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Traditional vs. Smart Packaging – Exploring the Influence of Packaging on Purchase Intention

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ABSTRACT

***Title:** Traditional vs. Smart Packaging – Exploring the Influence of Packaging on Purchase Intention*

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Packaging is an essential tool in the field of marketing and over the years, technological developments have led to modern trends such as smart packaging which make it possible to enhance the benefits of traditional packaging by improving the quality and safety of a product. The study investigates how the use of different types of packaging affects consumers' purchase intention while simultaneously taking into account other factors, such as perceived product quality and consumers' technology affinity. In order to explore the relationship between these individual variables, quantitative data was collected by conducting two online surveys. Analyzing the data, a significant effect of both traditional and smart packaging on purchase intention was identified, which turned out to be more positive for smart packaging approaches. Additionally, the results show that consumers perceive food in smart packaging as being of higher quality compared to traditional packaging. After exploring that there is a significant mediating effect of perceived product quality, the interaction effect of technology affinity and packaging was identified as not statistically significant. However, there is a significant effect that smart packaging is more effective in increasing purchase intention among consumers with an average or a high level of technology affinity. These findings contribute to the literature by offering a foundation for future research and leading to managerial implications for approaching future marketing strategies.

Keywords: Smart Packaging, Purchase Intention, Technology Affinity, Perceived Product Quality, Consumer Behavior

SUMÁRIO

Título: Embalagem Tradicional vs. Embalagem Inteligente - Explorando a Influência da Embalagem na Intenção de Compra

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A embalagem é uma ferramenta essencial no domínio do marketing e, ao longo dos anos, os desenvolvimentos tecnológicos conduziram a tendências modernas, como as embalagens inteligentes, que permitem reforçar os benefícios das embalagens tradicionais, melhorando a qualidade e a segurança de um produto. O estudo investiga a forma como a utilização de diferentes tipos de embalagens afecta a intenção de compra do consumidor, tendo simultaneamente em conta outros factores, como a percepção da qualidade do produto e a afinidade do consumidor com a tecnologia. A fim de explorar a relação entre estas variáveis individuais, foram recolhidos dados quantitativos através da realização de dois inquéritos em linha. Analisando os dados, identificou-se um efeito significativo tanto da embalagem tradicional como da embalagem inteligente na intenção de compra, que se revelou mais positivo para as abordagens de embalagem inteligente. Além disso, os resultados mostram que os consumidores percebem os alimentos em embalagens inteligentes como sendo de maior qualidade em comparação com as embalagens tradicionais. Depois de explorar que existe um efeito mediador significativo da qualidade percebida do produto, o efeito de interação da afinidade tecnológica e da embalagem foi identificado como não sendo estatisticamente significativo. No entanto, existe um efeito significativo de que a embalagem inteligente é mais eficaz para aumentar a intenção de compra entre os consumidores com um nível médio ou elevado de afinidade tecnológica. Estes resultados contribuem para a literatura, oferecendo uma base para investigação futura e conduzindo a implicações de gestão para a abordagem de futuras estratégias de marketing.

Palavras-chave: Embalagem Inteligente, Intenção de Compra, Afinidade com a Tecnologia, Qualidade Percebida do Produto, Comportamento do Consumidor

TABLE OF CONTENTS

ABSTRACT	II
SUMÁRIO	III
TABLE OF CONTENTS	IV
TABLE OF FIGURES	VI
TABLE OF TABLES	VII
CHAPTER 1: INTRODUCTION	1
1.1 BACKGROUND	1
1.2 PROBLEM STATEMENT	2
1.3 RELEVANCE	2
1.4 RESEARCH METHODS	3
1.5 DISSERTATION OUTLINE	3
CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK	5
2.1 PACKAGING	5
2.1.1 Functions of Packaging	6
2.1.2 Traditional Packaging	8
2.1.3 Smart Packaging	8
2.2. PURCHASE INTENTION	10
2.3 PERCEIVED PRODUCT QUALITY	11
2.3 TECHNOLOGY AFFINITY	12
2.4 CONCEPTUAL FRAMEWORK	13
CHAPTER 3: METHODOLOGY	14
3.1 RESEARCH APPROACH	14
3.2 PRIMARY DATA	15
3.2.1 Pre-Survey	15
3.2.1.1 Stimuli Development	15
3.2.1.2 Research Design	16
3.2.1.3 Measurement	17
3.2.1.4 Data Collection	17
3.2.1.5 Analysis and Results	18
3.2.2 Main Study	19
3.2.2.1 Data Collection	19
3.2.2.2 Research Design	19
3.2.2.3 Measurement	20
3.3 DATA ANALYSIS	21
CHAPTER 4: RESULTS AND DISCUSSION	22
4.1 RESULTS	22
4.1.1 Data Preparation	22
4.1.2 Manipulation Check	23

4.1.3 <i>Sample Characterization</i>	24
4.1.4 <i>Measure Reliability</i>	24
4.1.5 <i>Hypothesis Testing</i>	25
4.1.5.1 <i>Descriptive Statistics</i>	25
4.1.5.2 Hypothesis 1: Packaging and Purchase Intention	25
4.1.5.3 Hypothesis 2: Packaging, Perceived Product Quality, and Purchase Intention	27
4.1.5.4 Hypothesis 3: Packaging, Technology Affinity, and Purchase Intention ..	28
4.1.6 <i>Full Model Testing</i>	30
4.2 DISCUSSION	32
CHAPTER 5: CONCLUSIONS AND LIMITATIONS	35
5.1 MAIN FINDINGS & CONCLUSIONS	35
5.2 ACADEMIC AND MANAGERIAL IMPLICATIONS	37
5.3 LIMITATIONS AND FURTHER RESEARCH	38
REFERENCE LIST	I
APPENDICES	VI
APPENDIX 1: STIMULI PRE-SURVEY	VI
APPENDIX 2: PRE-SURVEY	VII
APPENDIX 3: DEMOGRAPHICS PRE-SURVEY	XIII
APPENDIX 4: CRONBACH’S ALPHA PRE-SURVEY	XIV
APPENDIX 5: DESCRIPTIVES RANKING PRE-SURVEY	XIV
APPENDIX 6: DESCRIPTIVES CONSTRUCTS PRE-SURVEY	XV
APPENDIX 7: MAIN SURVEY	XVI
APPENDIX 8: DEMOGRAPHICS MAIN STUDY (SAMPLE CHARACTERIZATION)	XXII
APPENDIX 9: CRONBACH’S ALPHA MAIN STUDY	XXIII
APPENDIX 10: INDEPENDENT SAMPLES T-TEST (H1)	XXIII
APPENDIX 11: HAYE’S PROCESS MODEL 4 TEST (H2)	XXIV
APPENDIX 12: MODERATION REGRESSION TEST (H3)	XXV
APPENDIX 13: HAYE’S PROCESS MODEL 5 TEST (H3 AND FULL MODEL)	XXVI

TABLE OF FIGURES

Figure 1: Classification of Smart Packaging 9

Figure 2: Conceptual Framework 13

Figure 3: Statistical Model Independent Samples T-Test (H1) 27

Figure 4: Statistical Model Haye’s PROCESS Model 4 (H2) 28

Figure 5: Statistical Model Moderation Regression (H3)..... 29

Figure 6: Statistical Model Haye’s PROCESS Model 5 (H3) 30

Figure 7: Statistical Model Haye's PROCESS Model 5 (Full Model)..... 31

TABLE OF TABLES

Table 1: Operational Model Main Study 21

Table 2: Data Preparation 22

Table 3: Mann-Whitney U Test Manipulation Check 23

Table 4: Overall Descriptive Statistics 25

CHAPTER 1: INTRODUCTION

1.1 Background

In today's rapidly changing world, there are more and more emerging trends that make it difficult for companies to compete, survive, and grow. Especially due to developments in technology, a variety of new marketing techniques have been arising, which makes it crucial for organizations to adapt their strategies to the modern world's requirements (Mammadbayov et al., 2021). In addition, a variety of other influences, such as material development, logistic requirements, environmental issues, consumer preferences, and additional marketing aspects, need to be considered to remain competitive and relevant for the consumer (Rundh, 2009). Considering the importance of packaging in the field of marketing, this represents a promising starting point for optimizing a company's marketing strategy, as packaging has been proven to be a crucial element for generating a competitive advantage and can act as the key to success (Silayoi & Speece, 2007). Particularly in the food sector, packaging plays an even more important role due to the variety of functions it fulfills during the consumer's process of purchasing, using, and disposing of the product. Therefore, it is even more essential to consider modern trends and adapt a product's packaging to meet consumers' needs (Vilnai-Yavetz & Koren, 2013). A variety of trends have emerged from consumer preferences. One of those trends is the implementation of smart packaging, including intelligent packaging and active packaging approaches, which aim to enhance the basic functions of traditional packaging and improve communication as well as the quality, safety, and shelf life of food (Sharma & Ghoshal, 2018). These approaches can be implemented in the form of various technologies, which can again be traced back to modern developments such as biosensors or nano materials and help to protect the food in the packaging from external elements like bacteria, light, oxygen, etc. (Bhatlawande et al., 2023). Especially because of the associated safety factors in terms of disease prevention and drug use, as well as sustainability and reducing food waste, smart packaging promises to be a successful marketing tool (Schaefer & Cheung, 2018). However, consumers' perceptions of these new technologies are influenced by a number of other factors. Hence, it is crucial to consider that a lack of familiarity with such technologies may lead to a restriction in the willingness to try the food in the packaging as they may not have sufficient information to assess it. In addition, consumers consider other factors, such as cost or quality, in their decision-making process, which can also be influenced by different packaging approaches (Young et al., 2020). Considering this information, it leads to the conclusion that it

is crucial for organizations to develop an understanding of consumer behavior to optimize their marketing strategies in order to increase consumers' purchase intention and, in turn, their sales.

1.2 Problem Statement

The scope of this research is to understand consumer behavior by expanding pre-existing research to examine the relationship between traditional and smart packaging approaches to consumer's purchase intention. It further aims to gain insights into whether other factors, such as the perceived product quality and consumers' technology affinity, have a contributing effect on this relationship. Hence, the problem statement can be summarized as follows:

How does the usage of traditional compared to smart packaging impact a consumers' purchase intention of a food option based on the perceived product quality and a consumers' degree of technology affinity?

This matter will be investigated by giving an answer to the following three research questions:

RQ1: What impact does smart packaging, compared to traditional packaging, have on consumers' purchase intention?

RQ2: What is the role of perceived product quality in the context of the relationship between packaging and consumer's purchase intention?

RQ3: Does a varying level of technology affinity impact the relationship between packaging and purchase intention?

1.3 Relevance

Despite the broad research on packaging in the last few decades and its importance in the field of marketing, there is a lack of research in a narrower field, which includes individual variables and specific smart packaging approaches. Thus, there are no studies that examine the moderating effect of technology affinity on the relationship between packaging and purchase intention or whether the degree of consumer's technology affinity has an effect on the strength of this relationship. Additionally, only a few academic papers explore the mediating effect of perceived product quality in this model.

However, as the packaging was already discussed to be an essential tool in marketing strategies, it is important to explore these variables and understand consumer's preferences and needs towards them. By gaining insights about consumer behavior in terms of the previously defined

variables, companies should be supported in their decisions on how to incorporate smart packaging approaches into their marketing strategies to improve their business variables.

1.4 Research Methods

To answer the research questions, primary data was used by conducting an exploratory as well as a confirmatory/explanatory research approach. For the explanatory approach, pre-existing literature was examined, and based on this, correlations between the individual variables were established. This research serves as a foundation for developing a conceptual model and hypotheses that should help to analyze the subject of this dissertation further. Regarding the confirmatory/explanatory approach, two surveys were conducted in the form of an online questionnaire, which helped to obtain quantitative data. The preliminary survey was conducted to gain insights into consumer preferences for smart packaging and to determine the final approach that will be used as stimuli for the main survey. For the main survey, an A/B split test was performed to investigate potential differences between traditional and smart packaging approaches in terms of their effect on purchase intention as well as in connection with perceived product quality as mediator and consumer's technology affinity as moderator. After collecting the data, a variety of statistical tests, such as an independent t-test, a moderation regression as well as Haye's PROCESS Model 4 and Model 5 test, is conducted to analyze the collected data and test the hypotheses.

1.5 Dissertation Outline

After providing a brief introduction to the subject and relevance of this dissertation, the next chapter presents an extensive literature review, including the development of hypotheses as well as a conceptual framework that forms the basis for the present research. The literature review contains an overview of traditional and smart packaging and connects it with the dependent variable purchase intention. In addition, the mediator perceived product quality and the moderator technology affinity are embedded in the theoretical framework. The third chapter then deals with the methodology of this dissertation and explains the methods that will be used to conduct the research, including its design and measurements. It also includes an overview of how the data was collected and how it will be analyzed. The fourth chapter includes a detailed analysis of the collected data by executing a variety of statistical tests and testing the previously developed hypotheses. Afterwards, these results will be discussed against the background of the literature review and methodology. The last chapter covers the main findings and

conclusions of the dissertation as well as theoretical and managerial implications. Furthermore, it will address the limitations of this work and the possibilities for further research.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

The aim of the following chapter is to provide a theoretical framework for the variables relevant to this research by reviewing prior academic research. Firstly, an introduction to the subject area of packaging will be provided including an explanation of its relevance and functions. This section deals with both traditional and smart packaging approaches and presents different types of packaging. The next part provides insights into consumers' purchase intentions and afterward focuses on the perceived product quality as mediator. Finally, the moderator technology affinity will be discussed by introducing two concepts. Based on the literature review, a conceptual framework is designed, and three hypotheses are built.

2.1 Packaging

The literature contains a multitude of definitions for packaging and what constitutes this tool. The European Parliament and Council of the European Union (1994) describe packaging as “all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer”. It can be divided into three levels, each of which is used for different purposes. Primary packaging is in direct contact with a product, while secondary packaging contains the product in its primary packaging. Secondary packaging, therefore, serves to protect primary packaging and make the product's identification possible. It is also used as a marketing tool to communicate the characteristics of a product to the consumer. This type of packaging is often discarded after the product has been purchased and consumed. Tertiary packaging contains both primary and secondary packaging and is used to protect it during the distribution chain (Ampuero & Vila, 2006; Simms & Trott, 2010).

Packaging plays an essential role in terms of marketing since it is one of the marketing approaches that can be used as a communication tool at the point of purchase and can, therefore, have a high influence on the decision-making process of consumers (Silayoi & Speece, 2007). This is particularly important in the Fast-Moving-Consumer-Goods (FMCG) sector as those often include low involvement purchases (Simms & Trott, 2010). To positively influence and attract consumer's attention, packaging consists of visual elements including graphics, colors, typography, size and shape, as well as informative elements related to the product itself or the used technologies (Silayoi & Speece, 2007). However, the particular design of a package is influenced by a variety of internal and external factors such as consumer values and behavior,

environmental issues, internationalization, requirements within the supply chain, competition or new technologies (Rundh, 2009). Certain factors can furthermore impact the packaging material. Paper, corrugated boards, and other paperboard products are the most widely used materials in the packaging market, followed by plastic packaging and metal (Rundh, 2005; Rundh, 2009). Moreover, those elements support a further characteristic of packaging; it should offer consumers as well as intermediaries convenience in dealing with the product (Prendergast & Pitt, 1996). In addition to its marketing-oriented functions, packaging also plays a major role in logistics as it is used to protect products during transportation through the distribution chain to minimize damage, spoilage or loss (Prendergast & Pitt, 1996; Rundh, 2005). In general terms, the characteristics of packaging should be adapted to the actual product, as the packaging itself is developed only for the purpose of the product and can vary to a large extent depending on the product category and its needs (Emblem, 2012).

Ultimately, it can be summarized that packaging can be a successful tool to create a competitive advantage as it influences the consumer's perception of a product as well as brand preferences (Silayoi & Speece, 2007). It further supports the positioning strategy, as the perception of products e.g., in terms of price range or durability, can be influenced by the individual packaging elements (Ampuero & Vila, 2006). Additionally, there is research that suggests adding packaging as the fifth element to the original '4 Ps Marketing Mix' framework, which emphasizes its importance in the field of marketing even more (Khan, 2014).

2.1.1 Functions of Packaging

As mentioned in the previous subchapter, packaging is a multifaceted tool and can be used for a variety of tasks. When reviewing the literature, four main functions can be identified, which consist of 1) containment, 2) protection and preservation, 3) communication and marketing, and 4) convenience (Emblem, 2012; Robertson, 2012; Rundh, 2005). It is possible to reduce overall costs and simultaneously maximize sales and profits by using a packaging design that fulfills these functions, as this allows the creation of added value beyond the functionality of the packaging (Paine, 1991).

The first function of packaging is the basic requirement to contain, and therefore secure, a product during the time it is transported and used by the consumer (Paine, 1991). It includes primary, secondary, and tertiary packaging to keep a variety of items together (Emblem, 2012).

By ensuring containment, it is possible to improve the environmental impact as it helps to reduce pollution and product loss e.g., due to leakage (Robertson, 2012).

Another function is the protection of the product which is often seen as the main purpose of packaging (Robertson, 2012). As the product goes through many stages in its life cycle and is exposed to harsh physical handling as well as a variety of potential hazards and environmental influences, ensuring protection is an essential part of maintaining the product in its original quality (Emblem, 2012; Rundh, 2005). This goes hand in hand with the function of preservation. After defining the product and its environment, as well as the properties of available packaging materials, it is possible to evaluate the necessary level of protection to preserve changes in the product and consequently extend its shelf life by delaying its deterioration (Emblem, 2012).

Furthermore, packaging serves as a communication and marketing tool. It is used to provide information about the weight and volume, provides instructions about the handling of the goods, serves as a source of identification, and contains RFID tags or a universal product code (UPC) to support handling at all stages of the distribution chain (Emblem, 2012; Robertson, 2012). For consumers, the packaging further incorporates legal, promotional, and usage information to enhance their decision-making process (Emblem, 2012). As packaging consists not only of informative but also of visual elements, it is possible to create a distinctive design that can support brand identification and stand out from the competition (Robertson, 2012; Rundh, 2005). As graphics and colors can impact the perceived quality and the consumer's purchase intention, they are crucial tools to convey a message and emphasize differentiation (Silayoi & Speece, 2007).

Finally, the fourth purpose of packaging is to ensure convenience at all levels. Due to ever-changing trends and various influences, it is essential to adapt packaging to the needs of production and the distribution chain as well as to those of the consumer to make the handling of the product as convenient as possible, as this helps to encourage sales (Paine, 1991; Robertson, 2012). This can be implemented, e.g., by providing easy-to-open features, dispensers, pre-prepared food or convenient shapes and sizes for consumers as well as the usage of pallets, cut-out holes or stable materials and shapes for the packaging line and distribution (Emblem, 2012; Robertson, 2012).

2.1.2 Traditional Packaging

Primarily, it can be specified that traditional packaging refers to packaging approaches that include the characteristics and elements presented in chapter 2.1.1 and make use of the previously defined four main functions: containment, protection and preservation, communication and marketing, and convenience (Lydekaityte & Tambo, 2020). In the food sector, packaging plays an essential role in the product's handling process, as it protects the food from external influences in order to slow down its deterioration process and thus extend its shelf life while simultaneously maintaining a high degree of quality and safety (Han, 2014). Since there is little to no physical touch between the food and the packaging, traditional packaging fulfills this purpose passively (Lee & Rahman, 2014). Traditional packaging is therefore also referred to as passive packaging due to its basic practical functions, which in turn leads to limitations in its ability to protect and preserve the food and can be supplemented by more advanced technologies (Lydekaityte & Tambo, 2020).

2.1.3 Smart Packaging

Due to new technologies and innovations in the field of materials, as well as developments in consumer needs and the emerging Internet of Things, traditional food packaging can be supplemented by smart packaging (Bhatlawande et al., 2024). By taking advantage of these technologies, smart packaging complements the traditional functions of packaging, as these elements make it possible to extend a product's shelf life by optimizing preservation and, therefore, help to increase sustainability by decreasing food waste (Beshai et al., 2020).

Reviewing existing literature, a variety of smart packaging approaches and their classification into subcategories can be revealed, including terms such as active, intelligent, interactive, clever, and responsive (Ahvenainen, 2003; Beshai et al., 2020; Gregor-Svetec, 2018; Lydekaityte & Tambo, 2020). In the scope of this thesis, smart packaging is divided into two categories, intelligent packaging, and active packaging, and will be classified as shown in Figure 1.

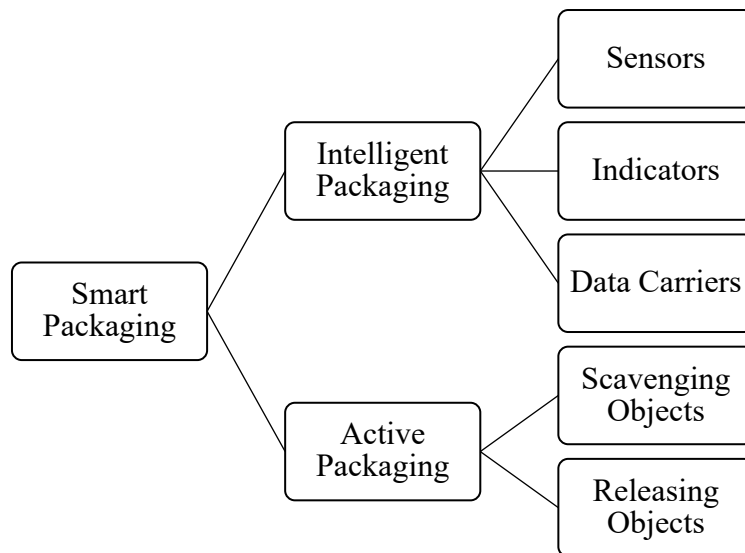


Figure 1: Classification of Smart Packaging

Intelligent Packaging serves as a tool to monitor the food inside of the packaging as well as its external environment to detect potential changes in its condition (Lydekaityte & Tambo, 2020). By sensing these changes, intelligent packaging can further provide information about the product quality both to the consumer and among the distribution chain, which, in return, can help improve safety and shelf life (Gregor-Svetec, 2018). Here, three approaches can be distinguished by dividing smart packaging into technologies consisting of a sensor, indicator, or data carrier, which are positioned either inside or on the packaging (Beshai et al., 2020).

Sensors are “device[s] used to detect, locate or quantify energy or matter giving a signal for the detection or measurement of a physical or chemical property to which the device responds” (Biji et al., 2015). They are composed of a receptor and a transducer, which exchange information to generate a signal, which in turn is measured by an external device (Gregor-Svetec, 2018). This helps to receive information about the status of humidity, temperature as well as gas concentration (Beshai et al., 2020).

Indicators are implemented to provide information about the “presence, absence or concentration of another substance or the degree of reaction between two or more substances by means of a characteristic change, especially in colour” (Biji et al., 2015). Thus, they provide qualitative rather than quantitative information. Indicators are usually divided into temperature indicators, freshness indicators, and gas indicators, and they are the most widespread approaches in terms of intelligent food packaging (Gregor-Svetec, 2018).

Finally, data carriers incorporate technologies such as barcodes and radiofrequency identification (RFID) tags. In contrast to sensors and indicators, they are not used to provide information about the quality of a product but serve as a tool to decrease theft and counterfeiting as well as fulfill automatization and traceability purposes along the distribution chain (Gregor-Svetec, 2018).

Rather than taking on a monitoring and information function like intelligent packaging, active packaging interacts with its environment to maintain or improve the quality of the food inside the packaging and thus simultaneously extend its shelf life (Biji et al., 2015). Here, two approaches can be distinguished. On the one hand, there are scavenging objects that remove excessive substances, and on the other hand, releasing objects are used to add desired compounds (Beshai et al., 2020; Ahvenainen, 2003). In most cases, these are sachets that are added to the packaging (Yildirim, 2018). However, active packaging can also come in other forms, such as labels or film types (Ahvenainen, 2003).

Overall, it can be summarized that smart packaging combines the technologies and advantages of both intelligent and smart packaging to adapt to the changes in a product's environment (Beshai et al., 2020; Gregor-Svetec, 2018).

2.2. Purchase Intention

Purchase intention can be defined as “the possibility that consumers will plan or be willing to purchase a certain product or service in the future” (Wu et al., 2011). As purchase intention plays a major role in forecasting consumer behavior and future sales, it is essential for marketers to observe changes and consider them in future strategies and decisions. There are a variety of factors that influence a consumer's intention to purchase a product. While some of these factors can be influenced by businesses, others are subject to influences such as personal circumstances (Morwitz, 2012).

As previously stated, packaging plays a major role in the consumer decision-making process. Since the actual purchase decision, in most cases, is made at the point of sale, packaging can be used as a tool to attract attention and to impact the consumer's purchase intention (Vilnai-Yavetz & Koren, 2013). It is further discussed in prior research that packaging can help to create a competitive advantage as well as differentiation by providing benefits to the consumer and

thus increase purchase intention as well (Wang, 2015). By implementing smart packaging approaches, the basic functions of traditional packaging can be further enhanced, and its advantages help to meet consumer needs all the better (Beshai et al., 2020; Lydekaityte & Tambo, 2020). Additionally, previous studies explored that consumers perceive smart packaging to be beneficial, particularly in terms of its functional value, and can be implemented as a tool to enhance purchase intention (Young et al., 2020).

Considering the results of pre-existing research and all the more advantageous features of smart packaging, this leads to the first hypothesis:

***H1:** Smart packaging has a higher impact on consumer's purchase intention compared to traditional packaging.*

2.3 Perceived Product Quality

Perceived product quality can be defined as a subjective evaluation of the superiority of goods that differs from the actual, objective quality and represents an abstract concept as it is not limited to a particular product feature (Zeithaml, 1988). When assessing product quality, a distinction can be made between intrinsic and extrinsic cues, whereby the impact of intrinsic cues is stronger (Szybillo & Jacoby, 1974). Additionally, consumers tend to perceive a product's quality by judging it in comparison to alternatives within their evoked set (Zeithaml, 1988).

Prior research indicates that the perceived quality of a product has a solid influence on the decision-making process of consumers and thus influences the purchase intention (Wang, 2015). Examining further existing literature about the relationship between perceived product quality and purchase intention, both a direct and an indirect relationship can be uncovered, depending on the existence of another variable as a mediating effect (Tsiotsou, 2006). Additionally, it was found that the use of different types and elements of packaging has a major impact on the perceived product quality and can have a varying effect on a consumer's purchase intention (Silayoi & Speece, 2007; Vilnai-Yavetz & Koren, 2013). According to Silayoi & Speece (2007) as well as Young et al. (2020), it can be added that packaging influences the emotional state of a consumer, which in turn has an impact on the level of quality it signals to the consumer.

Considering the literature review, the subsequent hypothesis can be formulated:

H2: The effect of packaging on consumer's purchase intention is mediated by the perceived product quality.

2.3 Technology Affinity

A variety of relevant scales and frameworks have been defined in pre-existing research to properly measure a consumer's technology affinity. One of those scales can be found in the work of Franke, Attig and Wessel (2018), who have developed the Affinity for Technology Interaction (ATI) scale. The ATI scale is economically unidimensional and consists of nine items that help to evaluate the technology affinity of consumers by exploring their preferences and interests in terms of technology.

Another established concept is the Technology Acceptance Model (TAM), which was introduced by Fred Davis in 1986. It should help to assess the willingness of an individual to use technology by considering the perceived ease of use and perceived usefulness in a relationship between system characteristics and potential system usage (Marangunic & Granic, 2014).

In the scope of this dissertation, the focus will be on the ATI scale as it helps to explore the willingness of an individual consumer to engage with technology and thus investigate how this affects a consumer's response to smart packaging approaches.

In previous research, it was explored that a lack of knowledge and familiarity with smart packaging can lead to a lower acceptance of those technologies, particularly due to the ability to assess their value and risks (Young et al., 2020).

Hence, it can be assumed that the degree of technology affinity has an impact on the strength of the relationship between packaging and consumer's purchase intention, leading to the third hypothesis:

H3: The degree of consumer's technology affinity affects the strength of the relationship between packaging and consumer's purchase intention.

2.4 Conceptual Framework

Considering the theoretical framework and the hypothesis derived from it, a conceptual framework was developed, as shown in Figure 2. It visualizes the relationship between the previously described variables and forms the basis for the research conducted in the scope of this dissertation.

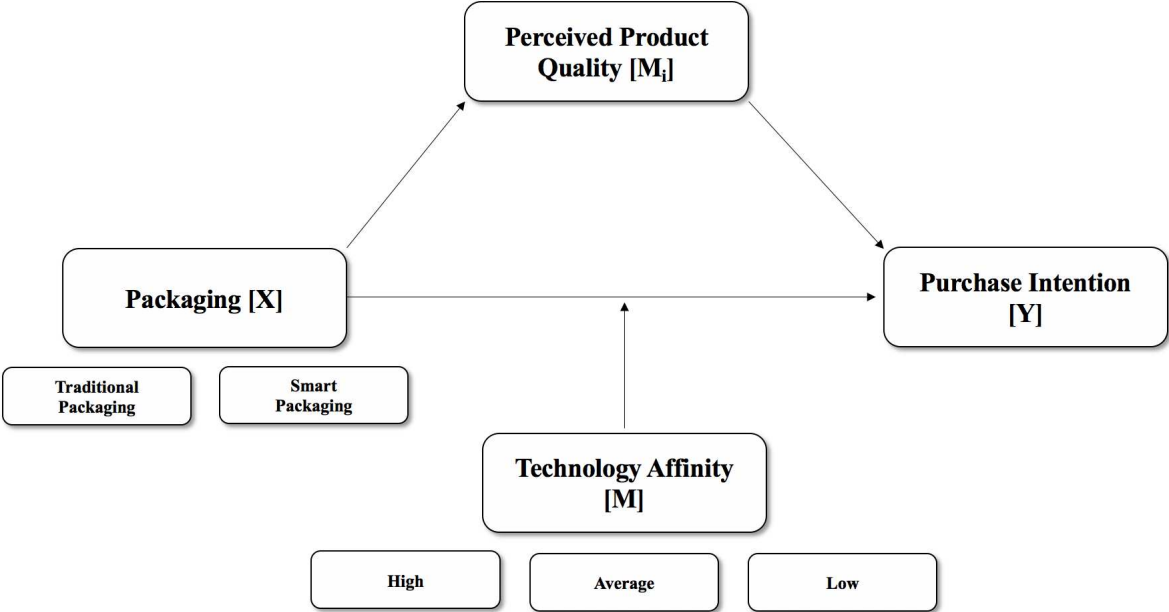


Figure 2: Conceptual Framework

CHAPTER 3: METHODOLOGY

This chapter deals with the approach to this research. It provides an overview of the methods used to gather data and describes their precise implementation in order to investigate the previously defined research questions and draw conclusions to test the derived hypotheses.

3.1 Research Approach

In the scope of this thesis, two research methods will be combined to properly explore the correlations between the independent and dependent variables as well as the effect of the mediator and moderator on their relationship. Therefore, an exploratory and a confirmatory/explanatory approach were selected.

The exploratory research was conducted in the second chapter of this dissertation in the form of an extensive literature review, which helps explore theories that have been identified in previous academic research work and create a foundation for the following research. Those insights serve in addition to the development of the conceptual framework.

Furthermore, a confirmatory/explanatory approach was implemented as it helps to collect primary data, which will be used to examine the relationships between the previously defined variables and test the hypotheses. This involves a quantitative technique in the form of two online surveys. An online survey was selected as a quantitative research method as it is possible to generate a high number of responses at a low cost and with no restrictions on location. However, this research method also has disadvantages such as the low response rate, the potential lack of representativeness, and the inflexibility and loss of control after publishing it. Nevertheless, as a high sample can be generated, and the disadvantages can be counteracted by a careful questionnaire design and a pilot survey, this method was evaluated to be the most appropriate for this dissertation (Kothari, 2004; Saunders et al., 2007).

At first, a preliminary study was executed to explore the consumer's perception of different types of smart packaging to uncover the stimulus most suitable for the main survey. To do so, four stimuli were developed based on prior research, and the respondents were asked to evaluate them in terms of different values. Each participant was exposed to all four stimuli with the same questions for each block. Nevertheless, the order in which the stimuli were shown was randomized to avoid the respondents being biased based on the sequence.

For the main study, an A/B split test was selected to explore the differences in consumer's perceptions of traditional and smart packaging. It further helps to investigate how different types of packaging affect consumers' purchase intention and how each stimulus affects the effect the technology affinity as moderator and the perceived product quality as mediator have on the relationship between the independent and dependent variable.

Qualtrics was used to develop both of the surveys. After finishing the data collection, the data set was downloaded in a format that can be used for the IBM SPSS software and was statistically analyzed with the help of it.

3.2 Primary Data

In order to answer the previously defined research questions and to test the hypotheses, primary data was collected to supplement the previously conducted literature review with additional data by implementing two online surveys. While the pilot survey aimed to develop the final stimuli, the main study focused on gathering data on the relationship between the individual variables.

3.2.1 Pre-Survey

Conducting a preliminary study can be an essential tool to get a first impression of consumer attitudes and to obtain a main survey that would provide high quality data. Due to the wide range of smart packaging concepts, a selection had to be made as to which type of packaging should be used in the main study. With the aim of evaluating a variety of packaging designs, a preliminary survey was conducted to identify the most appropriate type of smart packaging to be used as the final stimulus.

3.2.1.1 Stimuli Development

The first step in developing suitable stimuli was to explore previous academic research and empirical evidence in order to gain a better understanding of smart packaging approaches. As stated in Chapter 2, smart packaging is classified into intelligent packaging and active packaging approaches which again consist of subcategories. For the selection of possible smart packaging types, the individual subcategories were considered, and one technology was selected for each category to cover a broad range. Therefore, a stimulus for a "sensor", an "indicator" and a "data carrier" was developed, which leads to three stimuli for the intelligent packaging category. Even though the active packaging category consists of two subcategories, "scavenging objects" and "releasing objects", only one stimulus was created since the

technologies of both are similar with little visual difference for the consumer. In addition, many “releasing objects” approaches are scarcely perceptible to the customer when looking at the product packaging. For these reasons, it was decided to develop only one stimulus for “scavenging objects”.

After deciding on the four categories of smart packaging that should be used for the pre-survey, the next step was to narrow it down to four approaches that fit the same product category. After an extensive review of previous academic papers and studies, food was selected as the final product category. As the majority of smart packaging technologies are limited to certain types of food or chemicals, the category “fruits” was picked to focus on. Finally, four smart packaging approaches could be decided on which lead to the stimuli: 1) biosensor on a spinach packaging, 2) freshness indicator on a pears packaging, 3) QR code on an acai berry powder packaging, and 4) oxygen scavengers inside of a dried apricots packaging.

For each stimulus, a previously existing product packaging was selected, and the smart technology was added to it by editing it on Canva. While the biosensor (Beshai et al., 2020) as well as the oxygen scavenger (Desiccare, Inc., n.d.) were taken from internet sources, the QR code was generated with the help of the website <https://www.qrcode-generator.de> and the freshness indicator was created on Canva based on the ripeSense indicator (RipeSense, n.d.). The four stimuli used in the scope of the preliminary survey can be found in Appendix 1.

3.2.1.2 Research Design

After identifying and creating the four potential stimuli, they were incorporated into a questionnaire, which can be found in Appendix 2. It was created with the help of Qualtrics, and it was available in English. The preliminary survey includes questions on the familiarity, perceived usefulness, perceived product quality, attractiveness, and purchase intention of each of the four previously created stimuli. These questions were consistent for each participant, and each of the four packaging designs was shown to each respondent. However, the order of the individual smart packaging approaches was randomized so that biases due to the order could be excluded. At the end of the survey, the participants were asked to rank the individual approaches in terms of their preference and likeability.

3.2.1.3 Measurement

In order to create the questionnaire and gather data, pre-existing literature, and research were consulted to identify appropriate measures.

Five items were adopted based on the research of Jayasingh and Eze (2010), who developed an extended version of the Technology Acceptance Model (TAM) to consider the perceived usefulness. The following statements were examined: 'Using this type of packaging would make me a smart consumer.', 'Using this type of packaging would make my shopping easier.', 'Using this type of packaging would save money.', 'Using this type of packaging makes shopping more enjoyable.' and 'Overall, this type of packaging is very useful.'. Each statement was measured on a 5-point Likert Scale, ranging from 'strongly disagree' to 'strongly agree'.

Based on the research of Shih-Tse Wang (2015), three items were used to explore the perceived product quality, and the 7-point Likert Scale was adapted to a 5-point Likert Scale. The participants were asked to indicate how much they agreed with the statements 'The product is one that I felt superior to other products.', 'The product is one that I would feel easy about using.' and 'The overall quality of product is good.' from 'completely disagree' to 'completely agree'.

Finally, to assess the consumer's purchase intention, four items were taken into consideration, as proposed by Vilnai-Yavetz, I. and Koren, R. (2013). It included the items: 'I believe that most people would like to buy this product.', 'I would be glad to try the food in this packaging.', 'I would recommend this product to my friends.' and 'I would purchase this product.'. The original 7-point Likert Scale was adapted to a 5-point Likert Scale, and the answer options ranged from 'strongly disagree' to 'strongly agree' in each case.

3.2.1.4 Data Collection

The pre-survey was active for a period of seven days and was distributed non-randomly among friends and family members via the social media platform WhatsApp. This resulted in a sample of 30 participants, of which nine had to be excluded from the analysis due to missing data and repeated IPs, leading to a data set of 21 participants. The cleaned data set consists of 33.3% males and 66.7% females, ranging in age from 18-24 years to 45-54 years. With 61.9%, the majority of respondents are employed full-time, and at least 61.9% have completed a higher

level of education than high school. Furthermore, a total of 90.5% of the participants are residents of Germany. A more detailed overview can be found in Appendix 3.

3.2.1.5 Analysis and Results

To check whether the data collected is reliable, a Cronbach's alpha reliability test was conducted. As the measurements for perceived usefulness, perceived product quality, and purchase intention consist of more than one item, the analysis had to be performed for those constructs. Eleven of these scales had a Cronbach's alpha above 0.7, which proves their internal consistency and reliability. Only the construct 'perceived product quality' for the stimulus 'QR Code' had a value lower than 0.7 ($\alpha = 0.659$). However, even after deleting one of the items, the value would not rise above 0.7. Therefore, it was decided not to remove any of the items and continue the analysis with the scales applied. More detailed information on the Cronbach's alpha values can be found in Appendix 4.

To determine the final stimulus for the main study, it is necessary to analyze how consumers perceive and evaluate the individual smart packaging approaches. To do so, the ranking in terms of preference and likeability had to be considered. Conducting descriptive statistics (see Appendix 5), it is important to note that the values must be assessed in reverse order, as "1" stands for the most preferred and liked approach and "4" for the least preferred and liked approach. The analysis of the data results in the lowest Mean for the freshness indicator ($M = 1.67$) and the highest for the oxygen scavenger ($M = 3.57$). The biosensor ($M = 2.43$) and QR code ($M = 2.33$) show similar values. Interpreting these values while simultaneously taking the respective Median of each stimulus into account, the freshness indicator was rated the best on average and the oxygen scavenger the worst. This is further confirmed when looking at the standard deviation of the individual variables. The freshness indicator ($SD = 0.856$) and the oxygen scavenger ($SD = 0.746$) show the lowest standard deviation, which means that the ratings are closer to the Mean and therefore vary less.

After transforming and looking at the descriptive statistics of the individual constructs, including familiarity, perceived usefulness, perceived product quality, attractiveness, and purchase intention, the results were further confirmed. Again, there is a tendency towards the freshness indicator as the best-rated approach. Detailed information on these statistics can be found in Appendix 6.

Due to these results, no additional statistical tests had to be carried out, and the freshness indicator was chosen as the stimulus for the main survey.

3.2.2 Main Study

3.2.2.1 Data Collection

After developing and selecting the final stimuli, the main survey was created on Qualtrics and distributed via social media platforms such as WhatsApp and Instagram. Therefore, the data was collected by using a convenience as well as a snowball sampling method, leading to a non-randomly selected sample. There were no restrictions on the target group in terms of demographics. However, it was an essential criterion for the participants to do their own grocery shopping, which was ensured by a screening question at the beginning. Apart from this, there were no other criteria which led to exclusion. The survey was open for ten days, and participants had the opportunity to end their responses up to seven days after opening the link.

3.2.2.2 Research Design

After a brief introduction to the survey, the questionnaire opened with a screening question to exclude non-relevant participants from the survey. Since only consumers who do their own grocery shopping should be considered, the survey was terminated for respondents who had not been grocery shopping in the last twelve months.

To explore differences in the relationship between traditional and smart packaging on consumers' purchase intention and to study the effect of the perceived product quality and the technology affinity of consumers on each approach, the main survey was structured as an A/B split test and included randomization. At the beginning, half of the participants were shown a picture of traditional pear packaging while describing a shopping scenario. The other half were shown the same scenario and the same product picture, except that this pear packaging included a freshness indicator. They were also given a brief description of this smart packaging.

Participants were then asked to consider the scenario described while answering questions on familiarity, attractiveness, perceived product quality, and purchase intention. In the course of the questionnaire, they were also confronted with questions regarding their technology affinity, for which the relevant term 'technical systems' was defined to them beforehand. It further

included two manipulation questions to check whether the stimuli manipulation was successful in terms of how participants perceived each of them.

All questions used for the main study were the same for each respondent, regardless of the packaging and the scenario they were shown at the beginning, and it was conducted in English. The main survey can be found in Appendix 7.

3.2.2.3 Measurement

In order to collect high-quality data that can be used to answer the research questions and analyze the hypotheses, it is important to build the questionnaire on the basis of previously conducted research and to use tested measurements.

Therefore, the same measurements were used to evaluate the perceived product quality and the purchase intention as in the preliminary survey, using a 5-point Likert Scale from ‘strongly disagree’ to ‘strongly agree’.

Based on the research of Franke et al. in 2018, nine items were adopted to consider the consumer’s technology affinity. In the scope of this research, the originally used 6-point Likert Scale was converted to a 5-point Likert Scale, which ranged from ‘completely disagree’ to ‘completely agree’. The survey includes the following items: ‘I like to occupy myself in greater detail with technical systems.’, ‘I like testing the functions of new technical systems.’, ‘I predominantly deal with technical systems because I have to.’, ‘When I have a new technical system in front of me, I try it out intensively.’, ‘I enjoy spending time becoming acquainted with a new technical system.’, ‘It is enough for me that a technical system works; I don’t care how or why.’, ‘I try to understand how a technical system exactly works.’, ‘It is enough for me to know the basic functions of a technical system.’ and ‘I try to make full use of the capabilities of a technical system.’.

Framework	Measure	Items	Scale	Reference	Cronbach α
IV	Packaging	Stimuli	<i>na</i>	<i>na</i>	<i>na</i>
Moderator	Technology Affinity	9	5-point Likert Scale	Franke, Attig, & Wessel (2018)	0.87
Mediator	Perceived Product Quality	3	5-point Likert Scale	Shih-Tse Wang (2015)	<i>na</i>
DV	Purchase Intention	4	5-point Likert Scale	Vilnai-Yavetz, & Koren (2013)	0.84

3.3 Data Analysis

Subsequent to the data collection, a series of tests must be carried out in order to create the basis for further analysis. This includes preparing and cleaning the data set, performing an outlier analysis, performing a manipulation check, and performing descriptive statistics using IBM SPSS. Afterward, further statistical analysis can be conducted to test the hypotheses that have to be adapted to the developed variables and conceptual model. In the scope of this dissertation, this includes an independent samples t-test to explore differences in the relationship between traditional and smart packaging approaches in terms of their effect on consumer's purchase intention. Additionally, Hays's PROCESS model will be conducted to explore the mediating effect of perceived product quality and a moderation regression will be conducted to explore the effect of consumers' technology affinity as a moderator. Finally, the full conceptual model will be evaluated with the help of Hays's PROCESS model 5.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Results

The following subchapter deals with the analysis of the data collected in the main study. For this purpose, the data set is first prepared by adjusting it to include to missing or duplicate data. Additionally, an outlier analysis and a manipulation check are conducted, and the sample is characterized. Based on this preparation, the previously developed hypotheses and the full model will be examined.

4.1.1 Data Preparation

Before a statistical data analysis can be carried out, it is essential to clean and prepare the collected data set. Initially, a total of 185 observations were recorded. However, 39 of those were deleted as they were missing data due to incomplete responses or leaving the survey after the introduction part, and six participants were excluded as they failed the screening question. This resulted in a total of 140 participants, of which 68 were assigned to traditional packaging and 72 to smart packaging. After examining the data for duplicate IP addresses, nine responses were removed from the data set. It is further important to check whether there were participants who failed the manipulation. When the results were checked, seven participants were identified who failed the manipulation and had to be excluded from further analysis. As a final step, potential outliers had to be uncovered by performing a Mahalanobis Distance analysis. In the scope of this research, no outliers were identified, as there were no p-values lower than 0.001. In summary, this results in a final data set of 124 observations, of which 65 are used to conduct further analysis of traditional packaging and 59 for the analysis of smart packaging.

		Total	
Initial Observations		185	
Failed Screening Question		6	
Missing Data		39	
	Stimulus 1 (Traditional)	Stimulus 2 (Smart)	Total
Complete Observations	68	72	140
Repeated IPs	2	7	9
Failed Manipulation	1	6	7
Outliers	0	0	0
Valid Observation	65	59	124

Table 2: Data Preparation

As the data was collected in the form of an A/B split test design, the data set consists of values for two different groups. Since various statistical tests require a combination of those values and the used measurements consist of multiple items, it was essential to compute several new variables. This also included creating a new variable with the values 1 = “Traditional Packaging” and 2 = “Smart Packaging” to differentiate between both groups. Furthermore, three items of the Affinity for Technology Interaction (ATI) scale are negatively worded and, therefore, had to be reversed by recoding to enable further analysis (1→5, 2→4, 3=3, 4→2, 5→1). This led to a 5-point Likert Scale ranging from 1 = “strongly agree” to 5 = “strongly disagree” for the items “I predominantly deal with technical systems because I have to.”, “It is enough for me that a technical system works; I don’t care how or why.”, and “It is enough for me to know the basic functions of a technical system.”.

4.1.2 Manipulation Check

To investigate possible differences between a traditional and a smart packaging approach in relation to consumers’ purchase intention as well as in terms of perceived product quality as a mediator and consumers’ technology affinity as a moderator, participants were randomly presented with one of two stimuli. A manipulation check was conducted to check whether the differences in the stimuli influenced the perception of participants in an expected way. As the relevant values are not subject to a normal distribution and are therefore non-parametric, a Mann-Whitney U Test (Table 3) was performed. In the beginning, the null hypothesis is made that there is no difference between the variables. The asymptomatic significance (2-tailed) shows a value of <0.001, which proves a significant difference since it is below 0.05. The null hypothesis must, therefore, be rejected, which means that there are differences and the manipulation was successful.

Ranks		
Packaging Type	N	Mean Rank
Traditional Packaging	65	36.46
Smart Packaging	59	91.19
Test Statistics		
Mann-Whitney U		225.000
Wilcoxon W		2370.000
Z		-8.776
Asymp. Sig. (2-tailed)		<0.001

Table 3: Mann-Whitney U Test Manipulation Check

Additionally, the mean rank, which was calculated during the Mann-Whitney U Test, further shows that the values differ from each other. In combination with the Means of each stimulus, it can be summarized that smart packaging is perceived as more innovative ($M = 3.36$) than traditional packaging ($M = 1.42$).

4.1.3 Sample Characterization

The main study included a total of 124 valid observations, which will be analyzed in the scope of this research. To continue with the final results and discussion, the sample needs to be characterized in terms of demographics to obtain initial basic information about the respondents. In the following, a summary of the characteristics of the total sample will be provided. Nevertheless, it is important to mention that the frequency of most values is similarly distributed for both stimuli. The majority of participants identified with the female gender (70.2%), while 29% identified as male, and 0.8% did not want to provide an answer. The age of the participants ranges from 18-24 to 65+ years. However, a total of 51.6% of respondents are in the age group of 25-34 years, and 89.5% are younger than 45 years. Furthermore, 80.6% have completed a bachelor's or a master's degree, and the majority are either employed full-time (35.5%) or a student (41.1%). Another characteristic that needs to be emphasized is that 81.5% of the sample are residents of Germany. The monthly gross income of the participants is largely distributed similarly across the individual income levels. A detailed breakdown of the characteristics of both the entire sample and the individual stimuli can be found in Appendix 8.

4.1.4 Measure Reliability

To ensure the internal consistency and, thus, the scale reliability of the measurements used in the scope of the main study, new Cronbach's alpha values had to be computed. The reliability test proved relevant for the constructs "perceived product quality", "purchase intention", and "technology affinity", since these are multi-item constructs.

The Cronbach's alpha was calculated for each construct of each stimulus (Appendix 9). As mentioned in Chapter 4.1.1, three items of the technology affinity scale had to be recoded before conducting the reliability analysis. A Cronbach's alpha above 0.7 was calculated for all of the six measurements and therefore proved the data to be reliable and internally consistent.

4.1.5 Hypothesis Testing

In the following, the previously defined hypotheses will be tested by conducting descriptive statistics as well as an independent samples t-test and linear regression analysis.

4.1.5.1 Descriptive Statistics

In order to receive an overview, properly understand the collected data, and to obtain a basis for further evaluation, descriptive statistics need to be performed. This includes calculating the minimum and maximum value, the mean, the standard deviation and the variance for traditional and smart packaging as well as for packaging as a whole (Table 4).

Descriptives	N	Min	Max	Mean	Std. Deviation	Variance
Traditional Packaging						
Perceived Product Quality	65	1.00	4.67	2.7949	0.91229	0.832
Purchase Intention	65	1.00	4.75	2.4731	0.93241	0.869
Technology Affinity	65	1.67	4.56	3.1162	0.64950	0.422
Smart Packaging						
Perceived Product Quality	59	1.33	4.67	3.5593	0.78159	0.611
Purchase Intention	59	1.00	5.00	3.4746	1.01465	1.030
Technology Affinity	59	1.78	4.67	3.0546	0.66166	0.438
Total						
Perceived Product Quality	124	1.00	4.67	3.1586	0.93169	0.868
Purchase Intention	124	1.00	5.00	2.9496	1.09088	1.19
Technology Affinity	124	1.67	4.67	3.0869	0.65337	0.427

Table 4: Overall Descriptive Statistics

When looking at the mean values, there is a tendency for smart packaging to be perceived as a product with higher quality ($M = 3.5593$) than those with traditional packaging ($M = 2.7949$). Similarly, the purchase intention varies between the group of traditional packaging ($M = 2.4731$) and smart packaging ($M = 3.4746$), which indicates that the consumer's purchase intention is higher for smart packaging approaches than for traditional packaging. The technology affinity, on the other hand, does not show major differences between the two packaging approaches within the framework of the mean values, which implies that the participants in both groups have a similar affinity towards technology.

4.1.5.2 Hypothesis 1: Packaging and Purchase Intention

H1: Smart packaging has a higher impact on consumer's purchase intention compared to traditional packaging.

To properly understand the relationship between packaging and consumer purchase intention, an independent samples t-test was conducted to explore potential differences between traditional and smart packaging approaches (Appendix 10).

First of all, a difference in the mean of traditional packaging ($M = 2.4731$) and the mean of smart packaging ($M = 3.4746$) can be detected. As already stated above, these values indicate that the purchase intention for traditional packaging is lower compared to the purchase intention of smart packaging, which implies a difference in the effect of smart packaging on consumers' purchase intention compared to traditional packaging.

Looking at the Levene's Test for Equality of Variances, a p-value of 0.664 can be detected. As this value is higher than 0.05, the null hypothesis cannot be rejected, and equal variances for the t-test can be assumed.

The t-test for Equality of Means reveals a t-value of $t = -5.728$, which further indicates that there is a difference in the effect of traditional versus smart packaging on purchase intention. As both the one-sided p (<0.001) and the two-sided p (<0.001) show a value that is significantly below $p = 0.05$, the null hypothesis that there is no difference in the effect of traditional packaging and smart packaging on purchase intention can be rejected. Conversely, it can, therefore, be stated that there is a difference in the effect.

Moreover, the mean difference between the two groups is -1.00150, which shows that the purchase intention is generally higher for smart packaging than for traditional packaging. Additionally, a large effect size can be discovered as Cohen's d is 0.97237 and thus higher than 0.8, which shows a substantial difference in purchase intention between both groups of packaging.

Considering the results of the independent samples t-test, a statistically significant difference in consumer purchase intention can be detected between both groups, with a higher impact on smart packaging than on traditional packaging. Therefore, the hypothesis **H1 can be verified**.

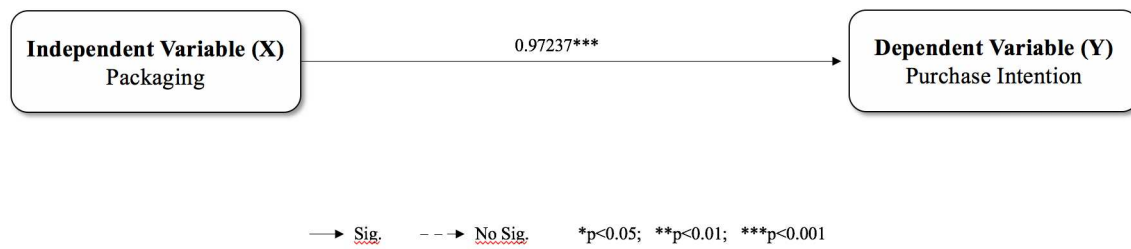


Figure 3: Statistical Model Independent Samples T-Test (H1)

4.1.5.3 Hypothesis 2: Packaging, Perceived Product Quality, and Purchase Intention

H2: The effect of packaging on consumer's purchase intention is mediated by the perceived product quality.

To examine the mediating effect of perceived product quality on the relationship between packaging and purchase intention, Model 4 of Haye's PROCESS model will be used (Appendix 11). Here, it is important to distinguish between the direct effect of the independent variable on the dependent variable and the indirect effect, which includes the mediator.

As a first step, the direct effect between packaging and purchase intention needs to be considered. Having a look at the p-value, it can be discovered that it is below 0.01 ($p = 0.0058$), which implies that packaging has a direct impact on consumer's purchase intention.

In analyzing the effect of the mediator, three effects have to be considered. On the one hand, how packaging affects the perceived product quality has to be evaluated. On the other hand, the effect of perceived product quality on consumer's purchase intention has to be considered. As the third effect, the indirect effect of packaging on purchase intention via the perceived product quality needs to be explored.

With a p-value of <0.001 for both of the first two effects, it can be stated that packaging significantly influences perceived product quality, and perceived product quality significantly predicts purchase intention. This also applies to the indirect effect, which is estimated to be a total of 0.6233 and differs from 0. As the p-value is < 0.001 and as the difference between the BootLCI (0.3686) and Boot ULCI (0.8966) is higher than 0, its statistical significance can be

revealed and indicates that perceived product quality mediates the relationship between packaging and purchase intention.

It can be concluded that the findings of the conducted PROCESS Model 4 support the second hypothesis which suggests the mediating effect of perceived product quality on the relationship between the independent and dependent variable. In particular, there is a partial mediation effect since the direct impact of packaging on purchase intention is still significant when the mediating role of perceived product quality is taken into consideration. Thus, the hypothesis **H2 can be verified.**

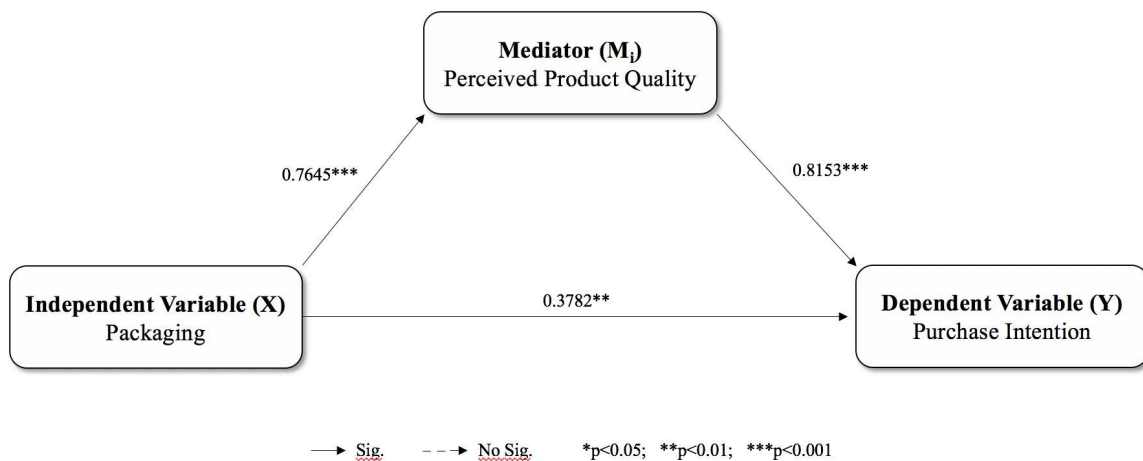


Figure 4: Statistical Model Haye's PROCESS Model 4 (H2)

4.1.5.4 Hypothesis 3: Packaging, Technology Affinity, and Purchase Intention

H3: *The degree of consumer's technology affinity affects the strength of the relationship between packaging and consumer's purchase intention.*

The third hypothesis will be tested by running a moderation analysis which will be executed by conducting a regression analysis using the interaction term "Packaging * Technology Affinity" (Appendix 12).

After carrying out this statistical analysis, the ANOVA is first considered, which shows an F-value above 0 (F = 10.930) and its high significance as the p-value is below 0.001. From this it

can be concluded that at least one of the predictors significantly contributes to the explanation of the variance in the dependent variable.

As a final step, the coefficients need to be examined. Looking at the independent variable packaging, it can be stated that it is highly significant ($p = < 0.001$). Nevertheless, the moderator technology affinity is not statistically significant ($p = 0.754$), which implies that the variable does not have a significant direct effect on purchase intention. In addition, the interaction effect “Packaging * Technology Affinity” shows a p-value of $p = 0.575$, which is also above 0.05. Hence, the interaction is not statistically significant and does not significantly influence the consumer’s purchase intention.

Even though the moderation analysis implies that packaging significantly affects purchase intention, technology affinity does not. Furthermore, the interaction between packaging and technology affinity does not significantly influence purchase intention. Consequently, there is no evidence to support the moderating influence of technology affinity on the relationship between packaging and consumers’ purchase intention, which leads to the conclusion that hypothesis **H3 is not supported**.

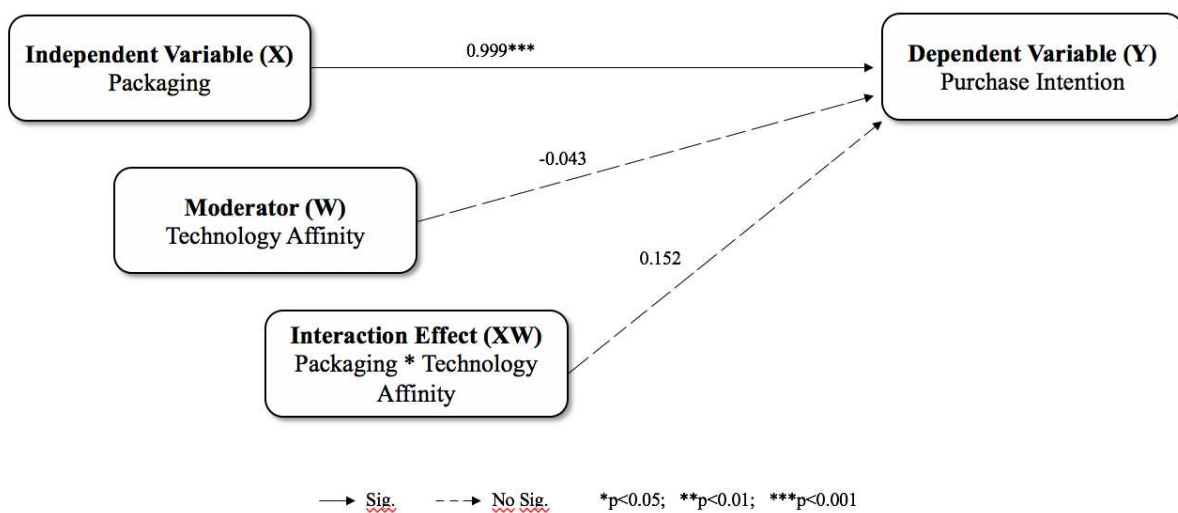


Figure 5: Statistical Model Moderation Regression (H3)

However, after conducting Haye’s PROCESS Model 5 (Appendix 13), more findings can be added. Although the interaction term between packaging and technology does not significantly predict a consumers’ purchase intention, the conditional direct effects of packaging on purchase

intention at different values of technology affinity can still be significant. Considering the findings of Haye’s PROCESS Model 5, three levels of technology affinity can be identified: low, average and high. At a low level of technology affinity, the direct effect of packaging on purchase intention is positive (Effect = 0.2748) but not statistically significant ($p = 0.1368$). Furthermore, the confidence interval (LLCI = -0.0884, ULCI = 0.6380) includes zero, which again indicates no significant direct effect. Considering an average level of technology affinity, it can be found that the effect is positive (Effect = 0.3779) and statistically significant ($p = 0.0062$). As the confidence interval does not include zero (LLCI = 0.1096, ULCI = 0.6461), a significant positive effect of packaging on purchase intention can be indicated for consumers with an average technology affinity. This also applies to consumers with a high level of technology affinity. Again, the analysis proves a positive effect (Effect = 0.4810) and statistical significance ($p = 0.0100$). In addition, there is again no zero in the confidence interval (LLCI = 0.1169, ULCI = 0.8450), implying a significant direct effect for consumers with high technology affinity.

Therefore, it can be concluded that technology affinity does not moderate the relationship but impacts the strength of the direct effect of packaging on purchase intention. Considering the findings of both statistical tests, it can be implied that hypothesis **H3 cannot be rejected**.

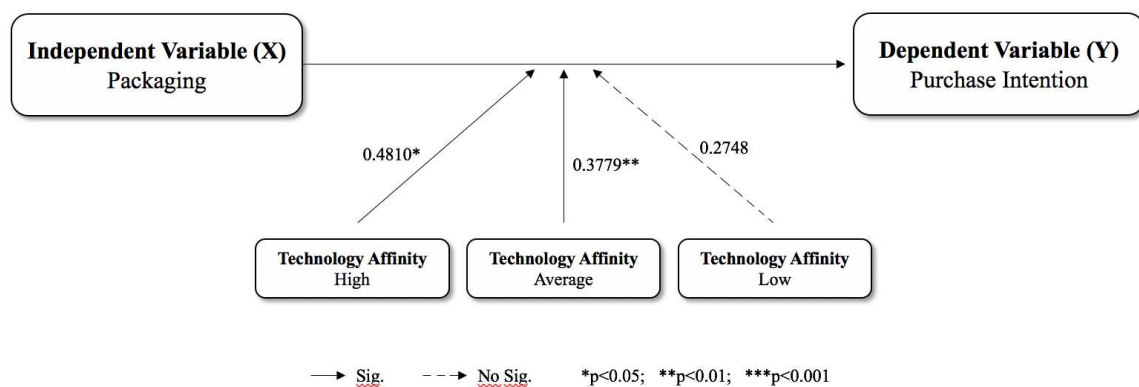


Figure 6: Statistical Model Haye’s PROCESS Model 5 (H3)

4.1.6 Full Model Testing

To evaluate the full conceptual model, Haye’s PROCESS Model 5 was used again as it fits the design of the developed conceptual model (Appendix 13).

Considering the outcomes of the statistical analysis, once more, a statistical significance can be proven in terms of the effect of packaging on perceived product quality ($b = 0.7645$, $t = 4.9860$, $p = <0.001$), suggesting that the mediator is influenced by the independent variable. When examining the purchase intention, it can be concluded that the perceived product quality has a highly statistically significant effect on it. Furthermore, the influence of packaging on purchase intention is further proven significant ($p = < 0.01$) and represents a direct effect, whereas technology affinity does not show a statistical significance ($p = 0.4059$) and thus does not affect it. To test whether a consumer's technology affinity moderates the direct effect of packaging on purchase intention, the interaction effect (packaging * technology affinity) further needs to be taken into consideration. As the p-value of the interaction effect is $p = 0.4073$, it can be assessed that there is no statistically significant interaction between those variables, and technology affinity does not moderate the direct relationship between the independent and dependent variables. However, the level of technology affinity does impact the strength of the direct effect of packaging on purchase intention when the consumer's level of technology affinity is average ($p = 0.0062$) or high ($p = 0.0100$). Finally, assessing the indirect, mediating effect of perceived product quality on packaging and purchase intention, a statistical significance can be found with an effect of 0.6232, which implies that there is a mediating effect of perceived product quality on the relationship between the independent and dependent variable.

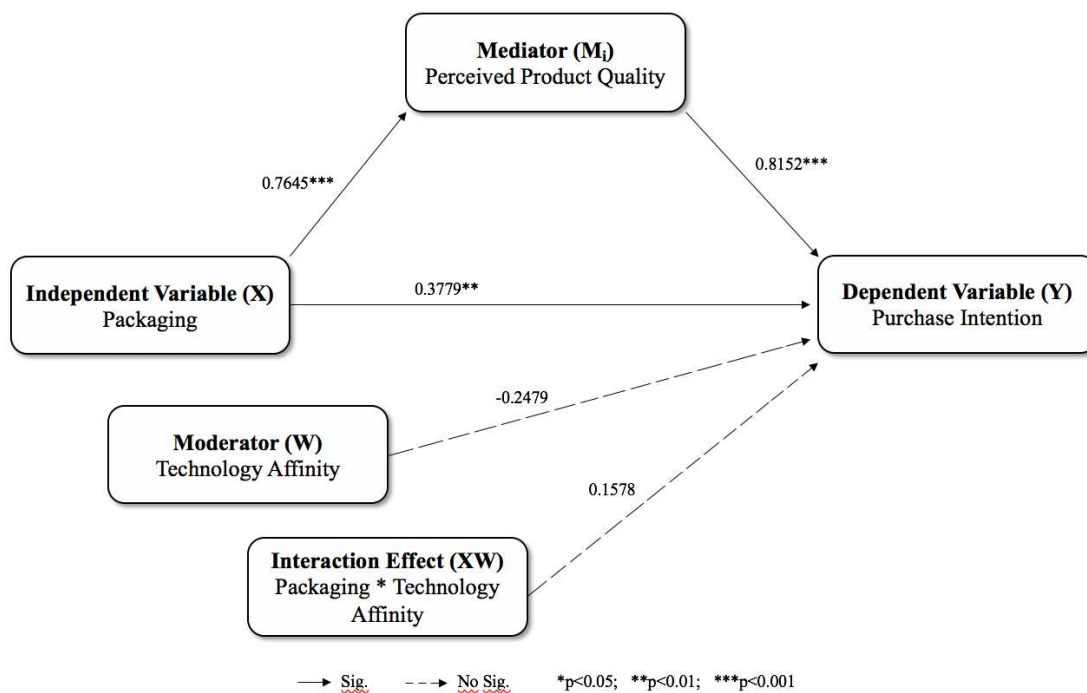


Figure 7: Statistical Model Haye's PROCESS Model 5 (Full Model)

4.2 Discussion

In this study, the relationship between the independent variable packaging and the dependent variable purchase intention was examined, with simultaneous consideration of perceived product quality as a mediator and consumer's technology affinity as a moderator. To do so, two surveys were conducted, of which the preliminary study focused on identifying the most suitable smart packaging approach to use for the final survey, and the main study explored the relationship of each variable to the others by performing an A/B split test. An online questionnaire was chosen as the research method for various reasons, including its low cost and geographical reach. However, this approach is also associated with disadvantages which occurred in the context of this research. This made it possible to reach a total number of 185 participants in the scope of the main survey, of which 61 had to be excluded from further analysis for different reasons. Although 50 participants per 1x1 variable is sufficient, this could influence the overall representativeness. Nevertheless, the chosen research method can be assessed as appropriate for the data collection as it has successfully investigated the research topic and generated internally consistent and reliable results to investigate the hypotheses.

In addition to the confirmatory/explanatory research approach, exploratory research was conducted in the form of a literature review, which contains literature on all relevant variables. Based on the literature review, three hypotheses were defined to explore the matter of the research.

After conducting an independent samples t-test, the first hypothesis was analyzed in terms of the direct relationship between packaging and purchase intention, and differences between traditional and smart approaches were examined. According to the extensive literature review, which deals with the benefits of packaging and emphasizes the additional advantages of smart packaging approaches, an effect of packaging approaches on consumers' purchase intention can be indicated, whereby a stronger effect of smart packaging approaches can be assumed. In line with those findings, the data collected in this dissertation verifies hypothesis H1 and proves that there is a statistically significant effect of both traditional and smart packaging on purchase intention. It can further be added that the results show that smart packaging approaches strengthen this effect even more positively in comparison to traditional packaging ($M_{smart} = 3.4736$, $M_{traditional} = 2.4731$, Cohen's $d = 0.97237$).

After proving the impact of the independent variable on the dependent variable, it is further important to consider possible mediators or moderators. For this research, the possible mediating effect of perceived product quality on this relationship was evaluated. After observing the academic results of previous research, it was found that a consumer's decision-making process is immensely influenced by the perception of a product's quality (Wang, 2015). Assessing the relationship of the variables by conducting Haye's PROCESS Model 4, it was found that the direct effect, as well as all three of the indirect effects, were statistically significant, which means that there is a significant effect of 1) packaging on purchase intention, 2) packaging on perceived product quality, and 3) perceived product quality on purchase intention. It can further be added that the effect persists when all three variables are considered as a whole (Effect = 0.6322, BootULCI – BootLCI \neq 0), which verifies hypothesis H2. Again, these results are consistent with the previously reviewed literature, which led to the assumption that the effect of packaging on consumers' purchase intention is mediated by perceived product quality.

Furthermore, it was explored whether a consumer's degree of technology affinity has a moderating effect on the relationship between packaging and purchase intention and, therefore, affects its strength. Since the relationship between the variable 'technology affinity' and the other two variables has not yet been researched to a large extent, an important limitation arises here with regard to the development of the hypothesis. However, reviewing Young et al. (2020), it was assumed that there is a moderating effect of technology affinity as a lack of knowledge and familiarity can lead to a lower acceptance of technologies. Nevertheless, after executing a moderation analysis on the collected data, no significant interaction effect of packaging and technology affinity on purchase intention could be detected. Considering these results, there was no statistical significance ($p = 0.754$) and thus no moderating effect of the variable on the relationship between packaging and consumer's purchase intention, which led to not validating hypothesis H3. As this is not consistent with the previously discussed literature, an explanation of this result could be the limited research and lack of information on this topic to date, which makes it difficult to develop an accurate hypothesis and may need to consider additional factors. Another possible reason could be that the ATI scale may measure a broad interest in technology and thus may not translate to the topic of smart packaging features due to a participant's lack of interest in food technologies. A third explanation could be a participant's potential unawareness of the benefits and functionalities of smart packaging approaches, as those were not further explained in the scope of the main survey. However, it was still found that the level

of consumer's technology affinity can still directly affect the direct effect of packaging on purchase intention. Whereas the direct effect is not significant for consumers with low technology affinity, the direct effect of packaging on purchase intention is significant and positive for consumers with average and high technology affinity. This implies that smart packaging is more effective in increasing purchase intention among consumers with average and high technology affinity but does not significantly impact those with low technology affinity. Therefore, the hypothesis H3 could not be rejected.

Finally, the full conceptual framework was tested by using Haye's PROCESS Model 5. Reviewing the results of this statistical analysis, the previously collected and discussed results were confirmed once more.

CHAPTER 5: CONCLUSIONS AND LIMITATIONS

For the final chapter of this dissertation, the main findings of the conducted research will be emphasized by simultaneously providing an answer to the previously defined research questions and indicating theoretical and managerial implications. Finally, the study's limitations will be highlighted, along with opportunities for further research.

5.1 Main Findings & Conclusions

To obtain an understanding of the relationship between packaging and purchase intention as well as to examine the role perceived product quality and consumers' technology affinity play in this, three research questions have been defined, which will be discussed in the following.

***RQ1:** What impact does smart packaging, compared to traditional packaging, have on consumers' purchase intention?*

The first research question investigates not only if there is an effect of packaging on consumers' purchase intention but also aims to examine potential differences in this effect depending on whether the packaging is traditional or smart. The findings imply that both traditional and smart packaging significantly influence consumer's purchase intention. This effect is not only confirmed by the statistical investigation of the direct relationship between the independent and dependent variables. Rather, it is emphasized by the fact that the statistical significance and, thus, the effect still exists when other variables such as perceived product quality and technology affinity are included. Comparing the impact of both approaches to each other, it can be noted that the impact of traditional packaging on purchase intention is smaller than the impact of smart packaging. Both variables show a mean difference of -1.00150, which indicates that consumers have a higher purchase intention for smart packaging products than they do for traditional packaging products. The effect size, as indicated by Cohen's d (0.97237), further suggests a large impact, meaning that the type of packaging substantially influences consumer purchase intentions.

***RQ2:** What is the role of perceived product quality in the context of the relationship between packaging and consumer's purchase intention?*

As perceived product quality is a major factor in the context of product packaging and its influence on purchase intention, this dissertation aims to explore the role of perceived product quality as a mediator in this relationship. It is important to consider that the perception of a product's quality is dependent on various factors that have not been considered in the scope of this thesis. Nevertheless, a statistically significant impact was measured by using Haye's PROCESS Model 4 for each of the three indirect effects, including the effect of packaging on perceived product quality, perceived product quality on purchase intention, and perceived product quality as a mediator on the relationship as a whole. Hence, it can be concluded that perceived product quality plays a significant mediating role in the relationship between packaging and purchase intention. It can further be discovered that the product quality is perceived as higher with smart packaging ($M = 3.5593$) compared to traditional packaging ($M = 2.7949$). This indicated that smart packaging enhances perceived product quality, which in turn increases consumer's purchase intention.

***RQ3:** Does a varying level of technology affinity impact the relationship between packaging and purchase intention?*

Finally, the third research question aims to study the potential effect of consumers' technology affinity on the relationship between packaging and purchase intention and whether there are differences with a varying level of technology affinity. Although there is no significant interaction effect of packaging and technology affinity on consumers' purchase intention, the direct effect of packaging on purchase intention and, thus, its strength is impacted by the level of technology affinity of consumers. For consumers with low technology affinity, no statistically significant effect was detected due to its p-value ($p = 0.1368$). This indicates that the usage of smart packaging approaches does not significantly impact consumers' purchase intention when their level of technology affinity is low. This could be explained by the limited awareness of the benefits of smart packaging and how it can enhance their experience, as their low technology affinity may decrease their ability to examine its value and utility. Conversely, both an average and a high level of technology affinity significantly and positively influence the direct effect of packaging on purchase intention. Thus, it can be concluded that smart packaging is more effective in increasing consumers' purchase intention among those who have an average or high technology affinity. It can further be explored that the effect of consumers with high technology affinity (0.4810) is higher than that of consumers with average technology affinity (0.3779) which indicates that the total effect of packaging on purchase intention is

greater at high levels of technology affinity compared to average levels and that an increase in technology affinity simultaneously leads to a stronger positive impact of packaging on consumer's purchase intention.

5.2 Academic and Managerial Implications

This research contributes to the field of marketing in terms of smart packaging approaches and their influence on purchase intention, especially against the background of the present level of a consumer's technology affinity. As the effect of technology affinity on this relationship has not yet been widely researched in existing literature, this study offers an approach to fill the existing literature gap by providing findings about the impact of varying levels of technology affinity on the relationship between packaging and purchase intention. It further reveals how an interaction of technology affinity and packaging may not significantly impact purchase intention but that the degree of technology affinity significantly and positively impacts the strength of the relationship between packaging and purchase intention. This provides valuable insight into the usage of smart packaging in the field of marketing. Given that this research represents merely a preliminary investigation, the following chapter offers insights into how this topic could be further explored in the future.

In addition to the academic implications, the research further reveals managerial implications. When developing marketing strategies for smart packaging approaches, there should be a focus on consumers with average to high technology affinity, as they are more responsive to smart packaging. Data analytics need to be used to create segmented and tailored marketing campaigns. It might make sense to use online marketing channels as this increases the possibility of targeting consumers with an average to high level of technology affinity.

When it comes to data analytics, it is further important to consider consumers with a low level of technology affinity as it can also help to gain insights into consumer behavior and their preferences in terms of smart packaging technologies. As data analytics can contribute to improving the features of those technologies and e.g., increasing the user-friendliness of smart packaging, this can also serve as a tool to influence the purchase intention of consumers with a low level of technology affinity, as this helps to minimize barriers.

Further considering the obtained results, organizations should set focus on educating consumers about the benefits and value of smart packaging approaches e.g., by publishing educational

campaigns. As previously discussed, packaging can positively influence consumers' perception of product quality and, in turn, increase purchase intention. However, consumers with a low technology affinity did not show the same effect as those with an average or a high technology affinity. This could be due to the fact that consumers with low technology affinity may not be aware of the additional benefits of smart packaging approaches. Also, a low level of technology affinity may make it more difficult for consumers to assess potential benefits and risks. Therefore, additional education of consumers about the functionalities of these approaches by companies in line with their products and technologies they use should be done as this can help to raise awareness and enhance the consumers experience with these technologies. By doing so, the perceived product quality and the purchase intention can be increased.

5.3 Limitations and Further Research

In the scope of this dissertation, there are a number of limitations that may restrict the results of this work. Although the research method used for exploring the subject of this work was evaluated as appropriate, it is important to notice that it may have led to potential limitations. Due to the sample size, it is possible that the representativeness of the results may have been influenced and decreased compared to a larger sample size. Additionally, the demographics show that the majority of the participants are younger than 35 years and female, which may have led to a bias in the results. Therefore, it could be helpful for future research to establish studies that explore this subject with larger and more diverse samples.

Due to the scope of this work, it was further essential to restrict the research to individual, selected variables. In this case, perceived product quality as a mediator and technology affinity as a moderator were chosen in addition to packaging as the independent variable and purchase intention as the dependent variable. However, it is important to consider that these investigations were limited, e.g., the perception of a product's quality is dependent on various factors that have not been considered in this thesis due to the limited scope of this work. Additionally, other theoretical approaches to the interaction of consumers with technologies were not taken into consideration, nor were other possible mediators and moderators that could affect the relationship between packaging and purchase intention or the full model. Considering this, further research needs to be conducted that implements these limitations in their studies and explores other potential variables and more precise measures of technology affinity to further explore the moderating effects by capturing relevant consumer attitudes towards smart packaging.

Finally, there are limitations due to the chosen stimuli. As it was not possible to investigate smart packaging as a whole and consider every product category, this dissertation sets its focus on one smart packaging approach (freshness indicator) and one product category (fruits and vegetables). Even if the results are internally consistent and reliable for these variables, it makes it difficult to draw general conclusions. Rather, it is essential for future research to conduct a wide range of studies that consider other smart packaging approaches and product categories.

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APPENDICES

Appendix 1: Stimuli Pre-Survey



Freshness Indicator



Biosensor (Food Sentinel System)



Oxygen Scavenger



QR Code

Sources of Images Used:

Image Number	Description	Original Source	URL/Reference
Image 1	Pears	Alibaba	https://www.alibaba.com/product-detail/Belgium-Netherlands-Import-Pears-Packaging-Fresh_1600617012445.html?spm=a2700.7724857.0.0.68d610df2XkmdP
Image 2	Spinach	Fresh Express	https://www.freshexpress.com
Image 3	Dried Apricots	Seeberger, CarePac	https://www.carepac.com/custom-dried-fruit-packaging/
Image 4	Acai Berry Powder	Purasana	https://www.vitalabo.de/purasana/acai-pulver-bio-1

Appendix 2: Pre-Survey

Dear participant,

The following research is being conducted as part of my master dissertation to pursue my Master's degree in Management with Specialization in Strategic Marketing at Católica Lisbon School of Business and Economics.

The study aims to evaluate consumer's perception of certain types of packaging, which will be shown to you. There are no right or wrong answers. The survey takes approximately 10 minutes to complete. All data collected will be kept strictly confidential and will only be used for academic research purposes.

If you have any further questions, or feedback regarding the survey, please feel free to contact me by e-mail: s-mhauk@ucp.pt

Thank you for your time and participation!

In the following, a variety of packaging types will be shown to you. Please answer all questions spontaneously and rate each packaging design with your honest opinion.

Freshness Indicator:

On the shown packaging, you can find an indicator which provides information about the ripeness of the fruit. The initial color of red indicates that the fruit is fresh and crisp. As the maturing process continues, the sensor changes its color to orange and finally yellow.



Biosensor:

On the illustrated packaging, you can find a barcode which turns unreadable in case of a safety risk due to toxins caused by bacteria.



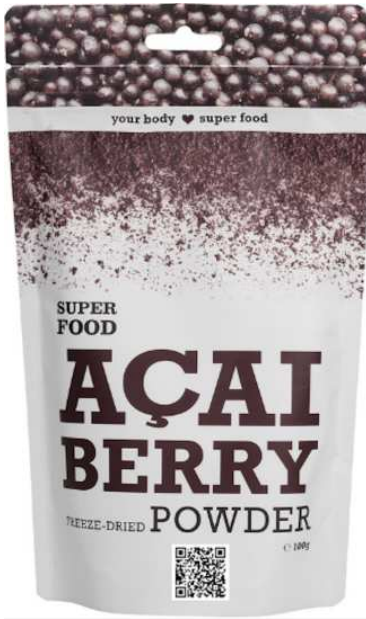
Oxygen Scavenger:

The illustrated packaging contains an oxygen scavenger in the form of a sachet, which helps to remove oxygen and therefore maintain the freshness of the food inside.



QR Code:

The shown packaging contains a QR code which can be scanned with a smartphone. After scanning this QR code, you will receive additional information including the packaging date, nutritional information, cooking instructions etc.



Questions for all four packaging types:

How familiar are you with this kind of packaging?

- Not familiar at all
- Slightly familiar
- Moderately familiar
- Very familiar
- Extremely familiar

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Using this type of packaging would make me a smart consumer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this type of packaging would make my shopping easier.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this type of packaging would save money.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this type of packaging makes shopping more enjoyable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, this type of packaging is very useful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The product is one that I felt superior to other products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The product is one that I would feel easy about using.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The overall quality of product is good.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How attractive is this packaging?

- Not attractive at all
- Slightly attractive
- Moderately attractive
- Very attractive
- Extremely attractive

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I believe that most people would like to buy this product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would be glad to try the food in this packaging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would recommend this product to my friends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would purchase this product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

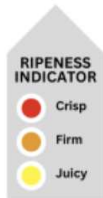
Ranking:

Please rank the following types of packaging according to your preferences and likeability.

Biosensor



Freshness Indicator



QR Code



Oxygen Scavenger



Demographics:

How old are you?

- Under 18 years
- 18 – 24 years
- 25 – 34 years
- 35 – 44 years
- 45 – 54 years
- 55 – 64 years
- 65+ years

Which gender do you identify with?

- Male
- Female
- Non-binary / third gender
- Prefer not to say

What is the highest level of education you have completed?

- Less than high school
- High school graduate
- Bachelor's degree
- Master's degree
- Doctorate
- Other

What is your current occupation?

- Employed full-time
- Employed part-time
- Self-employed
- Unemployed
- Student
- Working Student
- Retired
- Other

What is your country of residence?

- Germany
- Portugal
- Italy
- Spain
- Austria
- United Kingdom
- Switzerland
- Other, please specify:

What is your monthly gross income?

- Less than 500€
- 500€ - 999€
- 1,000€ - 1,499€
- 1,500€ - 1,999€
- 2,000€ - 2,499€
- 2,500€ - 2,999€
- 3,000€ - 3,499€
- 3,500€ - 3,999€
- More than 4,000€
- Prefer not to say

Appendix 3: Demographics Pre-Survey

Frequency Statistics				
Variable	Values	Frequency	Percentage	Cumulative
Gender	Male	7	33.3%	33.3%
	Female	14	66.7%	100.0%
Age	18-24 years	3	14.3%	14.3%
	25-34 years	14	66.7%	81.0%
	35-44 years	1	4.8%	85.7%
	45-54 years	3	14.3%	100.0%
Highest level of education	Less than high school	3	14.3%	14.3%
	High school graduate	3	14.3%	28.6%
	Bachelor's degree	8	38.1%	66.7%
	Master's degree	5	23.8%	90.5%
	Other	2	9.5%	100.0%
Occupation	Employed full-time	13	61.9%	61.9%
	Self-employed	1	4.8%	66.7%
	Unemployed	1	4.8%	71.4%
	Student	3	14.3%	85.7%
	Working Student	1	4.8%	90.5%
	Retired	1	4.8%	95.2%
	Other	1	4.8%	100.0%
Country of residence	Germany	19	90.5%	90.5%
	Portugal	1	4.8%	95.2%
	Switzerland	1	4.8%	100.0%
Monthly gross income	Less than 500€	2	9.5%	9.5%
	500€ - 999€	2	9.5%	19.0%
	1,000€ - 1,499€	2	9.5%	28.6%
	1,500€ - 1,999€	3	14.3%	42.9%
	2,000€ - 2,499€	3	14.3%	57.1%
	2,500€ - 2,999€	2	9.5%	66.7%
	3,000€ - 3,499€	1	4.8%	71.4%
	More than 4,000€	3	14.3%	85.7%
	Prefer not to say	3	14.3%	100.0%

Appendix 4: Cronbach's Alpha Pre-Survey

Cronbach's Alpha		
Construct	Number of Items	Cronbach's α
Stimulus 1: Biosensor		
Perceived Usefulness	5	0.841
Perceived Product Quality	3	0.759
Purchase Intention	4	0.839
Stimulus 2: Freshness Indicator		
Perceived Usefulness	5	0.888
Perceived Product Quality	3	0.866
Purchase Intention	4	0.858
Stimulus 3: QR Code		
Perceived Usefulness	5	0.814
Perceived Product Quality	3	0.659
Purchase Intention	4	0.889
Stimulus 4: Oxygen Scavenger		
Perceived Usefulness	5	0.813
Perceived Product Quality	3	0.730
Purchase Intention	4	0.855

Appendix 5: Descriptives Ranking Pre-Survey

Descriptive Statistics				
	N	Mean	Median	Std. Deviation
Biosensor	21	2,43	2.00	0.926
Freshness Indicator	21	1,67	1.00	0.856
QR Code	21	2,33	2.00	1.065
Oxygen Scavenger	21	3,57	4.00	0.746

Appendix 6: Descriptives Constructs Pre-Survey

Descriptive Statistics				
		N	Mean	Std. Deviation
Familiarity	Biosensor	21	2.00	1.342
	Freshness Indicator	21	2.14	1.424
	QR Code	21	2.71	1.347
	Oxygen Scavenger	21	2.76	1.375
Perceived Usefulness	Biosensor	21	4.1238	0.68550
	Freshness Indicator	21	4.1429	0.82980
	QR Code	21	3.6667	0.8449
	Oxygen Scavenger	21	3.1333	0.75454
Perceived Product Quality	Biosensor	21	4.1111	0.7698
	Freshness Indicator	21	4.1429	0.72703
	QR Code	21	3.6984	0.75207
	Oxygen Scavenger	21	3.5238	0.7998
Attractiveness	Biosensor	21	3.43	1.287
	Freshness Indicator	21	3.57	1.287
	QR Code	21	3.33	1.017
	Oxygen Scavenger	21	2.90	0.944
Purchase Intention	Biosensor	21	3.9405	0.79806
	Freshness Indicator	21	4.2500	0.68007
	QR Code	21	3.7857	0.81886
	Oxygen Scavenger	21	3.4286	0.90534

Appendix 7: Main Survey

Dear participant,

The following research is being conducted as part of my master dissertation to pursue my Master's degree in Management with Specialization in Strategic Marketing at Católica Lisbon School of Business and Economics.

The study aims to evaluate consumer's perception of certain types of packaging, which will be shown to you. There are no right or wrong answers.

The survey takes approximately 5 minutes to complete. All data collected will be kept strictly confidential and will only be used for academic research purposes.

If you have any further questions, or feedback regarding the survey, please feel free to contact me by e-mail: s-mhauk@ucp.pt

Thank you for your time and participation!

Screening Question:

Have you been grocery shopping in the last 12 months?

Yes

No

Traditional Packaging:

Imagine the following scenario: You are doing your weekly grocery shopping and are thinking about **buying some fruits**. As you are standing in the fruit department, you see the **following packaging of pears**.



Please answer the following questions with this scenario in mind.

Smart Packaging:

Imagine the following scenario: You are doing your weekly grocery shopping and are thinking about **buying some fruits**. As you are standing in the fruit department, you see the **following packaging of pears**.



On the packaging, you can find an **indicator which provides information about the ripeness of the fruit**. The initial color of red indicates that the fruit is fresh and crisp. As the maturing process continues, the sensor changes its color to orange and finally yellow.

Please answer the following questions with this scenario in mind.

Questions for both scenarios:

How familiar are you with this kind of packaging?

- Not familiar at all
- Slightly familiar
- Moderately familiar
- Very familiar
- Extremely familiar

How attractive is this packaging?

- Not attractive at all
- Slightly attractive
- Moderately attractive
- Very attractive
- Extremely attractive

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The product is one that I felt superior to other products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The product is one that I would feel easy about using.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The overall quality of product is good.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I believe that most people would like to buy this product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would be glad to try the food in this packaging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would recommend this product to my friends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would purchase this product.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How innovative do you perceive the shown packaging to be?

- Not innovative at all
- Slightly innovative
- Moderately innovative
- Very innovative
- Extremely innovative

In the following, you will be asked to assess yourself in relation to further statements. Please keep in mind that the term "**technical systems**" includes all kinds of apps and software applications as well as technical devices (e.g., mobile phone, computer, TV).

Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I like to occupy myself in greater detail with technical systems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like testing the functions of new technical systems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I predominantly deal with technical systems because I have to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I have a new technical system in front of me, I try it out intensively.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy spending time becoming acquainted with a new technical system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is enough for me that a technical system works; I don't care how or why.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to understand how a technical system exactly works.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is enough for me to know the basic functions of a technical system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to make full use of the capabilities of a technical system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How technologically advanced do you perceive the shown packaging to be?

- Not technologically advanced at all
- Slightly technologically advanced
- Moderately technologically advanced
- Very technologically advanced
- Extremely technologically advanced

Demographics:

How old are you?

- Under 18 years
- 18 – 24 years
- 25 – 34 years
- 35 – 44 years
- 45 – 54 years
- 55 – 64 years
- 65+ years

Which gender do you identify with?

- Male
- Female
- Non-binary / third gender
- Prefer not to say

What is the highest level of education you have completed?

- Less than high school
- High school graduate
- Bachelor's degree
- Master's degree
- Doctorate
- Other

What is your current occupation?

- Employed full-time
- Employed part-time
- Self-employed
- Unemployed
- Student
- Working Student
- Retired
- Other

What is your country of residence?

- Germany
- Portugal
- Italy
- Spain
- Austria
- United Kingdom
- Switzerland
- Other, please specify:

What is your monthly gross income?

- Less than 500€
- 500€ - 999€
- 1,000€ - 1,499€
- 1,500€ - 1,999€

- 2,000€ - 2,499€
- 2,500€ - 2,999€
- 3,000€ - 3,499€
- 3,500€ - 3,999€
- More than 4,000€
- Prefer not to say

Appendix 8: Demographics Main Study (Sample Characterization)

Frequency Statistics							
		Traditional		Smart		Total	
Number of Participants		65		59		124	
Gender	Male	16	24.6%	20	33.9%	36	29%
	Female	49	75.4%	38	64.4%	87	70.2%
	Prefer not to say	0	0%	1	1.7%	1	0.8%
Age	18 – 24 years old	17	26.2%	17	28.8%	34	27.4%
	25 – 34 years old	35	53.8%	29	49.2%	64	51.6%
	35 – 44 years old	7	10.8%	6	10.2%	13	10.5%
	45 – 54 years old	2	3.1%	5	8.5%	7	5.6%
	55 – 64 years old	3	4.6%	1	1.7%	4	3.2%
	65+ years old	1	1.5%	1	1.7%	2	1.6%
Highest level of education	Less than high school	4	6.2%	2	3.4%	6	4.8%
	High school graduate	8	12.3%	5	8.5%	13	10.5%
	Bachelor's degree	29	44.6%	26	44.1%	55	44.4%
	Master's degree	24	36.9%	21	35.6%	45	36.3%
	Other	0	0%	5	8.5%	5	4%
Current occupation	Employed full-time	23	35.4%	21	35.6%	44	35.5%
	Employed part-time	6	9.2%	6	10.2%	12	9.7%
	Self-employed	4	6.2%	1	1.7%	5	4%
	Unemployed	3	4.6%	5	8.5%	8	6.5%
	Student	21	32.3%	19	32.2%	40	32.3%
	Working Student	6	9.2%	5	8.5%	11	8.9%
	Retired	1	1.5%	1	1.7%	2	1.6%
	Other	1	1.5%	1	1.7%	2	1.6%
Country of Residence	Germany	53	81.5%	48	81.2%	101	81.5%
	Portugal	4	6.2%	7	11.9%	11	8.9%
	Italy	2	3.1%	1	1.7%	3	2.4%
	Austria	1	1.5%	1	1.7%	2	1.6%
	Switzerland	1	1.5%	0	0%	1	0.8%
	France	0	0%	1	1.7%	1	0.8%
	Norway	1	1.5%	0	0%	1	0.8%
	Poland	0	0%	1	1.7%	1	0.8%
	Sweden	1	1.5%	0	0%	1	0.8%
	Tunisia	1	1.5%	0	0%	1	0.8%
	United Arab Emirates	1	1.5%	0	0%	1	0.8%
Monthly gross income	< 500€	5	7.7%	8	13.6%	13	10.5%
	500€ - 999€	9	13.8%	9	15.2%	18	14.5%
	1,000€ - 1,499€	9	13.8%	10	16.9%	19	15.3%
	1,500€ - 1,999€	12	18.5%	6	10.2%	18	14.5%
	2,000€ - 2,499€	4	6.2%	6	10.2%	10	8.1%
	2,500€ - 2,999€	3	4.6%	4	6.8%	7	5.6%
	3,000€ - 3,499€	3	4.6%	1	1.7%	4	3.2%
	3,500€ - 3,999€	1	1.5%	2	3.4%	3	2.4%
	> 4,000€	12	18.5%	5	8.5%	17	13.7%
	Prefer not to say	7	10.8%	8	13.6%	15	12.1%

Appendix 9: Cronbach's Alpha Main Study

Cronbach's Alpha		
Construct	Number of Items	Cronbach's α
Stimulus 1: Traditional Packaging		
Perceived Product Quality	3	0.728
Purchase Intention	4	0.865
Technology Affinity	9	0.753
Stimulus 2: Smart Packaging		
Perceived Product Quality	3	0.723
Purchase Intention	4	0.897
Technology Affinity	9	0.787

Appendix 10: Independent Samples T-Test (H1)

Group Statistics					
	Packaging Type	N	Mean	Std. Deviation	Std. Error Mean
Purchase Intention	Traditional Packaging	65	2.4731	0.93241	0.11565
	Smart Packaging	59	3.4746	1.01465	0.13210

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
				F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference
		One-sided p	Two-sided p					Lower	Upper		
Purchase Intention	Equal variances assumed	0.189	0.664	-5.728	122	< .001	< .001	-1.00150	0.17485	-1.34763	-0.65537
	Equal variances not assumed			-5.704	118.106	< .001	< .001	-1.00150	0.17557	-1.34917	-0.65383

Independent Samples Effect Sizes				
		Standardizer	95% Confidence Interval	
			Lower	Upper
Purchase Intention	Cohen's d	0.97237	-1.403	-0.653
	Hedge's correction	0.97840	-1.395	-0.649
	Glass's delta	1.01465	-1.379	-0.588

Appendix 11: Haye's PROCESS Model 4 Test (H2)

Outcome Variable: Perceived Product Quality							
Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.4114	0.1693	0.7270	24.8598	1	122	0.0000
Model	coeff	se	t	p	LLCI	ULCI	
constant	2.0304	0.2389	8.4999	0.0000	1.5575	2.5033	
Packaging	0.7645	0.1533	4.9860	0.0000	0.4609	1.0680	

Outcome Variable: Purchase Intention							
Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.7840	0.6147	0.4661	96.5249	2	121	0.0000
Model	coeff	se	t	p	LLCI	ULCI	
constant	-0.1838	0.2413	-0.7616	0.4478	-0.6616	0.2949	
Packaging	0.3782	0.1347	2.8083	0.0058	0.1116	0.6449	
Perceived Product Quality	0.8153	0.0725	11.2470	0.0000	0.6718	0.9588	

Outcome Variable: Purchase Intention							
Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.4604	0.2119	0.9455	32.8079	1	122	0.0000
Model	coeff	se	t	p	LLCI	ULCI	
constant	1.4716	0.2724	5.4019	0.0000	0.9323	2.0109	
Packaging	1.0015	0.1748	5.7278	0.0000	0.6554	1.3476	

Total, Direct, and Indirect Effects of X on Y						
Total Effect of X on Y	Effect	se	t	p	LLCI	ULCI
	1.0015	0.1748	5.7278	0.0000	0.6554	1.3476
Direct Effect of X on Y	Effect	se	t	p	LLCI	ULCI
	0.3782	0.1347	2.8083	0.0058	0.1116	0.6449
Indirect Effect(s) of X on Y	Effect	BootSE	BootLLCI	BootULCI		
Perceived Product Quality	0.6233	0.1336	0.3686	0.8966		

Appendix 12: Moderation Regression Test (H3)

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.463	0.215	0.195	0.97878

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	31.412	3	10.471	10.930	<0.001
Residual	114.961	120	0.958		
Total	146.372	123			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.952	0.088		33.547	<0.001
Packaging	0.999	0.176	0.459	5.672	<0.001
Technology Affinity	-0.043	0.135	-0.25	-0.315	0.754
Packaging * Technology Affinity	0.152	0.271	0.045	0.562	0.575

Appendix 13: Haye's PROCESS Model 5 Test (H3 and Full Model)

```

*****
Model   : 5
  Y     : PI_Total
  X     : Packagin
  M     : PPQ_Tota
  W     : TA_Total

Sample
Size: 124

*****
OUTCOME VARIABLE:
  PPQ_Tota

Model Summary
      R      R-sq      MSE      F      df1      df2
P
,4114    ,1693    ,7270    24,8598    1,0000    122,0000    ,00
00

Model
      coeff      se      t      p      LLCI      ULCI
constant    2,0304    ,2389    8,4999    ,0000    1,5575    2,5033
Packagin    ,7645    ,1533    4,9860    ,0000    ,4609    1,0680

*****
OUTCOME VARIABLE:
  PI_Total

Model Summary
      R      R-sq      MSE      F      df1      df2
P
,7855    ,6170    ,4711    47,9268    4,0000    119,0000    ,00
00

Model
      coeff      se      t      p      LLCI      ULCI
constant    -,1805    ,2430    -,7429    ,4590    -,6616    ,3006
Packagin    ,3779    ,1355    2,7891    ,0062    ,1096    ,6461
PPQ_Tota    ,8152    ,0729    11,1816    ,0000    ,6708    ,9595
TA_Total    -,2479    ,2972    -,8340    ,4059    -,8365    ,3407
Int_1       ,1578    ,1897    ,8315    ,4073    -,2179    ,5335

Product terms key:
  Int_1      :      Packagin x      TA_Total

```

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	,0022	,6915	1,0000	119,0000	,4073

Focal predict: Packagin (X)
 Mod var: TA_Total (W)

Data for visualizing the conditional effect of the focal predictor:
 Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
  Packagin  TA_Total  PI_Total  .
BEGIN DATA.
  1,0000    -,6534    2,8311
  2,0000    -,6534    3,1059
  1,0000     ,0000    2,7722
  2,0000     ,0000    3,1501
  1,0000     ,6534    2,7133
  2,0000     ,6534    3,1943
END DATA.
GRAPH/SCATTERPLOT=
  TA_Total WITH  PI_Total BY  Packagin .
```

***** DIRECT AND INDIRECT EFFECTS OF X ON Y *****

Conditional direct effects of X on Y

	TA_Total	Effect	se	t	p	LLCI	UL
CI							
80	-,6534	,2748	,1834	1,4980	,1368	-,0884	,63
61	,0000	,3779	,1355	2,7891	,0062	,1096	,64
50	,6534	,4810	,1839	2,6160	,0100	,1169	,84

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
PPQ_Tota	,6232	,1320	,3738	,8859