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Systematic Review

Ethics of Manufacturing and Supplying Bottled Water: A Systematic Review

Jorge Alejandro Silva

Escuela Superior de Comercio y Administración Unidad Santo Tomás, Instituto Politécnico Nacional, Mexico City 11350, Mexico; jasilva@ipn.mx; Tel.: +52-55-5729-6000

Abstract: Bottled water is one of the most consumed healthy beverages in the world. At a compounded annual growth rate (CAGR) of 5.3%, bottled water sales may surpass USD 500 billion by 2030. While this indicates how popular bottled water is among consumers, it does not underscore various ethical concerns raised against the product and its business concept. The purpose of the paper is to investigate the ethics of manufacturing and supplying bottled water. It uses a systematic review of the literature through the PRISMA method to determine the major ethical concerns surrounding these topics. A total of 107 articles were identified, and 31 were subjected to further reviews and analysis. The study found that the manufacturing and supply of bottled water may be unethical if it ends in deliberate pollution and artificial scarcity. Water is an essential product that should be made available and accessible freely to support lives. The use of bottled water has benefits because pollution is removed during processing, which prevents the spread of diseases. In addition, it is practical to transport and consume it. Water bottlers, however, seek to convert water into an exclusive product for profits. This draws attention to the ethics of justice, care, and professionalism which collectively protect consumers against corporate greed and exploitation. Water bottlers contribute to significant environmental pollution and have done little to recycle or reuse plastics to minimize the potential environmental damage. More than 80% of plastic bottles end up in waste and may be washed down into the oceans where they affect the marine ecosystem.

Keywords: bottled water; scarcity; tap water; water ethics; water security

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1. Introduction

1.1. Background and Scope of the Study

The bottled water industry has grown tremendously over the past five decades, becoming one of the most profitable businesses in the world. With an estimated one million bottles of water sold every minute, the industry is not showing any sign of slowing down [1]. Moreover, the bottled water market is expected to grow at a compounded annual growth rate (CAGR) of about 5.3%, reaching more than USD 500 billion in revenue by 2030 [2]. While the popularity of bottled water remains stable, the industry is facing various environmental, human, and ethical concerns. Even more pressing is the fact that the carbon footprint of bottled water manufacturing is equivalent to the carbon emissions from about five million cars [3]. Apart from the environmental consequences, stakeholders have also raised concerns over ethical issues, including potential resource depletion, inequity in water access, and conversion of public resources into commercial products [3]. Poor waste disposal has also become a major concern as plastic water bottles continue to pile up in the rivers, lakes, and oceans.

In its simplest form, bottled water is clean or pure water developed using either the deionization of regular water (distillation) or reverse osmosis. The deionization of tap water is mostly common among small-scale manufacturers because it is cost-effective [4]. However, reverse osmosis is mostly used for mass production because it removes ionic and non-ionic impurities, effectively eliminating various harmful substances and protecting consumers from potential harm [5]. Bottled water may come in various categories,

including sparkling, natural, glacial, and artesian water. Sparkling or carbonated water is what many people consume as a healthier replacement for soft drinks such as soda. Glacial water is mostly obtained from glaciers and is considered healthier due to its high mineral content [5]. Natural and artesian bottled water is mostly obtained from various natural sources, including free-flowing springs and underground wells [6]. Manufacturers may enrich their products using essential minerals to increase their value and market popularity.

Bottled water has attracted significant research and debate due to the related ethics and environmental impact. Some researchers have argued that the manufacturing and sale of bottled water is unethical because it converts a freely available public good into a commercial product that can only be purchased by those who can afford it [7]. An essential public sector good such as water should be made available to everyone at no cost. However, bottled water may keep the essential product away from those who need it but are unable to purchase it. In addition, the lightweight plastic packaging material is not environmentally friendly and may become a potential hazard if not recycled or reused [8]. The manufacturing process consumes significant energy and may put additional pressure on natural resources. The growing backlash indicates that more consumers are beginning to question the ethics behind the bottled water business and its effects on environmental sustainability [8].

The manufacturing of bottled water was driven by the demand for clean and safe water for drinking following various safety concerns brought about by the Industrial Revolution. In the 1970s, many European households began suspecting that tap water could contain suspended impurities, including lead particles and other industrial effluents [9]. These concerns were amplified by the marketing companies that discovered an opportunity to sell bottled water as a healthier and safer alternative. By the late 1970s, there were already several European companies manufacturing and selling bottled water in various markets globally [10]. Perrier, Evian, and Vittel were the major bottled water brands in the 1970s [11]. Competition among bottled water companies such as Nestle, Danone, and Neptune was mainly through intense marketing and product differentiation [11]. Companies also competed through diversification, including the development of several brands to meet various consumer needs.

To generate more sales, marketers began promoting bottled water as a status symbol. Celebrities were hired to market bottled water in their music, sports, or film production. Various celebrities were also seen drinking water during interviews or shows, emphasizing both the status symbol and the need to remain hydrated [12]. Marketers also targeted young people in various sports facilities, including gymnasiums. The various marketing approaches played a critical role in driving sales and turning bottled water into a household product [13]. Over the years, bottled water sales have increased tremendously, turning the product into the fastest-selling non-alcoholic beverage [13]. The bottled water market has also attracted various organizations, both local and international. Some of the biggest brands in the market include Fiji Water, Dasani, Aquafina, and Evian. According to Hawkins et al. [14], the global annual consumption of bottled water has also grown to more than 400 billion litres or 1 million bottles every minute.

The popularity of bottled water has been based on its perceived quality, safety, taste, and convenience. In the 1970s, bottled water became popular because people considered it a safer alternative to municipal tap water which was perceived to be unsafe due to potential industrial chemicals [14]. While such perceptions were not entirely true, or even subjected to scientific examination, they became selling points for promoting bottled water in various markets. Another reason why many people considered bottled water over tap water was the perceived taste [15]. The mineral aspect also became a major selling point as marketers began listing various minerals present in their products and their potential effects on human health. Rather than going for tap water, which many people considered tasteless, most of the consumers went for bottled water [16]. Some of the minerals found in bottled water include calcium, iron, fluoride, bicarbonate, magnesium, potassium, and chloride.

Moreover, bottled water was more convenient than tap water because consumers could carry it to every place, including the gymnasium. Those who were involved in outdoor activities such as jogging would carry water for refreshment and to prevent dehydration [17]. The convenience perspective is still strong even in the modern defense for bottled water. Despite many arguments against lightweight plastics used as containers, those who support bottled water believe that they make the product more convenient and affordable [17]. Options such as using glass bottles have been suggested but hardly implemented due to the cost. Bottled water competes with tap water in many markets, leaving manufacturers limited space to increase prices [18]. Since there are alternatives, consumers are more likely to switch to tap water rather than pay higher prices for bottled water. The convenience perspective also supports the use of cheaply available materials to make bottled water more affordable and accessible to various consumers.

The study focuses on determining the major ethical concerns surrounding the manufacturing and supply of bottled water, considering that there is not much previous research on the topic that uses a systematic literature review. The research question is "What are the ethical issues surrounding the manufacturing and supply of bottled water?".

1.2. Problem Overview

The problem addressed in this study is the ethical issues associated with the manufacturing and supplying of bottled water. The study also explores various solutions that water bottlers can apply in their businesses to improve their products and protect the environment from potential harm. The ethical paradigm examines the consciousness or commitment to the business values [18]. For instance, one of the business values requires companies to act in ways that do not put their consumers' health at risk. This may include checking the product quality to ensure that it does not contain chemicals that can put consumer lives at risk. Businesses are also required to examine the long-term effects of their business decisions on people's lives and the environment [19]. To create a sustainable business environment, companies should ensure that their business decisions do not produce chemicals that are hazardous to the soil or water. However, water bottlers have been accused of ignoring the environmental consequences associated with their products and mainly focusing on the profits [20]. For example, the production process of plastic bottles requires resources that have an impact on the environment such as climate change, due to the use of oil and gas. In addition, indirect effects on the production process must be considered, such as the transportation of products that generates pollution or the repercussions of disposing of these bottles on the environment, particularly in the oceans. Another point to consider is the excessive extraction from aquifers that reduces the availability of water for the local population [3,19,20].

In relation to the ethical paradigm, environmental activists criticize the consumption of bottled water due to the pollution that it generates, its high cost compared to tap water, as well as the increased scarcity of the resource [21,22]. For their part, industry representatives support the consumption of bottled water for the benefits that it offers safety and convenience. As for final consumers, their perception is usually mixed due to the influence from the industrial sector and environmental activists. However, the ethical dilemma should be framed in broader analyses that include regulations, environmental responsibility, and public health [21,22].

1.3. Buying Bottled Water

One of the major drivers behind the massive consumption of bottled water is the innovative packaging that appeals to target consumers. This has been a major concept used by marketers to portray bottled water as cooler, cleaner, and safer than tap water. Transparent plastic packaging has been a significant marketing concept in the bottled water industry [23]. Even with growing concerns against plastic packaging, the idea is still prevalent in many markets. The aim is to enhance the crystal-clear appearance that automatically makes consumers believe that bottled water is safer and healthier than tap water [24]. Moreover, the use of packaging to attract consumers is not a new marketing

concept since it has been used on various products to achieve a similar goal [24]. The "green packaging", for instance, has been used by companies to portray their products as environmentally friendly and sustainable.

However, there is no significant difference between tap water and bottled water regarding safety. Blind taste experiments, like the one conducted by Barrow et al. [25], have focused on determining whether consumers can tell the difference between tap water and bottled water using taste. The participants are given water from identical containers with probably different tops. They are then asked to identify the bottle containing tap or mineral water based on their tastes [26]. The results showed that participants were unable to tell the difference between tap water and bottled water using taste. There is also limited or no scientific evidence indicating a significant difference in taste between tap and bottled water. Despite such evidence, marketers still portray bottled water as tastier and healthier than tap water [27]. While there could be added flavours in some brands, still bottled water tastes nearly the same as tap water.

Despite the belief that bottled water is safer and tastes better, few people understand the rigorous requirements that municipal tap water must fulfil before being approved for drinking. The stringent requirements for microbial, chemical, and physical safety make tap water cleaner and healthier than bottled water [28]. Some people even consider bottled water to be the purified version of tap water after undergoing some enhancements. However, these safety measures are often lost in various marketing messages that portray tap water as unhealthy and less tasty [28]. In addition, the historical beliefs against tap water have persisted even in modern society, where many people still consider tap water to be unsafe for human consumption [29]. It would take longer for society to overcome various beliefs that have made tap water less desirable despite passing various safety requirements. Meanwhile, bottled water continues to grow in sales, sending more plastic waste to the rivers, lakes, and oceans.

Apart from the packaging, bottled water marketers also incorporate beautiful images of mountains and springs on the bottles to emphasize naturalism and purity. Bottled water marketers describe the product as pure and healthier than tap water [30]. The beautiful packaging and images are only used to emphasize the belief and convince more consumers to purchase the product. By creating an impression of extra purity, bottled water companies are trying to set themselves apart from conventional tap water suppliers [31]. The aesthetics are also part of the efforts to enhance the status symbol associated with bottled water. Other forms of impression include images of pregnant women often placed on the bottles to portray health and safety [32]. The various marketing innovations have contributed toward reducing negative perceptions and pushing more people to choose bottled over tap water. According to Wardrop et al. [32], turning people against bottled water may take more than just focusing on the environmental consequences.

Additionally, most bottled water companies have discovered ways through which they can overcome the potential environmental concerns brought against them. Through their corporate social responsibility (CSR) initiatives, bottled water companies have developed projects for restoring water in places that experience scarcity [33]. Water stewardship is a major CSR initiative that companies such as Coca-Cola (Dasani), PepsiCo (Aquafina), and Nestle are using to restore water in places facing imminent water crises [34]. The water stewardship efforts include constructing huge reservoirs to increase water supply, planting more trees to attract rain, and using technology to help communities purify water from rivers or lakes to make it safer for drinking and other domestic purposes [34]. Through their CSR efforts, bottled water companies have redeemed their corporate images, making themselves appear ethical and committed to sustainability. Moreover, bottled water companies have gained significant consumer loyalty, creating better opportunities for more revenue.

Despite some of the environmental concerns raised, consumers also prefer the variety they are offered by bottled water. Unlike municipal tap water, companies involved in the bottling business have developed varieties to meet various consumer needs [35]. The main

categories include spring water, mineral water, and purified water. Consumers can choose the type of water that they need for optimal health [36]. For instance, those who experience iron deficiencies may purchase mineral water to improve their health. Moreover, there is a variety in size and quality for consumers to decide what is best for their families [36]. For instance, those who live alone may be comfortable with a few bottles per day or weekly. However, those with bigger families may require larger containers to avoid water shortages [37]. Water bottlers continue to reduce the size of their products to break down the bulk further and allow those with limited income to purchase clean and safe water.

1.4. Limitations of Bottled Water

One of the biggest limitations associated with bottled water is the huge manufacturing cost. Most of the expenses go into the plastics and water processing to remove chemicals or biological impurities [37,38]. The manufacturing cost also affects pricing, making bottled water more expensive for families that require a lot of water. For smaller families, a gallon may be enough for a week or month. However, some larger families may require at least 2 gallons a day for drinking alone. In such a case, tap water becomes a less costly and suitable alternative to protect families against excessive expenditures [38]. However, those who have limited or no access to municipal tap water may have to rely on other alternatives, including boiling water before drinking to kill germs. Bottled water is more expensive and may be unsuitable for addressing challenges such as water scarcity [39]. Nonetheless, tap water is less expensive but may require a lot of resources to expand to rural areas where people face water challenges [39].

Another significant limitation associated with bottled water is the environmental impact. Although water bottlers claim that their products are environmentally friendly because they can be reused or recycled, more than 86% of the bottled water ends up in the garbage [40]. Only a small percentage of bottled water ends up in recycling facilities. However, even the recycling itself is not environmentally friendly because it is energy-intensive and generates significant carbon emissions. The reuse option is also open to bottled water but less effective due to the poor collection of plastic bottles [41]. Some companies have even come up with initiatives such as paying people some cash for every bottle returned for recycling or reuse. Reuse is more effective in the soft drinks industry because consumers have to return the glass bottles to the retailer after consuming the content [41]. Unlike plastic bottles, the reuse option is preferred because it is relatively more expensive to manufacture a single glass bottle.

According to Wilkinson et al. [42], water bottlers mostly prefer plastic bottles over glass ones because they are lightweight and shatter resistant. This makes them a safer and more convenient option for storage and transportation. While there are shatter-resistant glass bottles, they are too expensive and not cost-effective for the business [43]. Water bottlers mostly focus on challenges such as breakages that may occur during transportation or storage. Moreover, lightweight plastics are easier to transport than glass bottles. However, by choosing profits over sustainability, water bottlers are creating a significant challenge that may affect the environment for many years to come [43]. This also explains why researchers are focusing on the ethical aspects of the business to compel manufacturers to consider the long-term consequences associated with their business decisions [44]. Water bottlers have received millions of suggestions urging them to switch to reusable glass bottles, but the continuous use of plastic bottles indicates that there are limited incentives to move in the direction preferred by the consumers and environmental stakeholders [44].

While water bottlers always market their products as healthier, crispier, and tastier than tap water, this is not always the case. Studies have shown that tap water undergoes more rigorous tests and regular examination than bottled water [45]. While the municipalities are under an obligation to give detailed reports for scrutiny regarding water quality, the FDA only covers less than 60% of the water bottled companies. In addition, the FDA does not have sufficient staff to follow what every water bottler is doing to improve or lower the quality of their products [45]. It has also been suggested by many researchers that bottled

water is a purified version of tap water. The problem with tap water is that it carries an old perception that it is unsafe and potentially polluted by various industrial effluents. In addition, only a few municipalities have invested in detailed documentaries to explain and demonstrate water quality to viewers all over the globe [46]. Some studies have also shown that bottled water contains various impurities and contaminants, including bacteria, heavy metals, and chemicals [47]. Despite knowing the facts, water bottlers still market their products as cleaner and safer than tap water.

There was a period in 2010 when Fiji ran a campaign in Cleveland (Ohio) portraying municipal tap water as unsafe and unhealthy. The company used the campaign to portray its products as healthier alternatives [48]. At some points, the campaign even went to the extent of trying to warn people against consuming tap water. The Cleveland administrators took offence and conducted tests to determine if, indeed, they were providing unsafe water as claimed in the Fiji adverts [49]. The administrators found that their tap water was even better than Fiji products in terms of quality. The Fiji campaign indicates that water bottlers have no problem spreading falsehoods against tap water to sell their products [49]. There is also little regard for the financial impact, especially on the communities who are unable to afford the products. The Cleveland campaign also demonstrates the unethical aspect of bottled water marketing that is least challenged in research.

In the United States of America, for instance, the regulation of bottled water has always been left to the Food and Drugs Administration (FDA) since they are commercial products. However, the regulation of tap water is conducted by the Environmental Protection Agency (EPA). The main difference between the EPA and FDA is stringent requirements [50]. The EPA imposes higher standards and requirements for quality than the FDA does. This implies that tap water undergoes more stringent regulation than bottled water. In addition, the FDA does not conduct regular examinations of bottled water to determine changes in quality [48]. Once the product is approved by the FDA, it is up to other industry regulators to ensure that there is sustained quality [50,51]. Moreover, the FDA does not have sufficient staff to enforce various regulations, including visiting manufacturing facilities to examine the quality of their products. Bottled water can be a health risk to consumers despite being marketed as a safer and healthier alternative to tap water.

Even with the regular assurance that many plastics used in manufacturing water bottles are safe, the risk of plastic pollution cannot be wished away. Most plastics used in the manufacturing of water containers are derived from synthesized carbons [51]. A common example of the synthesized carbon used in plastic bottles is polyethylene terephthalate (commonly abbreviated as PET or PETE). Polyethylene terephthalate (PETE) is highly preferred for plastic bottles because it is lightweight and highly stable [52]. While PETE is largely safe and has remained so for years, a study conducted in 2001 found elements of phthalate in significant quantities. The study tested several plastic bottles to determine the potential risk of plastic poisoning [53]. This finding was quickly dismissed by the water bottlers but remains a significant step towards challenging the safety marketing that often ignores the potential health and environmental issues associated with bottled water [54]. More investigations may be required to determine the extent of plastic poisoning and its impact on consumers' health.

These limitations indicate that bottled water may not be the perfect product that marketers portray to generate higher revenue and profits. The limitations indicate that bottled water has weaknesses that have not been adequately challenged, even in research or academics. Most consumers believe the messages on the water bottles or adverts and rarely question whether the products that they consume are exactly as described in the commercials [55]. For instance, studies have shown that tap water may be cleaner and safer than bottled water despite marketers portraying an almost opposite message [56]. There is a need to challenge various marketing messages that have turned people away from tap water and made bottled water the perceived healthier alternative [57]. There is also a need to challenge various beliefs that increase the dependency on bottled water to enable consumers to explore various options that are less destructive to the environment.

2. Methodology

A systematic review of the literature was selected as an appropriate research design for this study. According to Wright et al. [58], systematic reviews explore the extent and quality of evidence available to support an intervention or issue. For instance, if an organization wants to apply a specific approach to its production or marketing, systematic reviews may help in synthesizing the available evidence and supporting the intervention. Systematic reviews provide direct answers to the research questions, making them preferable when looking for empirical support [58]. This method also helps in identifying potential gaps in the literature and suggesting potential directions for future researchers.

The systematic review was conducted using a method known as the Preferred Reporting Item for Systematic Reviews (PRISMA). The PRISMA framework improves the transparency when searching for sources and enforces adherence to inclusion and exclusion criteria. The PRISMA model uses guiding questions or instructions to identify sources that are more relevant to the research question [59]. Using the PRISMA flowchart (See Figure 1), the researcher was able to identify the databases where the sources were obtained, the number of articles found, the number of articles rejected for being irrelevant, the number of articles removed for duplication, and other articles rejected for being too old or falling beyond the required publication date [59]. The final articles were then subjected to data analysis to extract evidence and respond to the research question. The PRISMA checklist document is provided in the Supplementary Materials (see Table S1).

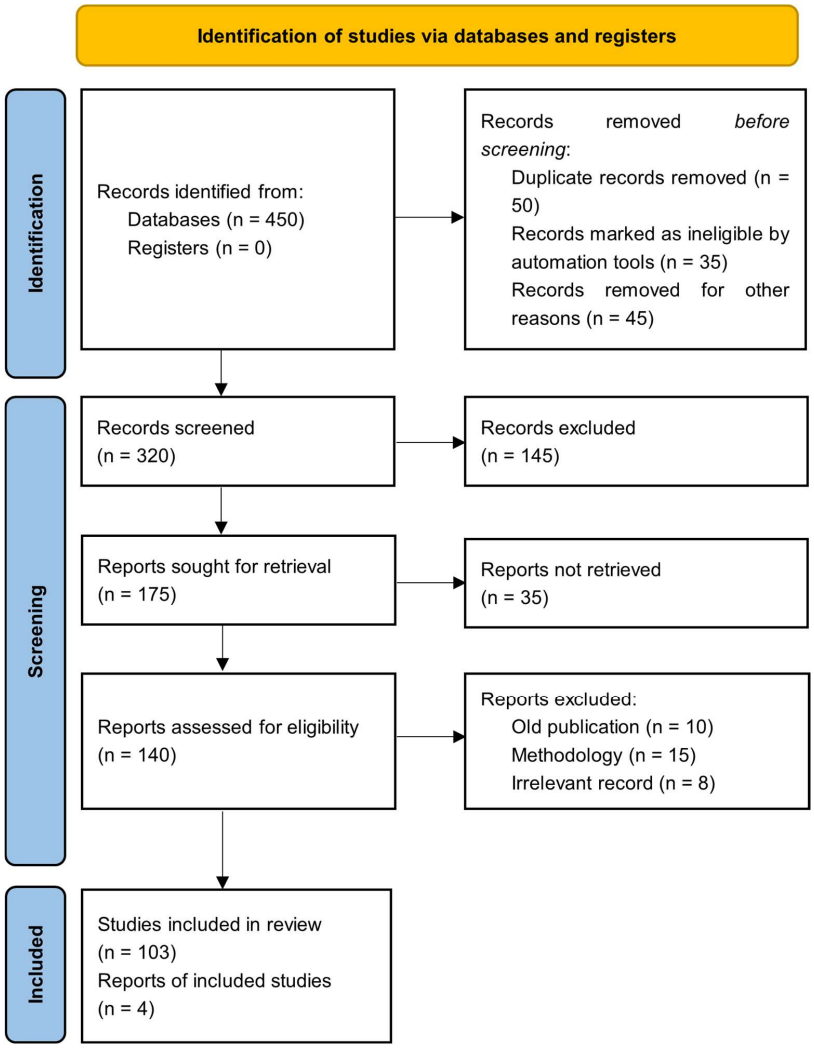

Figure 1. PRISMA flowchart diagram showing the steps in identification, selection, and inclusion of the articles. Source: table created by the author.

2.1. Question Formulation

The systematic review began with the development of an appropriate research question to obtain articles from various databases. The research question also helped in identifying relevant keywords that may be used in the search boxes to obtain articles [58]. The formulated question was as follows, "What are the ethical issues surrounding the manufacturing and supply of bottled water". This research question helped in obtaining the articles from various databases. It also provided direction for the study, including methods for collecting and analyzing data. The formulated question also helped in developing inclusion and exclusion criteria for narrowing the search to more relevant articles. This research question was chosen to consider the main topics addressed in this research, which was consistent with the research objective.

2.2. Source Identification

The source identification occurred in two steps: direct search and backward or forward snowballing. Direct search was conducted using mainly the following databases, namely Web of Science and Scopus, and in a complementary way, from the editorials, MDPI (Sustainability) and Elsevier (Science Direct), as well as from the commercial social networking site, ResearchGate. These databases were selected because they carry science-based articles and are suitable for collecting secondary data for scientific studies. In addition, they are databases of recognized prestige in the field of science, particularly the main databases. The various keywords that were used in the search included "water ethics", "bottled water", and "tap water". The keywords were combined to enhance the accuracy of the search. The Boolean operators, available in the databases, helped in combining keywords and improving the accuracy of the search results [58]. Among the criteria used for determining the search range included articles published between 2000 and 2024. This wide range helped in collecting hundreds of articles on the topic and narrowing the findings using the PRISMA framework.

The second type of search involved using article titles, authors, references, and citations to obtain related articles. The first method is known as backward snowballing and was conducted by selecting relevant articles and reviewing their references lists to obtain more articles. This method helped in locating more relevant articles used by the previous researchers to support their arguments [59]. The second approach is known as forward snowballing and was conducted by identifying relevant articles and looking for newer articles that have cited them [60]. This helped in obtaining more relevant and the latest articles. The new articles could also be subjected to backward snowballing to identify more articles. Both backward and forward snowballing helped in locating hundreds of articles and avoiding potential duplications.

2.3. Source Selection and Evaluation

Once the articles were obtained, the PRISMA framework helped in narrowing the search per the inclusion criteria. The selection and evaluation began with the source identification. Also, the researcher included some questions related to the inclusion and exclusion criteria that guided the screening. These included the following:

- Does the article explore the Ethics of Manufacturing and Supplying Bottled Water?
- Is the article relevant and published between the years 2000 and 2024?
- Is the source identified as a journal, website, book, or policy paper?
- Are the eligibility criteria expressed in a clear manner?
- Does the source exhibit any apparent bias due to funding or affiliation?

Under the PRISMA model, articles can be obtained from the direct search of various databases or identified using other strategies such as backward and forward snowballing [58]. The researcher obtained a total of 450 articles from various databases. None of the articles came from other registers other than the mentioned databases [58,60]. This stage also involved removing articles that were either duplicates, irrelevant, or marked

ineligible by the automation tools. This helped in narrowing the articles to about 320. The remaining articles were forwarded to the next step for screening.

After the first scrutiny, a total of 320 articles were forwarded to the screening stage. According to Wright et al. [58], screening involves the use of inclusion criteria and other parameters to remove articles that may be irrelevant to the research question and objectives. In this case, the eligibility criteria that were used included relevance to the research question, research topic, methods used in data collection and analysis, year of publication, and the findings. The researcher also focused on the publication dates to identify more relevant and updated research. The detailed screening process helped in removing at least 190 articles for various reasons, including being irrelevant to the research question and the overall objectives.

The final step in the PRISMA model is the inclusion. This is where the researcher selects the most suitable articles for further analysis and inclusion in the study. Several factors were considered when examining each article to determine whether they were suitable for inclusion. These factors included the abstract of each study, research question, methods used in collecting data, type of research (whether primary or secondary), year of publication, sample size, and participants. The researcher also examined the geographic characteristics to ensure that the selected articles reflected the issues affecting regions such as Europe and the United States of America. The final articles that were included in this study were 107 as shown in the list of references. Out of this number, 31 articles were selected for detailed analysis as shown in the results.

There was a significant risk of bias when selecting the final articles for inclusion or analysis. One of the evidence selection biases that was bound to occur in this study was the publication bias [58,60]. This is where the researcher focuses only on the studies with evidence considered to be more significant in answering the research question [58,60]. Articles with less significant evidence are ignored by the researcher even if they are relevant to the study. To avoid this type of bias, the researcher assigned numbers between 1 and 10 based on the article's relevance and importance to the study. The numbers helped in selecting articles without being a victim of publication bias.

2.4. Data Analysis

The researcher chose thematic analysis for collecting data from the included articles. The main steps in thematic analysis include familiarization with data, coding, developing themes, reviewing themes, defining themes, and developing the final write-up. A total of 31 articles were selected for detailed analysis. The researcher read the abstract, introduction, literature review, methods, and findings for each article for familiarization. Articles with detailed abstracts provided easier access and guidance to the rest of the content, helping the researcher to summarize the evidence for further analysis. The next step after familiarization involved the extraction of codes from the articles. According to Wright et al. [58], codes are words or phrases that carry significant purpose and meaning in a paragraph or article. Codes also provide insights into various themes used by the researchers to summarize the meaning.

The main themes identified from the articles included environmental concerns. These included water shortages, biodiversity loss, and waste management challenges. Such issues underscore the need to combat environmental degradation and to preserve natural ecosystems. Another theme identified was resource depletion. This theme highlights the excessive consumption of natural resources, particularly water, which is being used faster than it can regenerate. Triggered by the Industrial Revolution, this trend of resource depletion has only intensified with modern consumption habits. Another identified topic is social inequity: defined by uneven access to opportunities, including essential resources like water, and a general lack of equitable outcomes within communities. This issue is often perpetuated by deep-seated prejudice and the skewed distribution of resources and rights. There is an important theme identified related to public good which encompasses shared resources and services, such as potable water and infrastructure, which are crucial for the

well-being of society and are frequently affected by the issues. The last theme identified was contamination which refers to the environmental pollution primarily of water bodies with harmful substances, a major concern often worsened by industrial operations and inadequate waste management.

To address the issues regarding biases, a method known as GRADE was used for detecting and removing potential biases. This was aimed at improving the validity and reliability of the study. According to Wright et al. [58], validity examines the accuracy of the measure or outcomes. Reliability examines the consistency of the tool in producing similar results if the same method is repeated in another study. Factors such as information biases or publication biases can affect both the validity and reliability of a study. The GRADE tool helps in detecting issues regarding biases and suggesting actions that the researcher may take to address the problem. The GRADE also examines evidence quality, methods, and included articles to highlight potential biases that may affect the study outcomes.

This framework facilitated the classification of evidence quality into four tiers: "very low", "low", "moderate", and "high". These levels were methodically applied across five domains, with initial emphasis on the risk of bias. Bias was assessed based on the presence of design flaws that could compromise the integrity of the study results. The GRADE system primarily evaluated the evidence based on the outcomes and implications, disregarding the type of evidence. This evaluation involved determining the extent of bias and its impact on the reliability of the evidence. Such assessments were critical in filtering the studies to be included in the review, ensuring that only those with sufficiently credible findings were considered. In this way, the risks were eliminated, and the only limitations that could be mentioned have to do with the focus and scope of the research, not with the information found and analyzed, although the articles were sufficient to meet the objective of this research.

3. Results

The summarized findings appear as follows chronologically (see Table A1 in Appendix A for the details).

Botto [29] found that bottled water has a disturbing carbon and water footprint given the massive destruction to the environment. The author believes that water bottlers can address the challenge by focusing on recycling and reusing their plastics to minimize waste and environmental destruction.

Gleick and Cooley [16] estimated the energy footprint required for various phases of bottled water production, transportation, and storage. For bottled water transported over short distances, the researchers found that the energy consumed in production far outweighs the transportation footprint. However, for bottled water transported over long distances, the transportation energy footprint far outweighs the one needed for production. Carbon emissions occur during the production and transportation of plastic water bottles.

Parag and Timmons Roberts [15] lament the loss of the trust in tap water that has enabled bottled water to dominate the market for decades. The problem has been worsened by the belief that bottled water is cleaner and safer than tap water, even when the truth contradicts such beliefs. The authors believe that the situation can be addressed through the intense marketing of tap water and providing accurate information that will help in regaining the trust in tap water.

Hawkins [33] examined the impact of plastic bottles as a market and public device. The findings demonstrate how plastic bottles have created uncontrolled pollution on the land, air, and the sea. The author argues that the poor waste disposal has resulted in huge volumes of plastic bottles being washed into the seas where they continue to wreak havoc on the aquatic and marine ecosystem.

Lagioia et al. [19] found that the production and supply of bottled water in Italy remains unethical due to its massive impact on the environment. Plastic water bottles continue to pile up under the seas and lakes and may become a major sea navigation problem over the next decades.

Dijkstra and de Roda Husman [13] argue that the ethics of bottled water surround its carbon emissions during production, transportation, and waste disposal. Water bottlers have been unable to recycle or reuse most of their plastic waste, resulting in a growing major environmental problem that may take centuries to address. Water bottlers should focus on waste recycling and reuse to minimize the huge volume of plastic water bottles being washed into the oceans.

Tandon et al. [30] argue that the major ethical issues regarding plastic water bottles include environmental pollution, social disparities, and higher chances of creating artificial shortages for profitability. The focus on profits over human rights to clean and safe water has left many communities on the verge of a water crisis. On the other hand, water bottlers continue to purchase underground water sites, leaving communities with unstable sources of clean and safe water.

Hawkins et al. [14] examined the social and material life of bottled water in society. The findings indicate that bottled water promotes social disparities by adding cost to a commodity that should be available freely to everyone. Bottled water also encourages plastic pollution due to the poor waste disposal. Even the bottling companies do not pay attention to the damage caused by their products.

Garfí et al. [20] argue that bottled water has limited benefits compared to the tap or treated water that many people consume in urban areas. However, the current perceptions in favour of bottled water make it difficult for many people to understand the value of tap water. Most people still consider tap water to be tasteless and potentially contaminated.

Le Coadou et al. [40] say that bottled water has always been perceived as healthier and tastier than tap water. The term "mineral water" has been used mostly to emphasize the various health benefits that one may obtain from bottled water. The focus on health and taste has prevented many consumers from understanding the various environmental consequences associated with bottled water.

Wardrop et al. [32] have joined other researchers in raising the awareness regarding the dangers of plastic waste for the environment. They argue that water bottlers mainly focus on the profits obtained from their products. Only a few bottling companies have sponsored efforts to clean up the environment by collecting plastic bottles and returning them to factories for recycling or reuse.

Wilkinson et al. [42] describe bottled water as a convenient product that helps in keeping people hydrated and healthy. However, the world should also focus on the environmental consequences associated with bottled water. This will encourage recycling and reuse and protect natural resources from potential depletion.

Chae and An [37] argue that plastic pollution has emerged as one of the major concerns associated with bottled water. Other key ethical concerns include resource depletion and converting a public good into a commercial product, exclusive to those who can afford it. The study calls for the increased push for the recycling and reuse of plastic bottles to minimize environmental pollution.

De Souza Machado et al. [38] say that the microplastics from plastic bottles are emerging threats to the terrestrial ecosystem. According to this study, millions of metric tons of plastic bottles have been washed into the oceans over the decades. The huge plastic waste continues to affect the terrestrial ecosystem, leading to the loss of aquatic or marine ecosystems in places that have been severely affected.

Gogoi et al. [43] say that despite being perceived as cleaner and healthier than tap water, studies are now showing that bottled water may contain certain contaminants, including chemicals that can be harmful to consumers. An example of such contaminants includes traces of phthalates that are often added to plastics to make them durable.

Greene [17], in his study, talks about a change in the water access paradigm, focusing on the convenience brought by bottled water. The study argues that the focus on convenience and taste has made tap water less popular among the current generations. Moreover, the new paradigm is less focused on the plastic waste pollution associated with bottled water.

Horowitz et al. [26] talk about the life cycle of bottled water, indicating that significant carbon emissions occur during production and transportation. The poor disposal of plastic waste is also responsible for the growing plastic waste pollution around the globe. The researchers cite recycling and reuse as potential solutions to the problem.

Thompson et al. [39] argue that ethical concerns associated with bottled water can be avoided by switching to alternative water sources such as municipal tap water. However, a shift towards tap water can only be made possible through intense marketing and promotions to reduce the negative perceptions that portray tap water as tasteless and potentially unhealthy. Less demand for bottled water may also force the bottling companies to consider improving their business practices to protect the environment.

Lebreton and Andrady [31] explain the growing plastic waste pollution as an unethical business practice by the bottling companies. The study argues that there is limited concern for people and the planet among the bottling companies.

Vanham et al. [28] argue that the study raises attention to the growing water footprint associated with the manufacturing and distribution of plastic bottles. The study urges Europeans to consider questioning the ethics behind plastic water bottles and encourages a renewed focus on tap water as the primary source of clean and safe water for families.

Akhbarizadeh et al. [41] talk about a study that points toward chemical contaminants as a major ethical concern associated with bottled water. Despite being marketed as the cleanest and healthiest sources of water, plastic bottles may contain chemicals that can be harmful to consumers. An example of such chemicals is the phthalate that is often added to plastics to enhance their durability.

Ford-Stille [12] said that regulators have failed to set sufficient standards for protecting the public against plastic waste. The poor waste disposal occurs because there are limited regulations or enforcement to compel bottling companies to collect plastic bottles and return them to factories for recycling. Regulators have also failed to compel water bottlers to use alternative reusable glass bottles to minimize pollution.

Geerts et al. [36] suggest the use of tap water to replace bottled water due to plastic waste pollution. The researchers argue that tap water is healthier and tastier but poorly marketed. This has enabled negative perceptions to grow quickly, making bottled water appear healthier and tastier. The authors argue that intense marketing and providing adequate information will assist people in understanding the value of tap water.

Barrow et al. [25], in their study, argue that the packaging of soft drinks and other beverages, including bottled water, generates significant carbon emissions. Plastic bottles also add more stress to the environment because they are non-biodegradable, and it may take hundreds of years before they decompose. The authors believe that plastic waste pollution is a major problem that should not be ignored by water bottling companies.

Ferrara et al. [24] suggest the use of glass to replace the plastic bottles. While this remains a viable solution, it has always been ignored by the water bottlers who consider glass to be too expensive, and it would lead to higher prices. Glass bottles are reusable and less likely to cause the massive pollution associated with plastic bottles.

Mainardi-Remis et al. [27], in their study, argue that the massive plastic pollution and social disparities are the major ethical challenges associated with plastic bottles. However, setting boundaries and investing in alternative glass bottles may protect the planet against plastic waste pollution. Reducing the number of plastic bottles will also reduce the millions of metric tons of plastic waste that ends up at the bottom of the sea.

Villanueva et al. [35] urge consumers to consider the health and environmental impacts associated with plastic bottles. Although plastic bottles remain popular, their impact on the environment and other health challenges cannot be ignored.

Wang et al. [44] said in their study that plastic water bottles are not the only source of the plastic waste menace. Various pharmaceutical products are contained in plastic bottles and have been distributed across the globe for centuries. Plastic bottles are only known for pollution because they are massively produced, and a very small percentage go for recycling or reuse.

Wen et al. [34] describe China's plastic ban as one of the efforts towards mitigating plastic waste pollution. The country has banned the importation of plastic bottles into the country to reduce pollution while encouraging the production of alternative containers to replace plastics.

Parag et al. [18] examined the economic viability and social impact of bottled water. The study found that bottled water is not economically viable for low-income families. It enhances social disparities and cannot secure families against a potential water crisis. Bottled water is also responsible for the massive plastic pollution that many communities experience almost daily.

Silva-García et al. [23] argue that the continuous development and supply of bottled water have raised significant ethical concerns, including the massive pollution, social inequities, and resource depletion. In addition, the cost of bottled water makes them unsuitable for protecting communities against water crises. Despite the popularity of bottled water, this study argues that there is a need for regulators and municipal administrators to begin promoting tap water as a viable alternative.

4. Discussion

4.1. Environmental Concerns

The fact that the water bottling business has become increasingly popular indicates a significant disconnect between ethics and decision-making [59]. Water bottlers have focused on the business and proceeds that come from it rather than their long-term effects on people's lives and society [60]. The study has found that many water bottlers consider their businesses to be ethical and within the legal frameworks. None of the major bottling companies believe that there is a need to examine their ethics and change their business operations that may cause harm to others [61]. Moreover, most water bottlers claim that they have taken sufficient measures to make their products environmentally friendly and sustainable.

At least four ethical paradigms begin to emerge when discussing the various issues associated with water bottling. The four paradigms include the ethics of justice, care, professionalism, and critique. The ethics of justice examines whether one's actions are justifiable, impartial, and less discriminative to others [60,61]. Water bottlers may fail this type of ethical paradigm because they have been accused of socially alienating those who are unable to purchase their expensive products. Since access to water is more like a human right, making it too expensive is like a deliberate attempt to deny this essential product to those who cannot afford it [62,63].

The ethics of care examines whether companies are acting with sympathy, empathy, and compassion to the needs of others [63]. For water bottlers, the ethics of care requires empathy towards various aspects of the environment that may suffer due to excessive plastic waste [64]. For instance, the continuous piling up of plastic waste under the rivers, lakes, and oceans may significantly destroy aquatic life and damage the marine ecosystem. Plastic poisoning from broken bottles may contaminate the water and make it toxic for the surrounding communities [65].

The ethics of professionalism requires companies to reflect the highest standards of professional conduct in line with their mission, vision, and core values. Most organizations demand professionalism from their employees and may act against those who act contrarily to the company's core values [66,67]. Water bottlers should also focus on the potential impact of their business activities and products on the surrounding communities and other stakeholders.

Based on the above ethical lenses or paradigms, the paper found at least five areas which water bottlers need to examine to avoid ethical concerns. The five areas include environmental impact, resource depletion, inequity in water access, public good, and contamination [67]. The relationship between ethics and the environment has been debated in various water discourses, including corporate social responsibility. The main argument is that water bottlers should protect water from potential contamination and depletion so that it can always remain available for future needs [68]. The public good debate examines

whether it is appropriate for companies to convert goods that are available for public use into commercial products that only a few can afford [69]. The social inequities examine the impact of putting a price on a product that should be available freely to meet people's needs. Water bottlers should respond to each of the raised concerns to ensure that their products meet the basic ethical expectations.

One of the biggest ethical concerns found in this study is the environmental impact of bottled water. Water bottlers are responsible for producing more than 3.8 billion metric tons (MT) of PET plastic resin between 2002 and 2014 alone [53,69]. There have been growing concerns over the use of plastics for food packaging, including packaging beverages such as water. However, the biggest concern is that plastic is now available nearly everywhere [70]. Unlike in the past, the plastic menace has reached a point where it can be found littered all over the place. A huge chunk of plastic bottles has also been washed into the rivers, lakes, and oceans. The problem is caused by the uncontrolled production of plastic bottles without considering the potential environmental consequences [71]. For instance, between 1950 and 2015 alone, more than 8.3 billion metric tons of plastic were produced. More than 80% of this plastic has been wasted, with the majority ending up in landfills [14,23,71]. Only 9% of the plastic waste has been recycled or reused to minimize environmental pollution.

The plastic menace contradicts what manufacturers say about their products, including the promise to recycle or reuse plastic bottles. Whenever confronted with the environmental issues associated with their products, most water bottlers cite recycling and reuse as solutions to the problem [5,11,14,71]. However, since the plastic age, less than 20% of plastic bottles have been recycled or reused to reduce potential pollution [72]. This means that water bottlers have largely failed to meet their environmental promise, resulting in a huge environmental problem. There have also been limited efforts by the water bottlers to collect bottles from every place where they are found and route them back to the factories for recycling [73]. The irresponsible production and failure to clear the plastic menace is what many people consider unethical, especially given the ongoing production and limited mitigation measures [74]. It seems as if water bottlers prioritize their profits over the potential effects of their products on the environment.

Euromonitor International [73] argues that nothing indicates a slowdown in the production of plastic bottles as oil and water companies ramp up their activities. With the increasing plastic production, polluted waterways are becoming a more ubiquitous and conspicuous symbol. In the past, it was plastic bottles that became the ubiquitous symbol of pollution everywhere [74]. However, recent environmental studies indicate that more plastics are being swept into the wetlands, rivers, and oceans. In 2010 alone, more than 8.5 million metric tons of plastics were swept into the oceans due to poor waste management [75]. There are also more than 150 million metric tons of plastics moving through the marine ecosystem. Plastics also continue to cling to the aquatic vegetation, making it difficult for fish and other aquatic animals to obtain sufficient food [76].

Apart from pollution, plastic production is one of the largest consumers of water. However, this has always been hidden from many people because the focus has been on environmental pollution. Plastic production has one of the largest water footprints given that it consumes huge volumes in every step in the life cycle [76]. Water use extends as far as the extraction of oil or natural gas from the wells to the separation of various components, including resins that eventually become plastic containers [77]. For the single-use plastics created for beverage bottles, the consumption is even more troubling. There are only a few plastic manufacturing factories that possess recycling facilities to ensure that water remains in circulation with only a small portion going to waste [78].

The PET (polyethylene terephthalate) production accounts for the largest water footprint during the production of plastics. PET is the type of plastic used for water bottles or soda bottles [73,78]. For PET production, one can account for water consumption using the blue footprint and grey footprint [79]. The "blue footprint" is from water that evaporates into the atmosphere during the extraction and processing of petroleum products to develop plastic resins. Once the plastic pellets are produced, they are too hot and have to be cooled

to minimize potential thermal pollution [80]. The water used for cooling purposes is what researchers describe as the "grey footprint". Both the grey and blue footprints contribute to the massive loss of water during the production of plastic bottles [81].

It may be unethical for water bottlers to continue producing more plastic bottles when the world is struggling to overcome the massive pollution already created. Pacheco-Vega [80] was unable to find a justifiable ethical framework for the water bottlers even when looking at the issue from the utilitarian perspective. Utilitarians believe that actions that contribute to the common good are justifiable even when they may appear unethical [81]. For instance, causing injury to one individual to save hundreds of people may look unethical but can be justified based on the outcomes. Water bottlers have been unable to provide any ethical framework to justify the sale of water bottles and its environmental consequences [82]. It is also difficult for water bottlers to claim moral grounds when they can only recycle or reuse less than 20% of the water bottles that they produce [83]. Ethics require water bottlers to cease distributing more plastics and join local communities to collect and safely dispose of the millions of metric tons of plastic waste across the globe.

Some recommendations regarding this section include raising the awareness on the part of bottled water companies about the use of plastic, for which investment in containers made from other materials that do not have a high impact on the environment should be prioritized. In addition, the circular economy must be considered in the use of packaging. It is also important that transparency and accountability prevail regarding water quality, its supply, and its impact on the environment. Likewise, it is vitally important to promote new environmental regulations and policies that resolve the problems stated in this section.

4.2. Resource Depletion

While the risk of pollution has been heavily documented, researchers have yet to determine the extent to which bottled water can lead to resource depletion. According to Berman and Johnson [84], resource depletion occurs due to over-exploitation of the natural sources of a valuable resource, to an extent where there are limited chances of replenishment. Water being a valuable resource is facing the imminent risk of depletion from uncontrolled extraction, especially from underground sources [84]. In California, stakeholders have raised concerns regarding the extraction of billions of metric tons of groundwater, lowering the aquifer and making its accessibility difficult for farmers and citizens [73,85]. This means that those who want to dig for groundwater in places such as California have to go deeper than they would have done under natural circumstances [86].

The problem is that some of the water bottlers do not consider water as a fundamental human right. They consider water as a commercial commodity that should be converted into profits. Berman and Johnson [84] talk about water bottlers who are willing to continue their drilling operations, even at the expense of humanity. For instance, there are many rural communities without access to tap water. For such communities, underground aquifers are the only source of clean and safe water for their families [87]. However, the excessive extraction of these valuable resources may expose various communities to water scarcity. Moreover, if too much groundwater is withdrawn for bottling, it may lead to streams and springs drying due to lowered water tables [87]. There are places where the water table has sunk to almost 10% lower than it was about 100 years ago due to the massive extraction of water for bottling [88].

Water bottlers are also paying too little to compensate for what they take from communities. A study by Wang et al. [77] found that water bottlers pay what may be equivalent to just 10% of what they withdraw from the local communities. For fairness, water bottlers should pay local communities what is equivalent to the resources that they take. Some companies try to compensate local communities through various corporate social responsibility initiatives [88]. Coca-Cola, for instance, has established various CSR initiatives under its water stewardship programme [89]. The initiatives focus on supporting local communities to increase water supply. This includes building dams and connecting communities to water sources using taps. While these initiatives may enhance the access to clean and safe

water, they may not be sufficient and rarely compensate the surrounding communities where they extract water [64,89]. For instance, some of the stewardship programmes may be located in countries where water bottlers have not fully exploited the available water.

Water bottlers can easily move their operations to other countries or states with sufficient water supply. However, the local communities that they are leaving behind may not have the resources to move to other areas in search of clean and safe water [90]. Once a valuable resource such as water is gone, communities may be forced to rely on other sources, including potentially contaminated water from the rivers or lakes depending on one's distance from the nearest resource [91]. Water bottlers should be guided by the ethics of care to avoid business activities that can harm local communities. However, the ethics of care is either lacking or poorly implemented in several water bottling companies [92]. The primary focus has been on profit generation with only a few organizations developing various initiatives to support local communities [24,37,39,92].

In this section, it is recommended that the use of tap water be encouraged because it requires fewer resources compared to bottled water. Likewise, it is necessary to invest in technology that allows the efficient use of water.

4.3. Inequity in Water Access

Water bottlers have argued that their products help in addressing water shortages in places with emergencies or water crises. During disasters such as floods or hurricanes, water bottlers have played a crucial role in supporting local communities by distributing hundreds or thousands of water bottles to those in need [93]. Moreover, a strong case for bottled water focuses on the convenience that it provides to those in meetings, physical activities, or events where drinking water is necessary [94]. Since people may not carry water to international meetings and conferences, bottled water has always been a great solution for keeping people hydrated and refreshed. Moreover, bottled water helps maintain good health by acting as an alternative to soft drinks [94]. Although water bottles offer sufficient health alternatives, not everyone can afford them. The price for a 1 L bottle of water, for instance, ranges from USD 0.50 to USD 5.00 across many states [65,74,94].

According to Allaire et al. [78], the sale of bottled water can raise significant questions regarding the equitable access to clean drinking water. There has been a growing debate over whether water should be considered a human right. Rodwan [82] argues that the question that people should ask is whether one can survive without water. While humans can survive without food for several days, it is nearly impossible to survive without water even for two days. This means that water is more essential to life than food. If water is considered a non-human right, there are nearly no ethical questions regarding the business activities that can make access difficult [82,94]. However, the essential nature of water to human rights has prompted many stakeholders to consider it among the top human rights that should not be ignored [95]. This means that water bottlers may be violating human rights through exorbitant pricing that makes their products difficult to access among low-income communities.

Moreover, in regions facing water scarcity, the availability of water bottles at a price (cost) can create significant disparities. This makes water a privilege to those who can afford it. This is a problem that many water bottlers continue to ignore, despite the societal impact [89,95]. The cost of bottling continues to rise, making the product nearly unaffordable to many communities around the globe. Other challenges such as sinking water tables caused by the overexploitation of water make clean water inaccessible to many communities [96]. Without access to clean water, people may be forced to rely on potentially contaminated water in their neighbourhoods [97]. Such situations can also increase the chances of opportunistic diseases such as cholera, diarrhoea, dysentery, typhoid, and hepatitis A [65,97]. Apart from enhancing the disparities, inadequate access to clean and safe water can be detrimental to the local communities. Globally, more than 700 million people live in places with poor access to clean and safe water.

Since there is a general agreement about the essentiality of water, attaching a cost to it should be considered unethical. The ethics of care requires companies to act in ways that promote the well-being of everyone in society [11,41,66,97]. Keeping an essential product from those who need it through exorbitant pricing may be considered unethical. This should be treated the same as a pharmacist charging exorbitant prices for a product that is so essential for people's survival [98]. One can also argue that water bottlers are essentially capitalizing on a product which they believe that people have no choice but to purchase [99]. Scare tactics used in the advertisements also add to the unethical nature of the behaviour. The case in Cleveland (Ohio) shows how water bottlers can use scare tactics against municipal tap water to convince more people to purchase bottled water [99].

In this section, increasing support to supply the population with water equitably should be considered as a recommendation. Well, the dependence on bottled water by developing countries is notable, so if the infrastructure of these countries is improved and efficient quality water supply systems are implemented, the inequality gap that exists will be reduced, especially in rural areas that have a greater number of deficiencies in terms of public services.

4.4. Public Good

Water is a public good and should not be treated as an exclusive product. However, water bottlers continue to treat a public good as an exclusive and commercial product from which they generate massive profits, sometimes at the expense of local communities [100]. However, the concept of public good has been challenged by those who question the extent to which it applies to companies. For instance, land is a public good but can also be converted into commercial products through privatization and farming [47,51,100]. Many have questioned why commercial organizations such as water bottlers should not have access to a commodity that they can convert into profits. Water bottlers argue that they only take a small portion of the available water and leave the rest for other stakeholders, including communities, municipals, and other organizations [101]. There are also no laws limiting the extent to which water bottlers can use the amount of water available for the public good.

The ethics of justice demands that companies promote fairness in their business activities. There have also been various efforts at both domestic and international levels to promote fairness in business practices [102]. The problem with the privatization or commercialization of public goods such as water is that it promotes unfairness and ensures that beneficiaries are excluded from enjoying the good. Municipal tap water is a public good and is available for nearly every house. Although people have to pay for the water supply, the cost is always low enough for people to afford [103]. Additionally, some laws compel municipalities to provide essential goods such as water to needy communities. The ethics of justice and fairness can only be achieved when water bottlers make their products affordable and not a privilege to only individuals who can afford them [104]. Without fairness, many individuals may be pushed into using contaminated water and becoming exposed to various opportunistic conditions.

Water utility companies provide water access to large populations, especially in urban areas. The utility companies also provide water access to rural areas facing potential scarcity [11,67,75,104]. Compared to the private water bottlers, the utility companies understand the need to treat water as a public good, including investments in large reservoirs that provide water to local communities [105]. Utility companies have also invested in recycling facilities to convert wastewater into clean products for domestic or industrial use. However, the market is currently dominated by private water bottlers who are more focused on profitability than expanding the access to the essential commodity [105]. Moreover, most public agencies are poorly funded and may not have sufficient resources to supply water to every place where there is a need [106]. The continuous dominance by the water bottlers has proven detrimental to the environment and natural water sources,

making it necessary for municipalities to consider increasing their investments in clean water supply and marketing.

Another significant issue raised against water bottlers is the move to purchase groundwater distribution channels, making them unavailable to the public. Purchasing groundwater sites essentially converts a public good into a private commodity [107]. This also takes away the human right to clean and safe water for drinking and other domestic consumption. Additionally, whenever the public is denied access to clean water, bottled water shifts their attention from the public systems and water treatment facilities [80,101,107]. Instead of putting pressure on the local administrators to expand the water treatment facilities and distribution channels, people begin to depend on bottled water for their survival [78,107]. Eventually, the administrators fail to provide accountability for water issues or develop long-term solutions [67,106,107]. Water bottlers have also enhanced the public distrust of tap water by portraying it as unhealthy in their marketing and promotions. Without pressure from the public, there is limited incentive for municipal administrators to improve the water infrastructure.

Although bottled water has witnessed tremendous growth in sales, its impact on the environment and other ethical concerns remains troubling. Bottled water is expected to surpass about USD 500 billion in sales by 2030 [2,11,77,107]. Bottlers all over the world sell at least 1 million bottles every hour. The product is so popular that it has been listed among the best-selling beverages in the world. Water bottlers market their products as healthy and alternative to unhealthy beverages such as soda and beer [107]. Those who are struggling to overcome alcohol addiction, for instance, may use water to manage their cravings. Water bottlers also portray tap water as unhealthy and tasteless, and hence unsuitable for families. Since the 1970s, there has been a major shift toward bottled water as more people consider it healthier and full of minerals than tap water [37,75,107]. However, studies have shown that municipal tap water may be cleaner and even healthier than bottled water based on the stringent regulations that it undergoes.

5. Conclusions

This study examined the ethical issues surrounding the manufacturing and supply of bottled water. It used a systematic review of the literature through the PRISMA method to determine the major ethical concerns surrounding these topics. A total of 107 articles were identified, and 31 were subjected to further reviews and analysis. The question asked was, "What are the ethical issues surrounding the manufacturing and supply of bottled water?". It was found that three types of ethics begin to emerge when examining the topics. These types of ethics include the ethics of justice, care, and professionalism. The ethics of justice requires water bottlers to act fairly in their business activities and avoid operations that can cause unnecessary harm to the stakeholders, including the environment. However, this type of ethics has not been met because water bottlers continue to produce more plastic despite the heavy impact on the environment. Water bottlers have been criticized for creating social exclusion by pricing their products out of reach for many. Recognizing access to water as a fundamental human right implies that its excessive cost effectively restricts its availability to those with limited financial resources. True justice is achieved only when clean and safe drinking water is accessible to all.

The ethics of care has also not been met because some consumers believe that water bottlers have failed to act with sympathy, empathy, and compassion toward their customers and the environment. For example, plastic waste accumulation in rivers, lakes, and oceans threatens to devastate aquatic life and harm the marine ecosystem. Contamination from plastics, including broken bottles, can poison water sources, rendering them toxic to nearby communities. Consequently, it is imperative for water bottlers to prioritize environmental and community health over mere profit, in line with the ethics of care.

Some marketing behaviours that portray tap water as dangerous have failed the professionalism test because they are not based on facts and are largely driven by unfair competition practices. The potential effects of their operations and products on the surrounding communities and other stakeholders should also be a focal point for water bottlers.

The key ethical concerns associated with water bottles include environmental concerns, resource depletion, inequity in water access, and public good. The production, transportation, and disposal of plastic bottles are major polluters of rivers, lakes, and oceans. At least 151 million metric tons of plastic waste exists deep in the oceans where it continues to wreak havoc on aquatic life. The excessive extraction of underground water can lead to resource depletion and may lower water tables, making clean water inaccessible to various communities. The sale of bottled water has also raised questions regarding the equitable access to clean and safe water. In regions experiencing water scarcity, the availability of bottled water at a price can create significant disparities, making the product a privilege to those who can afford it. Water bottlers are also purchasing underground water sites, turning a public good into an exclusive commercial product that is only available to a few in society. Converting public goods into commercial products may deny access to those who live in areas of scarcity, making water a privilege to high-income populations.

To tackle the ethics of justice, it is vital to guarantee a just and impartial allocation of resources, considering their effects on both water supply and the environment. Addressing the ethics of care entails the implementation of sustainable methods to reduce environmental damage, demonstrating concern for future generations and ecosystems. Regarding the ethics of professionalism, adherence to industry standards and regulations in bottling and labelling processes is essential to uphold product quality and foster consumer trust.

To ensure safety, environmental sustainability, and equitable access to clean water resources, policymakers should confront the task of regulating bottled water industry practices. They need to implement policies addressing plastic pollution, water quality standards, and labelling requirements to safeguard public health and the environment. In the bottled water industry, stakeholders such as manufacturers, distributors, and retailers encounter the challenge of balancing consumer trends and environmental issues. They should respond to sustainability demands regarding production processes and packaging materials while also meeting consumer preferences and demands. Finally, consumers' choices regarding bottled water are influenced by factors like affordability, perceived health benefits, and availability. They may opt for bottled water due to convenience, taste preferences, or concerns about tap water quality. However, their consumption of single-use plastic bottles exacerbates the environmental problems, resulting in waste and pollution.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su16083488/s1, Table S1: PRISMA 2020 checklist [108].

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Appendix A

Table A1. Selected articles.

Title	Type of Document	Authors and Date	Findings
Tap Water vs. Bottled Water in a Footprint Integrated Approach.	Journal Article	Botto, 2009 [29]	The study found that bottled water has a disturbing carbon and water footprint given the massive destruction to the environment. The author believes that water bottlers can address the challenge by focusing on recycling and reusing their plastics to minimize waste and environmental destruction.

Table A1. *Cont.*

Title	Type of Document	Authors and Date	Findings
Energy Implications of Bottled Water.	Journal Article	Gleick and Cooley, 2009 [16]	In this paper, the researchers estimated the energy footprint required for various phases of bottled water production, transportation, and storage. For bottled water transported over short distances, the researchers found that the energy consumed in production far outweighs the transportation footprint. However, for bottled water transported over long distances, the transportation energy footprint far outweighs the one needed for production. Carbon emissions occur during the production and transportation of plastic water bottles.
A Battle against the Bottles: Building, Claiming, and Regaining Tap-Water Trustworthiness.	Journal Article	Parag and Timmons Roberts, 2009 [15]	In this study, Parag and Timmons Roberts lament the loss of the trust in tap water that has enabled bottled water to dominate the market for decades. The problem has been worsened by the belief that bottled water is cleaner and safer than tap water, even when the truth contradicts such beliefs. The authors believe that the situation can be addressed through the intense marketing of tap water and providing accurate information that will help in regaining the trust in tap water.
Packaging Water: Plastic Bottles as Market and Public Devices.	Journal Article	Hawkins, 2011 [33]	In this study, Hawkins examined the impact of plastic bottles as a market and public device. The findings demonstrate how plastic bottles have created uncontrolled pollution on the land, air, and sea. The author argues that the poor waste disposal has resulted in huge volumes of plastic bottles being washed into the seas where they continue to wreak havoc on the aquatic and marine ecosystem.
Empirical Study of the Environmental Management of Italy's Drinking Water Supply.	Journal Article	Lagioia et al., 2012 [19]	The study found that the production and supply of bottled water in Italy remains unethical due to its massive impact on the environment. Plastic water bottles continue to pile up under the seas and lakes and may become a major sea navigation problem over the next decades.
Chapter 14—Bottled and Drinking Water. In Food Safety Management a Practical Guide for the Food Industry.	Journal Article	Dijkstra and de Roda Husman, 2014 [13]	The study argues that the ethics of bottled water surround its carbon emissions during production, transportation, and waste disposal. Water bottlers have been unable to recycle or reuse most of their plastic waste, resulting in a growing major environmental problem that may take centuries to address. Water bottlers should focus on waste recycling and reuse to minimize the huge volume of plastic water bottles being washed into the oceans.
Water and Energy Footprint Assessment of Bottled Water Industries in India.	Journal Article	Tandon et al., 2014 [30]	The study argues that the major ethical issues regarding plastic water bottles include environmental pollution, social disparities, and higher chances of creating artificial shortages for profitability. The focus on profits over human rights to clean and safe water has left many communities on the verge of a water crisis. On the other hand, water bottlers continue to purchase underground water sites, leaving communities with unstable sources of clean and safe water.
Plastic Water: The Social and Material Life of Bottled Water; MIT Press.	Journal Article	Hawkins et al., 2015 [14]	The study examined the social and material life of bottled water in society. The findings indicate that bottled water promotes social disparities by adding cost to a commodity that should be available freely to everyone. Bottled water also encourages plastic pollution due to poor waste disposal. Even the bottling companies do not pay attention to the damage caused by their products.

Table A1. *Cont.*

Title	Type of Document	Authors and Date	Findings
Life Cycle Assessment of Drinking Water: Comparing Conventional Water Treatment, Reverse Osmosis and Mineral Water in Glass and Plastic Bottles.	Journal Article	Garfí et al., 2016 [20]	The study argues that bottled water has limited benefits compared to the tap or treated water that many people consume in urban areas. However, the current perceptions in favour of bottled water make it difficult for many people to understand the value of tap water. Most people still consider tap water to be tasteless and potentially contaminated.
Quality Survey of Natural Mineral Water and Spring Water Sold in France: Monitoring of Hormones, Pharmaceuticals, Pesticides, Perfluoroalkyl Substances, Phthalates, and Alkylphenols at the Ultra-Trace Level.	Journal Article	Le Coadou et al., 2017 [40]	Bottled water has always been perceived as healthier and tastier than tap water. The term "mineral water" has been used mostly to emphasize the various health benefits that one may obtain from bottled water. The focus on health and taste has prevented many consumers from understanding the various environmental consequences associated with bottled water.
Estimation of Packaged Water Consumption and Associated Plastic Waste Production from Household Budget Surveys.	Journal Article	Wardrop et al., 2017 [32]	This study joins other researchers in raising the awareness regarding the dangers of plastic waste for the environment. The study argues that water bottlers mainly focus on the profits obtained from their products. Only a few bottling companies have sponsored efforts to clean the environment by collecting plastic bottles and returning them to factories for recycling or reuse.
Occurrence, Fate and Transformation of Emerging Contaminants in Water: An Overarching Review of the Field.	Journal Article	Wilkinson et al., 2017 [42]	This study describes bottled water as a convenient product that helps in keeping people hydrated and healthy. However, the world should also focus on the environmental consequences associated with bottled water. This will encourage recycling and reuse and protect natural resources from potential depletion.
Current Research Trends on Plastic Pollution and Ecological Impacts on the Soil Ecosystem: A Review.	Journal Article	Chae and An, 2018 [37]	The study argues that plastic pollution has emerged as one of the major concerns associated with bottled water. Other key ethical concerns include resource depletion and converting a public good into a commercial product, exclusive to those who can afford it. The study calls for the increased push for the recycling and reuse of plastic bottles to minimize environmental pollution.
Microplastics as an Emerging Threat to Terrestrial Ecosystems.	Journal Article	De Souza Machado et al., 2018 [38]	The microplastics from plastic bottles are emerging threats to the terrestrial ecosystem. According to this study, millions of metric tons of plastic bottles have been washed into the oceans over the decades. The huge plastic waste continues to affect the terrestrial ecosystem, leading to the loss of aquatic or marine ecosystems in places that have been severely affected.
Occurrence and Fate of Emerging Contaminants in Water Environment: A Review.	Journal Article	Gogoi et al., 2018 [43]	Despite being perceived as cleaner and healthier than tap water, studies are now showing that bottled water may contain certain contaminants, including chemicals that can be harmful to consumers. An example of such contaminants includes traces of phthalates that are often added to plastics to make them durable.
Bottled Water in Mexico: The Rise of a New Access to Water Paradigm.	Journal Article	Greene, 2018 [17]	This study talks about a change in the water access paradigm, focusing on the convenience brought by bottled water. The study argues that the focus on convenience and taste has made tap water less popular among the current generations. Moreover, the new paradigm is less focused on the plastic waste pollution associated with bottled water.

Table A1. *Cont.*

Title	Type of Document	Authors and Date	Findings
Life Cycle Assessment of Bottled Water: A Case Study of Green2O Products.	Journal Article	Horowitz et al., 2018 [26]	This study talks about the life cycle of bottled water, indicating that significant carbon emissions occur during its production and transportation. The poor disposal of plastic waste is also responsible for the growing plastic waste pollution around the globe. The researchers cite recycling and reuse as potential solutions to the problem.
Legal Control of Water Resources: Cases and Materials, 6th ed.; American Casebook Series; West Academic Publishing.	Book	Thompson et al., 2018 [39]	This study argues that ethical concerns associated with bottled water can be avoided by switching to alternative water sources such as municipal tap water. However, a shift towards tap water can only be made possible through intense marketing and promotions to reduce the negative perceptions that portray tap water as tasteless and potentially unhealthy. Less demand for bottled water may also force the bottling companies to consider improving their business practices to protect the environment.
Future Scenarios of Global Plastic Waste Generation and Disposal.	Journal Article	Lebreton and Andrady, 2019 [31]	This study describes the growing plastic waste pollution as an unethical business practice by the bottling companies. The study argues that there is limited concern for people and the planet among the bottling companies.
The Consumptive Water Footprint of the European Union Energy Sector.	Journal Article	Vanham et al., 2019 [28]	The study raises attention to the growing water footprint associated with the manufacturing and distribution of plastic bottles. The study urges Europeans to consider questioning the ethics behind plastic water bottles and encourages a renewed focus on tap water as the primary source of clean and safe water for families.
Worldwide Bottled Water Occurrence of Emerging Contaminants: A Review of the Recent Scientific Literature.	Journal Article	Akhbarizadeh et al., 2020 [41]	The study points toward chemical contaminants as a major ethical concern associated with bottled water. Despite being marketed as the cleanest and healthiest sources of water, plastic bottles may contain chemicals that can be harmful to consumers. An example of such chemicals is the phthalate that is often added to plastics to enhance their durability.
Regulated and Hydrated: A Case for Regulating Bottled Water; Santa Clara University: Santa Clara.	Journal Article	Ford-Stille, 2020 [12]	According to Ford-Stille, regulators have failed to set sufficient standards for protecting the public against plastic waste. The poor waste disposal occurs because there are limited regulations or enforcement to compel bottling companies to collect plastic bottles and return them to factories for recycling. Regulators have also failed to compel water bottlers to use alternative reusable glass bottles to minimize pollution.
Bottle or Tap? Toward an Integrated Approach to Water Type Consumption.	Journal Article	Geerts et al., 2020 [36]	This study suggests the use of tap water to replace bottled water due to plastic waste pollution. The researchers argue that tap water is healthier and tastier but poorly marketed. This has enabled negative perceptions to grow quickly, making bottled water appear healthier and tastier. The author argues that intense marketing and providing adequate information will assist people in understanding the value of tap water.
Carbon Footprint of Soft Drinks Packaging; Carbon Trust.	Journal Article	Barrow et al., 2021 [25]	The study argues that the packaging of soft drinks and other beverages, including bottled water generates significant carbon emissions. Plastic bottles also add more stress to the environment because they are non-biodegradable, and it may take hundreds of years before they decompose. The authors believe that plastic waste pollution is a major problem that should not be ignored by water bottling companies.

Table A1. *Cont.*

Title	Type of Document	Authors and Date	Findings
Lca of Glass versus Pet Mineral Water Bottles: An Italian Case Study.	Journal Article	Ferrara et al., 2021 [24]	This study suggests the use of glass to replace the plastic bottles. While this remains a viable solution, it has always been ignored by the water bottlers who consider it to be too expensive, and it would lead to higher prices. Glass bottles are reusable and less likely to cause the massive pollution associated with plastic bottles.
Setting Boundaries within a Bottled Water Plant Aid to Better Visualize the Water Use: An Approach through the Water Footprint Indicator.	Journal Article	Mainardi-Remis et al., 2021 [27]	This study argues that the massive plastic pollution and social disparities are the major ethical challenges associated with plastic bottles. However, setting boundaries and investing in alternative glass bottles may protect the planet against plastic waste pollution. Reducing the number of plastic bottles will also reduce the millions of metric tons of plastic waste that ends up at the bottom of the sea.
Health and Environmental Impacts of Drinking Water Choices in Barcelona, Spain: A Modelling Study.	Journal Article	Villanueva et al., 2021 [35]	This study urges consumers to consider the health and environmental impacts associated with plastic bottles. Although plastic bottles remain popular, their impact on the environment and other health challenges cannot be ignored.
Occurrence of Pharmaceuticals and Personal Care Products in Bottled Water and Assessment of the Associated Risks.	Journal Article	Wang et al., 2021 [44]	This study argues that plastic water bottles are not the only source of the plastic waste menace. Various pharmaceutical products are contained in plastic bottles and have been distributed across the globe for centuries. Plastic bottles are only known for pollution because they are massively produced, and a very small percentage go for recycling or reuse.
China's Plastic Import Ban Increases Prospects of Environmental Impact Mitigation of Plastic Waste Trade Flow Worldwide.	Journal Article	Wen et al., 2021 [34]	This study describes China's plastic ban as one of the efforts towards mitigating plastic waste pollution. The country has banned the importation of plastic bottles into the country to reduce pollution while encouraging the production of alternative containers to replace plastics.
Bottled Water: An Evidence-Based Overview of Economic Viability, Environmental Impact, and Social Equity.	Journal Article	Parag et al., 2023 [18]	This study examined the economic viability and social impact of bottled water. The study found that bottled water is not economically viable for low-income families. It enhances social disparities and cannot secure families against a potential water crisis. Bottled water is also responsible for the massive plastic pollution that many communities experience almost daily.
Integral Index of Water Quality: A New Methodological Proposal for Surface Waters.	Journal Article	Silva-García et al., 2023 [23]	The continuous development and supply of bottled water have raised significant ethical concerns, including the massive pollution, social inequities, and resource depletion. In addition, the cost of bottled water makes it unsuitable for protecting communities against water crises. Despite the popularity of bottled water, this study argues that there is a need for regulators and municipal administrators to begin promoting tap water as a viable alternative.

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