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Review Article

Examining the Concept of Water Footprint in the Context of Responsible Consumption and Production

Sorumlu Tüketim ve Üretim Bağlamından Su Ayak İzi Kavramının İncelenmesi

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Abstract: The importance of water and water scarcity have become critical with issues such as climate change and global warming, which are important in the sustainability of human and environmental life. Therefore, the water footprint, which indicates the quantity of water utilised and the extent of pollution, has become a responsibility for governments, businesses, producers and consumers. Water footprint can result from irresponsible production and consumption. Responsible consumption and production are key objectives of sustainable development. Through responsible consumption and production, production and consumption patterns based on sustainability are adopted, considering both current and future generations. Thus, with responsible consumption and production, natural resources can be used efficiently and fairly, consumption can be more conscious, waste and wastage can be prevented, and a fair, poverty and hunger-free and decent quality of life can be created for all segments of society. Water footprint has also been one of the key issues addressed in responsible consumption and production. Water footprint should be reduced for responsible consumption and production. In this study, the concept of water footprint is discussed within the context of responsible consumption and production, reflecting the 12th goal of sustainable development. It is recommended in the study that businesses should focus on production methods and products that will reduce their water footprint with a responsible production approach, and include labels related to water footprint on product packaging. It is among the recommendations to conduct research that measures the water footprint of businesses and consumers and the effectiveness of marketing communications related to water footprint.

Keywords: Water Footprint, Virtual Water, Responsible Consumption and Production, Sustainable Development, Sustainability.

Özet: İnsan ve çevre yaşamının sürdürülebilirliğinde önem arz eden iklim değişikliği ve küresel ısınma gibi konular ile suyun önemi ve su kıtlığı, kritik bir konuma gelmiştir. Bu yüzden, suyun kullanım ve kirlenme miktarını gösteren su ayak izi devletler, işletmeler, üreticiler ve tüketiciler için bir sorumluluk haline gelmiştir. Su ayak izi, sorumsuz üretim ve tüketim sonucunda meyk dana gelebilmektedir. Sorumlu tüketim ve üretim, sürdürülebilir kalkınmanın temel amaçlarındandır. Sorumlu tüketim ve üretim sayesinde hem mevcut hem de gelecek nesli düşünerek sürdürülebilirliği temel alan üretim ve tüketim şekilleri benimsenmektedir. Böylece, sorumlu tüketim ve üretim ile doğal kaynaklar, verimli ve adil bir şekilde kullanılabilecek, daha bilinçli tüketim yapılabilecek, atık ve israf engellenebilecek ve toplumun her kesimi için adil, yoksulluğun ve açlığın giderildiği ve insana yakışır kaliteli bir yaşam tarzı yaratılabilecektir. Su ayak izi de sorumlu tüketim ve üretimde ele alınan önemli meselelerden biri olmuştur. Sorumlu tüketim ve üretim için su ayak izinin azaltılması gerekmektedir. Bu çalışmada, su ayak izi, sürdürülebilir kalkınma 12. hedefini yansıtan sorumlu tüketim ve üretim bağlamından kavramsal bir şekilde ele alınmıştır. Çalışmada işletmelerin sorumlu üretim yaklaşımıyla su ayak izini azaltacak üretim yöntem ve ürünlerine odaklanmaları, ürün ambalajlarında su ayak izi ile ilgili etiketlere yer vermeleri önerilmektedir. İşletmelerin ve tüketicilerin su ayak izini ve su ayak izine ilişkin pazarlama iletişiminin etkinliğini ölçen araştırmaların yapılması öneriler arasında yer almaktadır.

Anahtar Kelimeler: Su Ayak İzi, Sanal Su, Sorumlu Tüketim ve Üretim, Sürdürülebilir Kalkınma, Sürdürülebilirlik.

1. Introduction

As the human population increases, an increase in production and consumption processes is inevitable. Unconscious and environmentally unaware forms of production can bring many environmental problems. Many environmental problems such as air pollution, soil pollution and water pollution can arise from unconscious and irresponsible production and consumption patterns far from environmental awareness. Among these environmental problems, water pollution is increasingly being addressed today in relation to water use and climate change. A tendency towards using more water in production processes to meet the needs and desires comes to the agenda with the increasing population. However, unconscious water use and water pollution may also occur during consumption. In the meantime, the conscious consumption of water is the responsibility of both businesses and consumers.

Water use is very intense in many activities such as eating,

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drinking, and product production (Aldaya et al., 2012). Therefore, water consumption and the resulting water pollution are mostly caused by activities such as bathing, cleaning, washing, irrigation, irrigation, processing and cooling. In this context, total water consumption and water pollution can be defined as the sum of a large number of independent water-demanding and polluting activities (Hoekstra, 2008). In this respect, water scarcity is a global concern. This concern is evidenced by the projected increase in global freshwater demand by 30% and food demand by 50% by 2030 (Palhares et al., 2020: 24). The United Nations World Water Development Report states that urgent action to prevent a global water crisis is inevitable. Because it is stated that many people in the world face poverty, environmental degradation, poor health and many water-related disasters. It is explained in the report that these problems are exacerbated by factors such as consumption increase, climate change and population growth (WWAP, 2009).

Water is the most important and valuable natural resource that meets the needs. Hence, action should be taken to protect every drop of water. Additionally, the importance of water in agricultural production, food prices and soil quality cannot be overstated (Mishra, 2023). Freshwater resource play a vital role in agricultural production, economic activities, human activities and ecosystem maintenance. Therefore, efficient, productive, equitable, and sustainable management of freshwater resource is imperative (Gleick & Palaniappan, 2010). Moreover, excessive water consumption and resulting freshwater scarcity pose a global risk, thus making water footprint reduction a pressing global issue (Hoekstra, 2019). It is important to reduce the water footprint, which shows the amount of water use resulting from human consumption (Hoekstra & Chapagain, 2007), for responsible consumption and production and sustainable development. In this study, it is aimed to examine the water footprint conceptually from the context of responsible consumption and production, which reflects the 12th goal of sustainable development. The concept of responsible consumption and production and water footprint is a relatively new and rapidly developing field of study. With the increase in the number of consumers and businesses that engage in responsible consumption and production, addressing the water footprint from the perspective of businesses and consumers has become important. In addition, there may be a need to understand the impact of water footprint on consumers' product purchasing intentions and behavior from the context of responsible consumption and to measure the effectiveness of water footprint in businesses' marketing communication efforts. This situation may lead to a new perspective in marketing studies. Water footprint can create a new marketing opportunities and perspective. In this regard, considering the concept of water footprint from the context of responsible consumption and production can help to provide a guide for both marketing practitioners and researchers, provide conceptual inferences and contribute to research proposals. This study, which addresses the concept of water footprint, contributes to expanding the existing literature on water footprint and responsible consumption and production. This shows the importance of the study and its purpose. Additionally, no study has yet been found in the literature that addresses the concept of responsible consumption and production and water footprint together. Therefore, considering the water footprint from a marketing perspective and evaluating it from the context of responsible consumption and production reflects the importance of the study by filling the gap in the literature. In line with this importance and purpose, the concept of water footprint has been examined from the context of responsible consumption and production in order to complete the gap in the literature. Thus, first of all, the concept of responsible consumption and production will be discussed from the perspective of sustainable development, and then the concepts of water footprint, water footprint components, virtual water will be explained and studies in the literature on water footprint will be included.

2. Responsible Consumption and Production

The concept of sustainability, which refers to being able to be protected at all times even if time progresses (Heinberg, 2010), was discussed in the "*International Union for the Conservation of Nature (IUCN) Yearbook*" in 1972, Goldsmith's "*Blueprint for Survival*" book (Kidd, 1992) and the Club of Rome's "*Limits to Economic Growth*" report (Meadows et al., 1972 as cited in Yeni, 2014: 184). Sustainable development was defined in the "*Our Common Future*" report published by the "*World Commission on Environment and Development (WCED)*" in 1987. According to this report, sustainable development is defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987).

"*The Sustainable Development Goals*" were adopted by the United Nations in 2015 as a call to action for all humanity to protect the planet, end poverty and achieve prosperity and peace by 2030. Therefore, the "*Sustainable Development Goals*" are also referred to as the Global Goals due to their universal purpose. It is stated that each action included in these goals is in interaction with each other and in this respect, action towards one goal will affect the results in other goals. In this respect, it is important for development to balance the economic, environmental and social dimensions of sustainability (UNDP, 2024). Sustainable development goals are shown in Figure 1.

Figure 1. The sustainable development goals

Source: (UN-United Nations Turkiye, 2024)

Responsible consumption and production, which is one of the sustainable development goals, states that ensuring the sustainability of both current and future generations' livelihoods is possible through sustainable consumption and production patterns (UN, 2024). While developed countries enjoy a high standard of living, many challenges such as poverty, human rights issues, migration, gender inequality, environmental degradation, and the extinction of animal and plant species persist in low and developing countries. Irresponsible consumption and production practices underlie these problems (Gunawan et al., 2020). It is obvious that a significant majority of the world's population still consumes less than the level that can meet their essential needs (UNDP, 2024). Although the world's resources are being depleted, the population is growing, and 931 million tonnes of food are wasted annually, even though a significant portion of the world's population is struggling with hunger. Therefore, it is stated that if the world population reaches 9.8 billion by 2050, natural resources as much as three planets will be needed to sustain life. It can be understood from this that food waste is one of the indicators of overconsumption. For this reason, in terms of responsible consumption and production, addressing food waste is an urgent action (UN, 2024). In the fight against food waste, it is necessary to ensure efficiency in the production and supply chain by halving food waste per capita for both retailers and consumers. This will contribute to food security and lead to the creation of a resource-efficient economy (UNDP, 2024).

Responsible consumption and production refers to ensuring production, development, and meeting the needs and demands of customers by considering the environmental, social, and economic dimensions of sustainability without jeopardizing the sustainability of future generations (Wang et al., 2018: 433). It states that the goal of industries should be to ensure the life cycle throughout the entire supply chain process from production to consumption and from the producer to the consumer (Gunawan et al., 2020).

Responsible consumption can be addressed in the literature as socially conscious consumption, socially responsible consumption, consumer ethics, sustainable consumption, ecological awareness, environmental responsibility, green consumption, and environmentally sensitive consumption (Gupta & Agrawal, 2017). Responsible consumption reflects the responsibility to recognize ecological imperatives and to personally limit consumption. The ecological imperative here is any species and its interaction with both the physical and biological environment that it needs to sustain its life. An example of this is that humans, as a species, need water, air, food, and physical space. Therefore, the ecological imperative is abused as the depletion of resources and the occurrence of pollution pose a threat to biological processes. Consequently, responsible consumption involves using resources efficiently and wisely for the human population (Fisk, 1973: 24). Thus, with responsible consumption behaviour, consumers can become "*eco-citizens*" (Marchand & Walker, 2008: 1164).

Managing natural resources efficiently, eliminating toxic pollutants and wastes, encouraging businesses and consumers to reduce waste and recycle, changing consumption habits, and directing energy sources to sustainable ones are important for responsible consumption and production (UN, 2024). Imposing consumption taxes on luxury products, removing flush toilets, organising recycling processes by collecting garbage, and developing advertisements to prevent excessive consumption

are forms of responsible consumption (Fisk, 1973: 25). Behaviors associated with responsible consumption and production include developing solutions for sustainable production and consumption model, transitioning to circular economy, reducing waste, supporting sustainable purchasing practices, making conscious purchase, purchasing from local and sustainable sources, reducing plastic consumption, developing recyclable, repairable, reusable, and long-lasting products, and designing and purchasing products considering their environmental and social impacts (UN, 2024). Personal behaviours for responsible consumption can be as follows (Marchand & Walker, 2008: 1164):

- **Abstention:** Less consumption or avoidance of consumption,
- **Attitude:** Negative view of non-essential consumption,
- **Awareness:** Considering ecological quality in the selection of products,
- **Alternative:** Identifying alternatives that can replace traditional consumption.

Rising consumption levels and consumption patterns bring environmental and social challenges to the forefront. Therefore, responsible consumption and production necessitate practices aligned with sustainability, promoting sustainable development while reducing the ecological footprint (Dwarapureddi et al., 2021). For example, agriculture stands as the world's largest water consumer,with irrigation demands accounting for 70% of freshwater usage. Accordingly, it is urgent to reduce the ecological footprint for sustainable development, responsible consumption and production (UNDP, 2024). The water footprint, derived from the ecological footprint, differs in its focus. While the ecological footprint indicates the area required for human survival, encompassing productive land and water ecosystems, the water footprint specifically refers to the eater needed to sustain the population (Hoekstra & Chapagain, 2007).

3. Water Footprint

The concept of water footprint emerged in 2002 with Hoekstra's idea that water use should be considered in the supply chain process (Hoekstra et al., 2009). Later, upon the request of the Water Footprint Network, Hoekstra et al., (2009) published "*Water Footprint Manual: State of the Art 2009*", which is a guide to the concept, methods, evaluation and calculation of water footprint. (Hoekstra et al., 2011) and thus the water footprint has been comprehensively introduced to the literature. In addition, pioneering studies on water footprint were conducted by authors named by Chapagain and Hoekstra, (2004), Hoekstra and Chapagain (2007), Hoekstra (2008), Gerbens-Leenes et. al. (2009), Mekonnen and Hoekstra (2010), Hoekstra and Mekonnen (2012), Aldaya et al. (2012), Chapagain and Tickner (2012), Vanham and Bidoglio (2013) and Hoekstra (2019).

According to Hoekstra (2008), water footprint is an indicator related to water use in a direct and indirect way. Water use here refers to the measurement of the amount of water consumed and/or polluted. He explained that the water footprint is more than a number indicating the total amount of water used; water footprint mostly reflects where, when and how water is used. In addition, the author stated that water footprint can be measured for all economic sectors and producers such as product, activity, consumer group, public, business, private enterprise. Retailers, consumers, food industries and businesses that use a lot of water have a role as change actors in the water footprint. Therefore, these actors are assessed by both direct and indirect forms of water use (Hoekstra et al., 2009).

Water footprint is a direct or indirect expression of freshwater use used to examine consumer water use and producer water use in a product's supply chain and to address the sustainability, fairness and efficiency of water use (Hoekstra, 2019). Therefore, the water footprint includes an indicator of the direct and indirect water use of a producer and consumer (Aldaya et al., 2012). While direct water use in the water footprint refers to domestic water use, indirect water use reflects the water use needed in agricultural and industrial product production (Vanham & Bidoglio, 2013). Indirect water use also refers to the virtual water contained in commodities such as sugar, cotton or grains, which are subject to trading activity (Aldaya et al., 2012). Hoekstra (2008) also defined water footprint in terms of product, individual or community and business. The water footprint of a product refers to the total amount of clean water used during the production of the product and also the total amount of clean water obtained from different processes of the production chain. The water footprint of a community or an individual reflects the total amount of fresh water used directly or indirectly. The water footprint of the business is the direct and indirect water use during the supply chain of the business, in other words, as a result of its own activities. Consequently, the sum of the amount of fresh water used by the enterprise in the production of goods and services shows the water footprint of the enterprise (Aldaya et al., 2012). Water footprint is the most comprehensive indicator that measures people's water use and the water pollution caused by water consumption. Therefore, water footprint is not just the water flowing from the tap, the water flowing into the field or the visible water consumption, but also all internal, external, direct and indirect uses of water (suverimliliği, 2024).

Figure 2 shows that the vast majority of the global water footprint is determined by the consumption of agricultural products, especially food. In Figure 2, the water footprint level of various consumption classes such as agriculture and industrial products on a global scale is considered as internal and external footprint. According

to Figure 2, the total external water footprint of countries is 16% of the global total water footprint (Hoekstra & Chapagain, 2007: 41-43).

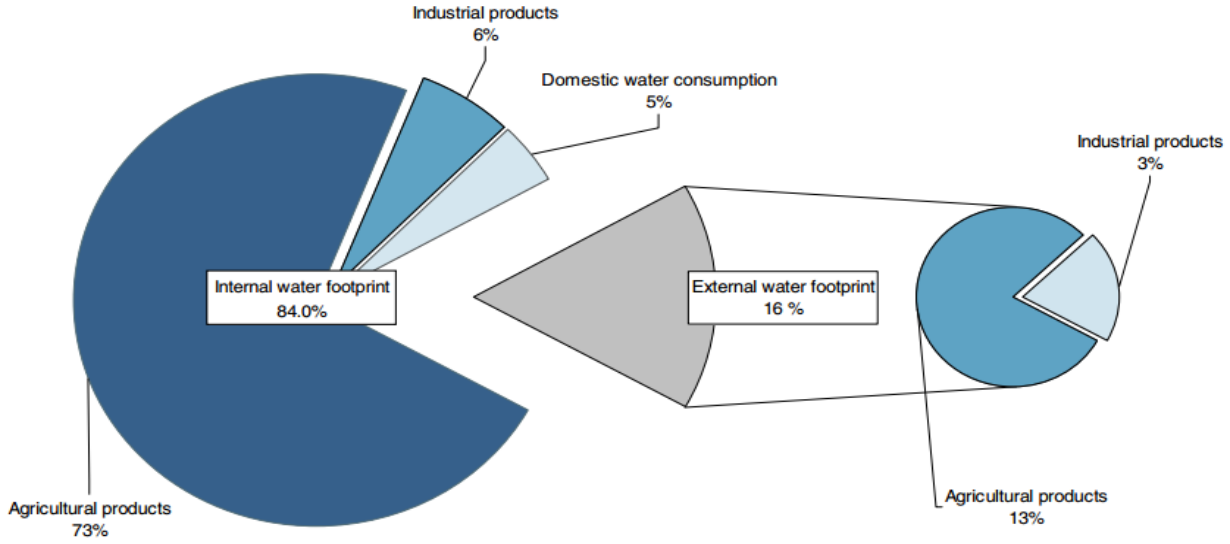

Figure 2. The impact of consumption classes on water footprint on a global scale

Source: Hoekstra and Chapagain (2007: 44)

Hoekstra et al. (2009) stated that the water footprint can be evaluated in four stages. These stages are given in Figure 3 respectively.

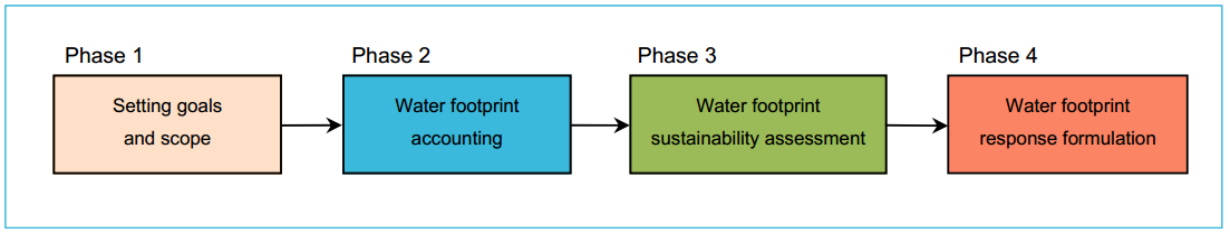

Figure 3. Evaluation of water footprint in four stages

Source: Hoekstra et al. (2009)

3.1. Components of Water Footprint

Water footprint refers to an indicator of water use different from the classical water withdrawal called water withdrawal and differs in three aspects. Firstly, evaporated water, in other words consumed water, indicates water footprint, while the return flow of water, in other words the use of water that is not consumed, indicates water withdrawal. Second, the water footprint measures the use of green and gray water, as well as blue water, which reflects water withdrawal. Third, water footprint includes both direct and indirect water use, while water withdrawals include only direct water use. In other words, water footprint shows the total water allocation of products, including pollution and water consumption during supply and production process (Hoekstra, 2008). Water footprint is the volumetric signature of the amount of water consumed by source and water pollution by type of pollution. Therefore, the components of the water footprint are expressed temporally and geographically (Hoekstra et al., 2009).

In Figure 4, components included in the water footprint are presented schematically by Hoekstra (2008). According to this figure, the author argued that the return flow of water withdrawal, i.e. the amount of water not intended for consumption, is not a component of the water footprint. Furthermore, the author stated that unlike water withdrawal, the water footprint also includes green and grey water and indirect water use.

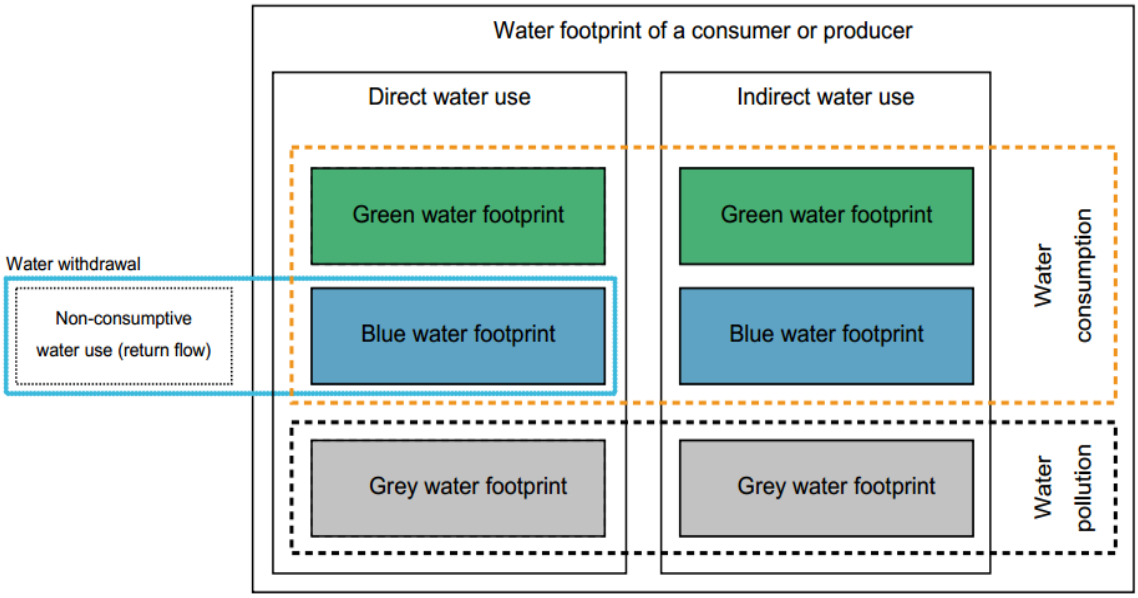

Figure 4. The components of a water footprint

Source: (Hoekstra, 2008: 12)

- **Blue water footprint:** It shows the amount of ground and surface water consumed in the production and supply chain of a product, in other words, the amount of water evaporated (Chapagain & Tickner, 2012; Hoekstra, 2008; Mekonnen & Hoekstra, 2010). The evaporation of water here refers to the loss of surface water in a basin as a result of water evaporating into a crop, returning to the sea or entering another basin (Hoekstra, 2008). The blue water footprint is smaller than the amount of water withdrawn, as some of the water is returned to surface water or to where it was withdrawn (Chapagain & Tickner, 2012: 565). Blue water withdrawn from groundwater, lakes and rivers (Rost et al., 2008) is used for domestic, industrial and agricultural irrigation purposes (Schyns et al., 2015). The most common use of blue water is irrigation (Rost et al., 2008). The use of blue water causes serious water scarcity and therefore paves the way for many environmental problems scarcity. The Ganges and Indus basins can be given as an example (Mekonnen & Hoekstra, 2010).

- **Green water footprint:** Falkenmark (1995) introduced green water for the first time and stated that green water is the sum of crop evaporation that occurs during the growth of a crop (As cited in Liu et al., 2009). The source of green water is moisture in the soil (Falkenmark & Rockström, 2006). It describes consumed rainwater (Chapagain & Tickner, 2012; Hoekstra, 2008; Mekonnen & Hoekstra, 2010). It also indicates the volume of soil moisture consumed by crops whose nutrient source is rain. (Chapagain & Tickner, 2012), i.e. the consumption of rainwater stored in the soil in the form of soil moisture (Hoekstra, 2008: 8). The green water footprint is the amount of water lost through evaporation during the growth of a plant (Chapagain & Tickner, 2012). Green water, which returns to the atmosphere through evaporation as a result of precipitation, is the main source of water for bioenergy production, timber, fibre, food and feed. Hence, green water, which is both a limited and critical resource, should be addressed in an important way in terms of food security, bioenergy potential and water scarcity (Schyns et al., 2019).

- **Grey water footprint:** It shows fresh water pollution. Thus, it indicates the amount of fresh water needed to absorb the pollutant load in the current environment (Chapagain & Tickner, 2012; Hoekstra, 2008; Mekonnen & Hoekstra, 2010). The grey water footprint shows how much water is needed to remove and dilute the harmful effects of pollutants in water. Moreover, blue water is not the only source of grey water; rain-fed agriculture and soil seepage also represent a grey water footprint (Chapagain & Tickner, 2012: 565-566).

Chapagain and Tickner (2012: 565) show the blue, green and grey water footprint components of the water footprint and water sharing in the hydrological cycle in Figure 5.

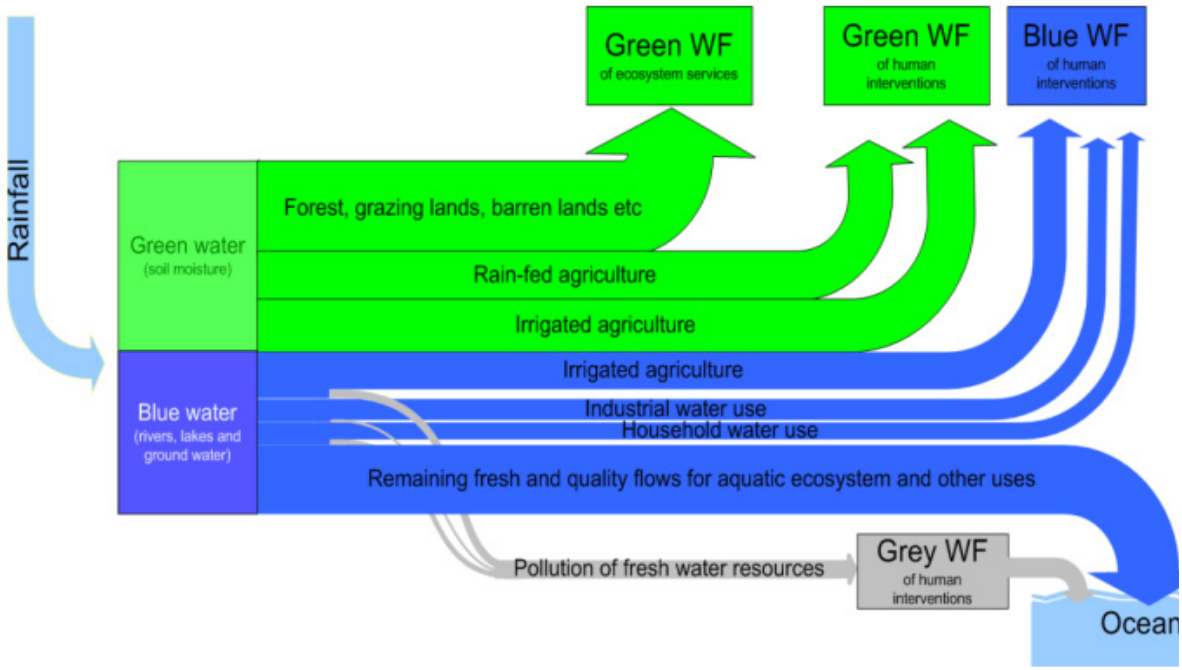

Figure 5. Components of water footprint and water partitioning

Source: Chapagain and Tickner (2012: 565)

Water footprints in a process are calculated as in Table 1. In calculating the grey water footprint (Hoekstra et al., 2009);

- *L*: *"the pollutant load in mass/time"*
- C_{max}: *"ambient water quality standard for that pollutant in mass/volume"*
- C_{nat}: *"its natural concentration in the receiving water body in mass/volume"*

Table 1. Calculating water footprints in a process

Water Footprint		Calculation
	Blue water footprint	BlueWaterEvaporation + BlueWaterIncorporation + LostReturnflow
	Green water footprint	GreenWaterEvaporation + GreenWaterIncorporation
	Grey water footprint	L÷(Cmax-Cnat)

Source: Hoekstra et al. (2009)

3.2. Virtual Water Concept in Relation to Water Footprint

Hoekstra and Chapagain (2007), who stated that countries can also have a water footprint, explained that the amount of water required in the production of goods and services to meet the needs of people living in the country is the water footprint of a country. They also explained that the country's water footprint has two parts: internal water footprint and external water footprint. Because they stated that all the products consumed in the country are produced not only in that country but also in other countries to meet the consumption needs of the

country. Therefore, they argued that the use of water is in two different ways, domestic and outside the borders of the country. They explained that the amount of water consumed from domestic water resources is the internal water footprint, while the amount of water consumed in the production of goods and services imported and consumed by people living in other countries is the external water footprint. It shows that water resources are taken from other countries for the production of products imported to the country and consumed in the country, not water resources for the country. Thus, the country's water footprint is externalized and the burden on its own waters is reduced. However, there will be more pressure on the water resources of other countries. As a reflection of this, the transferred virtual water is used in foreign trade activities related to agricultural products, which is increasingly adopted as a tool to protect the country's own resources and fulfil water security (Mekonnen & Hoekstra, 2010).

Virtual water was presented by Allan in the early 1990s as a solution to the problems related to water scarcity in the Middle East, and the situation of importing virtual water occurred. Thus, Allan suggested using virtual water imports, which come to the country along with food imports, as a method to relieve the existing pressure on domestic water resources, which can hardly be found. In this respect, in addition to internal water resources, virtual water import becomes an alternative water source and is considered as external water (Hoekstra & Chapagain, 2007). Virtual water, which has a close relationship with water footprint, is the amount of water used for the production of a good or service (Aldaya et al., 2010). Virtual water is a concept of water that is virtually embodied in any product. In other words, it is the water required in the production of a product. At the same time, concepts such as external water or embedded water can also be used for virtual water. External water here reflects virtual water imported by a country (Hoekstra, 2003: 13). The term virtual used in the concept of virtual water explains that a significant amount of the water used in the production of the product is not included in the product (Hoekstra, 2008: 10). Therefore, in addressing a country's water footprint, it is important to determine the virtual water flow entering and exiting the country. For this purpose, in measuring the country's water footprint, the use of domestic water resources should be taken as the starting point, and the virtual water flow leaving the country should be excluded and the virtual water flow entering the country should be included (Hoekstra & Chapagain, 2007). Virtual water flow occurs when water-intensive products are traded to another place or during the movement of products along a supply chain as in Figure 6 (Hoekstra, 2008: 10).

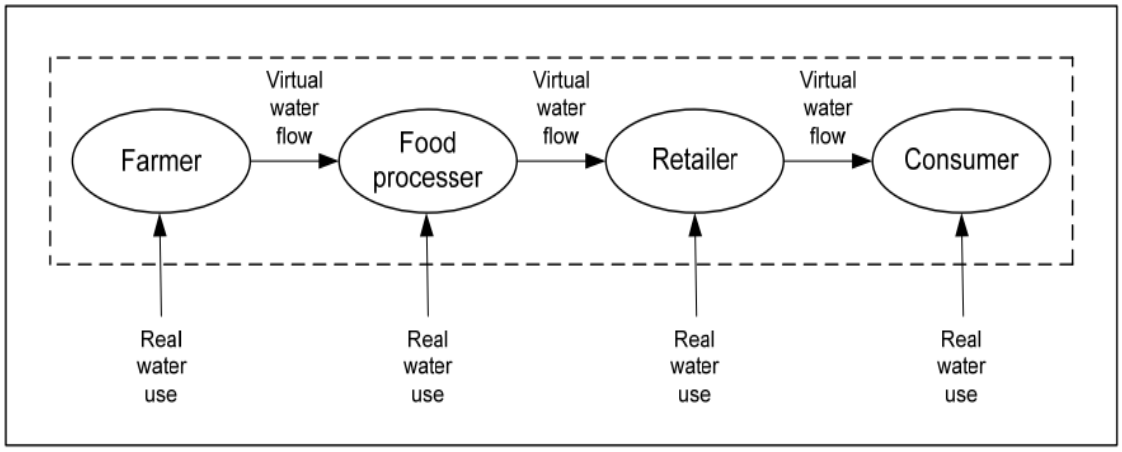

Figure 6. The virtual-water chain.

Source: (Hoekstra, 2008: 11)

Virtual water, which is the water inside the product and used in the production of an industrial or agricultural product (Hoekstra, 2003: 13), has been the subject of discussion in many countries about the problems related to virtual water in food production. Thus, discussions and studies about virtual water contribute to an increase in awareness of the impact of water scarcity on food security, and to understand the function of food trade in closing the water gap (Yang & Zehnder, 2007). The fact that 1-2 m3 of water is needed in the production of one kilogram of grain is an example of the importance of water in food production (Hoekstra, 2003: 13).

Virtual water trade is the volume of water in traded products (Aldaya et al., 2010). Exporting a water-intensive product to another country means exporting water in a virtual form. Thus, support is provided to other countries regarding their water needs. Because real water trade between water-rich and poor countries is often impossible due to distance and some costs. However, trade in a water-intensive product is more realistic and takes place as virtual water trade. Therefore, it is more attractive for a country experiencing water scarcity to import products that require intensive water use, rather than producing them domestically, and it also contributes to water security. Countries with water-rich can benefit by producing and exporting products that require intensive water use (Yang & Zehnder, 2007).

3.3. Literature Review on Water Footprint

Studies on water footprint are relatively new and developing in the literature, especially in the context of responsible consumption and production and marketing. When the literature on water footprint is examined, it can be said that studies are mostly concentrated on the production of agricultural products and consumption of food products. In addition, there are studies in the literature that measure consumers' water footprint awareness. These studies in the literature are given in Table 2, based on the author/s, year and results of the study. Current studies on water footprint are mentioned in Table 2.

Table 2. Studies on water footprint in the literature

Author/s of the study	Year of Study	Results of the Study
Chai et al.	2020	The study measured the blue water footprints of households living in China. It was determined that the blue water footprint per capita increased from 2012 to 2018, and urban households consuming more animal products had higher water consumption than rural households consuming more starchy products. Additionally, it has been found that there is a higher water consumption in clothing products in cold places and in aquatic products in coastal areas. In the study, it was also determined that the blue water footprint showed a positive relationship with the income variable.
Çamur et al.	2020	The authors examined the knowledge, attitudes and behaviors of university students in terms of water consumption. As a result of the study, they found that 51.5% of the students had heard about the water footprint before and 18% did not pay attention to their daily water consumption.
Gómez-Llanos et al.	2020	In their study, the authors measured both indirect and direct water consumption and perceptions of sustainable water consumption within the scope of the water footprint indicator in Spain. It was determined in the study that information about water footprint has a positive effect on responsible behavior towards water consumption.
Temiz et al.	2022	Students studying in the 3rd grade in primary education were given two hours of both theoretical and practical training on water footprint. At the end of the study, it was revealed that the students had knowledge about water saving, but they heard about the water footprint for the first time.
Tuninetti et al.	2022	It has been revealed that the implementation of the diet, which is both healthy and sustainable, recommended by the EAT-Lancet Commission, will reduce the water footprint by 12% worldwide. However, it has been determined that with the implementation of this diet, the population will increase by 40% worldwide.
Chen et al.	2023	In their study, the authors developed three recycling scenarios for domestically produced cotton-containing T-shirts and examined the spatial water footprint in this scenario. The authors stated that if there is a decrease in the water footprint, the effect of this decrease will be felt more in places where water stress is very intense. They also stated that the spatial water footprint transparently shows the environmental impact of all stages of the product and will be an important element for the sustainability of supply chain management.
García-Herrero et al.	2023	They examined food consumption in the EU with both the blue water footprint and the AWARE method. The authors note that the impact of water footprint on food consumption increases by 30% across the full supply chain. Here, wine and chocolate products are at the top of the rankings. According to the two methods used in the study, it was determined that the products with the highest pressure and effect were almonds and cashews.
Güneş et al.	2023	In their study, the authors examined the water footprint on the example of materials used in products in two different patisseries in Konya. When plant and animal products are compared, it has been found that animal products have a higher water footprint. Additionally, it has been determined that the products with the highest water footprints are cocoa and chocolate-related products.
Nydrioti & Grigoropoulou	2023	The authors conducted a study on water footprint labeling on products, demographic factors and water sustainability in Greece. As a result of the study, it was understood that young consumers are not very aware of the environmental problems related to water. However, it was understood in the study that consumers prefer a numerical label about water consumption and are willing to pay more for sustainable water products than other products.
Rusu et al.	2023	The water footprint of the consumption of food products in Romania was measured in the study. As a result of the study, it was determined that cereals, milk, meat and dairy products had the most impact on water footprint.

Source: The table was created by the author based on the literature

4. Result and Discussion

Many objectives to be achieved for sustainable development may be related to water. However, decisions on how and at what level to utilise water resources are not only made by water managers (WWAP, 2009). Everyone who uses water and needs water should make decisions on how and at what level to use water resources and comply with these decisions. Because water is one of the most basic and indispensable resources for everyone.

Water is an important resource in sustaining life, food production, cleaning, clothing and many other sectors. At this point, the water footprint, which shows the amount of water use and pollution, concerns both governments, businesses, farmers and individual consumers. In particular, climate change and global warming, the importance of water and issues related to water scarcity are in a critical position on the agenda. In addition, as a result of migration, population growth, air pollution, soil pollution, unconscious production and consumption, unconscious and excessive use of water, water pollution and thus water footprint may occur. In this respect, all segments of the society are responsible for the water footprint. Water footprint has also found an important position in the context of responsible consumption and production. Through responsible consumption and production, production and consumption patterns based on sustainability are adopted by considering both current and future generations. Thus, with responsible consumption and production, natural resources can be used efficiently and fairly, more conscious consumption can be made, waste and wastage can be prevented, and a fair, poverty and hunger-free and decent quality lifestyle can be created for all segments of society. One of the critical solutions and behaviours available to governments, businesses and consumers for responsible consumption and production and thus sustainable development is the reduction of water footprint. More conscious use of water and prevention of water pollution are of great importance for both responsible consumption and production and sustainable development.

Although it is stated that agricultural production and irrigation have a very large share in the water footprint (Allan, 1993; Mekonnen & Hoekstra, 2010; Lovarelli et al., 2016; Vanham & Bidoglio, 2013), there is also a study (Ercin & Hoekstra, 2014) showing that the change in consumption patterns has an impact on achieving a sustainable level of water footprint with the scenarios developed for 2050. In addition to responsible production in water footprint, responsible consumption is important and effective. In responsible production and marketing efforts, businesses should adopt practices that reduce the water footprint, focus on recycling, reusability, alternative production resources that can replace water, production forms, and products that will create less waste in the environment and require less water. Additionally, consumers should consume more consciously, create less waste and wastage, purchase eco-friendly, recyclable, reusable and repairable products through responsible consumption. Water, being a scarce resource, can pose obstacles to sustainable development and sustainable marketing when not used efficiently and correctly. Hence, to promote sustainable development and marketing, awareness should be among both producers and consumers, and water-related policies and practices should be established and enhanced at the state level. Important stridess can be made in addressing the water footprint by adopting a holistic and interactive approach to water use.

When access to water and sanitation in the world is examined, more than 2.2 billion people cannot access water and more than 4.2 billion people cannot access sanitation (World Water Council, 2022). When the world's demand for water is examined, it is claimed that it will increase by 55% between 2000 and 2050. It is also estimated that water demand will increase from 3,500 km^3 to 5,425 km^3 (Islam & Karim, 2019). It has been revealed that Türkiye ‹s annual water consumption is 57 billion m^3, 77% of this water consumption is consumed for irrigation and 23% is consumed for drinking-use water and industrial water (DSI, 2023). It is predicted that after 2030, Türkiye 's annual usable water volume per capita will be less than 1.000 cubic meters. Since this value is between 1.700 ~ 1.000 m^3 according to the Falkenmark Indicator, which expresses water scarcity, it is understood that Türkiye is experiencing water shortage and water stress (The Republic of Türkiye Ministry of Agriculture and Forestry, 2023). A report measuring Türkiye's water footprint was prepared in 2014 in cooperation with WWF-Türkiye (World Wide Fund for Nature), The Republic of Türkiye Ministry of Agriculture and Forestry, Unilever and OMO. According to the report, Türkiye's total water footprint is 140 billion m^3/year, the water footprint of production is 139.6 billion m^3/year, and the water footprint of consumption is approximately 140.2 billion m^3/year. Agriculture has a share of 89%, domestic water use has a 7% share and industrial production has a 4% share in Türkiye's total water footprint. The amount of water footprint per person is 1.977 m^3/year. In terms of virtual water, daily water consumption per person is 5,416 liters. Therefore, the report predicts that Türkiye will have water shortage by 2030 (WWF, 2014). Pilevneli et al. (2023) estimated in their study that the period in which the impact of climate change on Türkiye's water capacity will be greatest will be between 2015 and 2040. The annual water footprint per capita in Türkiye is 1,519 m^3, in the European Union it is 1,750 m^3, and in the world it is 1,243 m^3 (Machinery Specialized Organized Industrial Zone, 2023). When the data on water demand, water scarcity and water consumption in the literature are examined, the demand for water increases in future scenarios and as a result, water scarcity comes to the fore. This situation exists both in the world and in Turkey. The agricultural sector has a significant share in the water footprint. As seen with all these data, it is suggested that a responsible production perspective should be adopted in agricultural irrigation and production, water should be used economically, and alternative sources other than

water should be used in production. In addition, with responsible consumption, the water footprint in personal water use should be reduced by reducing domestic water use and consumers should adopt responsible consumption in this direction.

The water footprint has emerged as a contemporary issue in marketing. There is pressing need to expand research on water footprint with a focus on responsible consumption and production. Studies assessingthe water footprint of both businesses and consumers are essential. Marketing communication strategies should be employed to raise consumer awareness about water footprint and encourage more responsible consumption habits. Businesses can incorporate information about the water footprint of their products into their marketing efforts, including labels on product packaging. Demonstrating commitment to responsible production practices should also be emphasized in marketing communications and products. Consumers need to be educated about responsible consumption and water footprint, promoting reduced water usage and the purchase of eco-friendly products. Effective marketing communication efforts should highlight products produces with a responsible perspective, eco-friendly products, and those with reduced water footprints, and marketing mix that will enable consumers to purchase these products should be emphasized.

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