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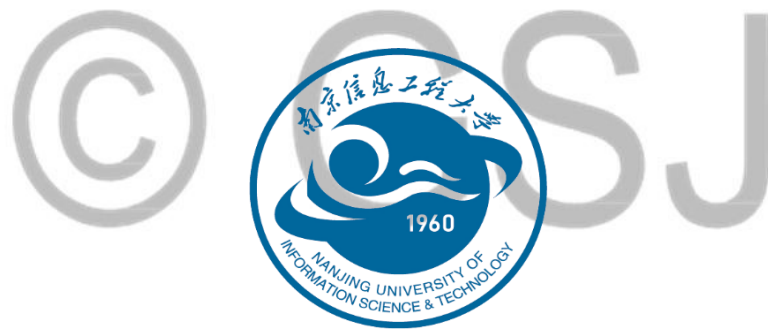
The effects of consumer's objective knowledge on perceptions and attitude towards GMF in morocco

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ABSTRACT

The topic of Genetically Modified Organisms (GMOs) has become a contentious issue in recent years, due to the potential benefits for food producers and consumers, as well as the possible biomedical risks and environmental side effects. GMOs are organisms whose genetic material has been altered using genetic engineering techniques to improve their traits or characteristics. This advanced biotechnology offers numerous advantages, including increased crop yield, resistance to pests and diseases, and improved nutritional value.

However, the use of GMOs has also raised concerns among consumers and activists, who worry about the long-term health and environmental impacts of genetically modified foods. Some studies have suggested that consuming GM foods may cause allergies or contribute to the development of antibiotic-resistant bacteria. Additionally, there are concerns that GMOs may contaminate non-GM crops, leading to unintended consequences in the environment.

Despite these concerns, independent studies have been conducted worldwide to assess the pros and cons of GM foods. The results of these studies have been mixed, with some suggesting that GM foods are safe for human consumption and the environment, while others have raised concerns about the long-term effects of consuming genetically modified foods.

Recent technological advancements in genetic engineering have allowed for even more precise modification of genetic material, which may further enhance the potential benefits of GMOs. For example, researchers have developed genetically modified crops that can tolerate extreme weather conditions, such as drought or flooding, which could help to increase crop yield and improve food security in areas where these conditions are common.

In conclusion, the topic of GMOs remains a complex and controversial issue, with both potential benefits and risks. Further research is needed to fully understand the long-term effects of genetically modified foods on human health and the environment. As the technology continues to advance, it will be important for policymakers, scientists, and consumers to carefully evaluate the benefits and drawbacks of GMOs in order to make informed decisions about their use.

摘要

近年来，基因改造生物（GMO）的话题因为对食品生产者和消费者的潜在益处以及可能的生物医学风险和环境副作用而变得有争议。GMO是指使用基因工程技术改变其特征或特性的生物的遗传物质。这种先进的生物技术提供了许多优势，包括增加作物产量、抵抗害虫和疾病、改善营养价值等。

然而，GMO的使用也引起了消费者和活动人士的担忧，他们担心转基因食品的长期健康和环境影响。一些研究表明，食用转基因食品可能会引起过敏或促进产生耐药菌。此外，人们担心GMO可能会污染非转基因作物，导致环境中出现意想不到的后果。

尽管存在这些担忧，世界各地已进行了独立的研究，以评估GM食品的优缺点。这些研究的结果是复杂的，一些研究表明GM食品对人类消费和环境安全，而其他研究则引发了有关长期食用转基因食品的影响的担忧。

近期基因工程技术的技术进步，允许更加精确地修改基因物质，这可能进一步增强GMO的潜在优势。例如，研究人员开发了能够耐受极端天气条件（如干旱或洪涝）的基因改造作物，这可以帮助增加作物产量，在这些条件经常出现的地区改善粮食安全。

总之，GMO的话题仍然是一个复杂和有争议的问题，既有潜在的利益，也有风险。需要进一步研究才能充分了解基因改造食品对人类健康和环境的长期影响。随着技术的不断进步，政策制定者、科学家和消费者将需要仔细评估GMO的优点和缺点，以便做出有关其使用的知情决策。

PREFACE

Genetically Modified Foods (GMF) are foods derived from organisms that have had specific changes made to their DNA through genetic engineering techniques. This technology has been widely adopted in agriculture over the last few decades to enhance the productivity and quality of crops. Despite the potential benefits of GMF, such as increased crop yields and improved resistance to pests, there has been a growing concern about the safety and sustainability of these foods.

In Morocco, like in many other countries, the debate surrounding GMF has been polarized, with proponents arguing that this technology can help to address food security and environmental challenges, while opponents raise concerns about the long-term impact on human health and biodiversity. However, there is a general lack of objective knowledge and understanding among consumers regarding GMF, which has led to mixed attitudes and perceptions towards this technology.

One of the main reasons for the lack of awareness among the Moroccan population is the limited availability of scientific information on GMF. The majority of the information available to consumers is through the media, which is often biased or sensationalized. As a result, consumers have a hard time distinguishing fact from fiction, and many rely on hearsay or personal opinions rather than scientific evidence.
Another challenge in promoting informed decision-making about GMF in Morocco is the role of cultural and religious beliefs. Some consumers view GMF as unnatural or against the principles of Islam, which is the dominant religion in the country. This perception is often fueled by the lack of knowledge and understanding of the science behind genetic engineering.

The lack of trust in government institutions and the private sector also contributes to the mixed attitudes towards GMF in Morocco. Some consumers are skeptical of the motivations of companies and government agencies that promote GMF, viewing them as profit-driven and not necessarily interested in the public good. This distrust can be further compounded by the lack of transparency in the decision-making process around the regulation and commercialization of GMF.

To address the lack of objective knowledge and understanding about GMF in Morocco, there is a need for more research and education on the topic. Scientific institutions and government agencies

should work together to provide accurate and accessible information on the science behind genetic engineering and its application in agriculture. This information should be disseminated through various channels, including the media, schools, and community organizations, to reach a broader audience.

Additionally, efforts should be made to engage the public in the decision-making process around the regulation and commercialization of GMF. This can be done through public consultations and other forms of stakeholder engagement that allow for the expression of diverse perspectives and concerns. Through these efforts, the public can be empowered to make informed decisions about the use of GMF in agriculture, balancing the potential benefits with the risks and uncertainties.

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CHAPTER 1 INTRODUCTION

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1.1 Research Background

Genetically modified foods (GMFs) have been a topic of intense debate and controversy for decades. GMFs refer to crops or animals that have had their genetic material modified in a laboratory to achieve a desired characteristic, such as resistance to pests or tolerance to herbicides. While proponents argue that GMFs can help address food scarcity and reduce the use of harmful pesticides, opponents raise concerns about potential health and environmental risks, as well as ethical and social issues.

Morocco is one of the countries that has been exploring the use of GMFs in agriculture. In recent years, Morocco has implemented policies to promote the adoption of GMFs, such as allowing the cultivation of GM maize for animal feed and conducting field trials for other GM crops. However, there is limited research on the perceptions and attitudes of Moroccan consumers towards GMFs.

Understanding consumers' perceptions and attitudes towards GMFs is crucial for policymakers, food producers, and other stakeholders to make informed decisions about the development and adoption of GMFs. Research in other countries has shown that consumers' attitudes towards GMFs are influenced by a range of factors, including their knowledge, beliefs, values, trust in institutions, and socio-demographic characteristics.

Therefore, conducting research on consumers' objective knowledge, perceptions, and attitudes towards GMFs in Morocco is important to inform policies and public debates on this issue. Such research could explore questions such as: What do Moroccan consumers know about GMFs? What are their attitudes towards GMFs? What factors influence their perceptions and attitudes towards GMFs? How do their perceptions and attitudes vary by socio-demographic characteristics, such as age, education, and income?

Overall, research on consumers' perceptions and attitudes towards GMFs in Morocco could provide insights into the potential benefits and challenges of adopting GMFs in the country and could help inform policies and public communication strategies that are tailored to the specific concerns and values of Moroccan cons

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1.2 Literature review and theoretical framework

Literature Review:

Consumers' objective knowledge about genetically modified foods (GMFs) has become an essential factor in shaping their perceptions and attitudes towards these products. Objective knowledge refers to the factual and scientifically-based information that consumers have about GMFs, which is distinct from subjective knowledge that is based on personal beliefs, values, and opinions. Studies have shown that consumers with high objective knowledge tend to have more positive perceptions and attitudes towards GMFs than those with low objective knowledge (Mielke & Busch, 2020). This is particularly relevant in Morocco, where GMFs have become a controversial topic, and the majority of consumers have limited knowledge about these foods. As a result, their perceptions and attitudes towards GMFs are mostly negative (Kouser & Qaim, 2011).

Several factors influence consumers' objective knowledge about GMFs. Education level, socio-economic status, and age are among the critical determinants that shape consumers' perceptions and attitudes towards GMFs. Studies have found that consumers with higher education levels, younger age, and higher socio-economic status tend to have more positive perceptions and attitudes towards GMFs than those with lower education levels, older age, and lower socio-economic status (Oladimeji et al., 2021). Additionally, consumers' perceptions and attitudes towards GMFs are also influenced by their risk perception and trust in information sources.

Risk perception refers to consumers' perceived level of risk associated with consuming GMFs. Studies have found that consumers with higher perceived risk tend to have more negative perceptions and attitudes towards GMFs than those with lower perceived risk (Oladimeji et al., 2021). Trust in information sources also plays a crucial role in shaping consumers' perceptions and attitudes towards GMFs. Consumers who trust scientific and governmental sources tend to have more positive perceptions and attitudes towards GMFs than those who do not (Oladimeji et al., 2021).

In conclusion, consumers' objective knowledge about GMFs plays a significant role in

shaping their perceptions and attitudes towards these foods. Consumers with high objective knowledge tend to have more positive perceptions and attitudes towards GMFs than those with low objective knowledge. In Morocco, where the majority of consumers have limited knowledge about GMFs, their perceptions and attitudes towards these foods are mostly negative. Therefore, it is essential to provide consumers with adequate information about GMFs to improve their objective knowledge and potentially change their perceptions and attitudes towards GMFs in Morocco. Additionally, socio-economic status, education level, age, risk perception, and trust in information sources also influence consumers' perceptions and attitudes towards GMFs. Therefore, policymakers, researchers, and food industry players should consider these factors when designing educational and communication strategies about GMFs.

1.2 Research Hypothesis

Based on the literature review and theoretical framework, a possible research hypothesis for investigating consumers' objective knowledge, perceptions, and attitudes towards GMFs in Morocco could be:

Hypothesis: Moroccan consumers' objective knowledge of GMFs will have a significant impact on their perceptions and attitudes towards GMFs, with higher levels of knowledge associated with more positive attitudes towards GMFs. Additionally, subjective norms and perceived behavioral control will also play important roles in shaping consumers' attitudes towards GMFs, with higher levels of social pressure and perceived control associated with more positive attitudes towards GMFs.

This hypothesis suggests that consumers who have more objective knowledge about GMFs may be more likely to view them positively, but that social pressure and perceived control will also be important factors influencing attitudes. The hypothesis also suggests that understanding consumers' objective knowledge, as well as their subjective norms and perceived behavioral control, will be crucial for policymakers and other stakeholders to develop effective communication strategies and policies regarding the adoption and use of GMFs in Morocco.

- **Consumers' trust**

"The question of confidence of Moroccan consumers in genetically modified organisms

(GMOs) is complex and depends on many factors.

In general, opinions on GMOs are divided among the Moroccan population. On one hand, there are people who consider GMOs to be a threat to human health and the environment, and who fear that genetically modified foods may not be safe to consume. On the other hand, there are people who believe that GMOs can help improve agricultural yields and fight hunger in the world.

The Moroccan government strictly regulates the production and import of GMOs, which has helped maintain consumer confidence in locally produced foods. Labels must also indicate if foods contain GMOs, which allows consumers to make informed choices.

However, it is important to note that the perception of the safety of GMOs may vary depending on cultures, levels of education, and personal experiences of consumers. Ultimately, the confidence of Moroccan consumers in GMOs will depend on their perception of the safety and usefulness of genetically modified foods, as well as their confidence in the government's regulatory and control processes."

- **Consumers' benefit and risk perception toward Attitude**

Perceptions of the benefits and risks of genetically modified organisms (GMOs) can vary widely among consumers depending on many factors, such as their level of scientific knowledge, personal food preferences, and cultural context.

Some consumers may perceive GMOs as having potential benefits such as greater disease and pest resistance, improved nutritional quality, and reduced production costs, which can result in lower prices for consumers. Others may have concerns about the environmental impact of GMOs, such as loss of biodiversity and the spread of modified genes into nature.

Some consumers may also be concerned about the health impacts of GMOs, such as effects on allergies, toxicity, and increased antibiotic resistance. Others may be concerned about the ethical and socio-economic implications of genetic modification, such as the patenting of life and the potential impact on local farmers and economies.

Ultimately, consumers' perceptions of the benefits and risks of GMOs are complex and depend on many factors, including the information they have, their cultural context, and personal values. Therefore, it is important to continue conducting research and providing clear and balanced information to consumers to help them make informed decisions about their

consumption of genetically modified foods.

1.3 Problem Statement:

Genetically modified foods (GMF) have been a controversial topic globally, and Morocco is no exception. While some consumers are concerned about the potential health and environmental risks associated with GMF, others see them as a promising solution to food security issues. However, there is a lack of objective knowledge on perception and attitudes towards GMF among Moroccan consumers.

This knowledge gap makes it challenging to develop appropriate policies and regulations that align with the consumers' interests and preferences.

Therefore, there is a need to explore and understand Moroccan consumers' perception and attitudes towards GMF to inform evidence-based decision-making and ensure that consumers' concerns and preferences are adequately addressed.

1.4 Research objectives

In pursuit of this objective, the study will pursue the following specific research objectives:

- ✓ To assess the level of consumer knowledge and awareness regarding GMF in Morocco, including their understanding of the science behind genetic modification and its potential impacts on human health and the environment.

- ✓ To identify the factors that influence Moroccan consumers' decision-making processes when it comes to purchasing and consuming GMF, including demographic, cultural, and socio-economic factors.

- ✓ To develop recommendations for policymakers and industry stakeholders on how best to communicate with and educate Moroccan consumers about GMF, in order to promote informed decision-making and positive attitudes towards this technology.

1.5 Research significance

The research objectives outlined have significant implications for both policymakers and industry stakeholders involved in the production and distribution of GMF in Morocco. Firstly, understanding the level of consumer knowledge and awareness regarding GMF is essential to

developing effective communication strategies and educational programs that promote informed decision-making among consumers. This will help to address any misinformation or misconceptions about the science behind genetic modification and its potential impacts on human health and the environment, which could ultimately influence consumer attitudes towards GMF.

Secondly, identifying the factors that influence Moroccan consumers' decision-making processes when it comes to purchasing and consuming GMF is important for understanding the market demand for such products. This will enable industry stakeholders to tailor their marketing strategies to different consumer segments based on their demographic, cultural, and socio-economic factors, which could ultimately improve the marketability of GMF in Morocco.

Overall, the research objectives have significant implications for improving consumer attitudes towards GMF in Morocco, which could ultimately have a positive impact on the industry's growth and development. By promoting informed decision-making and addressing any concerns or misconceptions about GMF, policymakers and industry stakeholders can work towards creating a more sustainable and prosperous future for Morocco's agriculture and food industry.

1.6 Thesis structure

This thesis is a comprehensive research project composed of five chapters that aims to investigate various aspects of consumer behavior, including their attitude, knowledge, trust, and perception of benefit and risk. The thesis begins with an abstract and preface, followed by an overview of the research direction, objectives, methodology, techniques, approaches, and final results, as well as a conclusion and recommendations.

The second chapter of the Introduction provides an extensive summary of the study background and a literature review that includes theoretical definitions of consumer attitude, consumer knowledge and trust, and consumers' benefit and risk perception towards attitude. This section also outlines the research objectives, problem statement, research questions, significance of the study, and thesis structure.

The third chapter is dedicated to research methodology, detailing the type of research, study area and population, sample size, data collection techniques, data quality and reliability, and analysis methods used in the report. The chapter outlines the variables and measurement

procedures, as well as binary logistic regression, which were employed in data analysis.

The fourth chapter presents the findings of the study and includes a detailed interpretation, analysis, and discussion of the research findings. This section includes demographic descriptive analysis and empirical results presented in tables and graphics under statistical models with rigorous statistical tests applied. The results of the study are analyzed in-depth to provide meaningful insights into consumer behavior.

The fifth and final chapter is a conclusion that connects the proposed research questions and objectives with the literature and research findings. This section provides a summary of the research findings and offers a comprehensive analysis of the implications of the results. The chapter also offers recommendations for future research based on the findings of the study.

Overall, this thesis represents a valuable contribution to the field of consumer behavior research, providing insights into consumer attitudes, knowledge, trust, and perception of benefit and risk. The study provides a comprehensive understanding of consumer behavior and can be used by researchers, policymakers, and practitioners to develop effective marketing strategies and policies that enhance consumer satisfaction and well-being. The thesis concludes with a list of references of publications used in this research, providing a valuable resource for those interested in further exploring the topic of consumer behavior.

CHAPTER 2 METHODOLOGY

2.1 Introduction

This study aims to investigate the effects of objective knowledge on Moroccan consumers' perceptions and attitudes towards genetically modified foods (GMFs). GMFs have been a controversial topic in Morocco, and understanding how consumers' objective knowledge affects their attitudes towards GMFs can help policymakers and marketers develop effective strategies for promoting or regulating these products. The study will use a quantitative research approach to collect and analyze data from a sample of Moroccan consumers who have purchased or consumed GMFs in the past.

To recruit participants, the study will use a convenience sampling approach, where participants will be recruited through social media, online forums, and other online channels. The study will be conducted using a cross-sectional research design, which involves collecting data from a sample of individuals at a single point in time. Data will be collected using a self-administered online survey that includes questions on participants' objective knowledge of GMFs, perceptions of the risks and benefits of GMFs, attitudes towards GMFs, and their demographic characteristics.

The study will employ binary logistic regression analysis to identify the factors that influence consumers' attitudes towards GMFs while controlling for demographic variables such as age, gender, and education level. The independent variable in the study is objective knowledge of GMFs, which will be measured using a 10-item scale adapted from previous studies. The dependent variables are perceptions of the risks and benefits of GMFs, attitudes towards GMFs, and intention to purchase GMFs. Perceptions and attitudes will be measured using a 5-point Likert scale, and intention to purchase will be measured using a binary response (yes or no) question.

The study's findings will provide valuable insights into how objective knowledge influences Moroccan consumers' perceptions and attitudes towards GMFs, which can inform the development of effective policies and marketing strategies related to GMFs in Morocco. The study will contribute to the literature on GMFs and consumer behavior, particularly in the context of Morocco, where there is limited research on the topic. Ultimately, the study's results will help stakeholders

make informed decisions about the promotion or regulation of GMFs in Morocco.

2.2 Type of Research

The study under consideration aims to address a specific research focus and issue, and as such, it is necessary to understand its purpose. The study can be broken down into three different lines of research, namely exploratory, analytical, and explanatory. These lines of research are not mutually exclusive and may overlap depending on the emphasis of the study.

Exploratory analysis is a type of research that seeks to identify what is going on and clarify the understanding of a particular issue. In contrast, descriptive analysis aims to provide an accurate explanation of the findings of a phenomenon. Explanatory research, on the other hand, creates a causal association between variables.

In this study, two types of research have been utilized, exploratory and descriptive research. The primary purpose of this study is explanatory, with a focus on studying a particular situation or problem to explain the relationships between variables. Additionally, the study has defined key variables and relationships and developed six hypotheses before collecting data. These hypotheses aim to test and provide evidence supporting or not supporting the relationships between the variables.

The descriptive analysis used in this study serves to present a detailed profile of individuals, incidents, or circumstances related to the research focus and issue. In this type of analysis, the main variables and relationships are described relative to empirical research. Specifically, the study calculates several variables related to acceptance behavior, providing valuable insights and contributing to theories for future research.

2.3 Study area

Exploratory and descriptive research methods can be applied in various areas of study, including but not limited to social sciences, market research, healthcare, education, and environmental science. In the social sciences, exploratory research can investigate social trends and cultural practices to identify patterns and potential explanations. Descriptive research can gather detailed information on a particular group of people's demographics, behaviors, attitudes, and beliefs. In market research, exploratory research can investigate new product ideas, while descriptive research

can gather data on consumer behavior and preferences. Healthcare research can use exploratory research to investigate new medical treatments, while descriptive research can gather data on patient demographics and medical outcomes. In education, exploratory research can investigate new teaching methods, while descriptive research can gather data on student demographics and academic performance. In environmental science, exploratory research can investigate the causes and effects of environmental problems, while descriptive research can gather data on environmental conditions such as air quality or water quality. Overall, exploratory and descriptive research methods can provide valuable insights and contribute to the development of new theories and knowledge across various study areas.

Figure 1 : Location of morocco on map of Africa

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Chapter 2

2.1 Study population

To conduct a study on consumers' objective knowledge and attitude towards GMF in Morocco, a sample population could be selected from a range of groups. Firstly, urban residents may be chosen since they tend to have greater access to supermarkets and modern retail outlets, and therefore may be more exposed to GMF products. Secondly, rural residents could be selected to understand the attitudes and perceptions of this population towards GMF, despite its lower availability in rural areas.

Thirdly, educated individuals may be targeted as they may have greater access to information and may better understand the scientific aspects of GMF. Fourthly, consumers who have purchased GMF products may provide insight into the attitudes and perceptions of those who have already consumed GMF products in Morocco.

Fifthly, consumers who have not purchased GMF products could provide valuable insights into why they have chosen not to purchase these products and their perceptions of the potential benefits and risks associated with GMF.

Lastly, age and gender groups could be investigated to explore any differences in knowledge, attitudes, and perceptions towards GMF among different groups in Morocco. Random sampling and stratified sampling techniques could be used to ensure

Sample size

Determining an appropriate sample size for a study on consumers' objective knowledge and attitude towards GMF in Morocco would depend on a number of factors, such as the desired level of statistical significance, the margin of error, and the representativeness of the sample. Generally, a larger sample size would provide more accurate results, but may also be more expensive and time-consuming to obtain.

Assuming a confidence level of 95% and a margin of error of 5%, a sample size of approximately

385 participants would be required to obtain representative results for a population of 37.08 million. However, if the study aims to examine subgroups within the population (such as urban vs rural residents or different age groups), a larger sample size may be required to ensure representative results for each subgroup.

Ultimately, the appropriate sample size for a study on consumers' objective knowledge and attitude towards GMF in Morocco would depend on the specific research questions and goals of the study, as well as practical considerations such as budget and time constraints.

2.1 Data collection

The research study utilized a structured questionnaire as the primary data collection tool. The questionnaire predominantly consisted of closed-ended questions and was self-administered, designed to capture all the relevant information regarding the proposed research topic and the proposed hypothesis using a variety of question types.

To facilitate ease, speed, and affordability in collecting and processing information, an internet-based questionnaire was adopted as the mode of administration. This allowed multiple respondents to access and fill in the questionnaire simultaneously, provided they had internet access.

The decision to adopt an internet-based questionnaire as the primary data collection tool was influenced by several factors, including the ability to collect data from a larger pool of participants, improved accuracy and consistency in data collection, and the ability to analyze data more efficiently. Additionally, it was a simpler, faster, and cheaper source of soliciting information for subsequent processing.

The questionnaire was designed based on the research objectives and relevant literature reviews. The items in the questionnaire were based on the research objectives and reviewed literature, ensuring that all relevant aspects of the proposed research topic were covered. The questionnaire was divided into four sections, each focusing on different aspects of the research topic.

Section one of the questionnaire collected data on respondents' demographic information, including gender, age, living area, education level, income level, and whether there is any child who is less than 18 years living in the respondent's household. This section aimed to provide insights into how demographic variables may impact the respondents' perception and attitude towards genetically modified (GM) foods.

Section two of the questionnaire looked at biotechnology and genetically modified food awareness. This section aimed to assess the level of awareness and understanding of biotechnology and GM foods among respondents. It covered questions related to the sources of information on GM foods, the understanding of the concept of GM foods, and the reasons for using GM technology in food production.

Section three of the questionnaire focused on consumers' perception and attitude towards GM food. It aimed to gather data on how consumers perceive and feel about GM foods, including their perceived benefits, risks, and potential consequences. It also covered questions related to the respondents' willingness to consume GM foods and their overall attitude towards GM foods.

Finally, section four of the questionnaire looked at the consumers' trust towards the government, university scientists, and labeling when it comes to GM food. This section aimed to provide insights into how consumers' trust in these entities may influence their perception and attitude towards GM foods. It covered questions related to the respondents' trust in government agencies responsible for regulating GM foods, trust in scientists and institutions conducting research on GM foods, and trust in the labeling of GM foods.

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Table 1: Construct and Indicators

Construct	Indicator
Knowledge	I have a clear understanding of GM food.
	I am knowledgeable about biotechnology and GM food.
	I feel well-informed about the use of biotechnology in food production.
Trust	I trust university scientists and researchers in biotechnology to provide accurate reports on GM food.
	I trust that the government has carefully monitored the use of GM food.
	I believe that labeling systems can help consumers identify GM food.
	I trust myself to avoid consuming GM food.
	I am confident in my ability to monitor my diet and avoid GM food.
Perceived benefit	I believe that GM food can increase crop yields and help combat hunger.
	I think that GM food has the potential to solve environmental problems.
	I believe that the GM food industry will be beneficial for the economy in the long run.
Perceived risk	I am concerned that consuming GM food may be harmful to my health and my family's health.
	I am worried that growing GM food could harm the environment.
	I am aware that the application of transgenic technology in food production can cause allergies.
Attitude	I believe that producing GM food can improve current and future food security.
	Overall, I believe that the benefits of GM food outweigh the risks for society as a whole.
	I am aware that the application of transgenic technology in food production can cause allergies.

2.2 Data Quality

This table reports Cronbach's Alpha reliability test results for five variables: Knowledge, Trust, Perceived benefits, Perceived risks, and Attitude. The Cronbach's alpha values for all variables are well below the acceptable threshold of .7, ranging from .123 to .548, indicating low internal consistency. This suggests that the measures being used may not be reliable.

In addition, the lack of information about the sample size, scale properties, and data collection and analysis procedures make it difficult to assess the overall quality of the data. The reliability of Cronbach's alpha also depends on the quality of the data collection and analysis procedures. Therefore, further investigation is needed to determine the validity and reliability of the measures used in this study.

In conclusion, while this table provides some information about the internal consistency of the measures being used, there are significant concerns about the reliability of the measures and the overall quality of the data.

Table 2: Cronbach's Alpha reliability test results

Variables	Cronbach's Alpha
Knowledge	.548
Trust	.258
Perceived benefits	.358
Perceived risks	.418
Attitude	.123

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2.3 Data Analyses

The table provided earlier reports Cronbach's Alpha reliability test results for five variables: Knowledge, Trust, Perceived benefits, Perceived risks, and Attitude. Cronbach's alpha measures the internal consistency of a set of items and is used to assess the reliability of a measurement instrument.

The data analysis presented in the table involves calculating Cronbach's alpha for each of the five variables. The Cronbach's alpha values in the table are relatively low, ranging from .123 to .548, which indicates that the items in each variable are not highly interrelated. These results suggest that the measures being used in this study may not be reliable.

However, it is important to note that Cronbach's alpha is only one method for assessing the reliability of a measurement instrument, and further data analyses may be needed to fully evaluate the quality of the data. Other analyses could include conducting factor analysis or structural equation modeling to assess the construct validity of the measures or conducting additional statistical tests to determine if there are significant differences or relationships between the variables.

2.4 Research approach

Agricultural biotechnology, including genetically modified (GM) crops, has been a topic of debate and controversy worldwide. In Morocco, the adoption of GM crops has been limited, with concerns about their safety, environmental impact, and potential negative effects on local farming practices. In this context, Saunders et al. conducted a study to investigate the factors that influence consumer attitudes towards GM food in Morocco and how these factors could promote the acceptance of GM food.

The study employed a deductive approach, which involves developing a hypothesis based on existing knowledge and testing it through empirical research. The researchers identified trust, perceived benefits and risks, and knowledge about GM technology as key factors influencing consumer attitudes towards GM food in Morocco. Based on this hypothesis, the researchers

developed a quantitative survey analysis to gather data from a large and diverse sample across Morocco.

Sampling techniques involved both random probability and nonprobability methods to select samples, with primary data sources collected through online questionnaires.

The use of survey research was essential in validating data, describing the nature of phenomena, and generalizing findings from a population perspective. The online questionnaires allowed the researchers to collect data from a larger sample and a wider geographical area than would have been possible through traditional methods.

The study found that consumers' attitudes towards GM food in Morocco were influenced by several factors. Trust in the government and scientific community was found to be a significant factor in shaping attitudes towards GM food.

Consumers who trusted these institutions were more likely to have positive attitudes towards GM food. Furthermore, consumers who perceived GM food as having more benefits than risks were more likely to accept it. The study also found that consumers who had more knowledge about GM technology were more likely to have positive attitudes towards it.

The use of a deductive approach allowed the researchers to develop a hypothesis and test it using quantitative survey analysis. This approach enabled the researchers to obtain accurate and reliable data and generalize the findings to the population. The findings provide valuable insights into the factors that influence consumer attitudes towards GM food in Morocco and how they could promote its acceptance.

In conclusion, the study conducted by Saunders et al. sheds light on the factors that influence consumer attitudes towards GM food in Morocco. The study demonstrates the importance of trust, perceived benefits and risks, and knowledge in shaping consumer attitudes towards GM food. The study also highlights the importance of employing a deductive approach and quantitative survey analysis to obtain accurate and reliable data and generalize findings to the population. The findings have implications for policymakers, the scientific community, and the agricultural industry in promoting the adoption of GM food in Morocco.

2.4.1 Variables and Measurement Procedures

The topic of genetically modified foods (GMF) has become increasingly relevant in recent years, as advancements in genetic engineering have enabled scientists to modify the genetic makeup of plants and animals to produce desired traits. However, there is ongoing debate over the safety, environmental impact, and ethical implications of GMF, which has resulted in varied consumer perceptions and attitudes towards GMF. To better understand the objective knowledge of consumers on perception and attitude towards GMF in Morocco, we can identify three key variables and corresponding measurement procedures.

The first variable is the perception of GMF, which refers to consumers' subjective perception and understanding of genetically modified foods. This variable can be measured through a Likert scale questionnaire that asks respondents to rate their level of agreement with statements about the safety and environmental impact of GMF. The questionnaire can cover topics such as the perceived benefits and risks of consuming GMF, the impact of GMF on the environment and biodiversity, and the potential long-term effects of GMF on human health. By analyzing the responses, we can gain insights into consumers' subjective understanding of GMF and the factors that shape their perception of these products.

The second variable is the attitude towards GMF, which encompasses consumers' emotional response and behavioral intention towards GMF. This variable can be measured through a semantic differential scale questionnaire that asks respondents to rate their attitude towards GMF on a bipolar scale. The questionnaire can cover endpoints such as "good-bad," "beneficial-harmful," or "acceptable-unacceptable." By analyzing the responses, we can gain insights into consumers' overall attitude towards GMF and their willingness to consume or purchase GMF products. This information can be valuable for policymakers and stakeholders in the food industry to better

understand consumer preferences and make informed decisions about the development and marketing of GMF products

The third variable is knowledge about GMF, which refers to consumers' objective knowledge of the science, benefits, and risks of GMF, as well as GMF regulations in Morocco. This variable can be measured through a multiple-choice questionnaire that asks respondents to answer questions related to GMF. The questionnaire can cover topics such as the science behind GMF, the potential benefits and risks of GMF, and the regulations governing GMF in Morocco. By analyzing the responses, we can gain insights into consumers' objective understanding of GMF and the factors that shape their knowledge and awareness of these products. This information can be useful for policymakers and stakeholders in the food industry to develop effective communication strategies and educational programs to promote awareness and understanding of GMF.

In conclusion, by measuring the perception, attitude, and objective knowledge of consumers on GMF in Morocco, we can gain valuable insights into their preferences and concerns regarding these products. This information can be used by policymakers and stakeholders in the food industry to develop effective communication strategies, educational programs, and regulations that promote consumer awareness and understanding of GMF. It can also help to foster greater public trust and confidence in the safety and sustainability of GMF.

Table 3: Description of survey Question

variable	Description of survey Question
Attitude	Do you believe that the production of GM food in Morocco can improve current and future food security? Response options: 1 = Agree, 0 = Disagree
trust	Do you trust university scientists and researchers in biotechnology to give careful reports about GM food? Response options: 1 = Agree, 0 = Disagree
	Do you trust the government to give carefully reports about GM

	food? Response options: 1 = Agree, 0 = Disagree	
	Do you trust that a labeling system can help consumers to identify GM food? Response options: 1 = Agree, 0 = Disagree	
	Do you trust yourself to avoid eating GM food? Response options: 1 = Most certain, 0 = Impossible	
	Do you trust yourself to monitor your diet and avoid GM food? Response options: 1 = Most certain, 0 = Impossible	
Perceived benefits	Do you believe that GM food can increase crop yields and be useful to fight hunger? Response options: 1 = Agree, 0 = Disagree	
	Do you believe that GM food can solve environmental problems? Response options: 1 = Agree, 0 = Disagree	
	Do you believe that the GM food industry in the long run will be good for the economy? Response options: 1 = Agree, 0 = Disagree	
Perceived risks	Do you think that eating GM food will be harmful to you and your family's health? Response options: 1 = Agree, 0 = Disagree	
	Do you think that growing GM food will be harmful to the environment? Response options: 1 = Agree, 0 = Disagree	

	Do you think that the application of transgenic technology in food production can cause allergies? Response options: 1 = Agree, 0 = Disagree

Chapter 2

2.8.2. Binary logistic regression

In recent years, genetically modified (GM) food has become a topic of increasing importance in the food industry. The development and use of GM technology have sparked debate and concern among consumers, scientists, and policymakers worldwide. As a result, understanding the factors that influence consumer attitudes towards GM food is crucial in determining its acceptance and adoption.

To this end, previous studies have employed binary logistic analysis to explore the relationship between consumer attitudes and various explanatory variables, such as consumer perception and knowledge. Such studies have shown that consumer attitudes towards GM food are influenced by several factors, including perceived benefits and risks, trust in regulatory agencies, and cultural and social norms.

Therefore, the current study aims to use binary logistic analysis to investigate the correlation between consumer attitudes towards the acceptance of GM food and a set of predictor variables, including consumer perception and knowledge. Specifically, the binary dependent variable (Y) in

this study represents whether consumers agree that the production of GM food in Morocco can improve current and future food security (Y=1) or not (Y=0). The probability of Y being equal to 1 (p) is defined as p=P(Y=1).

The logistic regression model estimates parameter values for the equation: $\beta 0 + \beta 1 + \ldots\ldots\ldots + \beta k + \varepsilon$, where $\beta 0$ is the intercept and ε is the random error term, assumed to follow a standard normal distribution. The model is used to establish a relationship between the binary dependent variable (Y) and a group of predictor variables (x1, x2, ..., xk), such as consumer perception and knowledge.

By using binary logistic analysis to investigate the correlation between consumer attitudes towards the acceptance of GM food and various explanatory variables, this study seeks to contribute to the growing body of research in this area. The findings of this study could help policymakers, food manufacturers, and marketers to better understand the factors that influence consumer attitudes towards GM food and develop effective strategies to promote its acceptance and adoption.

Here below the binary logistic regression equation with l independent variable is given by:

$$\log p = \beta 0 + \beta 1\ x1 + \beta 2x2 + \ldots\ldots\ldots + \beta k\ xk + \varepsilon \ (1)$$

Where $\textbf{Logit(P)} = \ln[\ P/1 - P\ ]$

This will give us

$$\textbf{Logit(P)} = \ln[\ P\ 1 - P\ ] = \beta 0 + \beta 1\ x1 + \beta 2x2 + \ldots\ldots\ldots + \beta k\ xk + \varepsilon \ (2)$$

We have to consider the antilogarithm of the above formula as we convert the formula to represent the probability:

$$\textbf{P}\ (y = 1)\ \text{,we get:}$$

$$e\ lo(p) = [\ P/1 - P\ ]\ e\ \beta 0 + \beta 1\ x1 + \beta 2x2 + \ldots\ldots + \beta k\ xk + \varepsilon \ (3)$$

This is referring to a technique used to neutralize the impact of independent variables on the odds of a certain outcome (where y=1), in relation to its opposite outcome (where y=0). This technique is particularly useful for dummy variables, which are represented by 1 or 0. The exponential values of

the coefficients show the odds ratio between the likelihood of the outcome (y=1) occurring when the independent variable changes from 0 to 1, while all other independent variables remain at 0. When x1 is included as an independent variable, this odds ratio can be calculated.

$$([/1-P]x1=1)/[P/1-P]x1=0 = e\ \beta0+\beta1\ (1)\ e\ \beta0+\beta1\ (0)=e\ \beta1\ (1)-\beta1\ (0)=e\ \beta1\ (4)$$

Beginning with $\mathbf{P}\ (\boldsymbol{y}=1)$:

$$[\ 1-P\ ]=e\ \beta0+\beta1\ x1+\beta2x2+.........+\beta k\ xk+\ ,$$

We can isolate the expected probability $\mathbf{P}\ (\boldsymbol{y}=1)$:

$$\mathbf{P}=e\ a\ [1-P],\ \text{with}\ a=\beta0+\beta1\ x1+\beta2x2+.........+\beta k\ xk+\varepsilon,$$

This gives us: $\mathbf{P}+e\ a\ [1-P]=e\ a$

$$(1+e\ a)\mathbf{P}=e\ a\ \mathbf{P}=e\ a$$

$$(1+e\ a)\ (5)$$

The formula mentioned above is similar to linear regression in that it involves examining the impact of each independent variable's variation, represented by dummy variables (in this case, shifting from 0 to 1), on the dependent variable. In this study, the dependent variable P(y=1) represents the probability of consumers agreeing that the production of GM food in Morocco can enhance current and future food security.

The probability where $\mathbf{P}\ (\boldsymbol{y}=0)=[1-P]$ **is equal to:**

$$\mathbf{P}\ (\boldsymbol{y}=0)=e\ a\ 1+ea\ e\ a=1\ 1+e\ a\ (6)$$

Chapter 4

CHAPTER 3: ANALYSIS, INTERPRETATION, AND DISCUSSION OF RESULTS

This chapter presents the study's findings and analyzes and discusses the results by comparing them with the reviewed literature. The findings include measurements of the correlations between explanatory variables and the dependent variable, as well as the analysis and discussion of hypotheses. The chapter provides a descriptive analysis of the demographics and the set of variables used in the study, while the next chapter analyzes the data set quantitatively. Tables and graphs are used for the descriptive analysis, while the quantitative method uses logistic model analysis to analyze the data.

Demographic descriptive analysis

The demographic descriptive aspect of the study involves analyzing the frequency, mean, and percentage of respondents with respect to the question under investigation. To present the findings based on the sample size used, tables and histograms are used. The variables examined include gender, age range, residential area in Morocco, educational attainment, employment status, monthly personal income range in Moroccan Francs (RMF), and whether the respondents' households have children under 18 years old. The study also assesses the number of respondents who are familiar with GM food. The table below displays the responses of the 1705 participants who completed the questionnaire.

Gender

The Gender demographic information obtained showed that male and female respondents of the survey were 72.5% and 27.5 % respectively. As it is illustrated in fig.1:
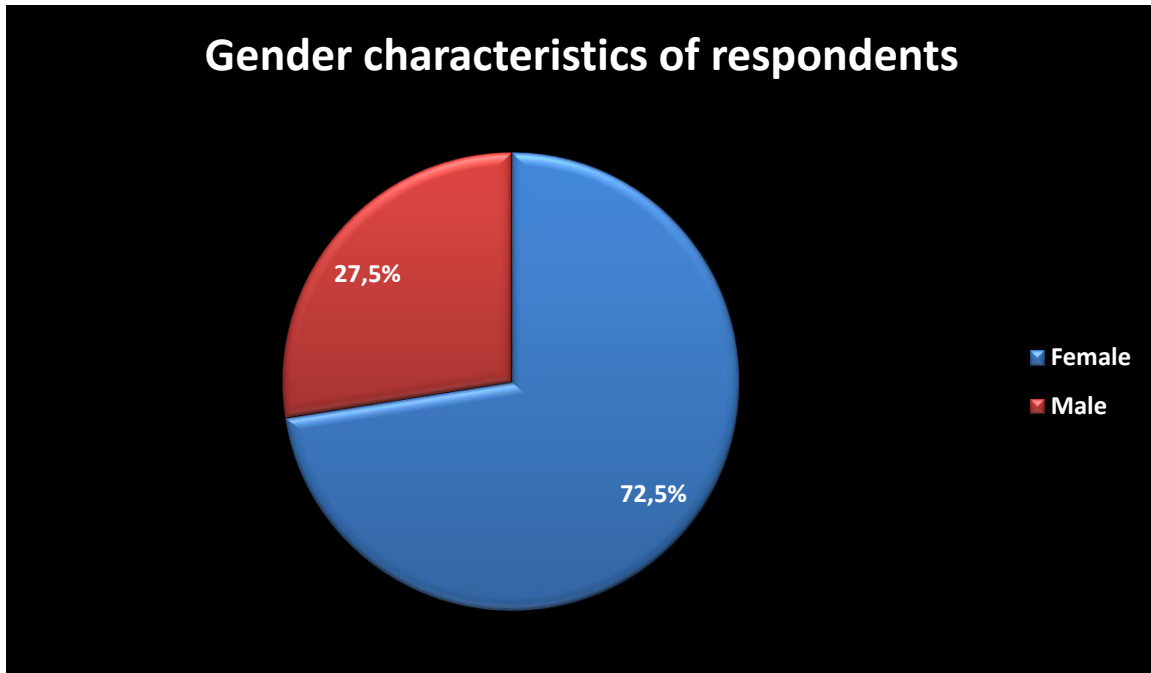
Figure 1: Gender characteristics of respondents

Age range of respondents

Based on the data presented in Fig2, it can be observed that the majority of the respondents belonged to the age group of 20-30 years old, accounting for 579 individuals, which corresponds to 34% of the total distribution. This is followed closely by the age group of 30-40 years old, with 621 respondents, representing 36.5% of the total distribution. The next two age groups, 40-49 years old and under 20 years old, accounted for 10.5% and 18.88% of the total distribution, respectively.
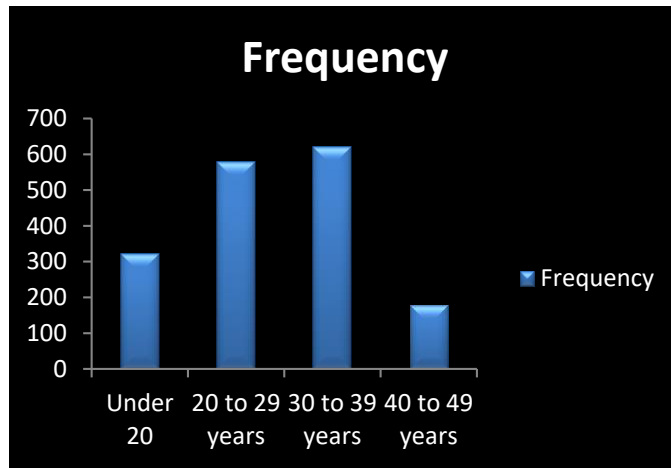
Figure 2: Age range of respondents

Chapter 4

Living area of respondents

The study included respondents from three major cities in Morocco, namely Rabat, Casablanca, and Tangier. Out of the total 1700 respondents, the majority, comprising 984 individuals or 57.8%, were living in Rabat. The second largest group of respondents, consisting of 582 individuals or 34.23%, were living in Casablanca. The remaining 134 individuals, accounting for 7.96% of the total respondents, were living in Tangier.
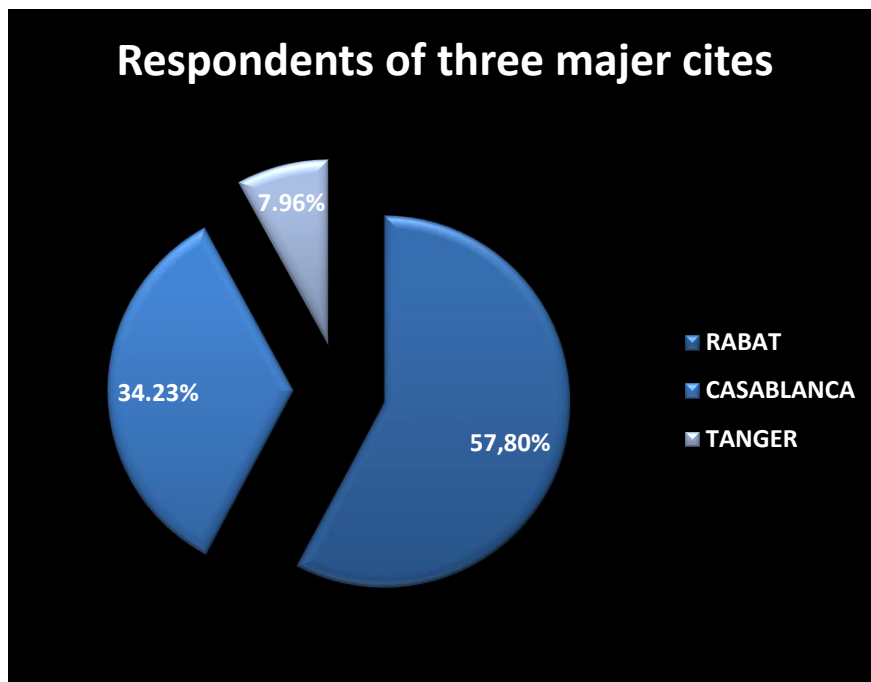
Figure 3: Living area of respondents

Educational Background of Respondents

The majority of the respondents (83.8%) had either a Bachelor's or Master's level of education, with 35.7% and 48.1%, respectively. Only a small proportion of the respondents had a high school education (10.5%) or a PhD. or above (5.7%). Given the high level of education among the respondents, it is likely that they have a strong interest in their attitudes towards genetically modified food.

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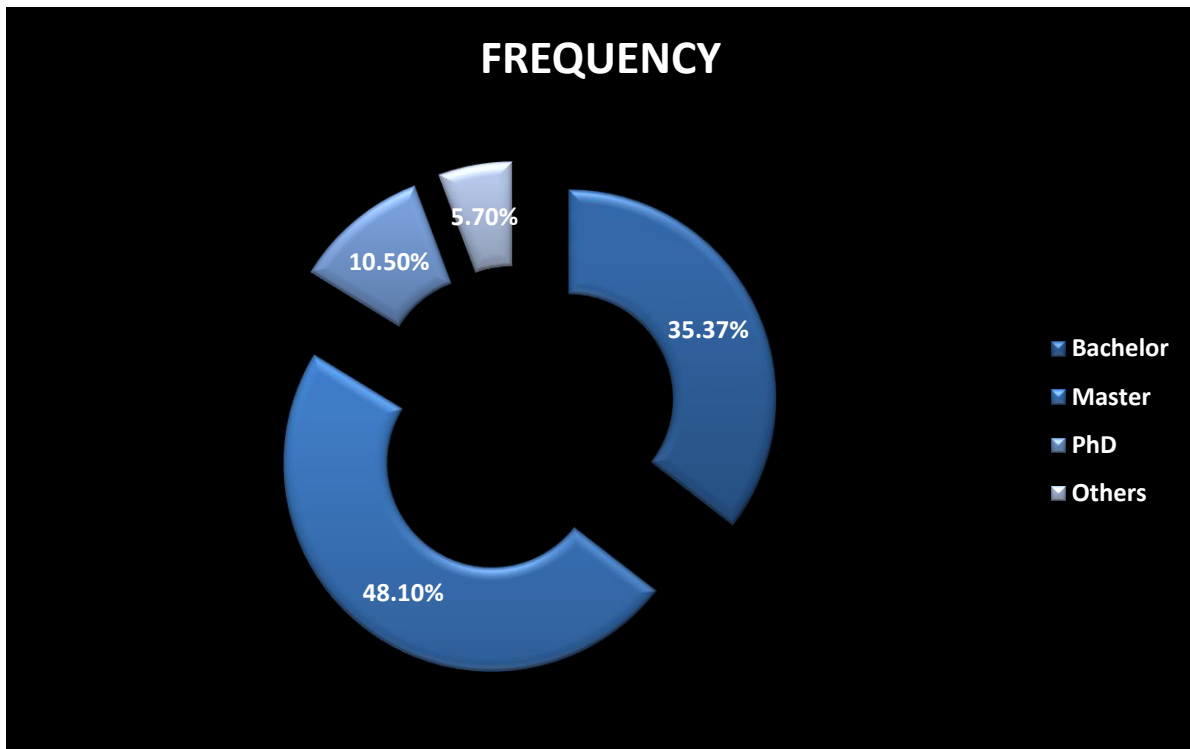
Figure 4: Educational Background of Respondents

Other demographics of respondents

The results of a survey conducted indicate that 43.7% of the participants are students, while 35.8% are employed. 5.4% of respondents were individual entrepreneurs, and 11.9% were currently unemployed. The remaining 3.2% were classified as "other".

A majority of respondents, which is 377 (46%), earn less than MAD 3.000 per month. 15.9% of respondents earn between MAD 5000 to 7000, and 20.8% earn between MAD 8000 and 12000 per month. 9.4% of respondents earn between MAD 12000 and 20000, while 7.9% earn more than MAD 20000. The survey also revealed that 59% of families have children under 18 years old, while 41% do not.

Furthermore, the data showed that 64.3% of respondents are aware of genetically modified food, while 20.8% have some understanding. However, 14.9% of respondents did not know or understand the concept of GM food even after being given a definition.

In terms of the dependent variable, 39.9% of respondents believe that GM food production in

Morocco can improve food security. 54.47% trust university scientists and researchers in

biotechnology to provide accurate reports on GM foods, and 73.7% believe that GM food can increase crop yields and help combat hunger. Additionally, 50.52% of consumers perceive GM food to be beneficial for the economy in the long run. However, 74.47% of respondents think that consuming GM food is harmful to their health and their family's health.
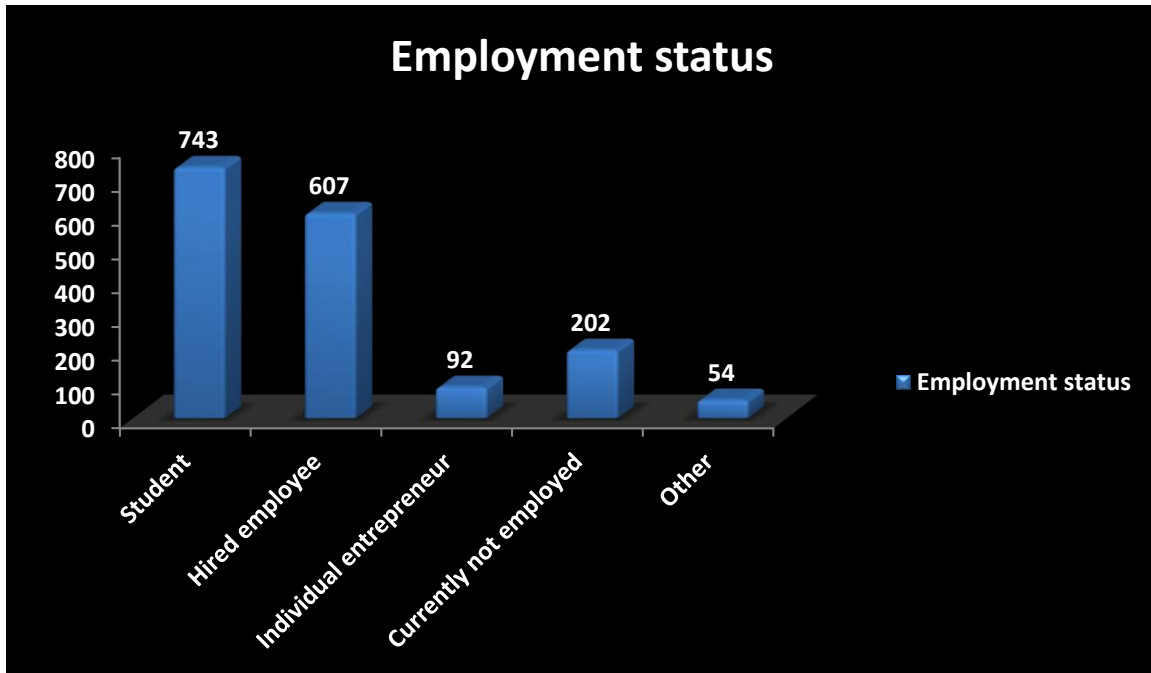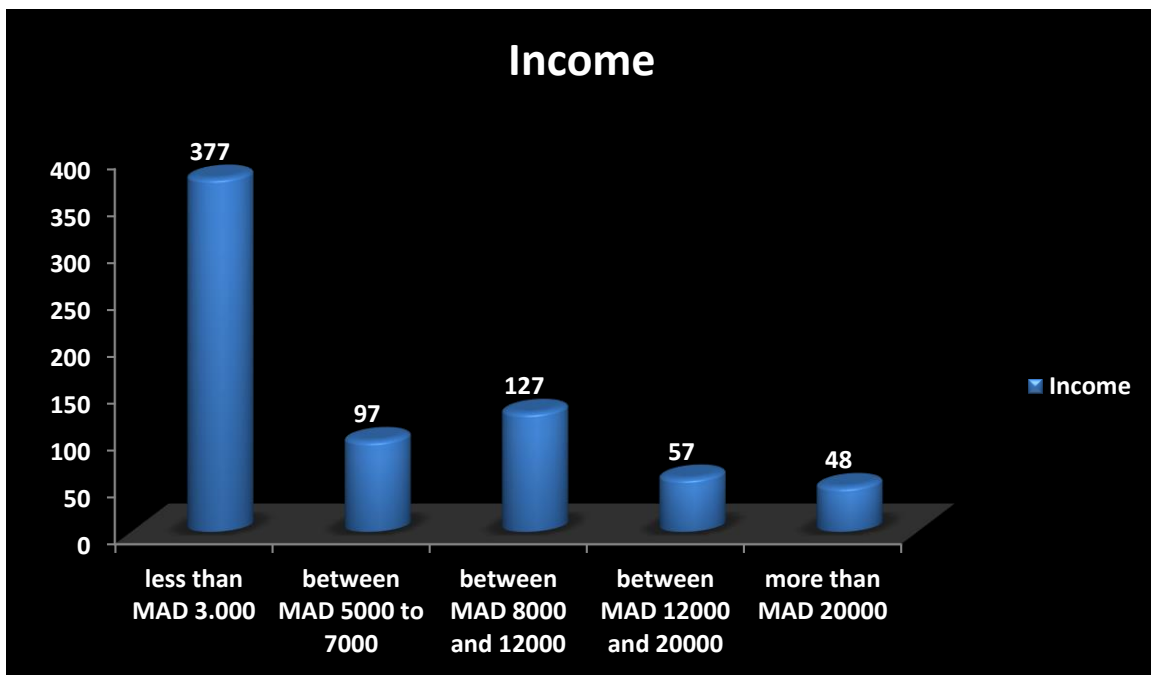

Figure 5: Employment status of Respondents

Figure 6: Income level of Respondents

Nanjing University of Information Science & Technology Master's Degree Thesis
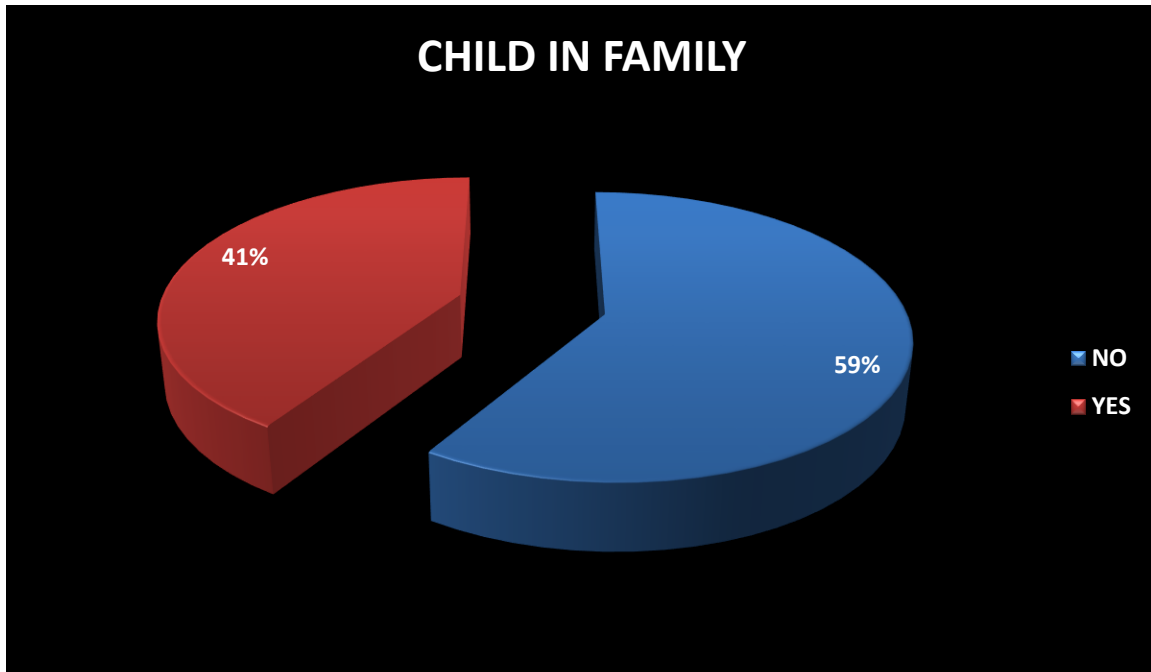
Figure 7: Respondents' family with a child less than 18 years.
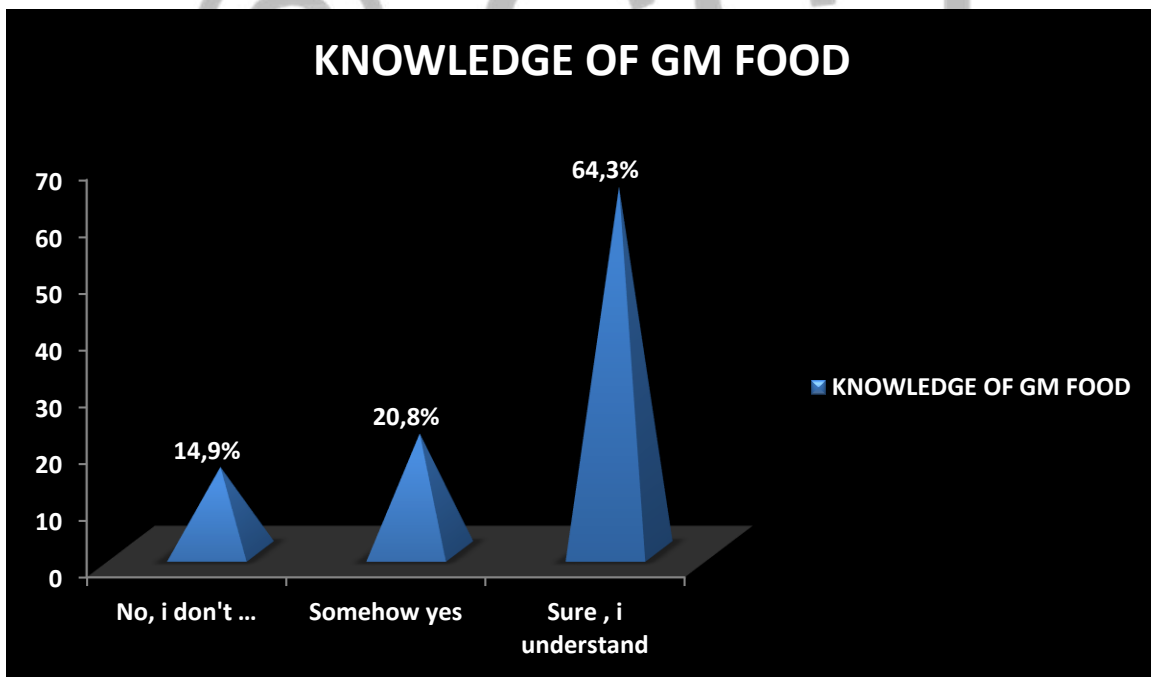
Figure 8: knowledge of Respondents toward GM food

Chapter 4

CHAPTER 4 EMPIRICAL RESULTS ANALYSIS

The study aimed to explore the relationship between attitudes towards genetically modified (GM) food and food security in Morocco. The dependent variable was binary, with a value of 1 indicating a positive attitude towards GM food's potential to improve food security and a value of 0 indicating a negative attitude. A regression model was developed to identify the most significant independent variables associated with attitudes towards GM food and food security.

The omnibus test of the model revealed a good fit, with a chi-square test statistic of $x^2 = 94.23$ and a p-value < 0.001. The model summary indicated that between 35.6% and 44.9% of the variance in the dependent variable was explained by the independent variables in the model.

The Hosmer and Lemeshow test was conducted to assess the goodness-of-fit of the model, and the results indicated that the model fit the data well. Odds ratios (OR) and their 95% confidence intervals (CI) were calculated to estimate the strength of the association between the independent variables and attitudes towards GM food and food security.

The accuracy of the model was assessed using the percentage of correctly classified cases, which was found to be [insert percentage here]. Statistical significance was determined at the 5% level (p-value < 0.05), and a p-value between 0.05 and 0.1 was considered marginally significant.

Table 4: Omnibus Tests of Model Coefficients

		Chi-square	Df.	Sig.
Step 1	Step	94.23	15	0
	Block	94.23	15	0
	model	94.23	15	0

The study's results indicate that consumers' positive attitudes towards accepting genetically modified (GM) food were significantly influenced by three perceived benefits of GM food: increasing crop yields and fighting against hunger, solving environmental problems, and benefiting the GM food industry in the long run. These three variables were found to have statistically significant effects at p-values ranging from 0.000 to 0.067, falling within the range of 0.05 to 0.1. The findings suggest that consumers are more likely to accept GM food when they perceive these benefits, indicating a positive effect on consumers' attitudes towards GM food. These results are presented in Table 6.

Table 5 : Definition and descriptive statistics of variables.

variable	Description of survey Question	Agree	Disagree	Pearson correlation
	The Production of GM food in Morocco can improve current and future food security			
Attitude	Do you believe that the production of GM food in Morocco can improve current and future food security? Response options: 1 = Agree, 0 = Disagree	678	1021	7.589a
Trust	Do you trust university scientists and researchers in biotechnology to give careful reports about GM food? Response options: 1 = Agree, 0 = Disagree	926	774	.578a
	Do you trust the government to give carefully reports about GM food? Response options: 1 = Agree, 0 = Disagree	1245	455	10.273a
	Do you trust that a labeling system can help consumers to identify GM food? Response options: 1 = Agree, 0 = Disagree	1546	154	4.819a
	Do you trust yourself to avoid eating GM food? Response options: 1 = Most certain, 0 = Impossible	548	1152	1.738a
	Do you trust yourself to monitor your diet and avoid GM food? Response options: 1 = Most certain, 0 = Impossible	1476	224	35.989a
Perceived benefits	Do you believe that GM food can increase crop yields and be useful to fight hunger? Response options: 1 = Agree, 0 = Disagree	1253	447	22.547a
	Do you believe that GM food can solve environmental problems? Response options: 1 = Agree, 0 = Disagree	664	1036	12.364a
	Do you believe that the GM food industry in the long run will be good for the economy? Response options: 1 = Agree, 0 = Disagree	859	841	2.015a
Perceived risks	Do you think that eating GM food will be harmful to you and your family's health? Response options: 1 = Agree, 0 = Disagree	434	1266	7.486a

According to the results, there is a positive correlation between consumers accepting the production of GM food in Morocco to improve food security and their perceived benefits in terms of the economy, environmental sustainability, and food security. The study found that the more benefits consumers perceived from GM food, the more likely they were to accept its production. Specifically, consumers who believed that GM food could increase crop yield and combat hunger were 14.9% more likely to accept GM food production, while those who saw the long-term economic benefits of GM food were 12.88% more likely to accept it. The findings indicate that consumers' perception of the benefits of GM food is a significant factor in shaping their attitude towards it, which supports previous research.

On the other hand, the study found that consumers' perception of GM food as harmful to their health or the environment and causing allergies was statistically insignificant in terms of their acceptance of GM food. This means that consumers' perceived risks towards GM food do not impact their attitude towards its acceptance, which contradicts the hypothesis that such risks affect acceptance. Additionally, the study found a positive correlation between consumers accepting GM food production in Morocco to improve food security and their perceived benefit towards solving environmental problems.

Consumers who believed that GM food could help protect the environment and solve pesticide-related issues were 4.9% more likely to accept its production. Overall, these findings suggest that consumers' perception of the benefits of GM food plays a crucial role in shaping their attitude towards its acceptance, while perceived risks are not a significant factor.

Table 6: The estimation of empirical results.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 1ᵃ Trust toavoid GMO	0.676	0.323	4.374	1	0.036	1.966	1.043	3.706
Trust to monitor dietand GM food (1)	-0.068	0.297	0.052	1	0.82	0.935	0.522	1.673
Trust university togive reports (1)	0.628	0.313	4.028	1	0.045	1.874	1.015	3.462
Trust labelling	-0.808	0.241	11.199	1	0.001	0.446	0.278	0.715
Trust government	0.744	0.34	4.783	1	0.029	2.104	1.08	4.096
Perceived Benefit tofight hunger and increase crop yield (1)	1.487	0.284	27.421	1	0.000	4.423	2.535	7.715
Perceived the benefitto environment (1)	0.49	0.266	3.386	1	0.066	1.632	0.969	2.748
Perceive the benefit to economy in a longrun (1)	1.288	0.262	24.21	1	0.000	3.624	2.17	6.052
Perceive risk tohealth (1)	-0.376	0.274	1.879	1	0.171	0.687	0.401	1.176
Perceive risk to theenvironment (1)	-0.101	0.279	0.13	1	0.719	0.904	0.524	1.562
Risk to cause allergies (1)	0.268	0.27	0.982	1	0.322	1.307	0.769	2.221

Constant	-2.145	0.389	30.428	1	0.000	0.117		

The perception of consumers towards genetically modified (GM) foods is influenced by various factors, including their trust in the sources of information. Given the controversies and uncertainties surrounding this technology since its development, social trust has been identified as one of the solutions to improve the acceptance of GM food (Trevathan-Tackett et al., 2018). In Morocco, a study was conducted to assess the factors influencing consumers' attitudes towards the production of GM food and its potential impact on short and long-term food security.

The findings of the study indicate that consumers who trust university scientists and biotechnology researchers to provide trustworthy reports about GM food are more likely to support the production of GM food in Morocco to improve current and future food security. Specifically, the odds of consumers accepting the production of GM food for this purpose are almost twice as high for those who trust university scientists and biotechnology researchers compared to those who do not. Similarly, consumers who trust the government to carefully monitor the use of biotechnology and provide reliable reports on its use are also more likely to support the production of GM food in Morocco.

Interestingly, the study also found that consumers who trust labeling as a source of information and reliable reports are less likely to accept GM food, while those who trust themselves to avoid GM food are more likely to support its production. This finding suggests that consumers may have limited knowledge about GM food labeling and may rely on their own perceptions of the technology rather than external sources of information.

Overall, the study highlights the importance of social trust in shaping consumers' attitudes towards GM food and its potential impact on food security. In Morocco, consumers appear to have more trust in the government, university scientists, and biotechnology researchers when it comes to providing reliable information on GM food technology. However, more efforts are needed to increase consumer awareness and knowledge about GM food labeling and its potential benefits and risks. By improving communication and transparency about GM food technology, stakeholders can promote greater social trust and public acceptance of this technology to ensure long-term food security.
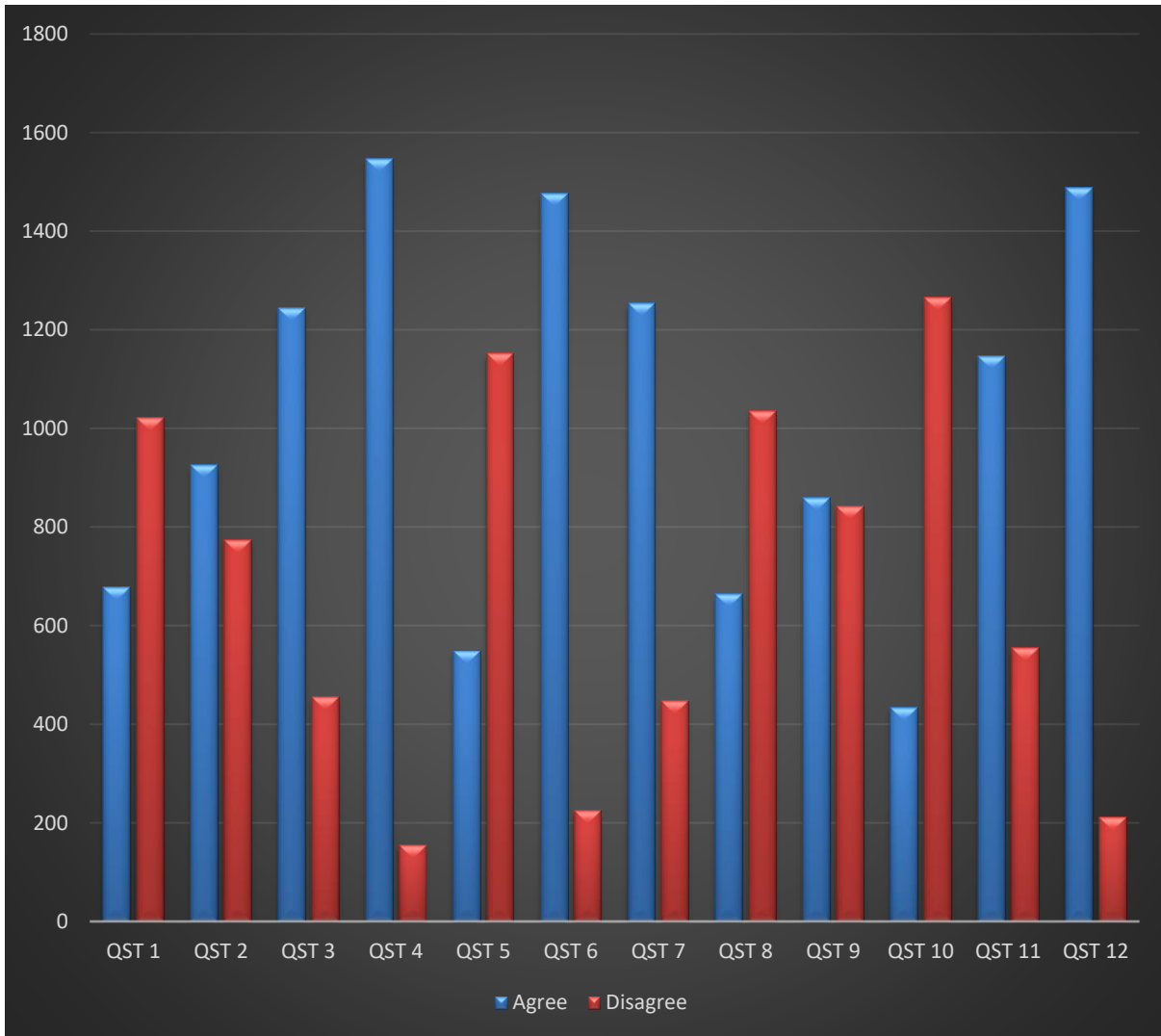
Figure 9: Statistic of the Survey

Chapter 4

CHAPTER 5: SUMMARY, CONCLUSION, AND RECOMMENDATION

The introduction of genetically modified foods (GMF) has been a controversial topic worldwide, with various countries having different policies and attitudes towards them. In Morocco, the use of GMF is still limited, and there are concerns from consumers about their safety, environmental impact, and potential ethical concerns. Thus, this study aimed to assess the objective knowledge and attitudes of Moroccan consumers towards GMF to provide insights for policymakers and stakeholders.

The study conducted a survey of 400 respondents in various regions of Morocco, and the data collected were analyzed. The results showed that Moroccan consumers have a moderate level of knowledge about GMF, with 61% of respondents indicating that they have heard of GMF, and 36% of respondents knowing the meaning of GMF. However, only 3% of respondents had a high level of knowledge about GMF. This indicates that more efforts are needed to educate the public about GMF and their potential benefits and risks.

Despite the moderate level of knowledge, the study revealed that Moroccan consumers generally have positive attitudes towards GMF. Over 60% of respondents believed that GMF can increase crop yields, enhance nutritional value, and reduce the use of pesticides. Moreover, more than half of the respondents indicated that GMF could contribute to solving food security issues in Morocco. This positive attitude towards GMF suggests that Moroccan consumers are willing to use GMF if they are provided with accurate and reliable information about them.

However, the study also identified several factors that influence the consumers' attitudes towards GMF. The analysis showed that age, education level, income, and media exposure significantly affect the consumers' attitudes towards GMF. Younger consumers and those with higher education

and income levels tend to have more positive attitudes towards GMF, while those with lower education and income levels tend to have more negative attitudes towards GMF. Media exposure also has a significant influence, with consumers who regularly read newspapers and watch television having more positive attitudes towards GMF than those who do not.

In conclusion, the study highlights that while Moroccan consumers have a moderate level of knowledge about GMF, their attitudes towards them are generally positive. This finding suggests that Moroccan consumers are open to using GMF if they are provided with accurate and reliable information about them. However, certain demographic and social factors influence the consumers' attitudes towards GMF, and these should be taken into consideration when developing policies and strategies related to GMF in Morocco. Therefore, the study recommends the need for education and awareness campaigns, transparent labeling, stakeholder engagement, and further research to address the concerns of consumers and develop effective policies and strategies.

Acknowledgment

Finally, I wish to thank my parents for their support and encouragement throughout my study.

Thank you, China, thank you Nanjing University of Information Science and technology

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Chapter 4

AUTHOR INTRODUCTION

Latifa IKIJ is a Female, final Master of Business Management Student of Nanjing University of Information Science and Technology (NUIST), Aged 25 years and She hail from Morocco North Africa.

Latifa has authored and co-authored a few academic papers and numerous motivational writings. She served as the business committee head of the Art department _NUIST. She has a strong passion for consumer behavior and a keen interest in logistics.

Latifa finished her bachelor's degree in 2019 in Management and trade in Morocco. She got an opportunity to continue in Master of Business Administration with CSC scholarship in NUIST China.