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THE BUSINESS OPPORTUNITY OF BLOCKCHAIN-BASED SYSTEMS TO PREVENT GREENWASHING: EXPLORING THE ROLE OF PERCEIVED CORPORATE SOCIAL RESPONSIBILITY ON STAKEHOLDERS' REACTIONS

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Chapter 1

Introduction

1.1 Introduction

Greenwashing is an increasingly common practice in the modern industry, that involves the use of marketing techniques to promote products or services as sustainable and environmentally friendly, without any real attention to sustainability (Delmas & Burbano, 2011). Many companies use this unethical strategy to improve their public image, trying to attract consumers who are increasingly aware of the environmental impact of their choices (Sun & Shi, 2022). However, these claims are often exaggerated or even false, and the only goal is to generate profits (Sapio, 2022).

Greenwashing takes many forms. A common example is the use of "eco-friendly" packaging that is actually unsustainable. For example, a biodegradable plastic bottle may be presented as an eco-friendly solution, but if not disposed of properly, it still ends up in landfills and pollutes the environment. Other greenwashing techniques may include using words like "natural", "organic" or "eco-friendly" without any official certification confirming these claims or elaborating misleading statistical data that hides the actual environmental impact of the product or service. (De Freitas et al., 2020) . As in the case of the Volkswagen automotive company, which resorted to the use of misleading advertising campaigns to promote its environmental image. The company used the slogan "Clean Diesel" to advertise its diesel vehicles, despite being found by the United States Environmental Protection Agency (EPA) to violate emissions regulations. Specifically, the accusation was that the company used emissions control software capable of detecting when the vehicle was undergoing an

emissions test and altering the engine's operation to emit fewer pollutants during the test. In reality, during normal driving, the vehicles would emit up to 40 times the maximum allowable amount of nitrogen oxides (NOx). Another distinguishing factor was the company's investment of billions of dollars in research and development of electric and hybrid cars, even though their sales continued to be dominated by diesel vehicles. Here we can see the crux of greenwashing, which is to try to conceal the true nature of one's activities and present oneself as an environmentally responsible company, despite the actions taken not corresponding to such an image. (Aurand et al., 2018).

However, greenwashing not only represents an injustice to consumers, but also a damage to the environment, because it involved both consumers-related, business-related, and ethical-related damages (Sestino et al., 2023). When companies do not make the necessary efforts to become truly sustainable, their impact on the environment can be much greater than admitted (Berrone et al., 2017).

In 2020, the European Commission conducted extensive cross-sector research to identify greenwashing cases. They found that in 53,3% of the cases examined, green claims were vague and unfounded and that 40% of them were completely unfounded and exaggerated (European Commission, 2020).

From a more global perspective, more than 75% of S&P 500 companies regularly publish information on their environmental policies and performance on their websites, and about 98% of products with environmental claims deceive consumers by committing deceptive tactics, tied to vagueness, falsehood and omissions (Choice, 2010; Zhang et al., 2018).

Businesses operate greenwashing more to obviate or seem to be compliant with the sustainable needs of the market and end consumers, concepts achievable through the application of a compliant corporate social responsibility.

The Corporate Social Responsibility (CSR) have become increasingly important in the business world in recent years and represents an important opportunity for companies to create sustainable value not only from a financial point of view, but also from a social and environmental one (Bosh-Badia et al, 2013). The bibliography examined (Porter et al., 2006) suggests that the companies' reputation is closely linked to its ability to adopt ethical and sustainable practices, and consequently, to improve its competitive position and generate value for all stakeholders. CSR focuses on integrating social and environmental objectives into the company's daily activities, through the definition of specific policies and strategies (Baumgartner, 2014). Effective CSR management may have a significant impact on the company's reputation and its ability to attract and retain consumers, investors, employees, and other stakeholders. Sustainability is a fundamental element of CSR. There are several business practices that companies can adopt to become more sustainable, such as the use of renewable energy, the reduction of greenhouse gas emissions, the reduction of waste, the use of recycled materials, and the adoption of ethical purchasing policies. When companies take a more responsible and sustainable approach, consumers tend to appreciate their commitment more, leading to an improvement in the relationship between the company and its stakeholders. This can lead to greater customer loyalty, increased sales, and the creation of new business opportunities. CSR may be analyzed from a multiple perspective as suggested by Carrol (1991), in terms of: 1) Philanthropic responsibility (Be a good corporate citizen): This refers to the

voluntary contributions made by a company to society, such as charitable donations, community development initiatives, and other acts of goodwill. Contribute resources to the community improve quality of life; philanthropic responsibility is considered the highest level of CSR and involves giving back to the community without any legal or ethical obligation. 2) Ethical responsibility (Be ethical): This relates to a company's commitment to behaving in a morally and ethically responsible manner. It involves adhering to principles of fairness, justice, and integrity in all business practices, including decision-making, treatment of employees, customer relations, and environmental stewardship. 3) Legal responsibility (Obey the law): Law is society's codification of right and wrong and must "play by the rules of the game". This refers to a company's obligation to comply with laws and regulations at the local, national, and international levels. Legal responsibility includes ensuring that the company's operations, products, and services meet all legal requirements, and that the company operates within the boundaries of the law. 4) Economic responsibility (Be profitable): This is the foundation of CSR and involves a company's primary duty to generate profits and provide economic value to its shareholders. Economic responsibility includes maintaining profitability, creating jobs, paying taxes, and contributing to economic growth and development. (Carroll, 1991).

By considering the new hypercompetitive and hyper technological scenario, new technologies may contribute to reach sustainably goals innovative technologies can play an important role in achieving sustainability goals and positively contributing to Corporate Social Responsibility (CSR). For example, the use of automated monitoring and control systems can improve energy efficiency and reduce consumption, while the digitization of production processes can reduce waste and

improve traceability. Additionally, technology can facilitate the sharing of information and collaboration among stakeholders, promoting transparency and accountability. Besides, technologies can also stimulate innovation and create new business opportunities that have a positive impact on sustainability and CSR.

Technology may be a great ally in the fight for sustainability, and IoT, AI, and Blockchain may play an important role in this process. For instance, Internet of Things (hereafter, IoT…consisting in a series of smart devices in the forms of interconnected objects able to communicate among them with an internet connection (Sestino et al., 2020), may can help reduce energy and resource waste and become more sustainable through automation and monitoring of consumption in many ways (Demartini et al., 2019). IoT technology can be applied in various ways, one of which is Predictive Maintenance. This refers to the ability of sensors embedded in industrial machinery to monitor performance and detect anomalies, allowing maintenance teams to schedule repairs proactively, and prevent costly breakdowns and unnecessary resource wastage (Abdel-Basset, 2018). Another application is in Waste Management, where IoT can optimize waste collection, sorting, and disposal processes. By monitoring waste levels in bins and optimizing collection routes, unnecessary collection trips can be reduced, leading to the optimization of resource usage. Smart sorting systems can also be used to separate recyclables from non-recyclables more efficiently, resulting in reduced waste contamination and improved recycling rates (Das & Khilar, 2019).

Moreover, IoT may allow businesses to monitor and manage their energy consumption in real-time through Water Management, where IoT can help optimize water usage in agriculture, industries, and households. Sensors can monitor soil moisture levels, weather patterns, and water quality, enabling farmers and water

management authorities to optimize irrigation, reduce water waste, and prevent overuse of resources (Marinakis & Doukas, 2018).

By considering the AI, can be used to improve the management of intelligent electricity networks, which are electricity distribution systems that use IoT technology to collect and analyze data in real time, enabling more efficient and sustainable energy management.

Importantly, new technologies may also positively influence supply chain management and optimization, making it more efficient, reducing waste, resource usage and increasing traceability, through IoT sensors that can be used to monitor the temperature and humidity of food products during transportation and storage, ensuring that products are always fresh and safe for consumption and optimizing inventory management, leading to reduced energy consumption and waste (Tian, 2017). This kind of technology can also be used to improve aspects of deep importance such as workplace safety and reducing accidents, thanks to the use of IoT sensors to monitor working conditions and detect potential danger situations. In this way, companies can take preventive measures to protect their employees and reduce workplace injuries.

Among the others, Blockchain consisting in a shared and immutable ledger that facilitates transaction recording and asset monitoring processes in enterprise networks (Singhal et al., 2018). Technically, blockchain results in is a data structure consisting of linked blocks of data, connected among them and diffused on different other data servers all over the world (Laurence, 2003): To clarify, Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system, finally resulting in digital ledger of transactions that is duplicated

and distributed across the entire network of computer systems on the blockchain (Sestino et al., 2022).

For instance, Blockchain may be useful to certify financial transactions with each block referring to the previous one forming a chain in linear and chronological order transaction recording and verification is done without the need for a central authority, where data is stored in a peer-to-peer network and validated by a series of network nodes (Guo & Lian, 2016). Through the use of blockchain, a company can identify areas where improvements can be made to reduce the environmental impact of its activities. It can be used to track the entire supply chain of its products, monitor energy consumption, natural resource usage, and waste management.

By considering the unforeseen opportunities enabled by the Blockchain, such technology may positively contribute to sustaining sustainable-oriented business strategies, coherently with a positive CSR paradigm. For instance, it is efficient in reducing waste and improving waste management through the implementation of recycling and material recovery systems by tracking the flow of recyclable materials from collection to recovery, ensuring the traceability and recoverability of these materials (Ltfi & Mesfar, 2022; Rainero & Modarelli, 2021).

 Thanks to this technology, a company can track and record all phases of the production process, from the selection of raw materials to the delivery of the final product to the final consumers: This allows for greater transparency and accountability along the entire supply chain, improving sustainability and social responsibility (Rejeb et al., 2019).

For instance, by considering the food industry, a real-world application of blockchain to monitor and certify the stages of the production of the offered products:

Thanks to blockchain, every stage of production, from cultivation to packaging, could be recorded and verified transparently (Perboli et al., 2018).

The Italian company "Oleificio Zucchi", for example, uses blockchain technology to track the production of their olive oil from origin to bottle. Each bottle has a unique QR code that consumers can scan to access production information, using a plate, created by them, called "Zucchi Traceability" to ensure the traceability of olive oil from olive harvest to oil production. Including the location of the olives, the date of harvest, the date of pressing and the date of bottling (https://www.oleificiozucchi.it/sostenibilita/filiera-zucchi-4-0-olio-da-oliva/).

However, in recent years there have been numerous initiatives and pilot projects that have introduced the use of blockchain in the food supply chain to improve transparency, traceability and food safety. (Xu et al., 2020). Examples of companies or consortia that have implemented blockchain in the food industry include IBM, Walmart, Nestlè and other, that have developed a blockchain-based food traceability platform, which have been adopted by several large food companies to improve the visibility and transparency of the supply chain (Collart & Canales, 2022).

According to a study conducted on a sample of food companies in different countries in 2021, 40% of the companies have already implemented or are considering the use of this technology to trace the food supply chain and improve transparency and food safety. Specifically, 25% of the companies that use blockchain do so for food traceability, 10% for quality management, 5% for supply chain management, and 5% for other purposes.

In the case of a farming company, it would be able to record information about the cultivation and harvesting of a particular product, along with information on the

farming practices used. This information would then be shared with processing and packaging companies, who could add further information on the processing stages. The verified information could then be used to ensure the sustainability of the product, and consumers would be able to verify that the product was grown using sustainable farming practices, that processing stages were carried out ethically and sustainably, and that the product was transported sustainably. In this way, blockchain would create a more transparent and sustainable supply chain, improving consumer trust and the reputation of companies that adopt this technology.

1.2 Purpose of the research

By considering the aforementioned contents, consumers may exhibit different reactions when interacting with companies. In guiding these behaviors, the role of individual differences can be fundamental. In this context, for example, in addition to environmental concern, which is the worry and sensitivity towards environmental issues originating from the awareness of the need to protect the environment and adopt sustainable behaviors to preserve natural resources and mitigate the effects of climate change, the conscientiousness of consumers can be considered as a determining factor in influencing their purchasing decisions.

Formally, conscientiousness has been defined as personality trait, defined as a "tendency to respond in certain ways in certain circumstances", or more generally, the tendency to think, feel, and behave in a relatively enduring and consistent manner over time in situations that offer traits, based on the propensity to follow socially prescribed norms for impulse control, to be goal-directed, to plan, and to be able to delay gratification (Roberts et al., 2009).

Moreover, by considering unethical business behaivour, when unethical business behaviors occur, consumers may exhibit adverse reactions towards the company, such as negative word-of-mouth. To address this issue and ensure the veracity of sustainable communications by companies, blockchain technology can be used as a tool for control and transparency, being able to guarantee that there is no hidden greenwashing in sustainable corporate communications that claim to be environmentally friendly. In this way, blockchain can favor a greater positive word-of-mouth, since this can be influenced by different levels of consumer conscientiousness.

In order to prove this assumption, an experimental study has been conducted among a sample of 400 participants. Results showed individuals' perceived ethical responsibility related to a blockchain-based system adopted by companies to certify that their pro-environmental claims do not suffer of green washing, have a positive effect on both their willingness to buy (Study 1) and on their word-of-mouth (Study 2). Importantly, such effect is magnyied for those consumers exibithing greater level of conscientiousness that thus may positively react and welcome such technologies.

1.3 Thesis structure

This thesis is organized as follow. In the next chapter (Chapter 2) we present the theoretical foundations behind our reasoning, by shedding light on the concepts of Corporate Social Responsibility, and consumers' reactions to greenwashing campaign. Then, in the Chapter 3 we present the methodological approach, and the administered

survey. In the following Chapter 4, we provide the results related to the statistical analysis conducted by revealing the main insights of our study.

Then based on the emerging results, in the Chapter 5 we propose some theoretical and managerial implications useful for practitioners, scholars and professions. Finally, in the Chapter 6 we provide the conclusion of our work, together with some limitations and avenue for future research.

Chapter 2

Theoretical Background

2.1 The relevance of Corporate Social Responsibility

Corporate Social Responsibility (CSR) is becoming an increasingly important concept in the business world, CSR represents a way for companies to demonstrate their commitment to sustainability and social responsibility. It focuses on defining specific policies and strategies aimed at integrating social and environmental objectives into the company's daily activities. It is a business approach whose the aim is to creating sustainable value not only from a financial perspective, but also from a social and environmental one, this is a strategic approach that aims to create long-term value for the company, society, and the environment.

To better understand these concepts, it is helpful to define the social and environmental context of corporate responsibility; According to this context, the way companies conceive of their activities changes over time and space, and in recent years, the concept of CSR has become increasingly important in the Western context, this has happened after a decade in which the theory of shareholder value maximization had a strong negative impact on the governance and performance of companies. Today, there is broad consensus that companies must be responsible and balance their economic objectives with environmental and social ones, considering the interests of stakeholders and the socio-political environment in which they operate. This requires constant and conscious effort from management, taking into consideration the trend towards which our current global market is heading, a world that seeks to develop in an economically and socially sustainable way, companies must

pay increasing attention to the external impact they generate. (Perrini & Tencati, 2011).

To better understand the rationale of a healthy CSR, we can also turn to stakeholder theory, highlighting the importance of the behaviors triggered by a company's actions towards stakeholders. As we can infer from Freeman's classic definition of a stakeholder, they are individuals or groups that can influence an organization's objectives. Therefore, it is crucial to pay attention to the actions taken, which will inevitably generate a reaction in the individual that will affect the achievement of a company's goal. Thus, it becomes a crucial aspect to establish, monitor, and take care of corporate responsibility during the life of a company that wants to have a positive impact on society and the environment, while earning profits and maintaining its financial sustainability.

For CSR to be accepted by a conscientious business person, it should be framed in such a way that the entire range of business responsibilities are embraced, it is suggested here four kinds of social responsibilities that constitute total CSR that might be depicted as a pyramid which are conveyed by the Carroll's pyramid, according to which there are four categories or components of responsibility (of CSR): economic, legal, ethical, and philanthropic. Beginning with the basic building block notion that economic performance undergirds all else. At the same time, business is expected to obey the law because the law is society's codification of acceptable and unacceptable behavior.

Next is business's responsibility to be ethical. At its most fundamental level,

this is the obligation to do what is right, just, and fair, and to avoid or minimize harm to stakeholders (employees, consumers, the environment, and others). Finally, business is expected to be a good corporate citizen.

In relation to economic responsibilities, based on the reasoning that, historically, business organizations were created as economic entities designed to provide goods and services to society, where profit was established as the primary incentive for entrepreneurship. Before anything else, the business organization was the basic economic unit in our society. As such, its principal role was to produce goods and services that consumers needed and wanted, and to make an acceptable profit in the process. At some point, the idea of profit transformed into a notion of maximum profit, and this has been an enduring value ever since. This is why all other business responsibilities are predicated upon the economic responsibility of the firm, because without it, the others become moot considerations and building upon Carroll's thought these economic responsibilities can be defined, in detail, as: perform in a manner consistent with maximizing earnings per share, be committed to being as profitable as possible, maintain a strong competitive position, maintain a high level of operating efficiency and be defined as one that is consistently profitable.

In the Carroll Pyramid, legal responsibilities refer to the idea that businesses must comply and perform in a manner consistent with various federal, state, and local laws and government regulations, because legal responsibility is seen as a fundamental step for businesses, since if they do not comply with laws, the foundations of the economic system and society itself are called into question. In other words, laws are the foundation on which business operations are based and their ability to create value for society. Therefore, legal responsibility is considered a fundamental prerequisite for

the success of businesses, as companies that comply with laws are able to create an environment of trust and stability for their activities and investors. Additionally, compliance with laws helps businesses avoid fines, sanctions, and other negative consequences that could compromise their reputation and ability to operate in the market.

The third level of the Corporate Social Responsibility (CSR) pyramid concerns "ethical responsibilities". This level implies that companies must act consistently with societal and ethical norms and expectations, recognize and respect emerging ethical norms adopted by society, avoid compromising norms to achieve business objectives, and define good citizenship as doing what is morally or ethically expected.

Ethical responsibilities are different from economic and legal responsibilities because they embrace activities and practices that are expected or prohibited by members of society, even if they are not codified in law. They embody norms, standards, or expectations that reflect a concern for what consumers, employees, shareholders, and the community consider right, fair, or in line with the respect or protection of the moral rights of stakeholders.

Ethical responsibilities can be seen as a driving force in the creation of laws or regulations. For example, environmental, civil rights, and consumer movements reflect fundamental changes in social values and can be seen as ethical bellwethers prefiguring and following subsequent legislation. It is important to distinguish between philanthropic and ethical responsibilities. Communities expect businesses to contribute to humanitarian programs or purposes that improve the quality of life, but they do not consider businesses immoral if they do not do so at the desired level.

Philanthropy is, therefore, more discretionary, or voluntary on the part of businesses, even though there is always a societal expectation that businesses provide it. Philanthropy is a business action that responds to society's expectations regarding corporate responsibility to be good corporate citizens and contribute to human welfare and goodwill. This may include financial or time contributions by businesses to the arts, education, or the community. Assisting public and private educational institutions, managers and employees participating in voluntary and charitable activities in their local communities and providing voluntary assistance to projects that enhance a community's "quality of life" are all examples of philanthropic responsibilities. It is important to carry out these activities consistently with society's philanthropic and charitable expectations to be considered good corporate citizens (Carroll, 1991).

2.2. Consumers' environmental concern and conscientiousness

Environmental concern can be defined as an individual's degree of interest and emotional engagement in environmental issues and problems (Bamberg & Möser, 2007), refers to the level of interest, care, and sensitivity people have toward environmental issues such as climate change, biodiversity loss, deforestation, pollution, and other problems that threaten the health and well-being of the natural environment. This concern can lead to conscious behaviors and choices for protecting and conserving the environment (Kollmuss and Agyeman, 2002).

Many studies have shown that environmental concern is a strong predictor of sustainable behaviors. For example, in a study conducted by Bamberg and Möser (2007), it was found that people who have a high level of environmental concern are

more likely to adopt sustainable behaviors, such as reducing waste and using more sustainable means of transportation.

Environmental concern or awareness of consequences has a strong effect on pro-environmental behavior or pro-environmental behavioral intent (Fujii, 2006), this can also be observed as predicted in Schwartz's norm activation theory, which explains these influences as follows: in order for the behavior to be performed, environmental concern or awareness of consequences induces a sense of responsibility to perform a behavior, which in turn activates a personal norm or a moral obligation to perform the behavior (Schwartz, 1977).

These influences that drive individuals' intentions may refer to a general value or attitudinal orientation. Regarding value orientation, (Stern, 1992) identified more than one and specifically four. One of these explains a link with environmental concern and anthropocentric altruism, where individuals tend to have a central interest and concern for the well-being of people rather than the environment itself, because they believe that a degraded environment can threaten people's health (Van Liere & Dunlap, 1978; Hopper & Nielsen, 1991).

Alternatively, the principle can be a more personal interest, where perceived personal threats caused by environmental deterioration are an important factor underlying responsible environmental behavior (Baldassare & Katz, 1992), or another view assumes that environmental concern may stem from deeper causes such as religious beliefs or post-materialist values (Stern, 1992).

Finally, it can be stated that some studies have observed a gradual shift among people with the second and third value orientations towards a so-called "ecocentric" view (Fransson & Gärling, 1999), similar to the last of the four orientations, namely the

NEP, a new way of thinking called the New Environmental Paradigm (Dunlap & Van Liere, 1978).

Conscientiousness is one of the five dimensions of the personality model known as the "Big Five", along with openness, extraversion, agreeableness, and neuroticism (Costa & McCrae, 1992; Stoeber et al., 2009) . It Is defined as one of the personal characteristics that can guide sustainable behaviors. According to the definition by John and Srivastava (1999), conscientiousness is a personality trait that refers to organization, perseverance, and responsibility. In other words, conscientious individuals tend to be organized, persistent, and reliable, and may therefore be more oriented towards sustainable behaviors.

In the environmental context, conscientiousness has been associated with sustainable behaviors (Schultz & Zelezny, 1998), as we can notice, in a study conducted by Kormos and Gifford (2014), it was shown that conscientiousness is a strong predictor of sustainable behaviors among university students. Participants who scored higher in conscientiousness were more likely to engage in sustainable behaviors, such as recycling and using less water.

Another study examined the effect of conscientiousness on the choice of sustainable products (Chan & Bishop, 2013), where the results showed that individuals with high levels of conscientiousness were more inclined to choose sustainable products compared to those with low levels of conscientiousness. Furthermore, participants with high levels of conscientiousness were also more likely to pay a higher price for sustainable products, indicating greater commitment and responsibility towards the environment. These results support the idea that conscientiousness can be a key factor

in promoting sustainable consumption behaviors and demonstrate important implications for the design of public policies and marketing strategies.

Importantly, conscientiousness may represent a crucial individual difference for explaining certain sustainable purchasing behaviors and may play a significant role in guiding sustainable purchasing behaviors. Conscientious individuals tend to be more responsible and persistent, goal-oriented, and reliable, and these characteristics may lead them to seek out information about products, carefully assess environmental impacts, and consider the long-term before making a purchase, which could make them more likely to choose sustainable products.

2.3 Negative effects of greenwashing on consumers' reaction: positive and negative word-of-mouth

The practice of greenwashing, as already discussed in the introduction, which is based on the environmental impact of products and companies, has become an increasingly relevant topic for consumers. However, many companies try to take advantage of this growing environmental awareness by using misleading marketing practices that suggest a concern for the environment that often does not correspond to reality.

This praxis has been used for decades and may seem harmless. Nevertheless, in addition to its negative effects on the environment, it has been shown to have negative effects on consumers' reaction, in relation to their willingness to buy, especially on the brand and products.

By considering consumers' reactions to product consumptions, the so-called word of mouth (WOM) is a type of communication that occurs between individuals and involves the sharing of information about a product, service, or brand (Karjaluoto et al., 2016). It is a powerful and influential force in consumer decision-making and

can have significant impact on a business's success or failure (Samson, 2006). Positive word of mouth occurs when individuals share favorable experiences and opinions with others (Carrol & Ahuvia, 2006), while negative word of mouth involves the sharing of negative experiences and opinions (Charlett et al., 1995). Research has shown that negative word of mouth can have a greater impact than positive word of mouth, as negative experiences tend to be more memorable and have a stronger influence on consumer behavior: As such, businesses must work to actively manage and monitor their reputation to ensure that negative word of mouth does not harm their brand (Berger, 2014).

One of the most damaging negative effects can arise from negative word-of-mouth (WOM), a cost-effective and efficient marketing strategy that many companies employ to advertise themselves, considered a vital tool for the growth of new products and seeding campaigns as it can help initiate the product adoption process (Yang et al., 2012).

Companies that engage in greenwashing behavior may suffer a negative effect on their reputations because of the spread of negative words about deceptive marketing practices and this could negatively impact consumer purchase intentions, who may become less likely to buy the products or services of these companies, thus generating bad corporate conduct (Newton et al., 2015).

Chen et al. (2014), extending WOM to the environmental field, propose that green word-of-mouth (green WOM) is the extent to which customers inform their friends, relatives and colleagues about the positive environmental messages and the environmentally friendly nature of a product or a brand.

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The magnitude of the negative effect resulting from companies' greenwashing behavior depends on numerous factors, including consumer characteristics, particularly relevant factors in today's global market, such as consumer sensitivity to environmental issues and their concern for the environment in general (Zhang et al., 2018).

Numerous studies have shown that WOM influences choice, diffusion, and sales (Berger & Iyengar, 2013), because consumers often transmit the environmental messages of products through WOM, i.e., in terms of verbal communications between consumers in social and professional contexts, which influence their purchasing behaviors (Chaniotakis & Lymperopolos, 2009).

The consequences can be consumer abandonment of the brand and product, as they may be disappointed by the company's unfulfilled ecological promises (Newell et al., 1998). This feeling of betrayal by the company is particularly pronounced in consumers with a high level of environmental concern, who consider the environment a moral value to defend (Luchs et al., 2010). These consumers react negatively to a company that uses greenwashing to promote products and brands, as this behavior goes against their personal values of consistency (Chernev & Blair, 2015).

2.4. Hypothesis development

Based on the discussion above, we predict that by considering a blockchain-based system used to guarantee that the considered company do not incur in greenwashing campaigns, individuals perceived ethical responsibility may positively affect both consumers' willingness to buy, and their positive word-of-mouth toward such a company. Moreover, this effect is moderated by consumers' conscientiousness.

Hypothesis. *Consumers' perceived ethical responsibility positively influence both their willingness to buy and their word of mouth. However, such effect is magnified for those consumers with higher level of conscientiousness.*

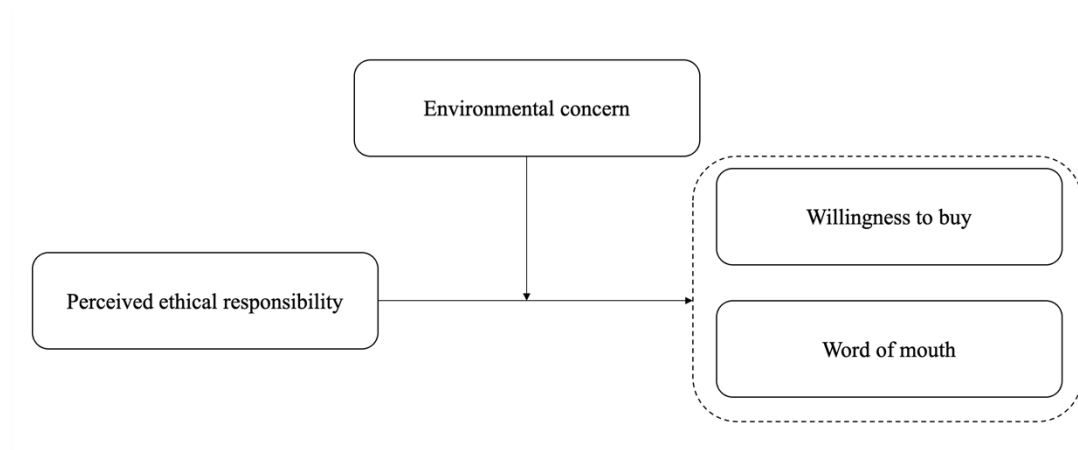The proposed conceptual framework is shown in the figure below (Fig. 1).

Figure 1. The proposed conceptual model.

Chapter 3

Methodology

3.1 Procedure and Questionnaire

In order to test the proposed conceptual model defined in the Chapter 2 (see Figure 1), a structured questionnaire has been developed and administered to a random sample of international participants involved in the experiment.

The aforementioned questionnaire comprised three sections: In the first section, we captured consumers' conscientiousness by using a scale proposed by Goldberg & Lewis (1992); Lynch et al. (2010); Saucier & Gerard (1994), specifically by using eight items (i.e., " I think to be organized", "I think to be efficient", "I think to be systematic", "I think to be practical", "I think to be disorganized", "I think to be loppy", "I think to be inefficient", "I think to be careless", assessed on a Likert scale from 1 to 7 points (1= "Totally disagree"; 7= Totally "agree").

Then, in the second section, we exposed the participants to a scenario regarding in a hypothetical situation, where an individual is in their favorite store searching for their ideal product in its most environmentally friendly and sustainable version for a special dinner. The desired product has been produced sustainably with low emissions and minimal impact on the external environment. On the shelf, the user finds the desired product with a QR code on the label that can be scanned using a smartphone. Once the QR code is scanned, the user is redirected to a dedicated web page that displays the entire production chain of the product, from the precise geographic location of production to storage, certification of environmental impact on waste

management, emissions, sustainability of raw materials used, and more. In this way the technology guarantees that the company cannot in any way have supported greenwashing practices and that everything it claims about its eco-sustainability is true.

The user can be sure that the information provided is accurate thanks to blockchain technology, which ensures data immutability and contributes to ensuring the overall quality of the product. The information entered into a digital platform built on blockchain technologies cannot be modified, so the user can be completely confident about the information communicated by the manufacturer. In this way, the user can purchase the desired product with the awareness of having made a sustainable and environmentally responsible choice.

In the third section, we asked participants to report their perceived ethical responsibility, by using a scale proposed by Carrol (1979; 1991), based on four items (i.e., "I believe that producers of such products permit ethical concerns to negatively affect economic performance", "I believe that producers of such products ensure that the respect of ethical principles has priority over economic performance", "I believe that producers of such products are committed to well–defined ethical principles", "I believe that producers of such products avoid compromising ethical standards to achieve corporate goals"), assessed on a Likert scale from 1 to 7 points (1= "Totally disagree"; 7= "Totally agree").

Then, we asked them to report their willingness to buy, by using a scale proposed by Dodds et al. (1991), using three items (i.e., "I would buy the product proposed by using this kind of technology", "I would consider buy the product proposed by using this kind of technology", "The probability that I would consider buying the product proposed by using this kind of technology is high"), assessed on a

Likert scale from 1 to 7 points (1= Totally disagree; 7= Totally agree); Their word-of-mouth, by using a scale proposed by Carrol (1979;1991), using three items (i.e., "I would recommend this kind of purchase to my friends ", "I would talk positively of this kind of purchase to others", "I would try to spend the good word about this kind of purchase"), assessed on a Likert scale from 1 to 7 points (1= "Totally disagree"; 7= "Totally agree").

Finally, we collected basic sociodemographic data in terms of participants' gender (i.e., "Male", "Female"), age, education ("Lower than high school diploma", "High School Diploma", "B.Sc", "M.Sc", "Ph.D"), and employment ("Employed", "Unemployed", "Unable to work", "Retired", "Student").

3.2 Sample

The questionnaire has been created using Qualtrics and made accessible for period of 3 weeks (24/24 hours – 7/7 days), from February 1st 2023 to April, 30th 2023, in the platform Mechanical Turk as well (Aguinis, 2021). Participants accessed the questionnaire and, after reading the information that guaranteed anonymity and confidentiality, completed the measures that were requested as described earlier.

Despite the original sample contained 404 questionnaires, we removed the 4 participants who failed the attention check question, thus the final sample consisted in 400 participants aged between 21 and 66 (M_{age} =35,35; SD_{age}= 8,89) of which 271 males (67,75%) and 129 females (32,25%). Thirty-four (8,5%) declared to have and high school diploma, or lower than high school diploma; three-hundred fifty declared to have a degree (respectively 248 participants held a B.Sc.; 102 participants held a M.Sc.) and only 32 gained a Ph.D. degree (3,50%).

A detailed table and figures showing the total sample composition is reported below (Tab. 1, Fig. 2, 3, and 4).

Gender		
Male	271	67,75%
Female	129	32,2%
Education		
Lower than high school diploma	2	0,50%
High School Diploma	32	8,00%
B.Sc	248	62,00%
M.Sc	102	25,5%
Ph.D	14	3,5%
Employment		
Employed	278	94,5%
Unemployed	9	2,25%
Unable to work	5	1,25%
Retired	2	0,5%
Student	6	1,5%
Age		
21-24	17	4,25%
25-29	70	17,5%
30-34	165	41,25%
35-39	53	13,25%
40-44	36	9,00%
45-49	21	5,25%
50-54	13	3,25%
55-59	20	5,00%
60-66	5	1,25%

Table 1. Results of the sample analysis: Participants' sociodemographic characteristics
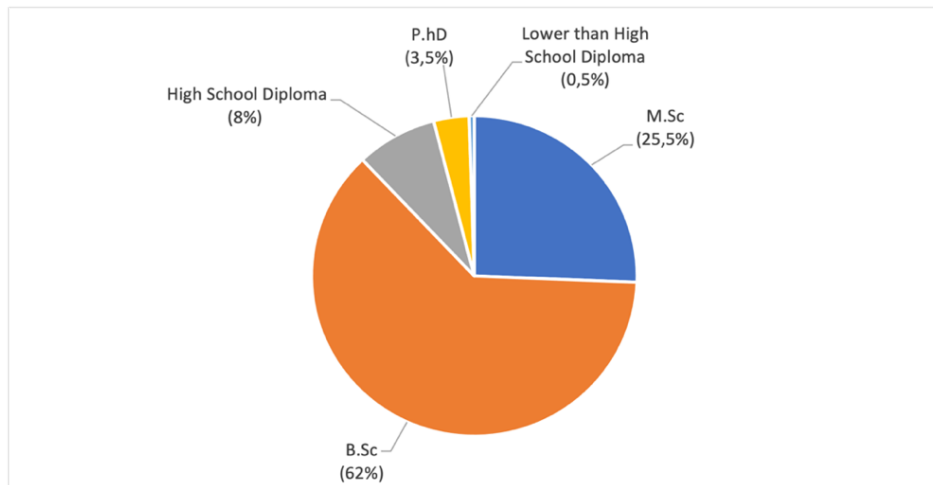
Education

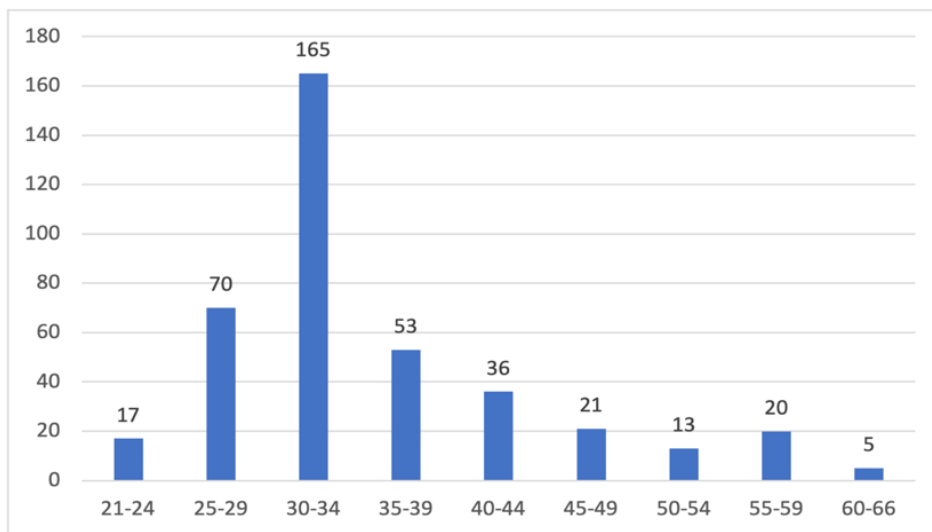**Figure 2.** Descriptive sample analysis of the level of education**.**

Age

Figure 3. Descriptive sample analysis of the level of age, where on the horizontal axis (x) the various age groups are reported and on the vertical axis (y) the number of people is reported.
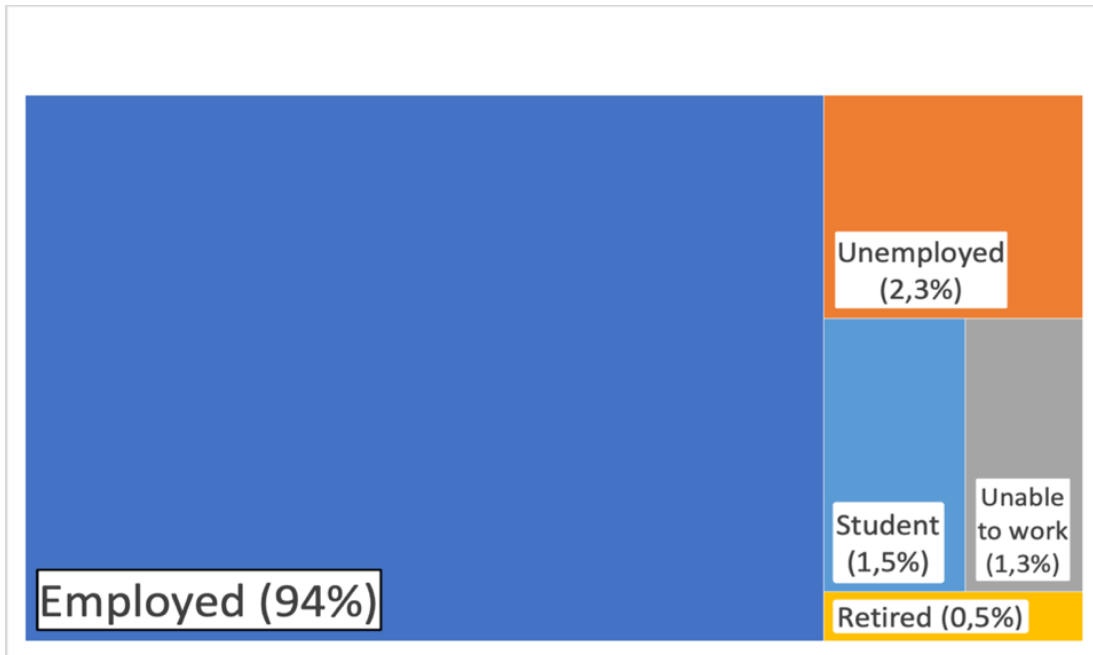
Employment

Figure 4. Descriptive sample analysis of the level of employment.

Chapter 4

Results

4.1 Results

To test the model presented in the Figure 1 related to our hypothesis, we implemented two different statistical analysis: In the first one, we evaluated the effect of individuals' perceived ethical responsibility on their willingness to buy by shedding light on the role of their conscientiousness (Tab. 2). In the second one, we focused on the effect of individuals' perceived ethical responsibility on their word-of-mouth by shedding light on the role of their conscientiousness as well (Tab. 3).

4.1.1 Effects of Willingness to Buy

To test our hypothesis, and specifically focusing on the effects on consumers' willingness to buy, we ran the simple moderation model (Model 1) by Hayes' (2017) of the PROCESS macro for SPSS (Table 2). The mediation model included individuals' perceived ethical responsibility defined as the independent variable *(X)*, consumers' willingness to buy as the dependent variable (*Y*), and their conscientiousness which acted as a moderator (*Mo*) in explaining the effect of the independent variable on the dependent variable.

Thus, as aforementioned employed the PROCESS SPSS macro, which was developed by Hayes (2018) to support scholars in running moderation and other regression–based analyses: Thus, it automatically computes the main effects of both the indpendent and moderating variables on the dependent varible, along with the effect of an interacton term, which is obtained by multiplying the independent variable

by the moderating one. If this effect is statistically significant, then a moderation is established. More importantly, the macro allows one to qualify such a moderation by estimating conditional effects, or the effects of the independent variables on the dependent variable at different levels of the moderator.

The obtained results show that individuals' perceived ethical responsibility (b= .972; t = 8.644; p = .000) and coscientiousness (b = .421; t = 3.007; p = .002) exerted a significantly positive effect on their willingness to buy. More importantly, there was also a significantly positive effect of the interaction between their perceived ethical responsibility, and coscientiousness (b = .062; t = 2.560; p = .001).

Therefore, coscientiousness influences the effect of individuals' perceived ethical responsibility on their willigness to buy. This means that individuals' with different levels of conscientiousness may exhibit different willingness to buy: The effect is always positive.

Thus, although conscientiousness is significant at all levels (that is, that the effects on willingness to buy are positive for all levels of conscientiousness), this effect increases more for those with high levels of conscientiousness.

Therefore, statistical analyzes confirm our hypotheses by explaining that individuals' perceived ethical responsibility related to a blockchain-based system adopted by companies to certify that their pro-environmental claims do not suffer of green washing, have a positive effect on their willingness to buy (willingness to buy companies' products/services): Such effect is magnyied for those consumers exibithing greater level of conscientiousness that thus may positively react and welcome such technologies.

Dependent variable: Willingness to buy (Y)	b	SE	t	p
Constant	.101	.608	.167	.867
Perceived ethical responsibility	.972	.112	8.644	.000
Conscientiousness	.421	.140	3.007	.002
Interaction	.062	.024	2.560	.001
R^2 = .556, MSE = .513, $F(3, 396)$ = 165.610, p = .000				

Table 2. Results of the moderated analysis (Mod. 1). Effects on willingness to buy.

4.1.2 Effects of Word-of-Mouth

To test the following hypothesis, but specifically focusing on the effects of word of mouth, we run the same simple moderation model (Model 1) by Hayes (2017) of the PROCESS macro for SPSS, as described in the previous explanation, in this case applied in Table 3. Within the mediation model, we include individuals' perceived ethical responsibility defined as the independent variable (X), consumers' willingness to buy as the dependent variable (Y), and their conscientiousness acting as a moderator (Mo) in explaining the effect of the independent variable on the dependent variable.

Firstly, individuals' perceived ethical responsibility exhibited a significant and positive effect on their word of mouth (b= 1.074; t = 9.862; p = .000). This implies that when individuals feel a strong sense of ethical responsibility, they are more likely to engage in positive word of mouth, advocating for and recommending products or services.

Secondly, conscientiousness also demonstrated a significant and positive effect on word of mouth (b = .405; t = 2.982; p = .000). This suggests that individuals who possess a conscientious disposition, characterized by carefulness, diligence, meticulousness and organization, are more inclined to engage in word of mouth activities, promoting and endorsing products or services to others.

And finally, the interaction between individuals' perceived ethical responsibility and conscientiousness displayed a significant and positive effect on word of mouth (b = .063; t = 2.702; p = .005). This signifies that conscientiousness plays a moderating role in the relationship between perceived ethical responsibility and word of mouth. In other words conscientiousness influences the effect of individuals' perceived ethical responsibility on their word of mouth behavior.

Thus , individuals with varying levels of conscientiousness may exhibit different word of mouth behaviors, however, regardless of their conscientiousness level, the effect of perceived ethical responsibility on word of mouth remains consistently positive. Notably, the impact of conscientiousness on word of mouth is amplified among individuals with higher levels of conscientiousness.

Therefore, these statistical analyses provide further support for our hypotheses, indicating that individuals' perceived ethical responsibility towards a blockchain-based system adopted by companies to ensure the credibility of their pro-environmental claims, has a positive impact on their word of mouth behavior (i.e., sharing positive information about companies' products/services).

Dependent variable: Word of mouth (Y)	b	SE	t	p
Constant	.551	.589	.934	.358
Perceived ethical responsibility	1.074	.108	9.862	.000
Conscientiousness	.405	.135	2.982	.000
Interaction	.063	.023	2.702	.005
R^2 = .621, MSE = .482, $F(3, 396)$ = 216.440, p = .000				

Table 3. Results of the moderated analysis (Mod. 1). Effects on word of mouth.

Chapter 5

Discussions and Implications

5.1 Overall discussion

As we have discussed in previous chapters, the concept of environmental sustainability has become increasingly relevant in contemporary society. Companies, aware of the importance of being perceived as environmentally responsible, often claim to adopt sustainable practices. However, many of these statements often turn out to be mere attempts at greenwashing, which are marketing strategies that seek to create an image of sustainability without actually implementing meaningful measures.

Through the two conducted studies, blockchain technology has proven to be a promising and effective solution for ensuring transparency and integrity in companies' environmental claims, thus combating corporate greenwashing. By utilizing blockchain, a form of distributed, immutable, and secure digital ledger that transparently tracks transactions and activities, it becomes possible to ensure that companies uphold their sustainability claims and provide verifiable and reliable information. These studies have revealed positive effects on consumers in terms of their willingness to buy and positive word of mouth when this technology is employed.

Specifically, in the first conducted study, we examined the effect of willingness to buy concerning the use of blockchain technology by companies to ensure the veracity of their environmental claims. The results demonstrated that consumers are more inclined to purchase from and trust companies that utilize blockchain to demonstrate their sustainability efforts, thus fostering greater trust and support for these companies through the purchase of their products.

The second study focused on the effect of word of mouth, whereby consumers share positive information about companies that adopt blockchain technology to verify their environmental claims. The findings indicated that consumers are more likely to share positive information and recommend these companies to their contacts. As we have observed, word of mouth plays a crucial role in the growth and development of businesses, and in this case, it contributes to spreading awareness and enhancing the reputation of companies that employ blockchain technology.

Thus, the study results confirm that the adoption of blockchain technology can be an effective means of ensuring the integrity of companies' environmental claims and combating greenwashing. Blockchain offers a transparent and secure solution for recording and sharing information about companies' environmental impact, providing consumers with the necessary confidence to make informed purchasing decisions and share their positive experiences. These findings suggest that blockchain has the potential to transform how companies communicate their sustainability efforts and promote more conscious and responsible consumer behavior.

5.2 Theoretical implication

Based on our study, we make several significant contributions to the theory. Firstly, we contribute to the research stream that focuses on consumers' perceived corporate social responsibility (Carroll, 1989) by providing evidence that in blockchain-based systems, the perceived ethical responsibility plays a crucial role in shaping consumers' behavior. This finding suggests that consumers' attitudes and actions are primarily driven by their perception of the ethical responsibility exhibited by companies operating using a blockchain system.

Furthermore, our study contributes to the research stream that focuses on the influence of environmental concern on consumers' purchasing behavior, drawing on the theory of environmental concern (Kollmuss and Agyeman, 2002), in particular contributes to the theory according to which, environmental concern or awareness of consequences has a strong effect on pro-environmental behavior or pro-environmental behavioral intent (Fujii, 2006). By providing empirical evidence on the influential role of environmental concern, demonstrating how it plays a key role in shaping consumers' attitudes and actions towards environmentally responsible products and services. The finding suggest that environmental concern positively influences the willingness to purchase among environmentally conscious consumers.

Lastly, our study also contributes to the theory regarding consumers' reactions to blockchain technology in the context of purchasing and consumption behavior. Specifically, we explore the influence of blockchain technology on word-of-mouth communication, which involves sharing information about products, brands, or services (Karjaluoto et al., 2016). Through the evidence provided, we demonstrate how the presence of blockchain technology used to ensure specific product certification or traceability has a significant impact on guiding consumers during word-of-mouth activities, serving as an important factor that increases the intention to positively promote that product combined with the technology. Additionally, we show how the presence of blockchain technology, used to certify or trace a particular product, at the same time has a significant influence on consumers' purchasing behavior, as the results suggest, with an increase of the willingness to buy of that type of product.

5.3 Managerial implication

Our findings suggest how to segment the market based on consumers' perceived ethical responsibility and environmental concern. Thus, marketing and managers may segment the references market by focusing on consumers who exhibit a higher level of environmental concern. By doing so, they can effectively promote the adoption of blockchain-based technologies and tools, positively influencing consumers' willingness to buy and their word-of-mouth behavior. This targeted approach allows companies to align their marketing efforts with the values and preferences of environmentally conscious consumers, ultimately improving market penetration and brand reputation.

Secondly, considering the moderating effect of conscientiousness, companies can develop targeted marketing strategies aimed at consumers with higher levels of conscientiousness. These consumers are more likely to positively respond to blockchain technologies and companies that exhibit a high perceived ethical responsibility. Companies can create specific communication campaigns that highlight sustainable practices supported by blockchain technology to engage and attract these conscious consumers.

Furthermore, the positive effect of perceived ethical responsibility on consumer word-of-mouth emphasizes the crucial importance of creating positive experiences for customers. Companies should strive to provide sustainable, high-quality products and services that not only meet but exceed consumer expectations. Satisfied customers are more likely to share positive information about companies through word-of-mouth, thereby contributing to the consolidation of the company's reputation and positive image. Therefore, investing in excellent customer service and

surpassing consumer expectations can have a significant impact on positive word-of-mouth and, consequently, on the growth and success of the company.

In order to conclude, the studies, reveal the positive effect derived from the adoption of blockchain technology on consumers' willingness to buy and word-of-mouth behavior. Companies may consider partnerships or collaborations with reputable and well-known blockchain service providers in the market to ensure traceability and transparency of their sustainable practices. By doing so, they can enhance the company's credibility while expanding its positive impact on sustainability.

Chapter 6

Conclusion

6.1. Conclusion

In conclusion, the blockchain technology has the potential to significantly impact the fight against greenwashing by enhancing transparency, accountability, and traceability in various industries. Through the use of blockchain, companies can track and verify their environmental practices, monitor supply chains, and certify sustainable initiatives. It enables the recording and sharing of immutable data, ensuring that information regarding the environmental impact of products or services can be independently verified. By leveraging blockchain, businesses can build trust with consumers and stakeholders, promote sustainability, and contribute positively to Corporate Social Responsibility (CSR) efforts.

The aim of the research was to understand how individual differences, particularly consumer conscientiousness, influence their reactions and purchasing decisions towards companies, as well as the impact of unethical business behaviors on consumer reactions, such as negative word-of-mouth. To address this issue and ensure transparency in sustainable corporate communications, the use of blockchain technology is proposed as a control tool. The goal is to demonstrate that the adoption of a blockchain-based system can foster positive reactions, such as increased purchase intention and positive word-of-mouth, especially among conscientious consumers. An experiment has been conducted to demonstrate that consumers' perception of ethical responsibility, in relation to a blockchain-based system adopted by companies to ensure the credibility of their pro-environmental claims, has a positive impact on their

purchasing willingness and word of mouth. In particular, it was found that the interaction between perceived ethical responsibility and conscientiousness amplifies the effect on purchasing willingness, this means that individuals with different levels of conscientiousness may exhibit varying purchasing propensities, but the effect is always positive.

Furthermore, perceived ethical responsibility and individuals' conscientiousness have a significant and positive effect on word of mouth, generating a greater propensity to promote and recommend products or services.

Finally, some managerial implications have been identified, such as segmenting the market based on ethical responsibility and environmental concern, promoting the adoption of blockchain technology to positively influence purchasing willingness and word-of-mouth, and investing in positive customer experiences and collaborating with blockchain service providers to enhance reputation and sustainability impact.

6.2 Limitations and future research

Despite the promising opportunity of this study, however our research is not exempt from limitations. For instance, we did not consider the role of participants' age: Thus, future research may investigate consumers' reactions both by combining their perceived ethical responsibility and environmental concern together with their age to show the differences among different generation. Moreover, by considering the worldwide level of digitalization, future studies may replicate our study in different geographical locations in order to shed light on certain cultural differences. Furthermore, we focused on consumers' environmental concern: Future studies may

consider other important and convergent consumers-related variables such related to their personality traits (e.g., as for conscientiousness, agreeableness) or related to technologies adoption (e.g., as for their innovativeness).

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