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# EXPLORING THE FACTORS INFLUENCING CONSUMERS' PURCHASE INTENTION OF GENETICALLY MODIFIED FOODS IN SENEGAL

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**Abstract**

Genetically modified foods play an integral role in ending hunger and food security challenges worldwide. However, its success and, to a considerable extent, its failure primarily rest with the final consumer of genetically modified foods. Therefore, investigating the underlying factors that motivate or obstruct consumers from patronizing genetically modified foods is instrumental in informing viable decision-making, improving the marketing of such products, and correcting erroneous impressions that consumers may hold concerning genetically modified foods in . As a result, this study explores the psychological elements in Senegal that either drive or inhibit consumer acceptance and purchase intentions for genetically modified foods.

Using a quantitative approach through a random data distribution method via online, respondents were recruited for this research. Six hundred and forty-one (641) valid respondents were used in the study after deleting unfit data. A structural equation modeling quantitative analysis methodology was employed in analyzing the gathered data. Smartpls SEM 3.3.3 statistical software was used.

The demographic profile of the respondents indicates that the majority of the sampled population are males, and the majority are aged between 20-30 years. Most of the respondents were bachelor's and master's degree holders.

From the findings, the constructs used in this study accounted for 53.6% of the total variance of the study. It was evidenced that attitude, subjective norms, and knowledge positively and significantly influenced the purchase intention of genetically modified foods directly. Risk and safety concerns affected the intention to purchase genetically modified foods negatively. Subjective norms and knowledge influence attitudes toward genetically modified foods, while risk and safety concerns negatively affect attitude. Attitude mediated the relationship between subjective norms and purchase intention. Analysis of variance indicated that age was insignificant in impacting the purchase intention of genetically modified foods. As income levels increased, the purchase intent of genetically modified foods decreased in the case of Senegal.

The findings of this study present potent and important policy implications to policymakers in the food and agriculture industry, business owners, and entrepreneurs to ensure acceptance and ready-market for genetically modified food, eradicate hunger and its related effects.

**Keywords:** Genetically Modified Food; Knowledge; Structural Equation Modeling; Attitudes; Health and Safety Concerns; Senegal.

# Chapter 1 : INTRODUCTION

## 1.1 Research Background

Due to the innovation of the latest technology, producing food has been a big challenge in the eyes of scientists and farmers. In recent decades, the future of agricultural industry has embraced a digital technology all over the world and the use of agro-biotechnology has raised consumer concerns about environmental, health, socio-economic and ethical risks. According to previous studies (Hakim et al., 2020), the greatest consumers of GM foods generally come from the United State and in fewer other countries from Asia and Europe but consumers give lower acceptance ratings when asked about the genetic modification of foods rather than when asked the same question using the term "biotechnology." Engineers and scientists report that: The integration of biotechnology into the field of agriculture makes the better use of limited resources, increases production, and reduces the use of pesticides and insecticides on Genetically modified (GM) crops (Brookes and Barfoot, 2012). Scientific and governmental leaders in Europe do not completely reject GM foods, but instead believe they have not been proven safe and therefore, invoke major principles that GM should be commercialize in order to boost their economy hence by knowing health risk will be a major concern of the consumers who have lack of knowledge on GMO's products. Most consumers failed to understand Genetically Modified Food and assumed that the recall of the product mean to be unsafe rather than merely not receiving more information on the production and labeling system; their only concern is to satisfy their stomach without even knowing the consequences of consuming genetically modified food (Wunderlich & Gatto, 2015). Therefore, the process of selective breeding, in which organisms with desired traits are used to breed the next generation and organisms lacking the trait are not bred, is a precursor to the modern concept of genetic modification (GM). With the discovery of DNA in the early 1900s and various advancements in genetic techniques through the 1970s it became possible to directly alter the DNA and genes within food (World Health Organization; (WHO), 2018).

According to the World Health Organization (WHO) GM Food is define as “Plants, animals or microorganisms in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and /or natural recombination.” Given the importance of predicting consumer attitude and behavioral decision making, much scholarly attention has been paid to

explore factors influencing consumers' acceptance and willingness to purchase GM food (Kikulwe et al., 2014). The question is how regulation of new food technologies affects the share of risk responsibility attributed to the self among consumers, and this is particularly relevant in the case of genetically modified (GM) food, given that consumers may be in an environment where they can control their choice on GM food products among the connection of risk and responsibility then calls for further investigation of the perceptive process behind risk benefits(Ali et al., 2021).

From the previous concept, GM foods are the plants and animals that its gene had already been manipulated. The method of alternating the trait of the animals or plants which is aimed to make it more productive for example: cotton, rice, soybean, tomatoes, corn, potatoes, papaya, meat, and any similar to these are called Genetically Modified Organism (GMO) also known as GM Food (GMF). Even greater inconsistency and confusion is associated with various "Non-GMO" or "GMO-free" labelling schemes in food marketing where even products such as water or salt, that do not contain any organic substances and genetic material are being labelled to create an impression of being healthier. Hence, people around the world have intensely debated on what they eat, how is it produced what are the advantages and disadvantages on the food being consumed. Therefore, as a consumer, making choices is a result of weighing the alternatives that go in hand with purchase knowledge, awareness, trust and between perceived benefits and risks of any products specially which goes into our organism (Huffman et al., 2004; Roosen et al., 2003). Among previous scholars, a number of studies have been conducted around the world to investigate consumer attitudes and purchase behavior regarding GM food. To our knowledge, GM food is only developed in South Africa, Sudan and Kenya in Africa because of the limited advance technology in some other area of the continent but this doesn't mean the lack of consumption of GM Food in other countries (Botha and Viljoen, 2009; Zerfu et al., 2009). Therefore, this research aims to enhance the understanding of the influence of customer trust and purchase intention of GM Food in Senegal also the researchers will help consumers to better comprehend and be more aware on foods created through genetic engineering, commonly called GMOs or genetically modified food which may have severe consequences on their health benefits. (Bouët & Gruère, 2011; Paarlberg, 2008) argues that while foods from genetically engineered plants have been available to consumers since the early 1990s and are a common part of today's food supply mostly around the world, there are a lot of misconceptions about them.

Typically, most researches focused on consumer socio demographics, awareness and perceptions about GM foods, as well as the benefits and risks they perceive (Carine and Zhang, 2021).

### 1.2 Problem statement

Global food security, soaring food prices, and post-harvest losses have become a significant source of concern that is gradually taking center stage in global leadership forums and discussions. These challenges have deprived many of nutritional value, thus calling for a collective effort from leadership, science, and technology to mitigate these challenges and their devastating effects. As a remedy to solving the above-stated challenges is the invention of genetically modified foods (GM foods). Genetically modified foods are edible foods from organisms and or plants that have their genetic makeup altered in a special which is unorthodox to the known natural way. GM food is seen as a positive way of ending food shortage, and crisis as GM food yield can be predictable, have a higher nutritional value, is resistant to pests and diseases, have a more extended shelf and storage life, and is easier to handle. However, the total acceptance and embrace of genetically modified foods primarily center on the perceptions, attitudes, intentions and behaviors of the final consumer. Genetically modified foods have dwindling fortunes in Africa, especially in the case of western Africa, as consumers are yet to come to terms with the consumption of genetically modified foods. On this account, this current study seeks to investigate the underlying mechanism that motivates or hampers consumers' purchase intention of genetically modified foods in Senegal- a prominent west African nation.

### 1.3 Objectives of the study

The general objective of this study is to assess the influencing factors that account for the purchase intention of genetically modified foods in Senegal. Put in simple terms, the main purpose of this study is to know the key determinants of the purchase intention of genetically modified foods among residents in Senegal.

The specific objectives of this thesis work will be;

i. To identify the major determinants that influence consumers' purchase intention of genetically modified foods in Senegal.
ii. To investigate the factors hindering consumers' purchase intention of genetically modified foods in Senegal.

iii. To provide a better understanding of what constitutes consumers' purchase intention of genetically modified foods in Senegal.

iv. To build empirical model on the relationship between attitudes and intentions to purchase genetically modified foods in Senegal

v. To investigate the demographical factors that inhibit consumers' willingness to use genetically modified foods in Senegal

**1.4 Research Questions**

To achieve these objectives, the study seeks to answer the following questions;

Question 1: Which factors influence consumers' willingness to purchase genetically modified foods in Senegal?

Question 2: Does attitude mediate consumers' purchase intention of genetically modified foods in Senegal?

Question 3: Which demographical characteristics influence consumers' purchase intention of genetically modified foods in Senegal?



**1.5 The significance of the study**

The significance of this thesis work is to help policymakers and industry players understand the importance of consumers' attitudes and purchase intention and how it affects genetically modified foods consumption in Senegal in the quest of fighting hunger and poverty in Senegal. It will enable policymakers to be well informed in making prudent and well informed policies to improve the intake of genetically modified foods in finding an antidote to hunger challenges. Consequently this study

1. Investigating Consumer attitudes and perceptions helps policymakers in achieving higher acceptance and proliferation of genetically modified foods, it also helps in decreasing the resistance, abstinence, product emotional management, and also helps in increasing their satisfaction and trust in genetically modified foods, hence the importance of this study.
2. This study adds on to the growing body of literature review on the factors influencing of the purchase intention of genetically modified foods among residents in Senegal..

3. This study acts as a guide to future studies in the purchase intention of genetically modified foods among residents in Senegal..

4. The study additionally gives an overall overview on the impacts attitudes, knowledge, health and safety concerns in the purchase intention of genetically modified foods among residents in Senegal.
5. The results of this study can be used by both policy makers and employees to implement and follow ways which have been identified to be more effective in increasing the purchase of genetically modified foods.
6. Moreover, the researcher based on the findings of this study has made concrete recommendations for the acceptance and proliferation of genetically modified Foods.

**1.6 Rationale and Justification of the research**

Genetically modified foods play an integral role in ending hunger and food security challenges worldwide. However, its success and, to a considerable extent, its failure primarily rest with the final consumer of genetically modified foods. Therefore, investigating the underlying factors that motivate or obstruct consumers from patronizing genetically modified foods is instrumental in informing viable decision making, improving the marketing of such products, and correcting erroneous impressions that consumers may hold concerning genetically modified foods. Research in the African setting, as well as in the senegalese setting surprisingly low and that researcher is of the view that this study will go a long to serve as a benchmark or gate opener for the proliferation of studies on GM foods in Africa. There is a lack of comprehensive study in this matter despite some research that have been carried out in this theme.

**1.7 Scope of the study**

The current study intend to investigate the underlying factors accounting for what motivate or obstruct consumers from patronizing genetically modified foods among residents and consumers of Senegal. Put in simple terms, the main purpose of this study is to know the key
determinants of the purchase intention of genetically modified foods of Senegalese consumers. Research is lacking in terms of understanding what constitute genetically modified food adoption especially in Senegal.

# Chapter 2：LITERATURE REVIEW

## 2.1 Attitudes towards GMO foods

The insight into consumer attitudes toward GM food proposes that attitudes are generally determined by considering the perceived dangers and advantages of both the method and the product (Tanius and Seng, 2015). Despite these factors, technological advancements (Siegrist and Hartmann, 2020) and societal changes are likely to have an impact on consumer attitudes toward risk and their choice of risk relievers (Falck-Zepeda and Gouse, 2017; Paarlberg, 2015; Siegrist and Hartmann, 2020). According to Fernbach et al. (2019), the role of scientists and communication specialists is crucial in informing the general public about GM foods and changing attitudes about their acceptance in the future. The perceived high risks and low benefits of GM foods are believed to contribute to negative attitudes and lack of acceptance as food options (Siegrist, 2021). In contrast, opposition to GM foods often arises from a lack of knowledge and a high level of self-confidence, while knowledge on GM foods leads to a more positive attitude, therefore a greater prospect of its acceptance (Landrum and Hallman, 2017). Boase et al., (2017) found that the psychological approach of the consumer is based on the idea that risk communication can change prior beliefs, attitudes, and knowledge about how things work, by revising errors, shifting importance, and addressing issues because self-assessed knowledge is a strong predictor of attitudes, and people tend to be poor judges of how much they know. Ali et al. (2021), Cudjoe et al. (2020) and Liu et al. (2018) report that the attitudes of consumers as direct purchasers of GM foods tend to be essential to the decision-making process by both producers and policymakers. Zhang et al., (2018) indicated that a significant portion of farmers in Asia's agricultural sector are not only as users of GM seeds and producers of GM goods, but also consumers of GM foods. In examining the defiance towards genetically modified foods, consumer purchase behavior is used as a starting point and rates of acceptance or rejection of genetically modified foods are explored. From the above elaborated arguments, this study posits that;

**Hypothesis 1:** Attitude positively affects the purchase intention of genetically modified foods.

**2.2 Subjective norms**

This refers to the belief about whether most people approve or disapprove of
the behavior. It relates to a person's beliefs about whether peers, family, friends and people of importance to the person think he or she should engage in the behavior. According to Ajzen, (1985) , subjective norm is the perceived social pressure to perform or not to perform a particular behavior. There is extensive evidence that subjective norms play an important role in environmentally responsible behavior (Mangafić et al., 2017). The social norm describes the degree to which individuals' decisions are influenced by their family members and other individuals. Consumers are more likely to purchase organic food if they believe that the people most valuable the most to them believe that genetically modified foods are good. In contrast, if consumers feel that their close relatives believe organic food is inferior to conventional food, then they are less likely to consume organic food. Zhu & Sarkis, (2016) suggest that despite weak attitudes toward sustainable dairy products, people may purchase sustainable dairy products if they wish to comply with others. However, Tarkiainen & Sundqvist, (2005) discovered a strong positive relationship between attitudes toward organic food and subjective norm rather than a significant direct relationship between subjective norm and desire to purchase. Teng, C. C., & Wang, (2015) found that customer decisions to buy organic food are highly influenced by both views regarding organic food and the subjective norm. It is possible that social norms indirectly affect behavioral intentions through their impact on attitude since consumers rely on subjective norm to determine not only if a certain behavior is acceptable or wrong but also whether it is helpful from a behavioral dimension. Consequently, this study from the standpoint of the arguments above posit that :

**Hypothesis 2:** Subjective norms positively affect the purchase intention of genetically modified foods

**Hypothesis 2.1:** Subjective norms positively affect attitude in the context of genetically modified foods.

**Hypothesis 2.2:** Subjective norms negatively affect risk and safety concerns in the context of genetically modified foods

### 2.3 Risk and safety concerns

The term of "risk perception" is normally defined as people's ability to understand hazards and hazard-related choices, for example, in relation to acceptability of institutional risk mitigation measures, or adoption of self-protective behaviors (Fischhoff, 2019). Risk and safety concerns have drawn attention as a construct in psychological study because they affect decision-making and can change technology adoption (Featherman et al., 2021). Therefore, health risk is the potential for unanticipated negative results and impacts to occur when consumers or users utilize a good or service (White and Sintov, 2017). In other words, any situation, activity, or violation that creates a significant risk of property loss, personal injury, or environmental impact raises safety concerns. According to FAO (2015), food safety is of interest in this context, as there is some evidence suggesting that food risks are perceived differently from non-food risks. It should be noted that it is impossible to completely avoid all food risks, and that food has cultural, symbolic, familial, and religious connotations that must be considered when developing risk messages.

Previous research findings suggest that consumers do not prioritize risk mitigation in themselves; despite this concern for risk mitigation, it is also important to consider consumer behavior when it comes to food preparation, as hygienic food preparation techniques could potentially eliminate many food safety risks (Fischer and Frewer, 2009; Frewer et al., 2016). From the perspective of public health, it is useful to set food safety objectives at the point of consumption, as the least controllable part of the food chain is within the domestic environment. However, public health is ultimately contingent on the adopted safety level of food preparation practices by the consumer. Food safety objectives may not be met when food is stored improperly, prepared, or cross-contaminated, leading to illness. It is, however, difficult, if not impossible, to legislate consumer behavior regarding food safety. It has been pointed out by Nauta et al., (2008) that in order to improve public health, effective information interventions must be implemented since food safety is least controlled at home, setting food safety objectives at the point of consumption is a useful measure from a public health perspective. Consequently, this study, from the standpoint of the arguments above, posits that :

**Hypothesis 3:** Risk and safety concerns negatively affect the purchase intention of genetically modified foods

**Hypothesis 3.1:** Risk and safety concerns negatively affect attitudes in the context of genetically modified foods.

### 2.4 Knowledge of GMO's

According to previous research (Hakim et al., 2020; Zhao et al., 2019), the concerns about the quality of food we eat are widespread among consumers, particularly in the developed world. Rather than purchasing conventionally produced alternatives, consumers choose GM products because they perceive that genetically modified products are safer, healthier, and more environmentally friendly and a consumer's knowledge is influenced by the type and quality of information they are provided with (Pratiwi, 2018; Xu et al., 2020b). Magnusson & Koivisto Hursti, (2020) point out that an essential component of enhancing knowledge is advertising, quality packaging, labeling, and certification. According to Boccia et al., (2018) consumer knowledge and awareness determines whether consumers will choose the products, as well as whether they will pay a premium or low price for them, so they are important factors to consider when determining the demand for the products. In addition to these factors, most of the consumers expressed their skepticism about the pureness of the product because there is no mechanism that distinguishes organic and inorganic ingredients (Kushwah et al., 2019). Nonetheless, consumers have more concern about the foods they consume daily due to their ignorance of the chemical components of GM foods and the severe health consequences they may cause. To develop and implement food safety policies and effective risk communication, evaluating consumer knowledge, judgments, and practices are very important (Hakim et al., 2020) because consumer concerns about food safety have increased due to intense media attention and growing general awareness of the relationship between diet and health (Cui and Shoemaker, 2018; Wunderlich and Gatto, 2015). These concerns have caused considerable changes in their food buying and consumption behaviors, which are yet to be comprehensively investigated. Consumption choices are a set of diverse factors such as sensorial, social, cognitive , situational, cultural, and demographic characteristics; some studies (Frewer et al., 2013) offer shreds of evidence that indicates that knowledge about GM food cannot positively affect consumers' acceptance (Kikulwe et al., 2011). Paarlberg (2015), reports that the problem lies in the fact that some consumers believe agricultural products should be grown organically and food supply should refrain from adding chemicals to food due to the adverse environmental impacts

and serious health threats these chemicals pose (Botha and Viljoen, 2009). Other studies claim that personal values and ethics deeply offset consumers' risks and benefits perception (Ali et al., 2021; Qian, L., Yin et al., 2017; White and Sintov, 2017). Hasnah H, (2016) reported that cultural beliefs are shaped by ethical principles, concerns regarding food security, climate change and an increase in environmental regulations, which influence their perception of the acceptability of genetically modified food. Consequently, this study, from the standpoint of the arguments above, it is posited that :

**Hypothesis 4:** Knowledge positively affects the purchase intention of genetically modified foods

**Hypothesis 4.1:** Knowledge positively affects attitude in the context of genetically modified foods.

**Hypothesis 4.2:** Knowledge positively affects risk and safety concerns in the context of genetically modified foods

**2.5 Consumer purchase intention**

Several factors may drive consumers decision to consume GM foods. In the findings of Kushwah et al., (2019), the price of a product is a key factor that consumers consider when making a purchase decision. It is possible for consumers to accept higher prices for some products, such as organic foods, if the prices are perceived as acceptable. Da Cunha et al., (2019) indicate that reducing the price of GM foods might encourage consumers to purchase them. Therefore, production and marketing strategies are determined by consumer beliefs, attitudes, responses to GM grown products, and the willingness of consumers to pay an affordable price for GM foods (Chevalier and Kashyap, 2019). It is, however, a complex process, which is determined by factors such as the market environment and policies as well as quality production, certification and infrastructure. Huang et al., (2006) revealed that a consumer's decision-making regarding GM foods should also be understood in order to help promote their consumption. A growing number of people are willing to consume GM food and pay a lower price because of food shortages Ludbrook, (2019) which is driven by the organic market. Based on consumer behavior theory (Han and Stoel, 2017) consumers are free to make their own decisions in balancing marginal health utility with marginal price. Researchers found that consumers check food labels when making a purchase, but are mainly interested in the component value of the products over

other aspects (Hakim et al., 2020; Piton et al., 2020). Various factors have been identified as influencing consumer intentions toward buying or consuming GM food, such as trust, attitudes toward GM food, and perceptions of their risks and benefits (Xu et al., 2020a). Food derived from genetically modified organisms has a higher risk perception if social trust is low. Individuals who spend less on food, regardless of whether they're Genetically Modified, usually possess low levels of social trust and tend to perceive GM foods to be higher quality, which explains the positive correlations of their willingness to purchase a product.

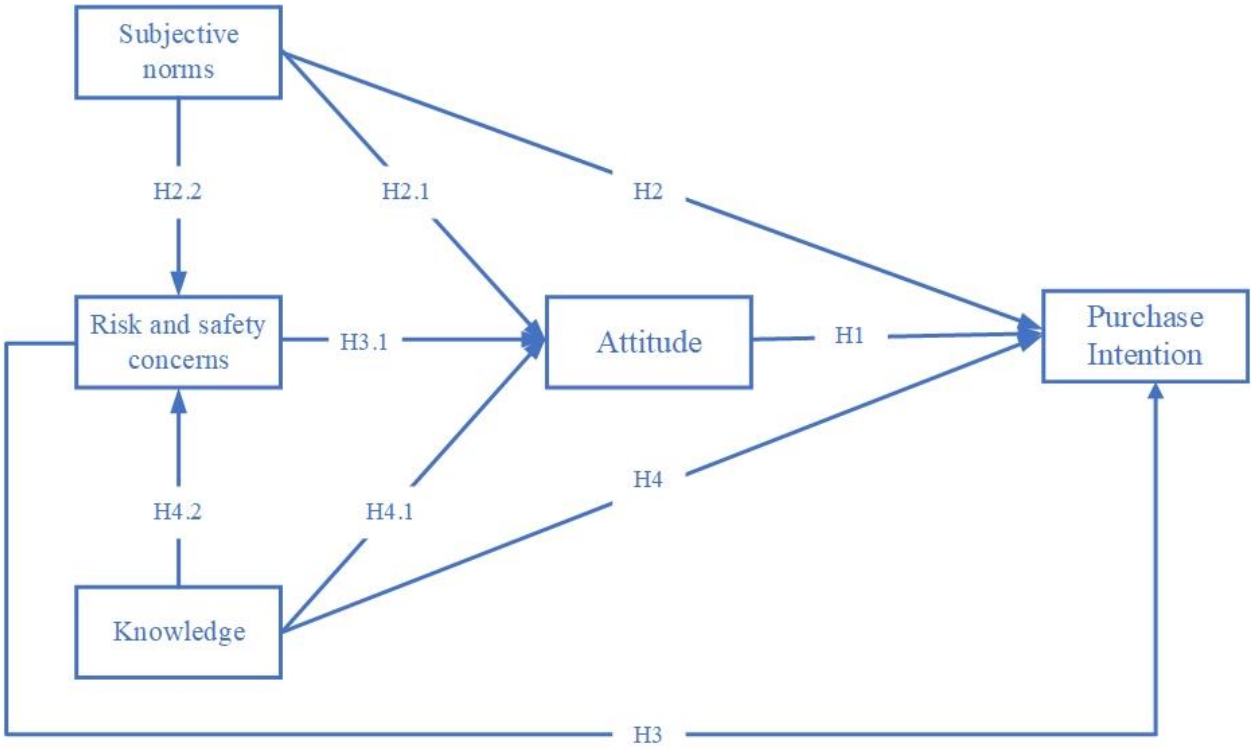



Figure 2-1: The conceptual framework for the current study

**2.6 Demographic Influencing Factors**

Global food insecurity is one of humanity's greatest challenges in the 21st Century. In recent years, consumers have become more aware of the harmful effects of chemicals present in their daily food. The right to food is considered a universal human right protected by international law. The right to food requires that all people have access to adequate nutrition. Olynk Widmar et al., (2017) found that consumer attitudes towards genetically modified food are mainly focused on the influence level of knowledge and socio-demographic status. Some studies have found that socio-demographic status, including gender, age and level of education influence consumer knowledge and attitudes concerning GM foods (Aliasgharzadeh et al., 2022; Şanlıer and Ceyhun

Sezgin, 2020; Vecchione et al., 2015). Furthermore, some countries also take cultural, religious, and ethical aspects into account (Karalis et al., 2020). Consumer perceptions may differ due to different environmental and economic conditions, traditions, and rapid changes in market structure. In the findings of Antonopoulou et al., (2009), consumers are opposed to genetically modified foods because they believe it will disadvantage developing economies and shift trade benefits against them. Lizotte (2016) has a consistent finding that higher educational attainment is associated with higher acceptance of GM foods. Therefore, in addition to facilitating identification between conventional products and products containing GM ingredients, the label allows consumers to identify products marked with ethical, cultural, or religious connotations.

# Chapter 3：DATA AND METHODOLOGY

## 3.1 Introduction

Methodology is an arm in the research approach that transforms ontological and epistemological philosophies into procedures that show how a study will be conducted. Thus, methods are elements used in the gathering and analysis of data (Kumar, 2019). The chapter also gives the concepts of the different quantitative and qualitative data analysis procedures and specifies the methodological stance employed to realize the aim and objectives of this study.

The chapter begins with a description of the study area. The research design and population are also discussed. This chapter also presents the design and administration of the choice experiment survey. The chapter ends with a description of the method of data collection.

## 3.2 Type of research

Research can be divided into three ways of research. This depends on the research topic and problem statement that research intends to find answers. Therefore, it is important to look at the purpose of this study. The purpose of research can be exploratory, descriptive, or explanatory. These categories are not mutually exclusive; they can overlap as a matter of emphasis. As any research study will change and develop over time, more than one purpose may be identified (Saunders, M, Lewis, P, & Thornhill, 2007). Explorable research is valuable for finding out what is happening and particularly to clarify the understanding of a problem.

Descriptive research seeks to provide an accurate description of observations of phenomena. Explanatory research establishes causal relationships between variables (Saunders, M, Lewis, P, & Thornhill, 2007.). This thesis makes use of two types of research; Exploratory and descriptive research. First, the thesis has an explanatory purpose. ‘The emphasis here is on studying a situation or a problem in order to explain the relationships between the variables’ (Saunders, M, Lewis, P, &Thornhill, n.d.). Furthermore, the key variables and key relationships are defined.

## 3.3 Study Area

Located on the Atlantic Ocean's coast, the Republic of Senegal is a nation in West Africa. Mauritania, Mali, Guinea, and Guinea-Bissau all border Senegal on its northern, eastern, south-east, and south-west sides, respectively. The Gambia is a small nation located on a tiny sliver of land bordered by the Gambia River, which divides Senegal's Casamance area in the

south from the rest of the nation. Senegal nearly surrounds the Gambia. Together with Cape Verde, Senegal has a marine boundary. Dakar is the governmental and commercial centre of Senegal. Nearly 17 million people live in Senegal, which has a land area of nearly 197,000 square kilometres (76,000 square miles).

Only a small portion of the population communicates in French, despite it being the official language. Wolof is the most widely spoken language of Senegal, where it coexists with French as the national language with 80% of the population speaking it as a first or second language. The Wolof, Fula, and Serer peoples make up the majority of the nation's ethnic and linguistic communities, similar to other post-colonial African governments. The majority of Senegalese are Muslims.

Senegal is divided into 14 regions, each of which is run by a Conseil Régional that is chosen at the arrondissement level based on population weight. Senegal is further divided into 45 departments, 103 arrondissements, 14 regions, 110 communes, and 320 communautés rurales, as well as collectivités locals (which elect administrative officers). On September 10, 2008, the Kaolack area of Kaffrine, the Tambacounda region of Kédougou, and the Kolda region of Sédhiou were divided from the Kaolack region. All regions have their names derived from respective capital cities to this day.

With an abundance of iron, zircon, gas, gold, phosphates, and recent oil finds, Senegal's economy is mostly driven by mining, construction, tourism, fishing, and agriculture, which are also the main sources of employment in rural regions. Fish, phosphates, groundnuts, tourism, and services are the main sources of foreign exchange for Senegal's economy. Senegal's agricultural industry is one of the country's most important economic sectors, making it particularly susceptible to changes in global commodity prices as well as environmental factors like variations in rainfall and climate.

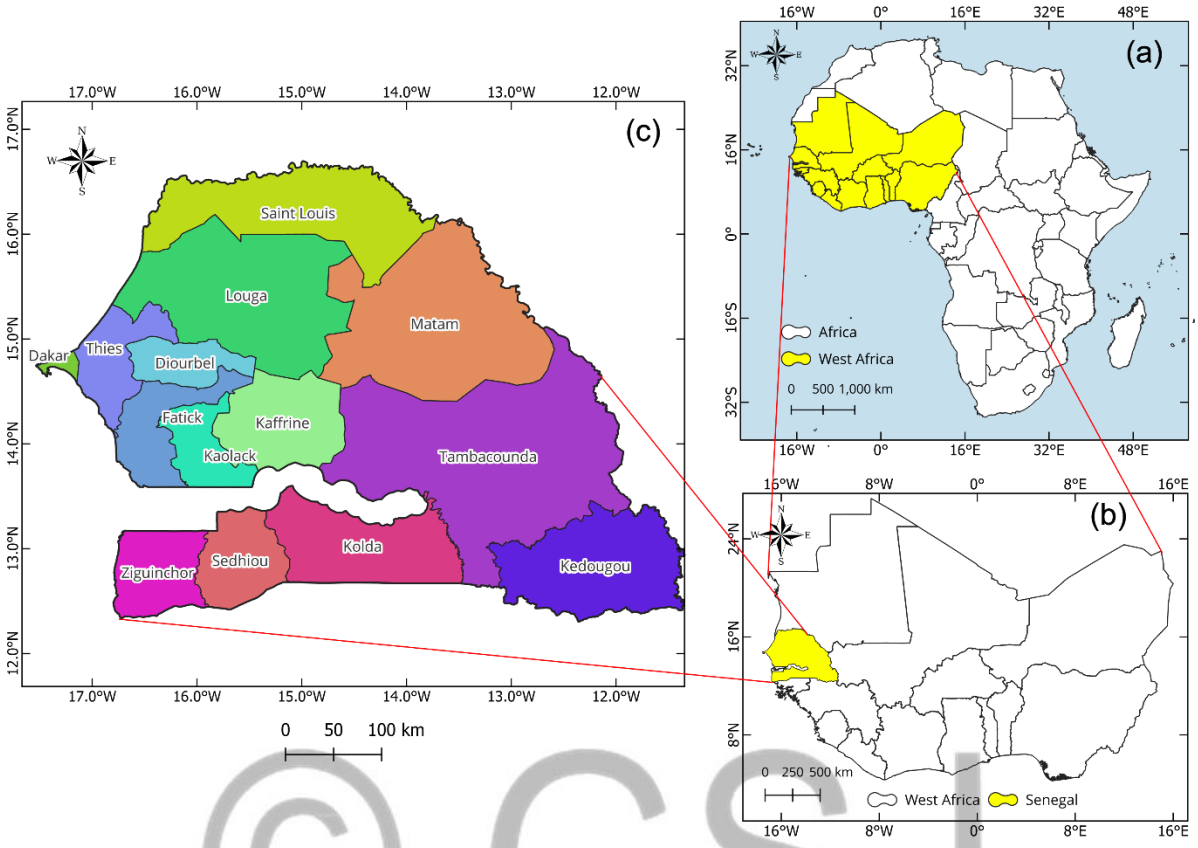



**Fig. 2.2** Map of Africa; Location of Senegal in the West Africa subregion Map of Senegal with administrative regions

### 3.3.1 Agriculture and food production in Senegal

Despite being located in the Sahel region, which is prone to drought, Senegal's economy is dominated by agriculture. Considering that only 5% of the land is irrigated, Senegal still relies on agriculture supported by rainfall. 75% of the workforce is employed in agriculture. Even though there is a very wide range of agricultural production, the bulk of farmers grow food for their own purposes. Senegal's main food crops include millet, rice, corn, and sorghum. Drought conditions and pest threats from birds, fruit flies, white flies, locusts, and fruit flies affect production. Furthermore, Senegal's agriculture economy is predicted to suffer greatly from the consequences of climate change due to harsh weather conditions including drought and elevated temperatures.

Senegal is a net importer of food, especially rice, which accounts for about 75% of imports of cereal. Numerous fruits and vegetables are farmed for both domestic and international markets, along with key cash crops including cotton, sugarcane, and peanuts. Gum Arabic exports reached

a record-high $280 million in 2006, making it by far the most important agricultural export. The main cash-crop vegetables in Senegal are green beans, industrial tomatoes, cherry tomatoes, melon, and mango. Although the Casamance region—which the Gambia separates from the rest of Senegal—produces significant amounts of crops, it lacks the infrastructure and transportation connections to increase its productivity.

Low output and scant investment are impeding the sector. If properly managed, the great and diverse potential output of fauna and forest products could help underprivileged farmers in rural areas. Although a locust invasion in 2004 had an impact on the agricultural industry, it has since rebounded and gross agricultural production has expanded rapidly.

### 3.4 Data Collection

Data for this study will be obtained from a primary data source. Primary data will be sourced from questionnaires given to random residents from different areas and regions within Senegal. The questionnaires were well-structured and consisted of three parts, the demographic dimension, purchase intentions (Dependent Variable) and Attitudes, subjective norms, knowledge, health and safety concerns (Independent Variables). The questionnaires were distributed randomly throughout Senegal electronically and adopted from prevailing literature.

The dependent variable in this thesis work is purchase intentions, while the independent variables are Attitudes, subjective norms, knowledge, health and safety concerns

### 3.5 Research Approach

The researcher used a quantitative approach to evaluate objective data consisting of numbers with the aim of achieving high levels of reliability in terms of data analysis. The quantitative method was used in this research so that relevant and accurate information could be obtained.

Quantitative research, on the other hand, is an inquiry into an identified problem, based on testing a theory measured with numbers and analyzed using statistical techniques and which is also, a means to examine social phenomena. In line with the quantitative approach decided upon, a structured questionnaire was also administered to all the target respondents.

According to Dane (2000), quantitative methods include reviewing a substantial amount of literature in order to provide direction for the research questions. Quantitative research is based on attempts to apply the methods to facilitate data analysis. Its strength is that it provides data that are easily quantifiable and based on reasonably objective evidence that lend itself to rigorous

analysis. Moreover, the result can be reduced to numerical statistics and interpreted in short statements (Saunders et al., 2003).

### 3.6 Research Design

Research design deals with planning the strategy or overall design of the study. This study uses survey research design. According to Ogutu (2012) a survey research method is probably the best method available to social scientists who are interested in collecting original data for the purposes of describing a population which is too large to observe directly. The way of take on different quantitative values is called a variable. In this survey, independent variables were selected rather than observations and analyses of relationships among the variables carried out in their natural settings. Sakaran (2003) posits, the survey method allows the collection of significant amount of data in an economical and efficient manner.

In addition to these, other scholars agree that a good design is flexible, appropriate, efficient, smallest experimental error, minimizes bias and maximizes the reliability of the data collected and analyzed. The survey design allowed investigation of possible relationships between variables. In this way the survey design was more appropriate for the study because it enabled data collection from broader category as well as comparisons between variables.



According to McBurney (2001), to attain the research objectives the researcher should employ a quantitative design that enabled the research to be executed as efficiently as possible yield maximum information with minimal expenditure of effort, time and money. The intention of using this approach is to evaluate objective data consisting of numbers with the aim of achieving high levels of reliability in terms of data analysis

### 3.7 Sample Size

According Kearl, Korte, Stites, Baker, and Remediation (1994) a sample is the chosen set of elements or units drawn from a larger whole of all the elements or the population which a research seeks to make conclusions. The selection of the sample size is of prime importance if the researcher indeed wants to ensure representativeness of the population under scrutiny. Marshall and Rossman (2014) points out that, for a sample size to be considered as optimum for a study or research, it should fulfill some basic assumptions and requirements such as: representativeness, efficiency, flexibility and consistency. Even though, it has been opined in

earlier discussions and commentaries that the best method of determining a sample size is by the use of confidence interval approach, Bradley (2007) argues that researchers on what is feasible within time or money available decide many sample sizes for research studies.

The sample size for this study was made up of 641 respondents residing in the various districts and regions of Senegal at the time of conducting the survey. All the 641 were in the best position to provide the information that this research needed. In order for the sample to be a clear representation of the population, the researcher concluded on 642 respondents after examining sample sizes of other similar studies from literature.

### 3.8 Methodology

#### 3.8.1 Questionnaires/Survey

A questionnaire is an important research tool used to collect information (Ainsworth, 2020). The questionnaire consists of serial questions that address separates issues that addresses the main objective of the study (Tischler, 2016) . The data collection tool that was used in this study was a structured questionnaire. A self-administered questionnaire was made up of predominantly closed-ended questions with a few open-ended questions. The study adopted an internet-administered questionnaire because it is simpler, faster, and cheaper source of soliciting information for subsequent processing. Such questionnaires can be administered to many respondents simultaneously. Respondents only need to be connected to the internet, read the questions and fills in the answers by themselves without any form of influence whatsoever.

The questionnaire was designed based on the literature review but not adopted from any study. The items in the questionnaire are based on the research objectives and reviewed literature and being designed to capture all the relevant information regarding the proposed research topic and the proposed hypothesis using a variety of question types.

#### 3.8.2 Likert Scale

Likert Scale is a measurement scale developed by Likert in 1932. A closed-ended, forced-choice scale called a Likert scale is used in surveys to provide a range of responses that go from one extreme to another. For instance, a scale with five options might contain less extreme options in the middle three points, with "strongly agree" at one end of the scale and "strongly disagree" at the other. It consists of a statement or a question, then five or seven answer statements. The

respondent chooses the option that best expresses the respondent's opinion on the statement or question.

Likert scales are excellent for capturing respondents' levels of agreement or sentiments regarding the topic more nuancedly because they give respondents various alternative answers. Nevertheless, because of weariness, social desirability, a propensity for an extreme response, or other demand features, Likert scales are vulnerable to response bias, in which respondents either agree or disagree with all of the assertions.

Likert scales are utilized frequently in survey research and in various social science disciplines like marketing or psychology. This study adopted a five-point Likert scale, and for the purposes of analysis, a numerical score is attached to each category, as seen in the table below.

**Table** 3-1:Tabulation of the Likert scale used in this study

| **Categorized measure** | **Numerical Value** |
|---|---|
| Strongly Disagree | 1 |
| Disagree | 2 |
| Neutral | 3 |
| Agree | 4 |
| Strongly agree | 5 |



### 3.8.3 Population and Sampling Method

A population is the full group of potential participants to whom the researcher wants to conduct the research for the study (Saunders, et al., 2003). The target population is mainly composed of residents and consumers within Senegal as at the time this study was undertaken. A sample size is sub set of the population drawn to represent the entire population or any combination of sampling units that does not include the entire set of sampling units that has been defined as the population (Garson, 2012). Deliberate sampling was used to obtain the sample size. Deliberate sampling is also known as purposive or non-probability sampling. This sampling method involves purposive or deliberate selection of particular units of the universe for constituting a sample which represents the universe which is from the target population to distribute the

questioner. When population elements are selected for inclusion in the sample based on the ease of access, it can be called convenience sampling (Kothari 2004).

In this thesis work that the author decided to solicit data from the general populace in Senegal to arrive at a meaningful conclusion. A simple random sampling technique is used for this purpose, and 500 questionnaires were sent out randomly through online means such, Emails, and WhatsApp and Google Forms.

### 3.8.4 Variables and Measurement Procedures

There are two types of variables; dependent and independent variables. A dependent variable change in response to changes in other variables. An independent variable causes change in a dependent variable. For this study, dependent variables were purchase intentions, whereas the independent mediating variables were Attitudes, subjective norms, knowledge, health and safety concerns.

### 3.8.5 Ethical Consideration



Ethical considerations were strongly upheld and followed to ensure the sanctity and authenticity of this research. This study ensured that:

- The consent of respondents was sought for, and that only those who were willing to participate were asked to fill the survey questions and subsequently included in the research.
- No respondents' identity will be made known during the study or in any publication, and the information will be used for research purposes only.
- Those respondents who were willing to complete the questionnaire were not be required to enter their names or to reveal any form of identity on the questionnaire and to ensure the anonymity of the respondents
- The respondent's right to recede from the research at any time was observed without any favoritism or another negative outcome.
- Participation was voluntary, and all data was managed confidentially

## 3.9 Data Analyses

Data collected was subject to both descriptive and inferential statistics. Data on the socio-economic characteristics of respondents and consumer purchase intentions of genetically

modified foods was coded, summarized, and descriptive statistics (mean scores, frequency counts, and percentages) were generated using Statistical Package for Social Science (SPSS) for analysis and interpretation of the information. Hypothetical statements were estimated, and analysis was done using structural equation modeling. The structural equation modeling used in this study was done using SmartPLS structural equation modeling software package. The software package uses the partial least square paradigm of structural equation modeling.

### 3.10 Structural Equation Modelling (SEM Model)

Structural Equation modeling as a structural analytical technique remains widely used in intention and behavioral studies in areas including waste sorting behavior (Cudjoe and Han, 2021; Cui, Y.F.; Bluemling, 2018; Hu et al., 2018; Katebi et al., 2022; Nketiah et al., 2022a; Ramayah et al., 2012; Wan et al., 2017), electric vehicle usage intention and behavior (Bailey and Axsen, 2015; Dimitropoulos et al., 2013; Heffner et al., 2007; Jaiswal et al., 2022; Noppers et al., 2015; X. Zhang et al., 2018). An expansion of factor analysis, structural equation modeling is a technique used to test the substantive theory using data from empirical studies (Chen and Chang, 2012; Roh et al., 2022; Verma et al., 2019). For instance, a theory might contend that specific mental characteristics do not influence other characteristics and that particular variables do not load on particular characteristics, and that the hypothesis can be tested using structural equation modelling (Gao et al., 2017; Wang et al., 2018, 2019, 2016; S. Wang et al., 2020). A system of linear equations between various observable and construct-based unobservable variables makes up a structural equation model (SEM). A structural element that connects the constructs to one another (often, this part expresses the endogenous or dependent constructs as linear functions of the exogenous or independent constructs) and a measurement part that connects the constructions to observed measurements make up an SEM. Comparable to a confirmatory factor analysis model is the second section. Visual representations of the SEMs are possible; these representations are known as path diagrams. Following that, conclusions are formed from a data set and the whole model is estimated.

When Liu et al., (2021) tested their SIB model using MPlus, they used structural equation modelling (SEM) approaches. A collection of multivariate techniques called SEM are used to examine whether models fit data in a confirmatory rather than exploratory manner (Bryne,

2010). SEM provides three key advantages over conventional multivariate techniques: (1) explicit assessment of measurement error; (2) estimation of latent (unobserved) variables via observable variables; and (3) model testing where a structure can be imposed and appraised as to match the data (Ceglarz et al., 2017; Dixon et al., 2020; Obuobi et al., 2022).

SEM models estimate these error variance parameters for both independent and dependent variables, but most multivariate techniques accidentally disregard measurement error by not explicitly addressing it (Byrne, 2010). Additionally, SEM allows for the estimation of latent variables from observed variables; however, measurement error is taken into consideration when creating composites (Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, 2017; Henseler et al., 2015; Zhang et al., 2021). Finally, utilizing SEM as a conceptual or theoretical structure or model, completely developed models can be tested against the data and evaluated for the fit of the sample data. SEM is an advanced statistical approach that examines simple models with sample sizes of at least 200. Larger samples would be necessary to achieve statistical power for more complicated models. Those models are initially assessed for fit in SEM. Once fit is satisfactory, individual pathways can be assessed. To assess the model fit, four statistics were taken into consideration (Atombo et al., 2017; Wang et al., 2017). Values of the Tucker Lewis index (TLI), also known as the non-normed fit index, and the comparative fit index (CFI) were assessed, with values of 0.90 and higher indicating a satisfactory level of model fit (Weston and Gore, 2006). In addition, values of 0.08 or less were seen as suggestive of good model fit when evaluating the standardized root mean residual value (Bentler and Huang, 2014; Hu and Bentler, 1998; Savalei and Bentler, 2010).

### 3.11 Data Quality

Reliability and Validity help not only to establish the trustworthiness of any study but also to constitute the credibility of the research (Saunders, 2009). They are, therefore, a very important part of the measurement process of research. Neuman (2005) argued that once a concept has been operationalized by proposing a way to measure such a concept, the measurement device should be both valid and reliable.

#### 3.11.1 Reliability

Reliability refers to the consistency to attain the same results again using the research instrument

(Neuman, 2005; Peterson, 2001). Reliability assessment of the research instrument is very important because it determines the inconsistencies that exist in the items or questions used in the measurement of the results. (Neuman, 2005) stated that though reliability can be indirectly inferred by validity, the reverse is not true. Deducing from Neumann's argument, it could be stated that if a measure is valid, it is reliable; and if it is not reliable, it cannot be valid. However, if a measure is reliable, it cannot automatically infer validity even though it is a very good indicator of obtaining measurement validity. Measurement of the reliability (internal consistency) of the instrument can be done by computing the Cronbach's coefficient alpha for each variable. Cronbach's alpha is one of the most commonly used metrics used in evaluating the internal consistency reliability related to scores derived from a scale or set of questions.

### 3.11.2 Cronbach Alpha

To measure the reliability of the results obtained from the questionnaire, Cronbach Alpha is used. This measures the internal consistency of the questionnaire to determine how closely related a set of items are as a given group. This method is named after Lee Cronbach who developed the method in 1951. This method is used to assess the reliability or internal consistency in a group of questions set to answer given topics in a questionnaire. Reliability can be defined as the measure of how skillful a measure is in what is supposed to measure. Lack of reliability in a questionnaire may lead to misinformation and drawing wrong conclusions hence the essence of this method.

Additionally, this method equips us with the knowledge about the important of a certain variable. For example, if we remove a certain variable, we test the internal consistency of the item to see if it increases or decreases. If the Cronbach alpha decrease after removal of a certain variable, it implies that the variable is less important but if it increase, it signifies the significance of that variable in the item if we delete a given question. According to Cronbach, (1951) the higher the Alpha reliability score the higher the consistency in the questionnaire.

Table 3-2: The category of Cronbach alpha and their associated reliability level

| **Cronbach's alpha** | **Internal consistency** |
|---|---|
| $\alpha \geq 0.9$ | Excellent |
| $0.9 > \alpha \geq 0.8$ | Good |
| $0.8 > \alpha \geq 0.7$ | Acceptable |
| $0.7 > \alpha \geq 0.6$ | Questionable |
| $0.6 > \alpha \geq 0.5$ | Poor |
| $0.5 > \alpha$ | Unacceptable |

### 3.11.3 Validity

According to Neumann (2005), the researcher's primary concern for the study was measurement validity, which may be divided into four categories: face, content, criteria, and construct validities. The questions or items we chose for this study are valid on both a face-to-face and a threshold level. These items were mirrored from the questionnaire used by (Ajzen, 2002; Tonglet, Phillips, & Read, 2004), which had also been mirrored from earlier research.

When the test's instrument adequately covers the entire topic under investigation, content validity happens. Neuman (2005) asserts that content validity deals with the issue of whether a measure accurately captures a definition's entire content. This implicitly presupposes that the sample should be sufficiently broad and representative of the relevant target populations or audiences in order to fall within the permitted ranges associated with measurements of this kind. By evaluating more studies on electric car commuting, the researcher was able to ensure that the questions/items on each construct fully measured the notion that it was intended to test. If an instrument measures what it should under the model under examination, this is known as construct validity. There are two varieties: convergent and discriminant validities. For measurements with many indications, construct validity is required (Neuman, 2005).

### 3.12 Mediation Analysis

In mediation, we take into account a middle variable, referred to as the mediator, that aids in illuminating how or why an independent variable affects a result (Simsekoglu and Nayum, 2019; Tolstoy et al., 2022). It is frequently of considerable interest to identify and research the

mechanisms by which an intervention accomplishes its effects in the context of pro-environmental and sustainable behavior studies (Hayes and Preacher, 2010). In addition to improving our understanding of human pro-social behavior and intention mechanisms of purchasing, examining mediational processes that clarify how the constructs impact the study outcome may also enable us to uncover alternative, more effective proliferation options (Bagozzi and Yi, 1988; Hair et al., 2019a; Johnson et al., 1999).

The explanation of the mechanism by which an intervention affects a result through mediation takes into account both causal and temporal relationships (Golob, 2003; Livingston, 2004). Mediation analysis aids in providing a focus for future intervention research, enabling the development of more effective and efficient strategies for policymaking. Mediation analysis is most effective when carried out using a well-established and robust theory and in the proper context (Bryman, n.d.). Mediation analysis can be carried out using a fairly open-ended, flexible framework that structural equation modeling offers.

### 3.13 ANOVA analysis of demo-graphical characteristics

Analysis of Variance, also known as ANOVA is a statistical technique that divides observed variance data into various components for use in further testing (Lepp and Gibson, 2003). The ANOVA test is used by analysts to evaluate the impact of independent factors on the predictor variables in a regression analysis (Atombo et al., 2017; Fraune, 2015; Gifford and Nilsson, 2014; Huang and Ge, 2019). The current study use a one-way ANOVA to investigate the impact of demographical characteristics on the purchase intention of genetically modified foods in Senegal. The demographical characteristics used in this investigation were gender, age, income levels, educational level and community of residence.

# Chapter 4：RESULTS AND FINDINGS

## 4.0 Introduction

This section discusses systemically, the results and give out some discussion and compared the findings with the previous studies over the region. The researcher used a qualitative type of data collection by randomly sending out 800 questionnaires, but only 653 questionnaires were recovered. Therefore, the study used 641 as the sample data, and 11 questionnaires received that were inconsistent and had errors were excluded from the analysis. The descriptive analysis uses tables and percentages, while the structural analysis used structural equation modeling using the Smart partial least square modeling approach (SmartPLS-SEM) using version 3.3.3.9 to analyze the data. The descriptive portion of the data gathered was analyzed using the computer software-Statistical Package for Social Services (SPSS) statistic 25 package.

## 4.1 Demographic characteristics of the sampled population

In this study, the following demographic features were considered; Gender, age, marital status, occupation, type of community, income level, family size, and level of education. The descriptive aspect deals with the use of tables and histograms to show either the frequency of variables, their mean, and their percentage in terms of the sample size used. The variables used include gender, the age range of respondents, and marital status, among others. The proceeding sub-sections depict the frequency distribution of the 642 respondents mobilized for this study.

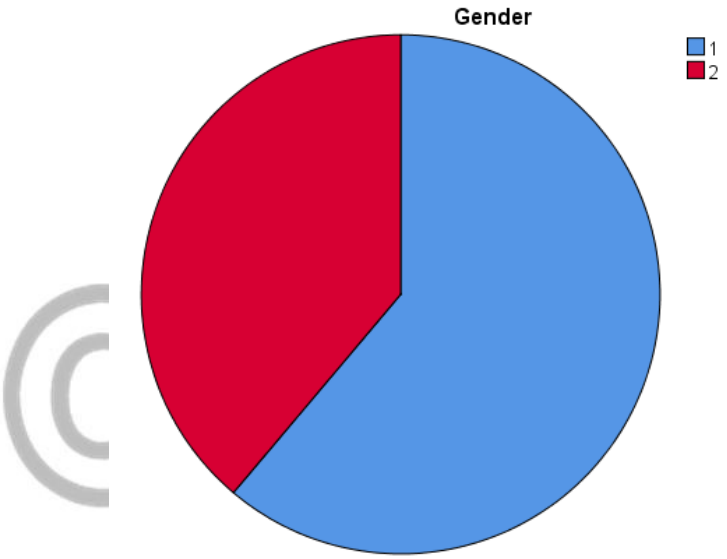
### 4.1.1 Gender

The demographical information obtained showed that the respondents of the survey did not split almost 50/50 by gender. Males constituted 61.2% translating into 392, with Females constituting 38.8%, also translating to 249, as tabularly captured in the table and represented in a pie chart diagram below:

Table 4-1 : Gender distribution of respondents

| Gender | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (Male) | 392 | 61.2 | 61.2 | 61.2 |
| | 2 (Female) | 249 | 38.8 | 38.8 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-1: Gender distribution of respondents



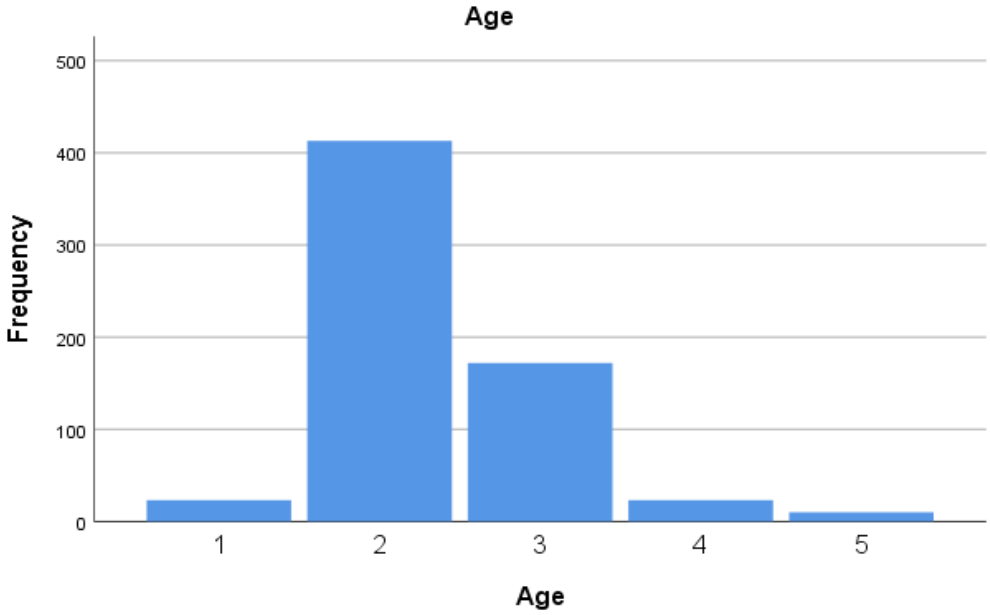

### 4.1.2 Age of Respondents

The age data obtained from the questionnaire respondents for the study are exhibited below. From the table and the bar chart below, it was realized that the age group 20-30 dominated the distribution, with 413 respondents constituting 64.4%, followed by the 31-40 age group, with 172 respondents also constituting 26.8%. Those between the age range of 41-50 years and those below 20 years of age were represented by 23 translating into 3.6% of the total respondents used in the study. Respondents above the age of 50 constituted 1.6% of the total respondents, which represents ten respondents.

Table 4-2:Age of Respondents

| Age | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (under 20 years) | 23 | 3.6 | 3.6 | 3.6 |
| | 2 (20-30 years) | 413 | 64.4 | 64.4 | 68.0 |
| | 3 (31-40 years) | 172 | 26.8 | 26.8 | 94.9 |
| | 4 (41-50 years) | 23 | 3.6 | 3.6 | 98.4 |
| | 5 (Above 50) | 10 | 1.6 | 1.6 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-2: Age distribution of respondents



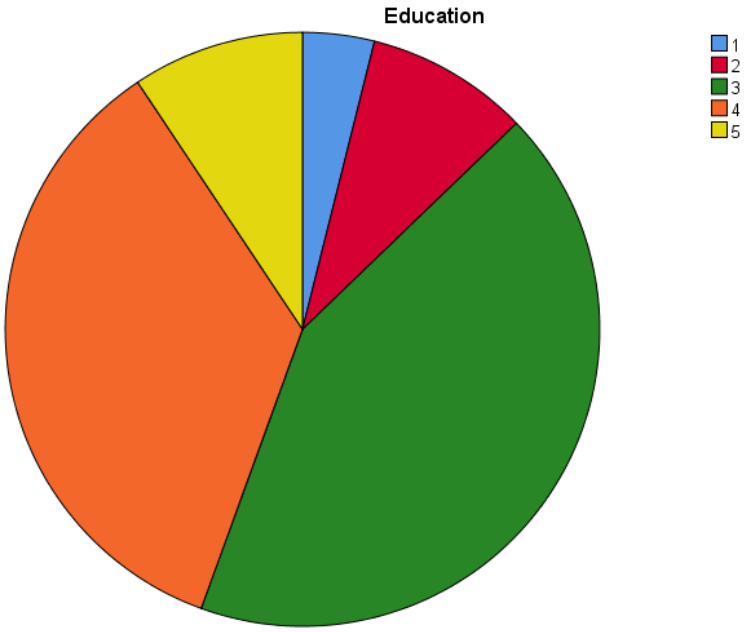

### 4.1.3 Educational Background of Respondents

Bachelor's and Master's levels of education were the two dominants among respondents. They constituted 42.7% and 35.1%, respectively, of the total respondents. High school respondents with only 3.9% and those with Ph.D. were 9.4 %. Those with junior college degrees represented 8.9% of the total respondents of the study.

Table 4-3:Educational Background of Respondents

| Education | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (High school and below) | 25 | 3.9 | 3.9 | 3.9 |
| | 2 (Junior college) | 57 | 8.9 | 8.9 | 12.8 |
| | 3 (Bachelor) | 274 | 42.7 | 42.7 | 55.5 |
| | 4 (Master) | 225 | 35.1 | 35.1 | 90.6 |
| | 5 (PhD) | 60 | 9.4 | 9.4 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-3: Educational level distribution of respondents



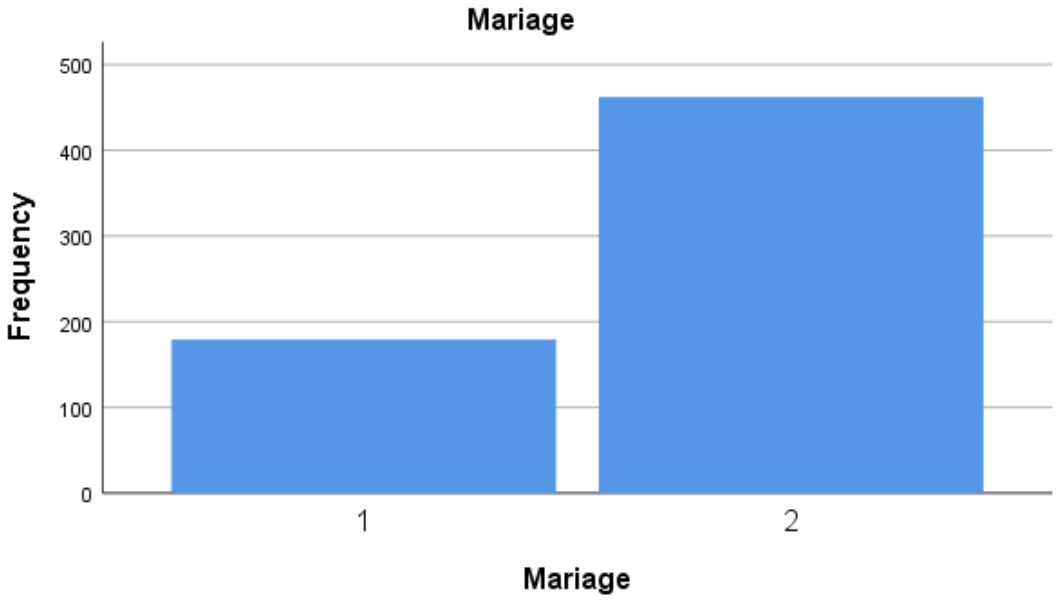

### 4.1.4 Marital Status of respondents

The demographical information obtained showed that most of the respondents to the survey were married. Married respondents constituted 72.1%, transcending into 462, with single employees constituting 27.9%, also translating into 179, as illustrated. None of the respondents did indicate that they are legally divorced.

Table 4-4:Marital Status of respondents

| Marriage | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (Single) | 179 | 27.9 | 27.9 | 27.9 |
| | 2 (Married) | 462 | 72.1 | 72.1 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-4: Marital status distribution of respondents




### 4.1.5 Occupation

Data from the respondents evidenced that students were in the majority, with 347 respondents representing 54.1%. Employees followed with 177 respondents translating into 27.6%. Employers were the least of the respondents, with 9.5% (61 respondents).

Table 4-5: Occupational distribution of respondents

| Occupation | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (Student) | 347 | 54.1 | 54.1 | 54.1 |
| | 2 (Employee) | 177 | 27.6 | 27.6 | 81.7 |
| | 3 (Employer) | 61 | 9.5 | 9.5 | 91.3 |
| | 4 (other) | 56 | 8.7 | 8.7 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-5: Occupational distribution of respondents

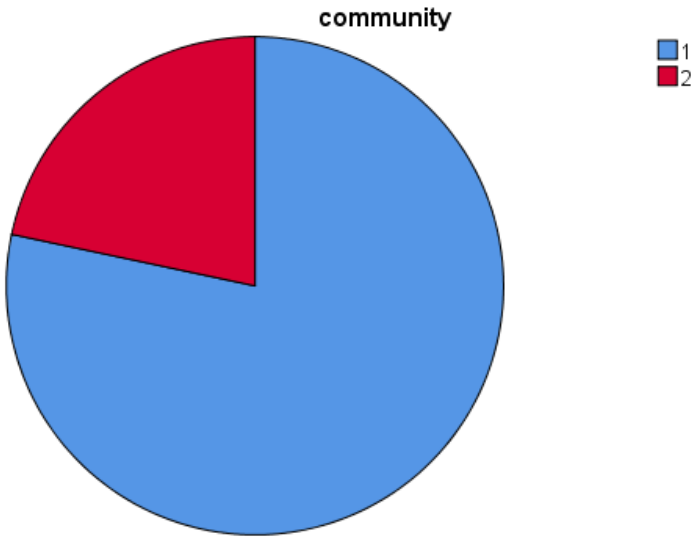

### 4.1.6 Type of residency

The results show that most of the sampled population resided in Senegal's urban areas. These respondents represented 78.3% of the sampled population. The remaining 21.7% of the respondents were living in the rural or suburban parts of Senegal.

Table 4-6:Type of community of residence of respondents

| Community | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1(Urban) | 502 | 78.3 | 78.3 | 78.3 |
| | 2 (Rural or suburban) | 139 | 21.7 | 21.7 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-5:Categorization of residency type of the sampled population.



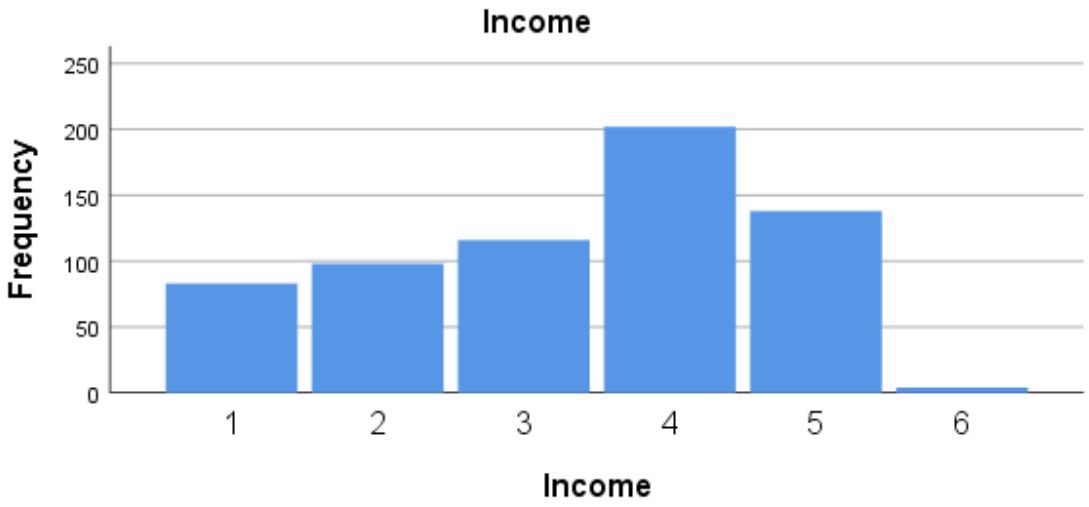

### 4.1.7 Income levels of Respondents

The income level obtained from the questionnaire respondents for the study are exhibited below. From the data, it was realized that those with income between 150,000 and 200,000 CFA francs dominated the distribution, with 202 respondents constituting 31.5%, followed by those above 200,000 CFA francs, with 138 respondents also constituting 21.5%. Those between 100,000 and 150,000 CFA francs were 116 in number, constituting 18.1% of the total respondents of the study. Respondents below 50,000 CFA francs constituted 12.9% of the total respondents, which represents 83 of the total respondents

Table 4-7: Income levels of respondents

| Income | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (Below 50,000 CFA) | 83 | 12.9 | 12.9 | 12.9 |
| | 2 (50,000 – 100,000 CFA) | 98 | 15.3 | 15.3 | 28.2 |
| | 3 (100,000 – 150,000CFA) | 116 | 18.1 | 18.1 | 46.3 |
| | 4 (150,000 – 200,000CFA) | 202 | 31.5 | 31.5 | 77.8 |
| | 5 (Above 200,000CFA) | 138 | 21.5 | 21.5 | 99.4 |
| | 6 (Not Applicable) | 4 | .6 | .6 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-7: Income levels of respondents.



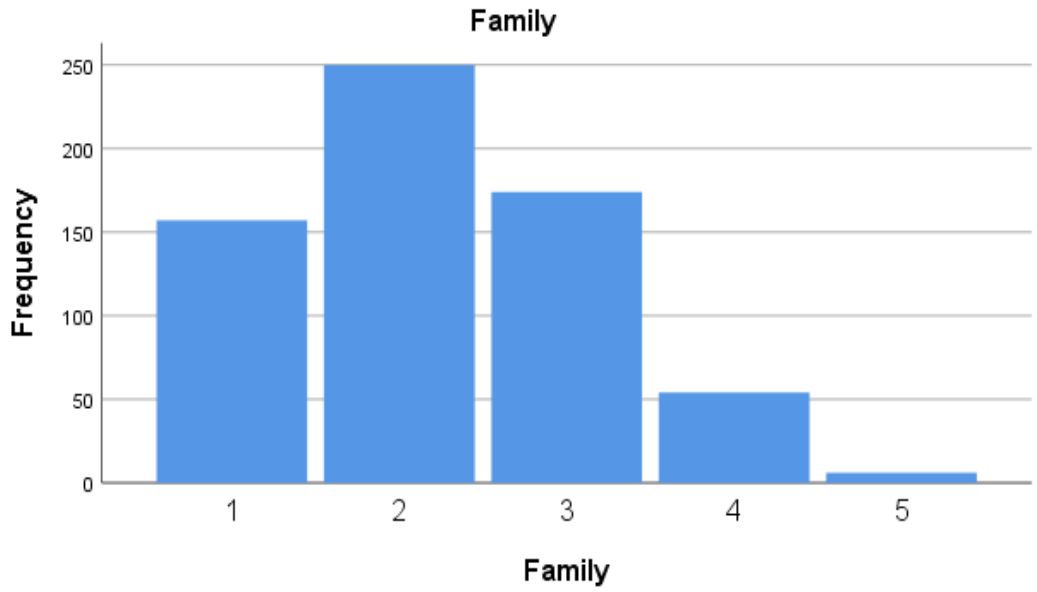

### 4.1.8 Family Size

Most of the sampled population had a family made up of 4 members who represented 39% of the total respondents. Those with 5 – 6 members in their immediate family were 174 representing 27.1%. Those with three members or fewer were 157 representing 24.5%. More so, those with more than six members in the immediate family were 54, representing 8.4% of the total respondents. The family distribution of respondents is illustrated below.

Table 4-8: Family levels of respondents

| Family | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 1 (3 members or less) | 157 | 24.5 | 24.5 | 24.5 |
| | 2 (4 members) | 250 | 39.0 | 39.0 | 63.5 |
| | 3 (5-6 members) | 174 | 27.1 | 27.1 | 90.6 |
| | 4 (more than 6 members) | 54 | 8.4 | 8.4 | 99.1 |
| | 5 (not applicable) | 6 | .9 | .9 | 100.0 |
| | Total | 641 | 100.0 | 100.0 | |

Figure 4-8: Family levels of respondents.




## 4.2 Results of analytical procedures

Results from the analytical tests mean, and correlations are provided and explained for each variable in this section. By presenting the outcomes of the combined data, I first set the scene for the subsequent impacting results. The test results are then presented below.

### 4.2.1 Preliminary analysis

#### 4.2.1.1 Variable Means and Standard deviations.

Primarily, a descriptive analysis of the dependent and the independent constructs used in this study were assessed. That is, the mean and standard deviation values of the items investigated. The means and standard deviation of the various items were assessed. Under attitude as represented in the table below, most of the variable items had satisfactory mean and standard deviation values. The means and the standard deviation of questionnaire statements under attitude "For me, buying genetically modified food is very good" were M =2.587, Standard deviation (std) =1.252 . ". For me, buying genetically modified food is important" were M =2.647, Standard deviation (std) =1.267. I like the idea of buying genetically modified food " were M =2.618, Standard deviation (std) =1.327, and I think buying genetically modified food is useful in solving food shortage M =2.563, Standard deviation (std) =1.282.

Table 4-9: Means and Standard deviations of attitude

| ***Question Code*** | **Question** | **Mean** | **Minimum** | **Median** | **Maximum** | **Standard Deviation** |
|---|---|---|---|---|---|---|
| *ATT1* | For me, buying genetically modified food is very good | 2.587 | 1.000 | 3.000 | 5.000 | 1.252 |
| *ATT2* | For me, buying genetically modified food is important | 2.647 | 1.000 | 3.000 | 5.000 | 1.267 |
| *ATT3* | . I like the idea of buying genetically modified food | 2.618 | 1.000 | 3.000 | 5.000 | 1.327 |
| *ATT4* | I think buying genetically modified food is useful in solving food shortage | 2.563 | 1.000 | 3.000 | 5.000 | 1.282 |

Under subjective norms, as represented in the table below, most of the variable items had satisfactory mean and standard deviation values. The means and the standard deviation of questionnaire statements under subjective norms "Most experts that I know will want me to buy genetically modified foods." were M =2.758, Standard deviation (std) =1.247. "Family will agree with me in buying genetically modified foods" were M =2.608, Standard deviation (std) =1.275. "The people who are important to me will prefer me buying genetically modified foods" were M

=2.791, Standard deviation (std) =1.273, and Friends will support me in buying genetically modified foods" had mean M =2.671, Standard deviation (std) =1.257.

Table 4-10: Means and Standard deviations of subjective norms

| ***Question Code*** | **Question** | **Mean** | **Mini mum** | **Median** | **Maximum** | **Standard Deviation** |
|---|---|---|---|---|---|---|
| *SN1* | Most experts that I know will want me to buy genetically modified foods. | 2.758 | 1.000 | 3.000 | 5.000 | 1.247 |
| *SN 2* | Family will agree with me in buying genetically modified foods | 2.608 | 1.000 | 3.000 | 5.000 | 1.275 |
| *SN 3* | The people who are important to me will prefer me buying genetically modified foods | 2.791 | 1.000 | 3.000 | 5.000 | 1.273 |
| *SN 4* | Friends will support me in buying genetically modified foods. | 2.671 | 1.000 | 3.000 | 5.000 | 1.257 |

Under knowledge, as represented in the table below, most of the variable items had acceptable mean and standard deviation values. The means and the standard deviation of questionnaire statements under the knowledge construct "I have sufficient knowledge on genetically modified foods." were M =3.103, Standard deviation (std) =1.162. "I know the advantages of buying genetically modified foods" were M =3.022, Standard deviation (std) =1.222. "I have an idea of the use of genetically modified food" were M =3.140, Standard deviation (std) =1.190, and "I know genetically modified foods is a way of ensuring food security" had mean M =3.120, Standard deviation (std) =1.224.

Table 4-11: Means and Standard deviations of knowledge

| *Question Code* | Question | Mean | Minimum | Median | Maximum | Standard Deviation |
|---|---|---|---|---|---|---|
| *KN1* | I have sufficient knowledge of genetically modified foods | 3.103 | 1.000 | 3.000 | 5.000 | 1.162 |
| *KN 2* | I know the advantages of buying genetically modified foods | 3.022 | 1.000 | 3.000 | 5.000 | 1.222 |
| *KN 3* | I have an idea of the use of genetically modified food | 3.140 | 1.000 | 3.000 | 5.000 | 1.190 |
| *KN 4* | I know genetically modified foods is a way of ensuring food security | 3.120 | 1.000 | 3.000 | 5.000 | 1.224 |

Under risk and safety concerns, as represented in the table below, most of the variable items had satisfactory mean and standard deviation values. The means and the standard deviation of questionnaire statements under risk and safety concerns "I am afraid of suffering health challenges when buying genetically modified foods" were M =3.683, Standard deviation (std) =1.274. "I will not feel totally safe buying genetically modified foods" were M =3.587, Standard deviation (std) =1.252. "I am worried buying genetically modified food will not be to my satisfaction" were M =3.501, Standard deviation (std) =1.209.



Table 4-12: Means and Standard deviations of risk and safety concerns

| *Question Code* | Question | Mean | Minimum | Median | Maximum | Standard Deviation |
|---|---|---|---|---|---|---|
| *RSC1* | I am afraid of suffering health challenges when buying genetically modified foods | 3.683 | 1.000 | 4.000 | 5.000 | 1.274 |
| *RSC 2* | I will not feel totally safe buying genetically modified foods | 3.587 | 1.000 | 4.000 | 5.000 | 1.252 |
| *RSC 3* | I am worried buying genetically modified food will not be to my satisfaction | 3.501 | 1.000 | 4.000 | 5.000 | 1.209 |

Under intention, as represented in the table below, most of the variable items had satisfactory mean and standard deviation values. The means and the standard deviation of questionnaire statements under intention "I am willing to buy genetically modified food in the near future." were M =2.885, Standard deviation (std) =1.267. "I plan to buy genetically modified food in the near future" were M =2.791, Standard deviation (std) =1.273. "I would like to be part of the people patronizing genetically modified foods in the future" was M =2.772, Standard deviation (std) =1.308 and I will recommend genetically modified foods to my friends." had mean M =2.718, Standard deviation (std) =1.351.

Table 4-13: Means and Standard deviations of Intention

| ***Question Code*** | **Question** | **Mean** | **Minimum** | **Median** | **Maximum** | **Standard Deviation** |
|---|---|---|---|---|---|---|
| *INT1* | I am willing to buy genetically modified food in the near future | 2.885 | 1.000 | 3.000 | 5.000 | 1.267 |
| *INT 2* | I plan to buy genetically modified food in the near future | 2.791 | 1.000 | 3.000 | 5.000 | 1.273 |
| *INT 3* | I would like to be part of the people patronizing genetically modified foods in the future | 2.772 | 1.000 | 3.000 | 5.000 | 1.308 |
| *INT 4* | I will recommend genetically modified foods to my friends. | 2.718 | 1.000 | 3.000 | 5.000 | 1.351 |

### 4.3 Confirmatory factor analysis

In several social and behavioral sciences fields, confirmatory factor analysis has cemented itself as a crucial analytical method. It is a component of the family of approaches for structural equation modeling that enable the examination of causal relationships between latent and observable variables in a priori-specified, theory-derived models (Cai et al., 2022). The primary benefit of CFA is its capacity to help researchers close the frequently noted gap between theory and observation (Anderson and Gerbing, 1988). The development of an instrument, for instance, can entail producing several objects for various distinct theoretical conceptions. Confirmatory factor analysis can provide the researcher with useful information regarding the fit of the data to the particular hypothesis measurement model (where items only load on the variables they were

created to measure) and point out the potential weakness of specific items (Anderson and Gerbing, 1988; Hair, 2007; Leguina, 2015). A CFA can be performed on data instead of an exploratory factor analysis, where every other item is independent to load on each variable and may result in a solution that is incompatible with the initial theory. CFA is best understood as a process, starting with model conceptualization and moving through model identification, parameter estimates, and eventual model modification (Bryne, 2010; Pfeiffer et al., 2021). The advantage of CFA over exploratory approaches is that it is disconfirmatory; models or hypotheses can be disproven, but results may also suggest prospective changes that should be looked into in following analyses (Chen and Yan, 2019; Henseler et al., 2015; Sarstedt et al., 2022). From literature, numerous studies have used the confirmatory factor analysis to check the quality of variables and variable items in questionnaire studies for structural equation modelling (Adjei et al., 2022; Cudjoe et al., 2022; do Paço et al., 2013; He et al., 2021; Nketiah et al., 2022a; Obuobi et al., 2022; Ru et al., 2019; Verma et al., 2019; S. Wang et al., 2020)

The Confirmatory factor analysis of r the study was carried out for all constructs and construct items used purposely for the study using partial least square-structural equation modeling (PLS-SEM) - SmartPLS 3.3.3 statistical software. The constructs – attitude, subjective norms, risk and safety concerns, knowledge and intentions had their CFA's investigated and assessed. Assessments, including factor loadings, Cronbach alpha, composite reliability, discriminant reliability, and average variance extracted were all assessed under the confirmatory factor analysis.

### 4.3.1 Factor loadings

In essence, factor loading is the correlation between the factor and the variable. Factor loading displays the variance on that specific factor that is accounted for by the variable (Hair, J., Black, W., Babin, B., Anderson, R., 2009; Hair et al., 2019a; Leguina, 2015). According to the SEM technique, a factor loading of 0.7 or above indicates that the factor extracts enough variance from the variable (Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, 2017; Hair, 2007; Hair et al., 2019b; Han et al., 2017; Sarstedt et al., 2022). From the statistical analysis, all questionnaire items used in the study exhibited satisfactory factor loadings. Factor loadings of all questionnaire items were from 0.737 to 0.954. Attitude had four (4) questionnaires items which ranged from 0.737 to 0.890. Subjective norms had four items with factor loading values ranging from 0.841 to

0.917. Knowledge of genetically modified foods had factor loadings from 0.763 to 0.871. Also, risk and safety concerns had a factor loading values from 0.874 to 0.914. The factor loading values for questionnaire items for intention were from 0.919 to 0.954. the factor loading values for questionnaire items are exhibited in the table below;

Table 4-14: Factor loading values for construct measurement items

| CONSTRUCT | FACTOR LOADING VALUE |
|---|---|
| ***Attitude*** | |
| **ATT1** | 0.883 |
| **ATT2** | 0.877 |
| **ATT3** | 0.890 |
| **ATT4** | 0.737 |
| ***Subjective norms*** | |
| **SN1** | 0.841 |
| **SN2** | 0.916 |
| **SN3** | 0.917 |
| **SN4** | 0.909 |
| ***Knowledge*** | |
| **KN1** | 0.763 |
| **KN2** | 0.875 |
| **KN3** | 0.871 |
| **KN4** | 0.825 |
| ***Risk and safety concerns*** | |
| **RSC1** | 0.897 |
| **RSC2** | 0.914 |
| **RSC3** | 0.874 |
| ***Intention*** | |
| **INT1** | 0.922 |
| **INT2** | 0.954 |
| **INT3** | 0.923 |
| **INT4** | 0.919 |

### 4.3.2 Cronbach Alpha

Internal consistency, or how closely connected a group of things are to one another, is measured by Cronbach's alpha. It is regarded as a gauge of scale dependability. Even if alpha has a "high" value, the measure may not be one-dimensional. Additional analyses can be carried out if you want to show that the scale in question is unidimensional in addition to testing internal consistency. One technique for determining dimensionality is factor analysis.

This overall evaluation of the dependability of a measure is provided by the resulting (alpha) coefficient of reliability, which has a range of 0 to 1. If every item on the scale is completely unrelated to one another (that is, if they are not correlated or have no covariance), then (alpha) = 0, and if every item has a high covariance, then (alpha) will increase as the scale's item count increases towards infinity. In other words, the more items have shared covariance and likely assess the same underlying notion, the greater the (alpha) coefficient.

Many methodologists advise a minimum "alpha" coefficient between 0.65 and 0.8 (or higher in many cases); "alpha" coefficients that are less than 0.5 are typically unacceptable, especially for scales claiming to be unidimensional. Although the criteria for what constitutes a "good" alpha coefficient are completely arbitrary and depend on your theoretical understanding of the scale in question, many methodologists recommend a minimum "alpha" coefficient between 0.65 and 0.8 (or higher in many cases). The Cronbach Alpha test was used to assess the reliability of the questionnaires used in eveluating the factors that influence the purchase intention of genetically modified foods in Senegal. This was done using smartPLS 3.3.3 software. The Cronbach’s alpha value of the factors ranged from 0.856 to 0.947. Hence the questionnaire was deemed reliable to assess the impact of constructs on the purchase intention of genetically modified foods in Senegal. Notably, any Cronbach alpha value greater than 0.7 is considered satisfactory (Cronbach,1951). Ferketich (1991) recommended that corrected item-total correlations should range between .30 and .70 for a good scale. Ferketich, (1991) asserts that corrected item-total correlations should range between .30 and .90 acceptable and good for analysis. However, Hundleby & Nunnally, (1968) suggested that a minimum alpha of 0.6 suffice for the early stages of research is the most preferred. After data collection, Cronbach’s alpha was computed for the variables.

The Cronbach alpha values exhibited from the statistical analysis proved satisfactory and valid. Attitude had a Cronbach alpha value of 0.869. subjective norm had a Cronbach alpha value of

0.918. the Cronbach alpha values for knowledge, risk and safety concerns and intention were 0.856, 0.816, and 0.947, respectively. The Cronbach alpha values of the questionnaire items used in this study are exhibited in the table below;

Table 4-15: Cronbach alpha values for construct measurement constructs

| Construct | Cronbach alpha value |
|---|---|
| **Attitude** | 0.869 |
| **Subjective norm** | 0.918 |
| **Knowledge** | 0.856 |
| **Risk and safety concerns** | 0.816 |
| **Intention** | 0.947 |

### 4.3.3 Composite reliability

This is an additional method via which an investigator can gauge the items' internal consistency. It is advised that a construct's reliability be at least 0.70. It's quite likely that all of your items consistently measure the same construct if your composite dependability is high. According to the outcome from the statistical analysis shown below, all of the structures' composite reliability varies from 0.902 to 0.962, which is higher than 0.70. A definite sign that each item accurately measures its relevant concept. Attitude had a composite reliability value of 0.911. Subjective norm had a composite reliability value of 0.942. The composite reliability values for knowledge, risk and safety concerns, and intention were 0.902, 0.924, and 0.962, respectively. The composite reliability of the questionnaire items used in this study are exhibited in the table below;

Table 4-16: Composite reliability values for construct measurement constructs

| Construct | Composite reliability value |
|---|---|
| Attitude | 0.911 |
| Subjective norm | 0.942 |
| Knowledge | 0.902 |
| Risk and safety concerns | 0.924 |

| | |
|---|---|
| Intention | 0.962 |

### 4.3.4 Average variance Extracted

AVE is the average variance value in the indicator variable that a predictor could explain (Hu et al., 2018; Q. Wang et al., 2020; Zhang et al., 2014). This is similar to explained variance in exploratory factor analysis (Moons and De Pelsmacker, 2012). Among other metrics, the average variance extracted (AVE) is frequently used to verify constructions. The AVE is a metric used in statistics to compare the variance reported by a construct to the variance brought on by measurement error (Cheatham, 2000). These conventional indices are derived from factor loadings from estimated least squares or maximum likelihood regressions. As a general guideline and for adequate convergence, it is generally encouraged to have an AVE of at least 0.50. (Fornell and Larcker, 1981; Henseler et al., 2015; Tingchi Liu et al., 2013). A value of the AVE that is less than 0.50 means that your constructs' variation is greater than the number of errors your items account for. In every measurement model, an AVE that is at least 0.50 must be calculated for each construct (Holden and Karsh, 2010; Laroche et al., 2001; Oehman et al., 2022; Tsen et al., 2006). in assessing the purchase intention of genetically modified foods in Senegal, the average variance extracted was computed. The results from the analysis proved satisfactory, as all constructs showed an AVE value higher than the acceptable minimum value of 0.5. Attitude had an AVE value of 0.721. subjective also had an AVE value of 0.803 higher than the minimum requirement of 0.50. The average variance extracted values for knowledge, risk and safety concerns, and intentions were 0.697, 0.802, and 0.864, respectively, above the minimum requirement of 0.50. the average variance extracted values for the construct used in this study are exhibited in the table below.

Table 4-17: Factor loading values for construct measurement items

| **Construct** | **Average Variance Extracted** |
|---|---|
| Attitude | 0.721 |
| Subjective norm | 0.803 |
| Knowledge | 0.697 |
| Risk and safety concerns | 0.802 |
| Intention | 0.864 |

### 4.3.5 Discriminant Validity

The questions or items we selected for this study have both face and criterion validities. These items were mirrored from existing literature questionnaire items (I. Ajzen, 1985; Ajzen and Cote, 2011; Cudjoe et al., 2022; de Koning et al., 2015; de Leeuw et al., 2015; Madden et al., 1992; Nketiah et al., 2022b; Paul et al., 2016; Y. Zhang et al., 2018a), which had also been mirrored from earlier research.

When the test's instrument adequately covers the entire topic under investigation, content validity happens. Neuman (2005) asserts that content validity deals with the issue of whether a measure accurately captures a definition's entire content. This implicitly presupposes that the sample should be sufficiently broad and representative of the relevant target populations or audiences in order to fall within the permitted ranges associated with measurements of this kind. By evaluating more studies on electric car commuting, the researcher was able to ensure that the questions/items on each construct fully measured the notion that it was intended to test. If an instrument measures what it should under the model under examination, this is known as construct validity. There are two varieties: convergent and discriminant validities. For measurements with many indications, construct validity is required (Neuman, 2005). It's important to consider discriminant validity since it shows whether your test accurately assesses the pertinent idea or whether it also assesses unintendedly related conceptions (Pedroni, 2000). This is dependent on how successfully you operationalized, or how well you were able to convert abstract concepts into attributes or observations that can be measured (Gujarati, 1995). To determine the degree of the link, one uses a correlation coefficient, such as Pearson's r. The correlation coefficient, which measures the strength and direction of the link between variables, has a value that is always between 0 and 1. (Hwang, 2016; Ma et al., 2021).

The discriminant validity for this study were robust and acceptable. The study adopted the Fornell and Larcker (Fornell and Larcker, 1981) criterion and heterotrait-monotrait ratio.

Table 4-18: Discriminant Validity of constructs (Fornell-lacker criterion)

| | Variables | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | Attitude | 0.849 | | | | |
| 2 | Intention | 0.645** | 0.930 | | | |
| 3 | Knowledge | 0.469* | 0.580** | 0.835 | | |
| 4 | Risk and safety concerns | -0.135** | -0.211** | 0.123** | 0.895 | |
| 5 | subjective norms | 0.645** | 0.633** | 0.504** | -.061** | 0.896 |

Table 4-19: Discriminant Validity of constructs (heterotrait-monotrait ratio (HTMT))

| | Variables | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | Attitude | | | | | |
| 2 | Intention | 0.708 | | | | |
| 3 | Knowledge | 0.529 | 0.623 | | | |
| 4 | Risk and safety concern | 0.156 | 0.231 | 0.161 | | |
| 5 | subjective norms | 0.717 | 0.678 | 0.558 | 0.070 | |



### 4.4 Structural Model Analysis

Structural model Analysis was used to assess how well the gathered data fits the structural conceptual model under scrutiny (Ceglarz et al., 2017; Dixon et al., 2020; Obuobi et al., 2022). Thus, in this case, the structural model analysis assess how well the data gathered from senegal fits the conceptual model to investigate genetically modified foods puchase intention in Senegal. This analysis was done using Smartpls 3.3.3 software. This study used Using the Standardized Root Mean Squared Residual (SRMR), Normalised Fit Index (NFI), Goodness of fit Index (GFI) to establish that our conceptual model had a good fit. The model fit indices, on the whole, fell within the acceptable range. The goodness-of-fit (GFI) value, which is determined by taking the square root of the average AVE and R square product, was 0.67, exceeding the permissible

minimum threshold of 0.36 (Leguina, 2015). Above the minimal threshold of >0.8, the Normalized Fit Index (NFI) was 0.897. With the acceptable upper limit set at 0.08 in the standardised root means square residual (SRMR) analysis, the SRMR value revealed a value of 0.024 (Henseler et al., 2015; Turaga et al., 2010; Zikmund, 2010). The table below shows the model fit metrics.

Table 4-20: Structural Model indices of study

| Structural Model **index** | **Benchmark values** | **Model values** |
|---|---|---|
| **SRMR** | < 0.080 | **0.058** |
| NFI | > 0.800 | 0.897 |
| GFI | > 0.36 | 0.67 |
| $R^2$ | | 0.536 |

### 4.5 Multicollinearity Test

The data were examined for multicollinearity in the last stages of the validity tests. Several of the fundamental presumptions for performing regression analysis will be broken if a multicollinearity impact occurs in the data (Cudjoe et al., 2020; Gujarati, 1995; Han et al., 2022). (Gujarati, 1995). To test for multicollinearity, Norusis (2008) recommended calculating the variance inflation factor (VIF) and tolerance values for each predictor. High correlations or nearly perfect linear relationships between the independent variables or predictions are referred to as multicollinearity

(Emrich et al., 2015; Podsakoff et al., 2003). When it does, the coefficients become unstable and the standard errors for the coefficient can get inflated, making it impossible to compute the values for a regression model in a distinctive manner. According to (Johnson, Kleinbaum, Kupper, Muller, & Nizam, 1999), a variable is considered to be extremely collinear and will cause issues with regression analysis if its Variance Inflation Factor (VIF) exceeds 3.5 (Agag and El-Masry, 2016; Kock, 2015; Schmalfuß et al., 2015; Verma et al., 2019). The results for the test, as shown in the table below, depict no problem of multicollinearity among the measurement items used in this study.

Table 4-21: Variance Inflation Factor (VIF) of construct items

| CONSTRUCT | VARIANCE INFLATION FACTOR (VIF) VALUE |
|---|---|
| ***Attitude*** | |
| **ATT1** | 2.870 |
| **ATT2** | 2.841 |
| **ATT3** | 2.486 |
| **ATT4** | 1.517 |
| ***Subjective norms*** | |
| **SN1** | 2.208 |
| **SN2** | 2.268 |
| **SN3** | 2.283 |
| **SN4** | 2.144 |
| ***Knowledge*** | |
| **KN1** | 1.843 |
| **KN2** | 2.275 |
| **KN3** | 2.509 |
| **KN4** | 1.740 |
| ***Risk and safety concerns*** | |
| **RSC1** | 2.349 |
| **RSC2** | 2.809 |
| **RSC3** | 2.214 |
| ***Intention*** | |
| **INT1** | 1.710 |
| **INT2** | 2.690 |
| **INT3** | 1.056 |
| **INT4** | 2.290 |



### 4.6 Structural hypothetical test results

This current study measured consumers' purchase intention of genetically modified foods by extending the theory of reasoned action with other constructs, namely knowledge and risk and safety concerns. The evaluation was done using smartpls 3.3.3 software.

The analysis showed that attitude is positively and significantly related to consumer purchase intention of genetically modified foods (β = 0.291, t-value= 6.587, p=0.000), thus, supporting hypothesis 1 (H1). Also, The analysis showed that subjective norm was positively and significantly related to consumer purchase intention of genetically modified foods (β = 0.266, t-value= 3.825, p=0.000), thus, supporting hypothesis 2 (H2). Hypothesis 2.1 which anticipated a positive relationship between subjective norm and attitudes towards genetically modified foods was confirmed as subjective norm impacted attitudes towards genetically modified foods in Senegal (β = 0.525, t-value=12.969, p=0.000). Subjective norms impacted risk and safety concerns in the context of genetically modified food purchase intention(β = -0.164, t-value = 3.503, p=0.000). The analysis showed that risk and safety concerns were positively and significantly related to consumer purchase intention of genetically modified foods (β = -0.197, t-value = 6.863, p=0.000) and attitude towards genetically modified foods (β = -0.130, t-value = 3.988, p=0.000) thus, supporting hypothesis 3 and 3.1 (H3 and H3.1).

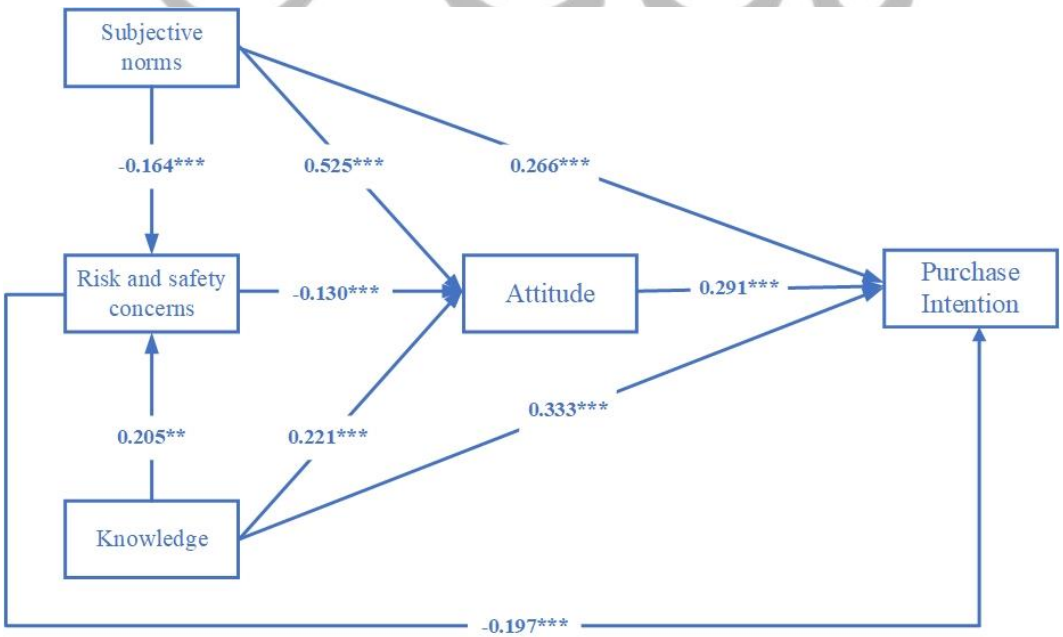
The analysis showed that knowledge was positively and significantly related to consumer purchase intention of genetically modified foods (β = 0.333, t-value = 8.222, p=0.000), attitude towards genetically modified foods (β = 0.221, t-value = 5.753 p=0.000) and risk and safety concerns (β = 0.205, t-value = 3.637, p=0.000) thus, supporting hypothesis 4, 4.1 and 4.2 (H4, 4.1 and 4.2). All the direct hypothetical statements of this study were confirmed. The table and the figure below show the hypothetical evaluation.

Table 4-22: Hypothetical Analysis, **Path coefficients, T-Values, P-Values**

| Hypothesis (H) | Path | Estimate | T-statistics | P-value | Confidence Interval | | Results |
|---|---|---|---|---|---|---|---|
| | | | | | 2.5% | 97.5% | |
| H1 | **ATT -> INT** | 0.291 | 6.587 | **0.000** | -0.095 | 0.122 | Supported |
| H2 | **SN-> INT** | 0.226 | 6.050 | **0.000** | 0.326 | 0.558 | Supported |
| H2.1 | **SN -> ATT** | 0.525 | 12.969 | **0.000** | -0.197 | 0.014 | Supported |
| H2.2 | **SN -> RSC** | -0.164 | 3.503 | **0.000** | -0.492 | -0.310 | Supported |
| H3 | **RSC -> INT** | -0.197 | 6.863 | **0.000** | -0.323 | -0.106 | Supported |
| H3.1 | **RSC -> ATT** | -0.130 | 3.988 | **0.000** | -0.425 | -0.226 | Supported |
| H4 | **KN -> INT** | 0.333 | 8.222 | **0.000** | 0.041 | 0.250 | Supported |
| H4.1 | **KN -> ATT** | 0.221 | 5.753 | **0.000** | 0.169 | 0.410 | Supported |
| H4.2 | **KN -> RSC** | 0.205 | 3.637 | **0.000** | 0.184 | 0.412 | Supported |



Figure 4-1: The graphical representation of hypothetical results towards GMO purchase intention.



### 4.7 Mediation Analysis

In mediation, we take into account a middle variable, referred to as the mediator, that aids in illuminating how or why an independent variable affects a result (Simsekoglu and Nayum, 2019; Tolstoy et al., 2022). It is frequently of considerable interest to identify and research the mechanisms by which an intervention accomplishes its effects in the context of pro-environmental and sustainable behavior studies (Hayes and Preacher, 2010). In addition to improving our understanding of human pro-social behavior and intention mechanisms of purchasing, examining mediational processes that clarify how the constructs impact the study outcome may also enable us to uncover alternative, more effective proliferation options (Bagozzi and Yi, 1988; Hair et al., 2019a; Johnson et al., 1999).

The explanation of the mechanism by which an intervention affects a result through mediation takes into account both causal and temporal relationships (Golob, 2003; Livingston, 2004). Mediation analysis aids in providing a focus for future intervention research, enabling the development of more effective and efficient strategies for policymaking. Mediation analysis is most effective when carried out using a well-established and robust theory and in the proper context (Bryman, n.d.). Mediation analysis can be carried out using a fairly open-ended, flexible framework that structural equation modelling offers. The mediational analysis,- which was performed using Smartpls 3.3.3- showed that attitude mediated other constructs significantly in developing purchase intentions towards genetically modified foods. From the table below, it could be seen that attitude partially mediated the impact of knowledge on GMO purchase intention ($\beta = 0.064$, t-value = 3.908, p=0.000). Attitude negatively mediated the relationship between risk and safety concerns and GMO purchase intention ($\beta = -0.038$, t-value = 3.158, p=0.002). Also, the relationship between subjective norms and intention to purchase genetically modified foods in Senegal was partially mediated by attitude positively ($\beta = 0.153$, t-value = 6.145, p=0.000).

Table 4-23: Mediation Analysis

| Path | effect | t-value | p-value | Results |
|---|---|---|---|---|
| Knowledge -> Attitude -> Intention | 0.064 | 3.908 | 0.000 | Partial mediation |
| Risk and safety concern -> Attitude -> Intention | -0.038 | 3.158 | 0.002 | Partial mediation |
| Subjective norms -> Attitude -> Intention | 0.153 | 6.145 | 0.000 | Partial mediation |

### 4.8 ANOVA analysis of demographical characteristics

Analysis of Variance, also known as ANOVA is a statistical technique that divides observed variance data into various components for use in further testing (Lepp and Gibson, 2003). Analysts use the ANOVA test to evaluate the impact of independent factors on the predictor variables in a regression analysis (Atombo et al., 2017; Fraune, 2015; Gifford and Nilsson, 2014; Huang and Ge, 2019). The current study uses a one-way ANOVA to investigate the impact of demographical characteristics on the purchase intention of genetically modified foods in Senegal. The demographical characteristics used in this investigation were gender, age, income level, educational level, and community of residence. As shown in the table below, female respondents (mean = 3.459, F = 23.362, p = 0.000) had a higher mean than males (mean = 3.459, F = 23.362, p = 0.000) in their intention to purchase genetically modified foods. Those aged below 20 years exhibited the highest mean in purchasing genetically modified foods (mean = 3.459, F = 23.362, p = 0.000), followed by respondents between the ages of 31- 40 years(mean = 3.459, F = 23.362, p = 0.000). Respondents aged 41- 50 years had the least mean towards purchasing genetically modified foods (mean = 3.459, F = 23.362, p = 0.000). However, age was insignificant in influencing the purchase intention of genetically modified foods. Purchase intention of genetically modified foods was significantly impacted by income levels, as shown in the table below. As income levels increased, purchase intention of genetically modified foods decreased marginally. Also, the educational level and community of abode of residents were impactful in influencing consumer purchase intention of genetically modified foods. Purchase intention of genetically modified foods was higher among suburban residents (mean = 3.459, F = 23.362, p = 0.000) than those in urban areas (mean = 3.459, F = 23.362, p = 0.000)

Table 4-24: ANOVA analysis of respondents' demography

| | Mean | Std. Deviation | Std. Error | F- value | significance |
|---|---|---|---|---|---|
| **Gender** | | | | | |
| Male | 2.735 | 1.246 | 0.063 | 4.577 | 0.033 |
| Female | 2.944 | 1.140 | 0.072 | | |
| **Age** | | | | | |
| under 20 years | 3.348 | 1.208 | 0.252 | 1.932 | 0.103 |
| 20-30 years | 2.796 | 1.155 | 0.057 | | |
| 31-40 years | 2.860 | 1.302 | 0.099 | | |
| 41-50 years | 2.420 | 1.303 | 0.416 | | |
| Above 50 | 2.567 | 1.315 | | | |
| **Income levels** | | | | | |
| Below 50,000 CFA | 3.102 | 1.149 | 0.062 | 4.594 | 0.003 |
| 50,000 – 100,000 CFA | 3.071 | 1.204 | 0.090 | | |
| 100,000 – 150,000 CFA | 2.956 | 1.358 | 0.174 | | |
| 150,000 – 200,000 CFA | 2.941 | 1.304 | 0.174 | | |
| Above 200,000 CFA | 2.795 | 1.259 | 0.138 | | |
| **Educational levels** | | | | | |
| High school and below | 3.000 | 1.357 | 0.271 | 4.036 | 0.003 |
| Junior college | 3.351 | 1.243 | 0.165 | | |
| Bachelor | 2.836 | 1.130 | 0.068 | | |
| Master | 2.662 | 1.230 | 0.082 | | |
| PhD | 2.816 | 1.268 | 0.164 | | |
| **Community** | | | | | |
| Urban | 2.750 | 1.197 | 0.053 | 7.011 | 0.008 |
| Suburban | 3.055 | 1.227 | 0.104 | | |

# Chapter 5 : DISCUSSSION AND CONCLUSION

## 5.1 Discussions

The challenges of food security and post-harvest losses have led to the invention of technologies to mitigate these challenges. Among such agricultural food technology alternatives is food genetic modification technology. However, there seems to be some form of negative energy in the total acceptance, adoption, and use, especially in the African setting.

Consequently, this study investigates the underlying psychological factors that motivate or hamper consumer acceptance and buying intentions of genetically modified foods in Senegal. The current extends the theory of reasoned action with knowledge, risk and safety concerns to investigate the psychological constructs underlying the intention to purchase genetically modified foods.

Statistical evaluations using the structural equation model showed that all constructs influenced consumer purchase intention of genetically modified foods. The constructs used in this study accounted for 53.6% of the total variance of the study.

Statistical investigations showed that attitude was positive and significant in influencing consumers' purchase intention of genetically modified foods. This means that consumers with a positive evaluation of genetically modified foods are ready to adopt genetically modified foods and therefore develop a favorable intention to adopt them. This finding is consistent with that of existing literature (Bredahl, 2001; Kang and Hustvedt, 2014; Y. Zhang et al., 2018b) , for example, Jin et al. (2022) found attitude as a pivotal antecedent of Chinese consumers' acceptance of genetically modified foods. Also, the finding of attitude influencing GM food purchase intention resonates with that of Siegrist et al. (2016), who established the influence of attitude on genetically modified food adoption among consumers in Switzerland.

Subjective norm was found to be statistically significant towards the purchase intention of genetically modified foods. Subjective norms were positive and significant in influencing attitude towards genetically modified foods but negatively and significantly impacted the risk and safety concerns associated with genetically modified foods. This means that the subtle, obvious and not-so-obvious pressure from relevant others, family, friends, social influencer, and society at large paramountly affects the individual in developing a favorable attitude and purchase intention of genetically modified foods. Moreso, this form of pressure from relevant people and society can inflate the risk and safety concerns of using genetically modified foods,

thus acting as a disincentive. This confirms findings from earlier studies on the impact of subjective norms on pro-environmental behaviors (Ahmed et al., 2021; Huang et al., 2006; Tingchi Liu et al., 2013). Zhang et al. (2018b) established that subjective norms compel Chinese consumers to develop a purchase intention of genetically modified food. Zhu et al. (2022) in their study on consumer intention to participate in food safety risk communication, noted that subjective norms were a major factor for consumer participation. Also, Kimenju and De Groote (2007) found subjective norms impactful among Kenyan consumers' willingness to pay for genetically modified foods.

The hypothetical analysis showed that risk and safety concerns negatively influenced attitudes toward genetically modified foods and the purchase intention of genetically modified foods, confirming the earlier findings of earlier literature (Adu-Gyamfi et al., 2022; Bredahl, 2001; Featherman, M.S., Pavlou, P.A., 2003; Featherman and Hajli, 2016; Jaiswal et al., 2022) on the negative impact of risk and safety concerns on behaviors and intentions. When consumers or potential consumers of genetically modified foods perceive that their health is at risk or they are likely to experience some form of health complications in the use of genetically modified foods, they are demotivated to do so, thereby affecting their purchase intention of genetically modified foods. Hakim et al. (2020) assert that even with compulsory labeling of genetically modified foods in Brazil, consumer's perception of having health complications as a result of using or adopting genetically modified foods hampered the willingness to buy these products.

According to the statistical analysis, knowledge was found to be significant towards the purchase intention of genetically modified foods. Knowledge on genetically modified foods was positive and significant in influencing attitudes towards the risk and safety concerns associated with genetically modified foods. This means that as consumers gather more and more knowledge on what, why, and the benefits of adopting genetically modified foods, they are compelled to develop a favorable attitude and purchase intention towards genetically modified foods. Moreso, the acquired knowledge helps diminish consumers' risk and safety concerns in using genetically modified foods, thus boosting their confidence in genetically modified foods. This confirms findings from earlier studies on the influence of knowledge on pro-environmental behaviors (Cotton et al., 2015; Minelgaitė and Liobikienė, 2019; Wei et al., 2016). Koivisto Hursti and Magnusson (2003) established that knowledge of genetically modified foods compels consumers

to develop purchase intention of genetically modified foods at will without any compulsion externally.

A mediational analysis confirmed that attitude partially mediated the relationship between knowledge and purchase intention of genetically modified foods, risk and safety concerns and purchase intention of genetically modified foods, and subjective norms and purchase intention of genetically modified foods. Attitude was positive in partially mediating between knowledge and purchase intention of genetically modified foods. This means that when individuals have enough knowledge of genetically modified foods and have a positive attitude toward them, their purchase intention is heightened. Attitude partially mediated between subjective norms and purchase intention of genetically modified foods. This confirms that when individuals feel enough pressure from family, friends, experts, and society on genetically modified foods and with a positive attitude towards them, their purchase intention is improved attitude as mediators can be traced to prevailing literature in other pro-environmental sectors (Bissing-Olson et al., 2016; Hakim et al., 2020; Kimenju and De Groote, 2007; Y. Zhang et al., 2018a).

Statistical outcomes from the ANOVA (analysis of variance) analysis showed that female respondents are more ready to purchase genetically modified foods than males in Senegal, aligning with that of earlier studies (Freeman et al., 2020; Pfeiffer et al., 2021; Sovacool et al., 2018). Age differences did not matter in purchasing genetically modified foods, as age groups were insignificant. It was seen from the ANOVA analysis that as the income levels of consumers increased, their purchase intention of genetically modified foods also decreased. This means that as people make more money, they can afford foods they deem healthier than genetically modified foods. Also, it was realized that people with higher education had a low inclination to purchase genetically modified foods. An increase in education showed a decrease in the purchase intention of genetically modified foods. This aligns with the literature (Abotalebi et al., 2019; Pfeiffer et al., 2021), which reported similar results. Community of residence was significant in influencing genetically modified food purchase intention. Those in the suburban areas had a higher mean than those in urban areas purchasing genetically modified foods. Thus, those in suburban areas do not have many reservations about purchasing genetically modified foods. This may be attributable to the fact that poverty, food scarcity, and hunger are rather severe in these areas, and satisfying the basic need of what to eat is more important to them. This finding is also

consistent with that of Adu-Gyamfi et al. (2022), who confirmed a higher mean for urban dwellers in their adoption of battery swap technology for electric vehicles.

**5.2 Recommendation**

The findings from this study also have important implications for policymakers on how to make genetically modified attractive and acceptable for all. The study revealed that perceived behavioral control, subjective norms, and attitude were the strongly significant factors affecting Senegal genetically modified foods. It is, therefore, essential for the general public to be educated on the advantagious use of genetically modified foods in mitigating hunger and food scarcity. Information relating to the advantageous nature of using genetically modified foods should be provided to motivate and encourage the formation of intention in its use. Such information should be tailored to make the general populace understand why it is important to use genetically modified foods. Also, policymakers can embark on a rigorous physical advertisement.Food and Agriculture ministry could erect billboards at strategic positions where they could be seen and appreciated.



The effect of subjective norms on genetically modified food purchase intention suggests that the pressures from family, friends, experts, influencers, and society in general influences individuals to purchase genetically modified foods. In order to heighten the purchase intention of genetically modified foods, it could be effective for policymakers to explore the options of increasing social pressure on residents and consumers towards genetically modified foods. For instance, policy makers could focus on disseminating and advertising this practice and implement sensitization sessions in communities on the advantages of adopting genetically modified foods. This could be done through organizing community-level sensitization campaigns where trained individuals will directly interact and educate community members on geneticall modified foods. We expect that when family and community members have more information about this, then they are more likely to increase social pressure upon others to adopt. This finding demonstrates that among the youth (based on the youthful nature of respondents), what others buy or eat in the context of food is more important and appealing than what they say and of particular importance was the behavior of the parents and, to some extent, celebrities. Therefore, these referent individuals are highly encouraged to adopt genetically modified foods as the teaming youth looks up to them as examples.

it is important for policymakers to use social media outlets to improve knowledge and education to expand genetically modified foods' use. The use of the Internet to disseminate information is very pivotal. The significance of subjective norms shows that people will interact with each other on the matter of genetically modified foods. And the way people affect each other is through communication. In this Internet era, Senegalese residents use a wide variety of social media platforms to communicate with their friends, colleagues, and relatives to obtain and disseminate information. Such social media outlets like Facebook, TikTok, Instagram, and Snapchat, among others, are powerful for carrying out such education.

To give consumers healthful foods that are valued for their qualities, food producers should work diligently on their product policies. In this regard, the results demonstrate that attributes labelled "healthy"—concerning the naturalness of ingredients, their local origin, the production process, and the non-use of pesticides—and that are "necessary for life"—reflecting the beneficial effects of food on individual health and weight management—have a significant impact on consumers' purchase intention. These may be the main elements businesses should concentrate on to increase the overall appeal while lowering their reluctance to eat nutritious food. The emphasis should be placed on taste in particular because it is frequently linked to barriers preventing nutritious foods' consumption.



### 5.3 Conclusion

Technologies have been developed to address the problems of post-harvest losses and food security. Genetically modified foods are one of many alternatives to agricultural technology. However, there appears to be some sort of oppositional energy in absolute acceptance, adoption, and use, particularly in the African context. As a result, this study explores the psychological elements at play in Senegal that either drive or inhibit consumer acceptance and purchase intentions for genetically modified foods.

Using a quantitative approach through a random data distribution method via online, respondents were recruited for this research. Six hundred and forty-one (641) valid respondents were used in the study after deleting unfit data. A structural equation modeling quantitative analysis methodology was employed in analyzing the gathered data. Smartpls SEM 3.3.3 statistical software was used for this analysis.

Statistical evaluations using the structural equation model showed that all constructs influenced consumer purchase intention of genetically modified foods. The constructs used in this study accounted for 53.6% of the total variance of the study. The findings showed that attitude positively and significantly influenced the purchase intention of genetically modified foods.

Subjective norm was found to be statistically significant towards the purchase intention of genetically modified foods. Subjective norms were positive and significant in influencing attitudes towards genetically modified foods but negatively and significantly impacted the risk and safety concerns associated with genetically modified foods. The hypothetical analysis showed that risk and safety concerns negatively influenced attitudes toward genetically modified foods and the purchase intention of genetically modified foods. Knowledge was found to be significant in the purchase intention of genetically modified foods. Knowledge of genetically modified foods positively and significantly influenced attitudes towards the risk and safety concerns associated with genetically modified foods. A mediational analysis confirmed that attitude partially mediated the relationship between knowledge and purchase intention of genetically modified foods, risk and safety concerns and purchase intention of genetically modified foods, and subjective norms and purchase intention of genetically modified foods. Statistical outcomes from the ANOVA (analysis of variance) analysis showed that female respondents are more ready to purchase genetically modified foods than males in Senegal. It was seen from the ANOVA analysis that as the income levels of consumers increased, their purchase intention of genetically modified foods also decreased. It was realized that people with higher education had a low inclination to purchase genetically modified foods. Community of residence was significant in influencing genetically modified food purchase intention. Those in the suburban areas had a higher mean than those in urban areas purchasing genetically modified foods. The study recommends robust recommendations to policymakers and allied stakeholders to promote the acceptance of genetically modified foods.

### 5.4 Limitation of the Current study

The current study was limited in the following ways, although its contribution is quite significant to the research community, policymakers, and other stakeholders. Time constraint was quite challenging to collect data through a questionnaire for the required study. The respondent took a lot of time before responding to the questionnaires while others could not return the

questionnaires on time. Due to time and cost limitations, the research focused only on purchase intention, as the current study could not extend it to behavior.

This study was limited to only five major constructs that could promote or limit the purchase intention of genetically modified foods. There was a delay in the data collection due to poor internet connectivity in the country. This may be improved in the future by enhancing internet connectivity over the country. Additionally, the turnover for the respondent was slow as it was difficulty to convince the respondent to answer the questionnaire, and others took too long. This may be overruled in the future by offering simple forms of incentive to the targeted respondents to encourage the respondent to be sincere in their responses.

### 5.5 Future Prospect studies

The current study offers the following considerations for further and/or future studies to enhance academic research on genetically modified food and organisms, especially in the African setting. Future researchers can use different methodologies and different predictor variables to investigate the major and minor psychological factors that account for the purchase intention of genetically modified foods. Additionally, specific aspects of attitude that account for the purchase intention of genetically modified foods should be investigated to understand this clearly.

The impacts of government measures like incentives should be evaluated on how they have affected consumers to develop buying intentions of genetically modified foods. Future research could extend this study to accommodate an investigation of how purchase intention translates into actual buying behavior.

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