths of consumer when using mobile shopping applications to buy products. Participation in this study is voluntary. It will involve a questionnaire of approximately 15 to 20 minutes in length to take place in Vietnam.

The procedures involve:

You may decline to answer any of the interview questions if you so wish. Furthermore, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher(s).

It will involve a survey of approximately 15 to 20 minutes in length to take place in Vietnam. You may decline to answer any of the interview questions if you so wish. With your permission, the questionnaire will be collect, and later transcribed for analysis. The answers will be put together into a PhD report and a number of journal articles. All information you provide is considered strictly confidential. Your name and your organisation's name will not appear in any thesis or report resulting from this study, however, with your permission anonymous quotations may be used. Only researchers associated with this research will have access. There are no known or anticipated risks to you as a participant in this study.

All information you provide is considered strictly confidential. Your name and your organisation's name will not appear in any thesis or report resulting from this study, however, with your permission anonymous quotations may be used.

Data collected during this study will be retained for two year in the researcher's accommodation in Hull city. Only researchers associated with this project will have access.

There are no known or anticipated risks to you as a participant in this study.

Should you [the participant] have any concerns about the conduct of this research project, please contact the Secretary, Faculty of Business, Law and Politics Research Ethics Committee, University of Hull, Cottingham Road, Hull, HU6 7RX; Tel No (+44) (0)1482 463536.

I hope that the results of our study will be of benefit to the organisations directly involved in the study, as well as to the broader research community.

I very much look forward to speaking with you and thank you in advance for your assistance in this project. Yours Sincerely

Name of Researcher: Thi Minh Tam Nguyen

Email of Researcher: THI-MINH-TAM.NGUYEN@2017.hull.ac.uk

Name of Supervisor: Professor Waymond Rodgers

Email of Supervisor: <u>w.rodgers@hull.ac.uk</u>

#### Appendix 3: Questionnaire (after pre-test and pilot study)

#### **QUESTIONNAIRE**

#### (FOR MOBILE APPLICATION USERS)

#### Dear sir/madam,

I am a Marketing PhD student of University of Hull. I am undertaking a research project to investigate the pathways lead customers to purchase their products via mobile application (app). To this end I kindly request that you complete the following short questionnaire regarding your business. It should take no longer than 10 minutes of your time. Your response is of the utmost importance to me. In addition, your answers are confidential.

Summary results of this research will be available in University of Hull library next three years.

Should you have any queries or comments regarding this survey, you are welcome to email me at <u>minhtam.tm@gmail.com</u> or THI-MINH-TAM.NGUYEN@2017.hull.ac.uk.

#### Thank you for your help!

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (X) THE RELEVANT BLOCK OR WRITING DOWN YOUR ANSWER IN THE SPACE PROVIDED.

# **SECTION A – BACKGROUND INFORMATION**

This section of the questionnaire refers to background or biographical information. Although I am aware of the sensitivity of the questions in this section, the information will allow me to compare groups of respondents. Once again, I assure you that your response will remain anonymous. Your cooperation is appreciated.

Please tell me something about yourselves:

1. Gender:  $\Box$  Male

□ Female

- 2. Age:  $\Box 18 22$ 
  - $\Box 23 37$
- 3. Occupation: □ Civil servant

Businessman

- $\Box$  Office worker
- □ Student
- $\Box$  Housewife
- □ Others. Please in details.....

4. Place to live now:  $\Box$  North of Vietnam

 $\Box$  Center of Vietnam

 $\Box$  South of Vietnam)

# **SECTION B – GENERAL INFORMATION**

This section of the questionnaire explores your experience when you shop online via mobile application.

4. Do you have a smartphone? (Smart phone is "a mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, Internet access, and an operating system capable of running downloaded apps")

## □ Yes (*please answer the next question*)

# □ No (please stop here. Thank you so much for your cooperation)

5. Have you ever installed any mobile application such as Lazada, Sendo, Tiki, Shoppee, Cho Tot, etc., in your mobile phone?

# □ Yes (*please answer the next question*)

# □ No (please stop here. Thank you so much for your cooperation)

6. Have you ever installed any mobile application in your mobile phone? (Mobile applications are a separate from desktop computing or other software, initial hosting is nearly always done via the mobile application distribution platform to then be downloaded to mobile devices. A mobile app is a computer program designed to run on smartphones, tablet computers and other mobile devices. Popular mobile shopping applications are listed as Amazon app, boots app, Sendo, Tiki, Chotot, etc.)

## □ Yes (*please answer the next question*)

# □ No (please stop here. Thank you so much for your cooperation)

7. Please tell me know how many time(s) have you shopped via mobile application per month?

□ Once	$\Box$ 6-10 times

 $\Box$  2-5 times  $\Box$  More than 10 times

8. What type of products did you purchase via mobile shopping application? (You can choose more than one answer)

Convenience products	Shopping products .
□ Newspapers/ Magazine	□ Computers, mobile phone, camera
□ Soft drinks	□ Household furniture

□ Food	□ Clothing
□ Toothpaste/ Soap/ Shampoo	□ Sports equipment
□ Cleaning products, dish-washing	□ Hotels and airline ticket
powder, detergents	
□ Coffee, tea and sugar	Perfumes and cosmetics
□ Fruit and vegetables	□ Kitchen utensils (plates, pots and pans)
□ Regular medicines and vitamins	□ Luggage, shoes
□ Others (please in details):	□ Others (please in details):
Specialty products	Unsought product .
Specialty products	Unsought product .
Specialty products  Architect designed house Special jewelry	Unsought product
Specialty products            Architect designed house         Special jewelry         Specialist sporting equipment	Unsought product  Life insurance and funeral insurance Charity donations Some types of exercise equipment
Specialty products            Architect designed house         Special jewelry         Specialist sporting equipment         Some types of computer software	Unsought product         □ Life insurance and funeral insurance         □ Charity donations         □ Some types of exercise equipment         e       □ New technology (especially
Specialty products            Architect designed house         Special jewelry         Specialist sporting equipment         Some types of computer softward	Unsought product  Unsought product  Life insurance and funeral insurance Charity donations  Some types of exercise equipment  New technology (especially when first introduced to the market)
Specialty products            Architect designed house         Special jewelry         Specialist sporting equipment         Some types of computer softward         Extensive international holiday	Unsought product         □ Life insurance and funeral insurance         □ Charity donations         □ Some types of exercise equipment         □ New technology (especially when first introduced to the market)         □ Counseling and personal support

# SECTION C – ACTION TO PURCHASE THE PRODUCT VIA MOBILE APPLICATION

Please give your opinions about the purchase decision process you make when you shop via mobile application (app). Each statement is accompanied by a five-point scale (5 = strongly disagree; 4 = disagree; 3 = uncertain; 2 = agree; 1 = strongly agree).

#### C.1. Need/ Problem Recognition

I would like to buy a new product:

Statement	1	2	3	4	5
	strongly	agree	Undecided/	disagree	strongly
	agree		neutral		disagree
Because I hope to get higher expected satisfaction					
(I want a better product/ I am tired of the current					
product and want something new although it is					
still good)					
Because I am not satisfaction with the current					
product (I need to repair it too often and it is not					
reliable/ It still works but if it breaks down, the					
cost for repairing is too expensive)					
Because of product depletion (The old product					
stops working and has to be replace/ The old					
product operates fairly well; but, it is best to trade					
it in before it loses resale value)					
Because of a new need (My partner/ family's					
member would like a new product/ The old					
product is still fairly well but s/he hope to buy a					
new one for a difference purpose. My partner/					
family member did not have this product before)					

# C.2. Information searching

Identify the source(s), which help you in searching for information about the product

Statement	1	2	3	4	5
	strongly	agree	Undecided/	disagree	strongly
	agree		neutral		disagree
Do personal sources (family, friends, neighbours,					
colleagues and acquaintances) help you in					
searching for information about the product					
Do commercial sources (advertisements, sales					
persons, dealers, display, demonstration,					

exhibition, etc.) help you in searching for			
information about the product?			
Do public sources (mass media, consumer rating			
organizations) help you in searching for			
information about the product?			
Do experimental sources (handling, examining			
and using the product) help you in searching for			
information about the product?			

# C.3. Evaluation of alternatives

When selecting the alternative options to purchase, which criteria you pay attention

Statement	1	2	3	4	5
	. 1		TT 1 '1 1/	1.	. 1
	strongly	agree	Undecided/	disagree	strongly
	agree		neutral		disagree
I pay attention to product quality (country of					
origin, product features, packaging, etc.)					
I pay attention to product brand (many and new					
models by brand, variety of known brands)					
I pay attention to product price (lowest price or					
comparison price)					
I pay attention to product payment (accept variety					
of payment methods)					
I pay attention to product delivery, returns and					
changes					
The app provides the product that I need					
The app provides the attractive product					
The app provides a function for product-					
information search					
The app provides a function for product preview					
The app provides comparison information about					
shopping					

The app provides promotional activities			
The app provides online help function			
The app is able to assure transaction security			
The app has a commitment to privacy protection			
The app has a flawed-product return guarantee			
The app has a refund guarantee			

# C.4. Purchase decision

Give your idea about these statements

Statement	1	2	3	4	5
	strongly	agree	Undecided/	disagree	strongly
	agree		neutral		disagree
I intend to continue purchasing products and					
services via mobile applications					
I strongly recommend others to purchase products					
and services via mobile applications					
I find purchasing products and services to be					
worthwhile via mobile applications					
I will frequently purchase products and services					
in the future via mobile applications					

# SECTION D – PATHWAY TO PURCHASE THE PRODUCT VIA MOBILE APPLICATION

This section explores your pathway to purchase a product when you shop online via mobile shopping application.

There are 6 purchase decision pathways which describe the way customers think and do when they purchase a product. Which is the right pathway for you?

Pathway to purchase the product	Name of product
I recognize a need to buy a product, then I go online to purchase it	
immediately without considering any other related information.	
After I recognize a need to buy a product, I evaluate the alternatives and	
then go online to purchase it.	
After searching related information from personal (my family member,	
friends, colleagues) or commercial source, I recognize my need for a	
product and go online to purchase.	
After searching related information from personal (my family member,	
friends, colleagues) or commercial source, I evaluate the alternatives and	
then go online to purchase it.	
After recognizing a need to buy a product, I search related information	
from personal (my family member, friends, and colleagues) or	
commercial source. Then I go online to purchase it.	
After searching related information from personal (my family member,	
friends, and colleagues) or commercial source, I recognize my need for a	
product. Then I evaluate the alternatives and go online to purchase it.	

I undertake that this information will no transpire and only be used to improve on the study of pathways lead customers to purchase online via mobile shopping application.

# THANK YOU SO MUCH FOR YOUR COOPERATION!

\_\_\_\_\_\*\*\*\*\*\*\*\_\_\_\_\_

# Appendix 4 - Adapting artificial intelligence sub-areas of machine learning and deep learning

Based on the discussed TPM concepts as well as the consumer decision-making process above, the purchase decision pathways can be tailored in the following fashion.

First, perception refers to "defining the problem" (Rodgers, 1997), which can be represented as the "*need recognition*." That is, consumer needs can be depicted as a subset of perception, which can be recognised and satisfied through the acquisition of products or services.

Second, sound information can be portrayed as reliable and relevant, transformed data (Rodgers, 1997). In these purchase decision pathways, this information source can be referred to as *"related product information."* Therefore, after defining the "need," online customers may attempt to process the information, which might influence the products/services that they intend to purchase. The sources of this information may originate from their own experience or come from their reference groups such as relatives, friends, colleagues, public information, etc.

Third, judgement illustrates "analysing perception and information" (Rodgers, 1997), which can be determined as "*evaluation of alternatives*" in order to select the best choice to purchase. In this step, consumers classify the extent of brands or products' criteria/options (consideration set, evoked set or awareness set) (Solomon, 2006; Campbell, 1969; Howard & Sheth, 1969) in order to make a comparison among them to purchase. This process relates to the brands or products, which customers consider acceptable for their next purchase (Howard & Sheth, 1969). Further, this process may be reduced to a few elements based on individuals' criteria namely, quality, price, previous exposure, brand awareness and more (Roberts & Lattin, 1991; Campbell, 1969; Howard & Sheth, 1969; Brown & Wildt, 1992).

Fourth, decision choice is "the highest expected value solution" (Rodgers, 1997). In this step, people may intend to purchase products/services that seem to be the best for them. Scholars have pointed out that online shopping intention can lead to online purchasing decision choices (Laohapensang, 2009; He et al., 2008); Pavlou & Fygenson, 2006); Carlos Roca et al., 2009). Thus, decision choice, in this case, can be referred to as "*purchase intention*."

This paper displays how a TPM demonstrates an artificial intelligence depiction of human process thinking via six algorithmic decision pathways that can be utilized for machine learning, neural networks and deep learning. Figure 4 demonstrates the modified algorithmic purchase decision pathways, where the arrows show the proposition relationships from one construct to other constructs.



Figure 2: Algorithmic modelling of consumers' decision processes

Source: Adopted from Rodgers (2006) and Blackwel et al. (2001)

We posit that a better understanding of the TPM can assist us in a better understanding of organisations' employment of machine learning, neural networks, and deep learning. That is, this paper highlights the importance of the algorithms that can be a framework for machine learning. The machine learning apparatus consists of algorithms, which can be programmed in the understanding of consumers. Further, as discussed, neural networks mirror pattern recognition, this is taken from cognitive psychology. In other words, organisations that study patterns of purchasing behaviour can apply this to the six dominant algorithmic pathways. Further, neural networks (i.e., pattern recognition), decision trees, forest trees, and regressions can power the algorithms and or graphs (see Figure 5). Taken together, we can improve our knowledge and application of the use of AI mechanisms, which can impact on the performance and efficiency of operations.

In neutral networks, repetitive actions will be carried out over and over to arrive at the final point (output). The most important features will be paid attention through learning slowly. In this process, a prediction, an error measurement, an incremental modification to the coefficients and a minor update in its weights can be involved in every step of a neutral network.

Similarly, to other neural networks for deep learning, in the beginning, consumer situations or activities can be collected as an input. Then these situations or activities might be used to predict through a set of guesses including the coefficients, or weights, map, etc. whether the input is the need recognition (need a product when changing the financial, physical situation, out of stock, see advertisement, etc.) or information searching (searching for information about products from personal, commercial, public or experimental sources) (layer 1). Next, the need recognition and information searching will be considered again to see whether they appear or disappear in the next step of consumers. In this step, it would be measured whether information searching takes part in the purchase decision-making process or not if, in the previous step, a need for consumer is recognised. In contrast, if information searching action is realised in the previous step, a need recognition will be estimated in this

stage. In this layer, need recognition or information searching may or may not be joined in the process. In the third layer, an evaluation of alternatives might be involved (comparison among brands on price, quality, features, etc.). After that, the purchase action (make a transaction, payment, etc.) will be counted as layer 4. The neural network updates its parameters through an effort to model data's relationship to ground-truth labels, to grasp the data's structure. Finally, a purchase decision-making pathway will be pointed out (output).

When considering the consumer's situation or activities (input) and a need recognition is confirmed in the first step (layer 1), the following algorithms might apply:

(1)  $P \rightarrow D$  highlights need recognition  $\rightarrow$  purchase decision (*quick buying pathway*)

In the first algorithmic pathway, the purchase decision is made based on the need recognition (NR) of the consumer. In other words, just after recognizing the need to shop, the consumer immediately makes the decision (D), with no consideration and analysing of any related information. In this pathway, the consumer skips the information searching (IS) and the evaluation of alternatives steps (EA).



(2)  $P \rightarrow J \rightarrow D$  implies need recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision *(selected buying pathway)* 

This algorithmic route relates to the purchase decision route, where the consumer is influenced by environmental change. After realizing the need for products, the buyer ignores the effect of related information and try to evaluate all alternatives. Then they tend to decide the final choices.



(3)  $P \rightarrow I \rightarrow J \rightarrow D$  relates to need recognition  $\rightarrow$  information searching  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*traditional formal buying pathway*).

This is one of the two most complicated purchase pathways. In this algorithm, the consumers employ their need recognition in order to choose and control the existing information which might support them to evaluate all possible options before making the final choices.



On the other hand, when reflecting the consumer's situation or activities (input) and the information searching is confirmed in the first step (layer 1), the following algorithms might occur:

(4)  $I \rightarrow P \rightarrow D$  depicts information searching  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*casual buying pathway*).

At the input step, if information searching is realised as the first action of a consumer (layer 1). Then, he/she recognises a need for a product (layer 2) based on the information searching then make the final decision (layer 4) without considering any alternatives (layer 3). This algorithm emphasizes the critical role of relevant information. The related material is used to identify the need of the consumer before choosing the final option.



(5)  $I \rightarrow J \rightarrow D$ , indicates information searching  $\rightarrow$  need recognition  $\rightarrow$  purchase decision *(impressionable buying pathway)*.

Different from the above algorithms, this pathway skips the need recognition of the buyer (layer 2). It pays attention to the significance of information (layer 1). The information, which can be related to product usage or experience or advertisement may guide customers to spot the demand, identify and examine all alternatives and their weight (layer 3) in order to decide the last selections (layer 4).



(6)  $I \rightarrow P \rightarrow J \rightarrow D$ . indicates that information searching  $\rightarrow$  need recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision (*modern formal buying pathway*).

The other complicated purchase decision route shows the way people are affected by available information (layer 1) to realize their needs (layer 2). Once this action is completed, they consider their alternative decisions (layer 3) and then select the best choices (layer 4).



In general, the whole neutral network of online purchase decision-making for the customer is described in Figure 5.

From an organisational viewpoint, the more the Internet develops and become a part of our lives, the more people emphasise the vital role of the power of AI technology as operationalized as machine learning, neural networks, and deep learning (Jordan & Mitchell, 2015). Marketers can do many things, such as predicting the potential consumers in the online users' shops (André et al., 2018) when they implement one of the six algorithmic pathways. This becomes a function of machine learning, which drives not only the six fundamental learning algorithms and theory development but also the on-going explosion in the online big data usage and low-cost computation availability (Jordan and Mitchell, 2015). In this way, the purchase decision algorithmic pathway model can be a guide for organisations to understand their consumers clearly through machine learning, neural networks and deep learning. To add to this perspective, TPM can contribute to building the fundamental statistical-computational-information-theoretic laws that power computer software systems in order to improve automatically through supervised and unsupervised learning experiences. The vast influence of big data can be captured routinely in the purchase decision algorithmic pathways. Further, the online consumers' use of the Internet or mobile platform can be recorded and saved automatically. Thus, setting the stage for big data sets for machine-learning algorithms apparatus.

#### Figure 5: The neutral network of online purchase decision-making





Each stage of purchase decision-making might be applied for deep learning through artificial layer neutral network. Depending on the extent of the criteria to estimate the alternative options, one or multilayers can be used for this stage. If each stage is multi-layer, then the methods have changed from machine learning to deep learning.

For example, based on the simple evaluation of alternatives, the six purchase decision algorithms can be fortified through an artificial single-layer neural network shown in Figure 6.

**Figure 6**: Artificial single-layer neural network for evaluation of alternatives of the purchase decision algorithm



Source: Authors generated

Also, when the consumer data set becomes more complex, an artificial deep-layer neural network can be set for the purchase decision pathways (see Figure ).

Figure 7: Artificial deep-layer neural network for evaluation of alternatives to purchase decision algorithms



Source: Authors generated

In contrast, from the consumer view, the buyers who purchase online can benefit from the Internet of Things (IoT) as depicted by instruments such as mobile devices, tablets, and smart appliances. On the most basic level, the IoT refers to objects which can connect and communicate via the Internet (Uckelmann et al., 2011). IoT technology influences consumer behaviour on online users' daily lives (Li & Wang, 2013). In this manner, when online users decide to buy goods, their mobile applications can automatically save and record this data for autonomously monitoring the consumption of goods and beverages and re-ordering of goods through a reminder application or announcement via retail applications.

#### Appendix 5

Expanding the purchase decision pathway model into the artificial intelligence (AI) area are discussed in order to illustrate how to adopt online consumer purchase routes for machine learning (case study in Vietnam)

#### Research methodology

This research primarily concentrates on online customers who have experienced mobile shopping application, and they used a mobile application or mobile applications to purchase online.

In this study, the researcher will consider the existing shopping decision pathways of customers who make a decision online via mobile application in Vietnam in order to exploring the nature of consumer purchase algorithmic decision pathways in Vietnam. These algorithmic paths are affected by consumer behaviours and the relationship between consumer purchase behaviours and decision-making process when using mobile shopping applications.

According to Criteo's report about online Vietnamese consumer, people at aged 18-24 and aged 25-34 are the most frequently customers who are willing to buy via mobile applications (94% and 93%) (Thông, 2018). This impressive figure shows the main group of online customers who have purchased products via mobile devices in Vietnam.

Most of people at this age 18-22 are usually undergraduate students. Văn (2017) identifies that 77 percentage of high school students (at age 18 -19) continue to study at the university or college. Normally, Vietnamese students will spend four year at the university, excluded medical university. Thus, when they graduate, they are at 22 or 23. It is said that that the age 18-24, most of people are students at the university. Therefore, this is one of the main reason that the sample will focus on the students in Vietnam in this research. They are called generation Z (Shatto and Erwin, 2016).
Moreover, people who are at aged 22-37 also one of the most frequently groups shop via mobile applications (Thông, 2018). They have usually worked from one to more than ten years after graduation. Thus, another respondent group of this study is individual at aged 22-37. They are represented for millennials (Shatto and Erwin, 2016).

## Data collection

A questionnaire was adopted as a data collection instrument. However, the distribution of questions was administered through the length and breadth of Vietnam. Hence, the study specifically adopted the probability sampling technique. With regard to data collection, the questionnaire was assisted in distributing to two different big cities (Ho Chi Minh and Danang) in Vietnam. A simple random technique was adopted for the study within 3 months range of time span used in collecting data for the study (Between December 2019–March 2020).

A total of 7700 questionnaires were distributed, 7649 of which were eligible to being valid for the analyses. We must emphasize that the entire questionnaire was prepared in two linguistic forms, the English and the Vietnamese format. It was so because the researchers wanted to do away with unnecessary ambiguity of the questions. The questionnaire was, however, pilot- tested with bachelor students in Danang University, where it was revealed that some of the questions were not properly situated and hence turned to be repeated. As a matter of urgency, they were all corrected and pre-tested again. This time, the error rate was meagre and even such an error was attributed to the way and manner some students attempted to answer the questions, as some of them just filled some part and left other ones unfilled. Some respondents were also filling almost every section of the questionnaire.

### Data Processes/cleaning

The data cleaning/processing phase involved a number of stages to arrive at the

requisite data needed for further steps. First, encoding was initiated purposed on deleting unnecessary fields from the original data. Repeating and validation of the data-set was scanned and checked. This was adhered to desist from errors in the event of running the data with the Python coding.

#### Data Repair

This stage involved the data consistency, thus where the accrued data was keenly monitored to ensure accuracies. The repairs are fixed as a result of encoding and decoding redoubtable rules in the previous step, thus through data processing. Finally, the entire binary dataset is stored as CSV.

## Conducting Association rules

The idea behind association rule mining is to determine all possible rules between items as an indication of true dependence. Hence, the Python software was deployed in generating rules for further deliberations.

### Algorithms of the purchase decision pathways

For the association rules of the purchase decision pathways, the online consumer responses are transformed and cleaned, and then it is called as the dataset. The association rules topology of the purchase decision pathways is related to thought and shopping behaviour generated by the online consumers. The corresponding algorithm is described as Algorithm 1. The online shoppers in the online buying process, instantiate the association rules of the purchase decision paths, that will drive to find the rules and prediction process of purchase decision actions. Algorithm 1 is the key analysis process.

## Algorithm 1

# Function encoder data and find frequent itemsets

def Encoder\_FreqItemsets(data, \*, minimum\_support=0.001):

te = TransactionEncoder()

te\_sed = te.fit(data).transform(data)

df = pd.DataFrame(te\_sed, columns=te.columns\_)

# Create itemsets

minimum\_support = 0.001 if minimum\_support == " else float(minimum\_support)

f\_i = apriori(df, min\_support=minimum\_support, use\_colnames=True)

# Size of itemsets

# f\_i['itemsets\_size'] = f\_i['itemsets'].apply(lambda x: len(x))

return f\_i

# Function search rules

def find\_rules(itemsets, consequents, length='', \*, min\_confidence):

# Create rules

min\_confidence = 0.6 if min\_confidence == " else float(min\_confidence)

rules = association\_rules(itemsets, metric='confidence',

min\_threshold=min\_confidence)

#### # Filter rules

rules = rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']]
rules = rules[rules['consequents'] <= frozenset(consequents)]</pre>

# Get size of antecedents and filter by size

rules['antecedents\_length'] = rules['antecedents'].apply(lambda x: len(x))

rules = rules if length == '' else rules[rules['antecedents\_length']>=int(length)]

return rules.sort\_values(by=['confidence', 'support'], ascending=False)

### Result

According to Nitin et al. (2007), depending on the threshold set on some variable measures and the number of transactions in the database, the association rules lends itself to many rules. Nevertheless, potent and redoubtable rules from a set of all possible rules, certain constraints are often used as measures of significance in order to ensure the selection of interesting. Basically, confidence and support are two of the best-known of these constraints. The minimum thresholds are set on their resulting values. The confidence measures how often items in the consequent appear in transactions that contain the antecedent while the support is a fraction of transactions that contain both the antecedent and the consequent. Lift, Laplace, Gain, etc. are other metrics which can be additional indicators that demonstrate the strength of the rules' relationships.

Based on the basic principles underlying the validity, accuracy, completeness as well as the reliability of the association rule technique, this technique is guaranteed with the percentages of the aforementioned metrics such as confidence, support, lift of the rules (Chen et al., 2016).

As can be seen from figure 11, the attributes with related variables were selected from the entire data set to initiate and generate an association between such variables in tandem with the objective of the present study. The rationale behind association rules is to foremost examine all salient rules embedded in a pool of datasets. It must be emphasized that one of the shortcomings of association rules is the utmost profusion of rules that are generated. Therefore, a need arises to reduce these rules to a small set of vital rules, as has been done in this study by concentrating on the rules with stronger rules.

The findings from this section shed more light on the association of the online consumer characteristics and activities as influential factors for customers to decide the purchase routes they spend when shopping online. Based on the selected antecedents such as consumer's characteristics (gender, age, occupation, income, etc.) or consumer decision process (need recognition, product information, evaluation of alternative and decision, the rules of purchase decision paths can be found.

Figure 11 presents some key findings of association rules of the data set governing the purchase decision paths of the online consumers.

The following findings indicate how four steps of purchase decision process may be applied for deep learning through artificial layer neutral network.

## Need recognition

Figure 10 explains one hidden layer (an artificial single-layer neural network) for the dominant purchase decision algorithms. There are four algorithmic decision pathways (namely quick buying pathway, selected buying pathway, casual buying pathway and traditional formal buying pathway), which are mentioned as the output of this neutral network.

Figure 1: Artificial single-layer neural network for need recognition of the purchase decision algorithm



In addition, an artificial deep-layer neural network can be developed for the need recognition if the hidden layers are more than one.

As can be seen from figure 11, in rule #1 and #2, when shopping electronic products (low price), male at aged 29-34 who are civil servant go with pathways 2 - selected buying pathway (need recognition  $\rightarrow$  evaluation of alternatives  $\rightarrow$  purchase decision) while others who earn 10-15 million VND choose pathway 4 - impressionable buying pathway (information searching  $\rightarrow$  need recognition  $\rightarrow$  purchase decision).

Rule #3 and #4 indicate that people (civil servant with income from 10 to 15 million VND or office worker with income from 5 to 10 million VND) who can go with the same pathway (pathway 1- *quick buying pathway* - need recognition  $\rightarrow$  purchase decision), might purchase different products (food or fast fashion). Moreover, in rule #5 to #10, when shopping the same product (cosmetic), buyers with different characteristics may spend the various pathways. It can be said that the result of paths might be change when the antecedents

change.

<b>D</b> <sup>1</sup>	17 1 6	1	4 1 41	1	1	41
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			Consequent				
Rules	Anteceden	t (X)	(Y)	Support	Confidence	Lift	Pathway
				%	%	%	
	(NR6_3,	NR7_3,					
	NR1_3,	NR3_3,					
	NR5_2,	NR4_3,	(fast fashion)	0.001688	1.000000	3.228883	
	NR2_3,	NR9_3,					
#1	NR8_2)						1
	(NR3_2,	NR4_1,					
	NR7_3,	NR1_3,					
	NR2_4,	NR9_1,	(book)	0.001688	1.000000	5.752427	
	NR8_1,	NR5_2,					
#2	NR6_1)						1
	(NR6_3,	NR7_3,					
	NR8_3,	NR3_3,					
	NR5_3,	NR2_2,	(EL)	0.001476	1.000000	4.822064	
	NR4_3,	NR1_2,					
#3	NR9_3)						2
	(NR3_2,	NR5_1,					
	NR7_3,	NR9_1,	(fast fashion)	0.001476	1.000000	3.241627	
#4	NR8_1,	NR1_1,					2

	NR2_1,	NR6_1,					
	NR4_3)						
	(NR3 2.	NR7 2.					
	NR4 1	NR5_1					
	NDO 2	ND1 1	(fast fashion)	0.001476	1 00000	2 241627	
	NK9_2,	NKI_1,	(last lasilioli)	0.001470	1.000000	5.241027	
	NR2_2,	NR6_1,					
#5	NR8_2)						2
	(NR3_2,	NR9_2,					
	NR8_3,	NR5_3,					
	NR2_2,	NR6_2,	(fast fashion)	0.001476	1.000000	3.241627	
	NR4_3,	NR1_2,					
#6	NR7_4)						2

Figure 3: A demo website for online purchase decision pathways

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1890033	(NR3_2, NR4_1, NR5_1, NR7_3, NR9_1, NR8_1, NR6_1, NR2_3, NR1_2)	(EL)	0.001688	0.666667	4.413408	9
1890495	(NR6_3, NR7_3, NR8_3, NR9_1, NR3_4, NR5_3, NR2_3, NR4_3, NR1_2)	(EL)	0.001688	0.666667	4.413408	9
1891379	(NR3_2, NR7_2, NR1_3, NR8_3, NR9_1, NR5_3, NR2_2, NR6_1, NR4_3)	(EL)	0.001688	0.666667	4.413408	9
1899827	(NR4_2, NR7_1, NR9_2, NR3_3, NR1_1, NR2_1, NR5_2, NR6_1, NR8_2)	(food)	0.001688	0.666667	2.590164	9
1901043	(NR7_3, NR9_1, NR3_4, NR1_1, NR5_2, NR6_2, NR4_4, NR2_3, NR8_2)	(fast fashion)	0.001688	0.666667	2.152589	9
1901584	(NR3_2, NR7_3, NR9_1, NR2_1, NR5_2, NR6_1, NR4_3, NR1_2, NR8_2)	(food)	0.001688	0.666667	2.590164	9
1901788	(NR3_2, NR7_3, NR9_2, NR8_1, NR2_1, NR5_3, NR6_1, NR4_3, NR1_2)	(fast fashion)	0.001688	0.666667	2.152589	9
1904051	(NR3_2, NR4_2, NR9_2, NR5_3, NR2_2, NR6_1, NR7_4, NR1_2, NR8_2)	(food)	0.001688	0.666667	2.590164	9
1904653	(NR3_2, NR7_3, NR9_2, NR5_2, NR2_2, NR6_1, NR4_3, NR8_4, NR1_2)	(book)	0.001688	0.666667	3.834951	9
1908277	(NR7_2, NR5_1, NR9_2, NR3_3, NR2_2, NR6_2, NR4_4, NR1_2, NR8_2)	(fast fashion)	0.001688	0.666667	2.152589	9
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1909976	(NR3_2, NR6_3, NR7_3, NR8_3, NR5_2, NR2_3, NR4_3, NR1_2, N	3, NR4_3, NR1_2, NR9_3) (fas		0.002532	0.600000	1.937330	9
1910498	(NR7_3, NR3_3, NR9_1, NR5_2, NR6_2, NR2_3, NR4_3, NR1_2, N	IR8_2)	(fast fashion)	0.001688	0.666667	2.152589	9
1911903	(NR3_2, NR7_2, NR1_3, NR9_1, NR2_1, NR5_3, NR6_1, NR4_3, N	R8_2)	(fast fashion)	0.001688	0.666667	2.152589	9
1912424	(NR4_2, NR1_3, NR8_3, NR3_3, NR9_1, NR2_1, NR5_2, NR6_2, N	IR7_4)	(food)	0.001688	0.666667	2.590164	9
1918078	(NR6_3, NR7_3, NR1_3, NR3_3, NR5_2, NR4_3, NR2_3, NR9_3, N	IR8_2)	(fast fashion)	0.001688	1.000000	3.228883	9
1918570	(NR6_3, NR7_3, NR1_3, NR8_3, NR9_1, NR3_3, NR5_3, NR4_3, N	IR2_3)	(fast fashion)	0.001688	0.666667	2.152589	9
1920620	(NR3_2, NR4_1, NR7_3, NR1_3, NR2_4, NR9_1, NR8_1, NR5_2, N	IR6_1)	(book)	0.001688	1.000000	5.752427	9
Showing 11 to	17 of 17 entries		Previous 1	2 Next			
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## **Product information**

Figure 4: Artificial deep-layer neural network for product information to purchase

# decision algorithms



Product information data is applied for deep learning through artificial layer neutral network with personal sources, traditional media sources, digital media source and experimental sources as the input of this neural network. The figure 13 shows multi hidden layer (a deep-layer neural network) for this dominant purchase decision algorithms.

Rule				Confidenc		Pathwa
S	Antecedent (X)	Consequent (Y)	Support	e	Lift	у
			%	%	%	
	(IS3_3, IS1_1,		0.00221	0.00000	2.89323	
#1	IS2_1, IS4_3)	(EL)	4	0.600000	8	2
	(IS1_1, IS3_2,	$(\mathbf{f}_{1}, \mathbf{f}_{2}, \mathbf{f}_{2}, \mathbf{f}_{1}, \mathbf{f}_{2}, \mathbf{f}_{2}, \mathbf{f}_{2})$	0.00221	0.750000	2.43122	
#2	IS2_2, IS4_1)	(last lashion)	4	0.750000	0	2
#3	(IS4_2, IS1_1,	(fast fashion)	0.00221	0.600000	1.94497	2

Figure 5: Key rules of product information towards the purchase decision pathways

	IS3_3, IS2_3)		4		6	
	$(IS1_3, IS2_1,$		0.00147		2.16108	
#4	IS4_3, IS3_1)	(fast fashion)	6	0.666667	5	2
	(IS4_2, IS3_3,		0.00147		3.24162	
#5	IS2_1, IS1_3)	(fast fashion)	6	1.000000	7	2

Figure 6: A demo website for online purchase decision pathways

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DEMO INTERFACE			ASSO	CIATION RU	JLES ANAL	YSIS		
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	Enter anteced	lents:		Enter consequents:				
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	Minimum Supp	port:	Minimum 0	Confidentce:		Antecedents lengt	th:	
	0.001		0.6			4		Submit
	Số bản ghi: 13	355						
		ANTECEDENTS		CONSEQUENTS	SUPPORT	CONFIDENCE	LIFT	ANTECEDENTS_LENGT
	998	(IS3_3, IS1_1, IS2_1, IS4_3)		(EL)	0.002214	0.600000	2.893238	4
	1133	(IS1_1, IS3_2, IS2_2, IS4_1)		(fast fashion)	0.002214	0.750000	2.431220	4
	1166	(IS4_2, IS1_1, IS3_3, IS2_3)		(fast fashion)	0.002214	0.600000	1.944976	4
	1296	(IS1_3, IS2_1, IS4_3, IS3_1)		(fast fashion)	0.001476	0.666667	2.161085	4
	1301	(IS4_2, IS3_3, IS2_1, IS1_3)		(fast fashion)	0.001476	1.000000	3.241627	4
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Evaluation of alternatives

When shoppers investigate the options, needed product, attractive product, a function for product, a function for product preview, comparison information about shopping, promotional activities, online help function, transaction security, commitment to privacy protection, flawed-product return guarantee, refund guarantee are considered as the input. The figure 23 shows multi hidden layer (a deep-layer neural network) for this dominant purchase decision algorithms.

Figure 7: Artificial deep-layer neural network for evaluation of alternatives to purchase decision algorithms



Figure 8: Key rules of evaluation of alternatives towards the purchase decision pathways

Rule				Confidenc		Pathwa
S	Antecedent (X)	Consequent (Y)	Support	е	Lift	у
			%	%	%	
	(EA14_1, EA16_1,					
	EA10_2, EA8_2,					
	EA18_1, EA12_3,	(fast fashion)	0.00186	1 000000	3.58862	
	EA15_1, EA17_1,		4	1.000000	9	
	EA11_2, EA13_1,					
#1	EA9_2)					3
	(EA9_3, EA8_2,					
	EA18_1, EA16_3,	(book)	0.00186	1.000000	4.89954	
	EA15_2, EA14_2,	(0000)	4	1.000000	3	
#2	EA12_2, EA17_1,					3

	EA11_2, EA10_3,					
	EA13_3)					
	(EA9_1, EA14_1,					
	EA16_1, EA8_1,					
	EA10_2, EA15_1,	(food)	0.00186	0 666667	5.10952	
	EA17_1, EA11_2,	(1000)	4	0.000007	4	
	EA12_2, EA13_1,					
#3	EA18_2)					3
	(EA14 1, EA16 1,					
	EA8_1, EA18_1,					
	EA15 2, EA10 1,		0.00186		4.83333	
	EA17 1, EA11 2,	(EL)	4	0.666667	3	
	EA12 2, EA13 1,					
#4	EA9 2)					3
	_ /					
	(EA9_3, EA8_2,					
	EA18_1, EA16_3,					
	EA15_2, EA14_2,	(1 1)	0.00186	1 000000	4.89954	
	EA12_2, EA17_1,	(DOOK)	4	1.000000	3	
	EA11_2, EA10_3,					
#5	EA13_3)					3

Figure 9: A demo website of key rules of evaluation of alternatives towards the purchase decision pathways

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8	Minimum Sup	port: Mi	nimum Confidentce:		Antecedents length		
	0.001		0.6		11		Subm
	Số bàn ghi: 10	073					
		ANTECEDENTS	CONSEQUENTS	SUPPORT	CONFIDENCE	LIFT	ANTECEDENTS_LENG
	14917360	(EA9_1, EA14_1, EA16_1, EA8_1, EA11_1, EA18_1, EA10_1, EA15_1, EA12_2, EA13_1)	EA17_1. (fast fashion)	0.001864	0.666667	2.392419	11
	14923395	(EA14_1, EA16_1, EA8_1, EA18_1, EA15_2, EA10_1, EA17_1, EA11_2, EA13_1, EA9_2)	EA12_2. (EL)	0.001864	0.666667	4.833333	11
	14924818	(EA14_1, EA17_2, EA18_1, EA16_2, EA8_2, EA15_2, EA10_1, EA11_2, EA13_1, EA9_2)	EA12_2, (fast fashion)	0.001864	0.666667	2.392419	11
	14929771	(EA9_1, EA8_1, EA16_3, EA10_1, EA14_3, EA15_3, EA17_1, EA11_2, EA13_1, EA18_2)	EA12_2. (comestic)	0.001864	0.666667	3.070100	11
	14953123	(EA9_1, EA14_1, EA16_1, EA8_1, EA10_2, EA18_1, EA15_1, EA17_1, EA12_2, EA13_1)	EA11_2. (fast fashion)	0.001864	0.666667	2.392419	11
	14953387	(EA9_1, EA14_1, EA16_1, EA8_1, EA10_2, EA15_1, EA17_1, EA11_2, EA13_1, EA18_2)	EA12_2. (food)	0.001864	0.666667	5.109524	11
	14962872	(EA9_1, EA14_1, EA15_4, EA8_1, EA17_2, EA10_2, EA18_2, EA11_2, EA13_2, EA16_4)	EA12_2. (book)	0.001864	0.666667	3.266362	11
	14966918	(EA10_2, EA18_1, EA8_2, EA16_2, EA15_2, EA14_2, EA17_1, EA11_2 EA13_2, EA9_2)	. EA12_2. (fast fashion)	0.001864	0.666667	2.392419	11
	14982697	(EA17_2, EA10_2, EA8_2, EA16_2, EA15_2, EA14_2, EA12_2, EA11_2 EA18_2, EA9_2)	LEA13_3, (fast fashion)	0.001864	0.666667	2.392419	11
	14988817	(EA14_1, EA16_1, EA10_2, EA8_2, EA18_1, EA12_3, EA15_1, EA17_1, EA13_1, EA9_2)	EA11_2, (fast fashion)	0.001864	1.000000	3.588629	11
	Showing 1 to 1	0 of 14 entries	Previous 1	2 Next		·	
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## Purchase decision

In this neural network, the online consumer intention can be recorded as the input. Figure 19 illustrates multi hidden layer for the four dominant purchase decision algorithms.

Figure 10: Artificial deep-layer neural network for purchase decision to purchase decision algorithms



Figure	11: Kev	rules of	nurchase	decision	towards t	he purcha	se decision	nathways
			P			P V		

Rule				Confidenc		Pathwa
s	Antecedent (X)	Consequent (Y)	Support	e	Lift	у
			%	%	%	
	(PI3_3, PI1_2,		0.00168	1	9.48000	
#1	PI2_1, PI4_1)	(luxury fashion)	8	1.000000	0	4
	(PI1_4, PI4_4,		0.00168		3.08593	
#2	PI3_4, PI2_4)	(cosmetic)	8	0.666667	7	4

Figure 12: A demo website of key rules of purchase decision towards the purchase

# decision

## pathways

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DEMO INTERFACE				AS	SOCIATION R	ULE	ES ANALY	SIS				
Association Rules												
🛓 Predict	E	inter ant	ecedents:			Enter c	onsequents:					
		PIIM PI3M PI2M PI4M			Actions - PH4#							
	N	Minimum Support:			Minimum Confidentce:			Antecedents lengt	Antecedents length:			
		0.001		0.6			4			Submit		
	s	36 bàn ghì: 1185										_
			ANTECEDENTS		CONSEQUENTS		SUPPORT	CONFIDENCE	LIFT	ANTECEDEN	TS_LENGTH	
		1422	(PI3_3, PI1_2, PI2_1, PI4_1)		(luxury fashion)		0.001688	1.000000	9.480000			
		1629	(PI1_4, PI4_4, PI3_4, PI2_4)		(comestic)		0.001688	0.666667	3.085937		ļ.	
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### **Appendix 5 - Transferring among algorithmic purchase decision pathways**

Depending on the effect and weight of the time pressure, customers might transfer their purchase decision pathway to another one. In other words, they might change their purchase decision pathways from the one-step path to two or three-step paths when they have more free time. In contrast, they may omit one or two steps if they do not have enough time and/or limited information and/or the environment changes. It means that they will follow the simple pathway (transferring from three or two-step paths to two or one-step path) (see figure 23). The following finding was found when asking 250 responses for their decision if they have more or less time to shop online.

Table	1 Numbe	r of online	<i>consumers</i>	transfers	their pu	urchase d	lecision	pathways
								• •

Transferring among	More free time	Less time	Transferring among
pathways			pathways
One-step path →two-	102	117	Three-step path→
step path			two-step path
Two-step path $\rightarrow$	85	84	Two-step path $\rightarrow$
three-step path			one-step path
One-step path $\rightarrow$	63	49	Three-step path→
three-step path			one-step path

As can be seen from the result, 74.8% of the online shoppers (187 people) spend more one step than the previous purchase decision route when they have more time. In which, around 40.8% of the buyers (102 people) change from one-step path to two-step path and 34% of the customers (85 people) skip from two-step route to three-step route. On the other hand, 25% of the customers (63 people) are available to spend more time for the three-step path from the prior one-step path for the same products.

On the other side, the percentages of the online customers who are willing to reduce the steps to shop online are 46.8% (117 people) from the three-step path to two-step path and 33.6% (84 people) from the two-step path to one-step path. While this figure for the threestep path to one-step path is 19.6% (49 people). Organisations can predict the transfer among algorithmic purchase decision routes from the purchase decision pathways based on the application of machine learning. Marketers can collect the purchase decision paths of the online consumers as the input. Depending on the effect and weight of these influent factors such as time pressure, information influence and environment changes (hidden layers), the customers might transfer their purchase decision pathway to another one. For example, they might change their purchase decision pathways from the one-step path to two or three-step paths or they might skip one or two steps if they do not have enough time and/or limited information and/or the environment changes. They will follow the simple pathway (transferring from three or two-step paths to two or one-step path) (see Figure 25).

In conclusion, based on the different factors, a new expected purchase decisionmaking pathway will be pointed out (output) (see Figure 1).



Figure 1. Transferring purchase decision neutral network