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THE NEED TO MONITOR THE WATER FOOTPRINT UNDER THE CONDITIONS OF SMART DEVELOPMENT APPLICATION

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Abstract

In this paper we set out to analyze the need to monitor the "water footprint", starting from the fact that water is an indispensable resource for the development of life, and its lack is one of the biggest problems facing the world today, one of the biggest concerns and, at the same time, one of the biggest challenges. Water scarcity is a risk both for the economy and for communities and ecosystems, being influenced by climate change, but also by the irresponsible behaviour of people. Finding solutions to protect this resource is a concern of the modern world in trying to protect sustainable development. The research methodology involved the analysis of the literature, data collection and processing, formulating opinions and conclusions on how to apply smart development principles to find viable solutions to reduce the "water footprint".

Key words: *water footprint, smart development, climate changes, social responsibility*

INTRODUCTION

Sustainable development, smart development, sustainable economy are increasingly used terms in the conditions in which humanity faces serious environmental problems, which although they have been discussed over time and which have been the subject of long debates in the attempt to raise awareness of the danger that threatens Planet Earth, have long remained at the stage of discussion or have been postponed in the hope that future generations will find solutions.

The risk of environmental degradation, depletion of resources, and impoverishment of the planet has existed and will continue to exist, and the postponement of measures to combat these dangers does nothing but confiscate the possibility of future generations to benefit from the right to enjoy what nature offers us all.

Under these conditions, issues related to the "carbon footprint" are discussed, and more and more often we talk about the "water footprint", given that water, the vital liquid for humanity, is an inexhaustible resource, it is an insufficient resource, but obligatory for the continuation of life on Earth. Climate change and population growth contribute to increasing pressure on water resources, especially freshwater resources, the lack of which affects a significant part of humanity.

If the "carbon footprint" is the amount of carbon dioxide produced by each person as a result of their activities, the "water footprint" is an environmental indicator that reflects the amount of water needed to carry out these activities on which our daily lives depend. And this includes not only the visible water consumption, but also the water consumption necessary to obtain the food and non-food products necessary for each person. Therefore, this "water footprint" refers to the volume of fresh water that is needed to obtain a product and which includes in addition to the volume consumed and the volume of wastewater that occurs throughout the production chain [4].

The concept of "water footprint" was first used in 2002 as an environmental indicator to express water consumption and to complement other indicators used up to that date, but which only quantified production issues.

This new indicator provided information not only on the volume of water consumed, but also on the volume of water resulting from the production activity, the location of consumption, being thus an explicit indicator regarding the geography of this consumption [5] and being able to influence decisions related to existence, availability and mode use of existing resources worldwide.

In this context we can talk about the role of monitoring the "water footprint" and its role in smart development, which in turn contributes to smart growth, first regionally and then globally.

Intelligent development is directly linked to the application of innovations that offer intelligent solutions that are economically efficient, friendly to the environment and human health, both physical and mental, which can provide them with the comfort they need as their consumers [11]. Intelligent development is thus based on the use of information, on the use of technologies, on the efficient communication between all the factors involved in any process [9]. In this way, regional development policies can in turn influence this intelligent development, taking into account the different restrictive factors [2].

MATERIALS AND METHODS

In order to determine the need to monitor the "water footprint", in this paper we aimed to identify from the bibliographic study of scientific papers that analyze this topic to identify ways to reduce water consumption. Various databases were consulted that allowed us to collect data, process them and interpret them using graphs. The evolution of the analyzed indicators was achieved by using indices with a fixed base, determined as follows:

$IFB = (x_n/x_1) \times 100$ according to [1]

where:
x = variable subject to the study;
n = 1,2,3 ... n, chronological series

Based on the analyzed data, conclusions were formulated regarding the topic of the paper.

RESULTS AND DISCUSSIONS

Marc Buckley, starting from the fact that "water is the most valuable resource we have" [8] showed that water is not only an important resource, but also a cross-cutting resource given that it directly or indirectly influences the objectives rural development proposed through public policies.

Hoekstra A. Y. [6] affirmed since 2008 that there are 3 categories of water footprints that differ depending on its origin and how to use it in the manufacture of a product, thus proposing a "network of water footprints". We can thus speak of a "green water footprint" which is represented both by water from precipitation, but also by evaporated water and which can be used to obtain production. There may then be a "blue water footprint" resulting from surface water and groundwater, either natural or artificial, and there may also be a "grey water footprint" which represents "the volume of freshwater that is required to assimilate the load of pollutants given natural background concentrations and existing ambient water quality standards" [7].

Viewed from the point of view of the place of consumption, the literature highlights an "internal footprint" which is given by the amount of water consumed in a country for the production of goods and services that are consumed by the population of that country and a footprint external water supply "which is represented by the water consumption necessary to obtain goods and services imported by the respective country.

There is also water use for import, virtual water import and virtual water for export, virtual water for re-export, elements that underlie the determination of the "water footprint" and a virtual water budget. The relationship between these categories of elements is presented in Figure 1.

In order to be able to move to measures to reduce the consumption of fresh water, this consumption must first be determined. Existing methods allow this, so that for each product, category of products or goods can be established "water footprint".

Of the total water consumed, over 90% is hidden in food and other consumer goods, in

the energy used or in the services we use, so that the average "water footprint" is about 3,000 liters/day/capita.

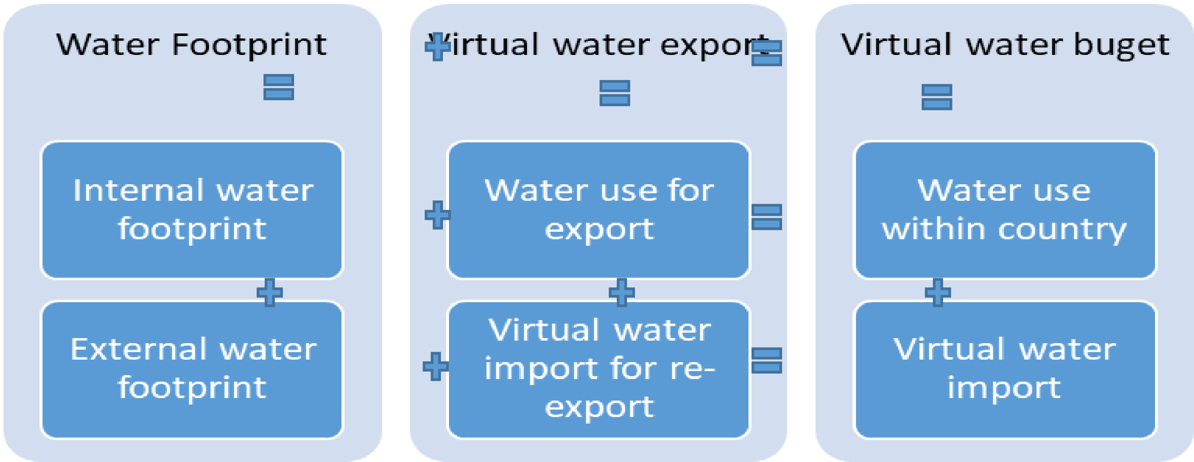

Fig. 1. National water accounting method
Source: Own determination.

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Obtaining food, and therefore agriculture as an important branch of the economy [12], is one of the most important consumers of water. This means that obtaining agricultural production is in turn a large consumer of water. The processing and marketing processes are also water consuming.

Obtaining a single kilogram of cereal requires a consumption of 1,644 liters of water [3]. According to the calculations, the production of one kilogram of meat requires a consumption of 51,779 liters of water for horse meat, 15,415 liters of water in the case of beef, over 8,700 liters of water for obtaining goat and sheep meat, almost 6,000 liters of water in the case pork and over 4,000 liters of water for 1 kg of chicken.

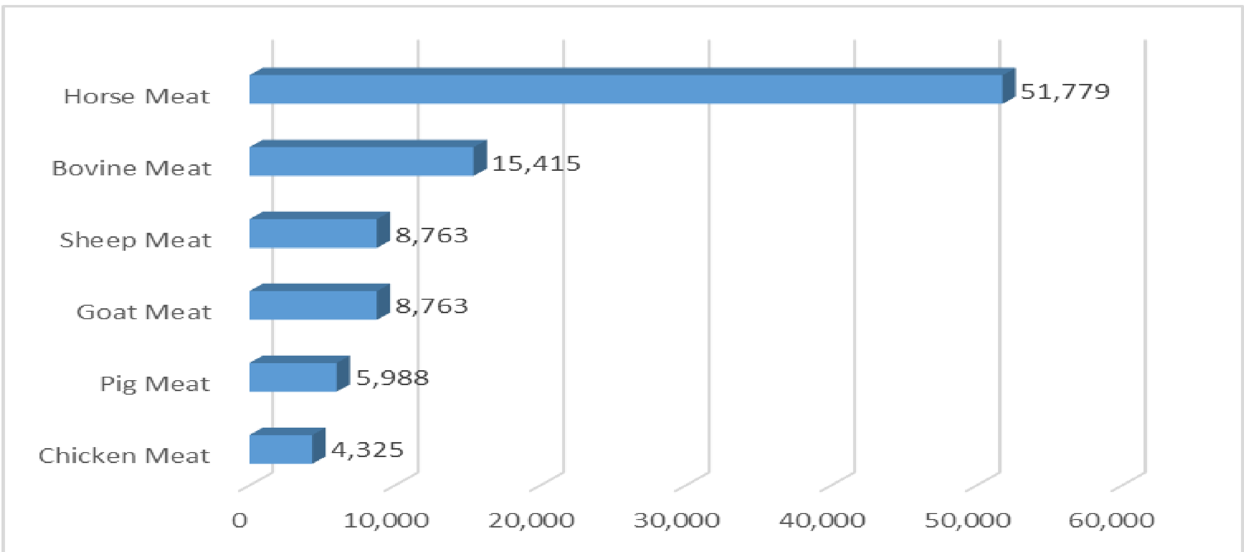

Fig. 2. Water consumption (in liters) required to obtain one kg of meat for different species
Source: Own determination [3].

The production of various other foods requires a high consumption of fresh water to obtain a single kg of product (5,677 liters for 1 kg of ham, 1,020 liters for 1 kg of milk) (Figure 3).

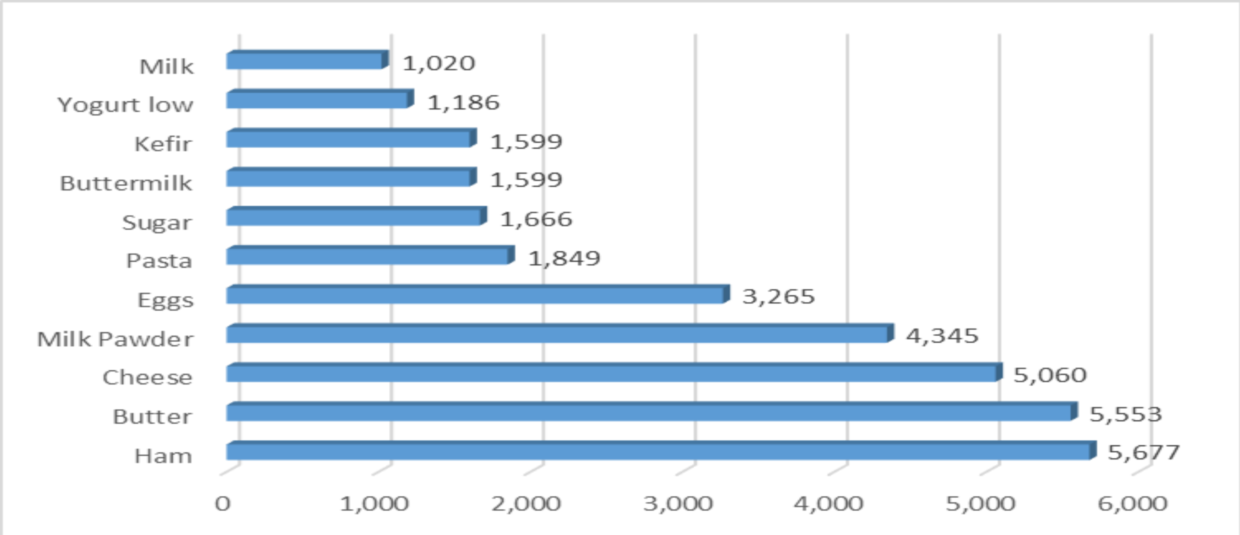

Fig. 3. Water consumption (in liters) required to obtain one kg of one kilogram of product
Source: Own determination [3].

It is therefore found that the "water footprint" is the larger the more complex the technological process. Therefore, for example, switching to a healthier diet would also be an advantage in terms of resource consumption.
A United Nations study shows that by 2030 the world's population will grow from 7 billion (2020) to 8.5 billion and reach nearly 10 billion by 2050 [13].

Given the limitation of the "water footprint" to the existing one at this time, there would be an exponential increase in water consumption from 21 trillion litres to over 29.1 trillion litres, which shows that an increasing part of the population will face with lack of water (Figure 4).

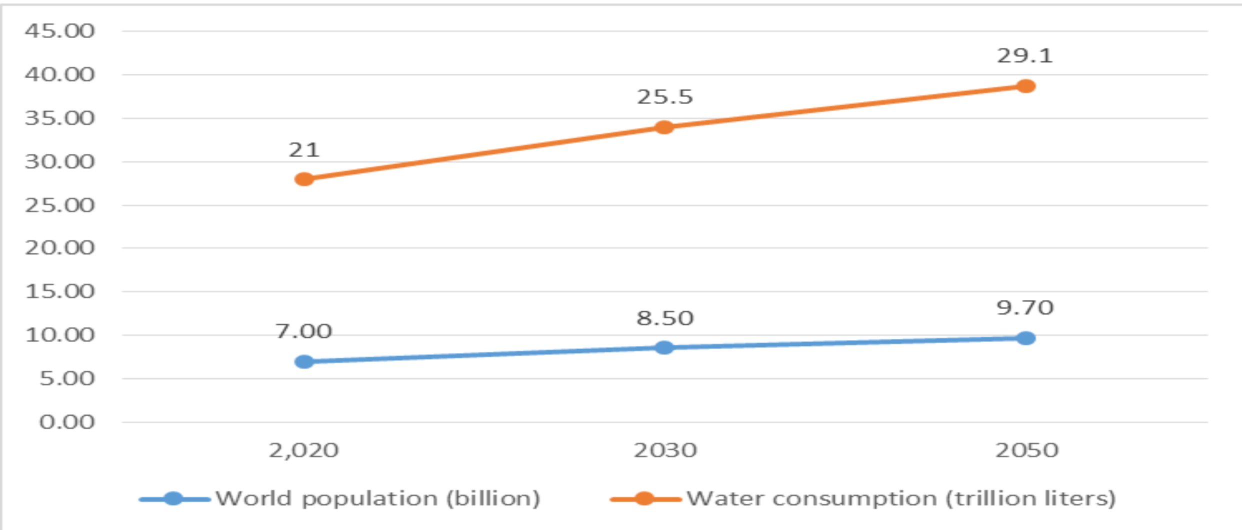

Fig. 4. Population evolution and water consumption
Source: Own determination [13].

Starting from the water consumption specific to each product, we find that, for example, the food of a single person in a single day involves a consumption of over 5,000 liters of water (Table 1).

Table 1. Water footprint, in liters, to ensure a person's food / day

	Food	**Water consumption (liters)**
Breakfast	Milk with cereals - 250 ml of milk - 30 gr cereal	**304** - 255 - 49
Lunch	Hamburger + 1 drink - 1 little bread - 2 slices of tomatoes - 1 chicken patty - 1 slice of cheese - 1 lettuce leaf - 1 drink	**1,050** - 85 - 12 - 737 - 90 - 1 - 125
Diner	Steak + potatoes + 1 salad - 1 beef steak (250 gr) - 1 potato - 1 salad	**3,850** - 3,495 - 105 - 250
Water footprint		**5,204**

Source: Own determination.

The solutions that exist, however, require the use of new technologies, educating the population, reducing the negative effects of pollution, etc. We find that there is a direct link between smart development and water footprint. Renewable energy production, for example, means not only a reduction in the consumption of natural resources, but at the same time a reduction in water consumption and the application of circular economy criteria, which although still confused with many barriers can be supported by its own advantages [10].

Regarding the producing companies, by reducing the "water footprint", by applying water conservation programs, they will be able to reduce their costs, simultaneously with the contribution they will bring to reducing pollution and increasing environmental sustainability. However, water conservation is also possible in household consumption, the use of "gray water" in homes or office buildings, hotels, etc. represent possible solutions.

In agriculture, "gray water" can also be used or water use solutions can be used to reduce the volume subjected to evaporation; hydroponic crops that benefit from low water consumption can be promoted; the system of so-called green sponges, etc. can be used.

Reducing consumption and waste, educating consumers, implementing innovative technologies, using renewable energy are solutions that can be applied today and will contribute to both reducing climate change and financial benefits for all those involved in this complex process of saving.

CONCLUSIONS

In conclusion, the water footprint is an environmental indicator that tracks the pressure that people exert on fresh water consumption and that reflects the relationship between use, consumption and how to manage it. Knowing this footprint will allow the identification of water use patterns, both at the level of each platform and at national and global level.

In this way, a frame of reference can be created through which economic activities can become more efficient, smarter, more environmentally friendly, more sustainable. At the individual level, the visualization of the water footprint will be able to contribute to the awareness of the fact that there is a need for a reduction of water consumption, of a rational use of it, but also regarding the importance that water has in our life.

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