From the BCFN's Double Pyramid to Virtual Water in the Production of Pasta Barilla

Luca Ruini, Laura Campra, Carlo Alberto Pratesi, Ludovica Principato, Massimo Marino and Sonia Pignatelli

Abstract We realize that water is a resource only when it becomes scarce. Until now, the issue seemed to interest only the least fortunate countries in the world, but this could all change: firstly because "high-quality" water—non-polluted freshwater—represents only a small part of the planet's reserves and secondly because of the increasing demand for water due to both the growing world population and more widespread wealth, which spurs more people in more countries to use (and waste) more water. Water use should be considered in both "real" terms (calculating the amount of water used for bathing, cooking, cleaning, etc.) and "virtual" terms (i.e., water footprint), estimating the total amount of water used in the entire life cycle of any product of service.

We realize that water is a resource only when it becomes scarce (Hanemann 2005). Until now, the issue seemed to interest only the least fortunate countries in the world, but this could all change: firstly because "high-quality" water—non-polluted freshwater—represents only a small part of the planet's reserves and secondly because of the increasing demand for water due to both the growing world population and more widespread wealth, which spurs more people in more countries to use (and waste) more water. Water use should be considered in both "real" terms (calculating the amount of water used for bathing, cooking, cleaning, etc.) and "virtual" terms (i.e., water footprint), estimating the total amount of water used in the entire life cycle of any product of service. It has been proven that agriculture is the phase in which the largest amount of water is used. By changing our diet—e.g., by eating more fruits, vegetables, and grains, while limiting animal protein—we could reduce our "virtual water" consumption, perhaps significantly (Hoekstra 2008).

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Therefore, if demand rises and supplies decrease—also due to pollution and climate change—the value of water is bound to increase, and the current inequalities between water-rich and water-poor populations will generate further conflicts. We know how control over oil reserves has sparked interests and fueled dramatic feuds, and wars over water could be even worse. Because, after all, we can survive without oil but not without water. According to Tony Allan, the fact that the Middle East is able to import food from countries that do not suffer from water scarcity has avoided conflicts for many years. Thus, virtual water can bring balance to shortages in dry countries, and consequently foster peace and stability in areas that would otherwise be engaged in water wars.[1]

Only 2.5 % of the world's water resources are available for human consumption, and 85 % of that share is used in agriculture. This is the reason why we all need to make an effort to foster a more sensible use of water, both in agriculture and in our daily lives, by choosing a diet with a lower environmental impact.

Indeed, according to a recent study,[2] if we persevere in producing and consuming food in the same way we are doing now, in the long run, we will cause serious food crises in various regions of the world. In other words, our dietary mistakes can cause us health problems, but can also determine noteworthy impacts on the environment (International Water Management Institute 2007).

1 The Barilla Center for Food and Nutrition's Double Water Pyramid

Barilla Center FOR FOOD & NUTRITION

Spurred by this awareness of the impacts that food choices can have on the environment, in 2010, the Barilla Center for Food and Nutrition (BCFN) developed the Double Food–Environmental Pyramid model: a tool that compares the nutritional aspect of foods with their environmental impact.

The first pyramid represents the different food groups according to the principles of the traditional Mediterranean diet: At the base, there are fruits and vegetables, which are low in calories and high in nutrition (vitamins, minerals, and water) and

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[1] Allan J.A. (2003), "Virtual water eliminates water wars? A case study from the Middle East", in Hoekstra A.Y. (editor), *Virtual water trade,* Delft, UNESCO-IHE, pp. 137–145. Allan J.A. (2011), "Virtual Water: Tackling the threat to our planet's more precious resource". London, New York: I.B Tauris.

[2] Molden D. (2007), *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture*, Earthscan.

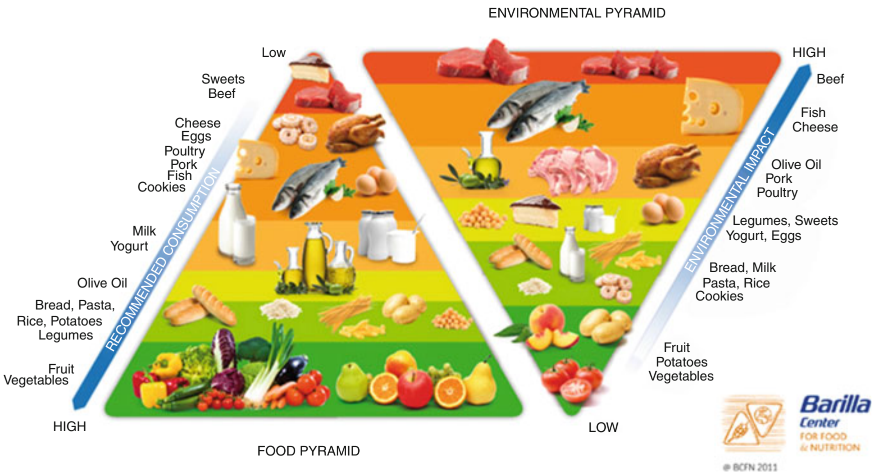


Fig. 1 The double food–environment pyramid. *Source* BCFN (2011a, b)

protective compounds, such as fibers. On the following levels of the pyramid, there are the other food groups with increasingly high calorie content, which are a staple of the North American diet although they should be eaten less often.

The environmental pyramid was created using data made available by scientific literature on the estimated environmental impact of each type of food, evaluating its whole life cycle assessment (LCA). This method evaluates a certain food's environmental impact by analyzing the entire supply chain, from raw matters to final product, including the management of any waste produced. The evaluation produces three quantitative indicators: ecological footprint (a measure of our Earth's ability to regenerate the resources employed), carbon footprint (the amount of greenhouse gas emissions produced), and water footprint (the amount of water resources used).

As shown in Fig. 1, the double pyramid points out that the foods having the highest impact on the environment are also the ones that we should eat less often (e.g., red meat), while the foods we should base our diet on (e.g., fruits and vegetables) have a lower environmental impact.

Although the BCFN's environmental pyramid was designed considering foods' ecological footprint, it could also take into consideration the water footprint.

Based on this indicator, a "water pyramid" could be placed next to the popular food pyramid, showing the relationship between environmental impact—in terms of water consumption—and recommended intake for each food group.

Box: The Barilla Center for Food and Nutrition

The BCFN analyzes data and suggests solutions with a multidisciplinary approach, with the goal of furthering knowledge about the global issues related to food and nutrition. Founded in 2009, the BCFN is a sounding board for the current needs of society and a hub of skills and experiences from around the world, thus fostering a constant and open dialog.

The complexity of the phenomena it investigates has led it to embrace a method that goes beyond the boundaries of single subjects. Thus, the issues it focuses on have been divided into four broad areas: food for sustainable growth; food and health; food for everyone; and food as culture.

The BCFN's research interests include science, the environment, culture, and economics. Within these fields, the BCFN conducts in-depth studies on relevant issues and offers suggestions on how to face food challenges of the future. Its activities are led by an Advisory Board made up of experts in complimentary fields, who suggest, analyze, and develop certain themes, and subsequently follow up with practical recommendations. The board currently includes, among others, Umberto Veronesi (oncologist), Gabriele Riccardi (nutritionist), Camillo Ricordi (immunologist), Claude Fischler (sociologist), Barbara Buchner (climate and environment expert), and Riccardo Valentini (agriculture, climate and environment expert).

The BCFN organizes events and presentations for public institutions and civil society organizations, such as the International Forum on Food and Nutrition, an important event for the leading figures in the field. The sixth edition ended in December 2014.

As there are no public data on the water footprint of fish, this food was not included in the graphical representation of the water pyramid. However, we can note it would have been important to consider both the amount of gray water used for fishing and industrial processing, and the amount used to grow food for aquaculture (fish farming). In any case, fish intake should be limited for reasons relating to the conservation of endangered species (yellowfin tuna, Atlantic bluefin tuna, swordfish, shark, etc.), regardless of virtual water consumption.

The outcome is an inverted pyramid in which different food groups are sorted by environmental impact in terms of water footprint: On top, there are the higher-impact foods and on the bottom the lower-impact ones.

In particular, we can note that—like in the ecological footprint model—red meat yields the highest water footprint, while fruits, vegetables, and grains have a considerably smaller effect.

By setting the food pyramid and the water pyramid next to each other (Fig. 2), we can see that most of the foods that nutritionists advise us to eat more often also have the smallest environmental impact in terms of water consumption. Vice versa, most of the foods we are supposed to limit also yield a high water footprint.

Therefore, if different food groups have different impacts on the world's water resources, what is the effect of our dietary habits on the environment?

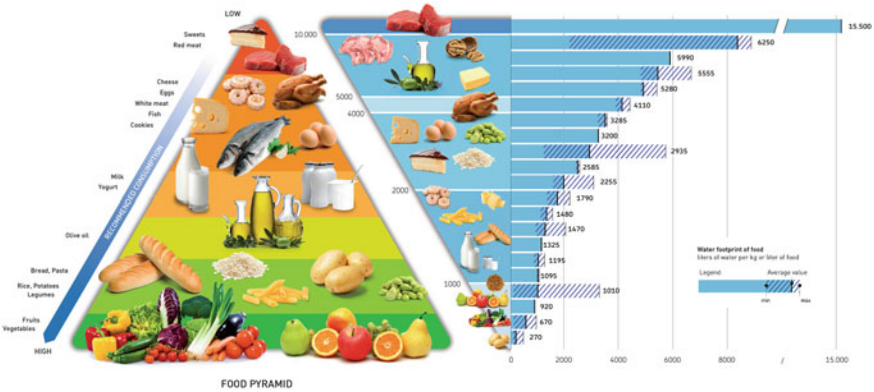


Fig. 2 The double food–water pyramid. *Source* BCFN (2012)

Box: The Importance of a "Water Economy"
Given the current demographic and economic trends, the BCFN has pinpointed the management of water resources as one of the world's greatest global challenges. Its position paper *Water Economy*, published in 2011, highlighted all the issues related to "high-quality" water, i.e., unpolluted freshwater, which represents only a very small part of the available water reserves and is a precious resource that must be managed with the utmost care. The world population growth and the level of wealth achieved in many countries drive people to use (and waste) more and more water, entailing the need to increase water resources.

With this increase in demand and decrease in availability, the economic value of water is bound to grow over time, causing imbalances that could lead to regional conflicts, perhaps even more serious and brutal than those for oil. Thus, we need to make a joint effort to promote a more sensible use of water, especially in agriculture and in our daily lives, choosing a sustainable food regimen, such as the traditional Mediterranean diet.

An individual uses an average of 2–5 L of water a day for drinking, while his or her daily consumption of virtual water embedded in food ranges from about 1500–2600 L for vegetarians to about 4000–5400 L for those following a meat-rich diet.

To better understand these differences, the BCFN detailed two different (but equally nutritionally balanced) daily menus, calculating their impact in terms of water consumption (as well as soil consumption and greenhouse gas emissions). The first menu is coherent with a diet rich in proteins from plant sources and low in animal fat, while the second one includes red meat, albeit in limited quantities. Comparing the water footprint of the two menus clearly shows that even a limited

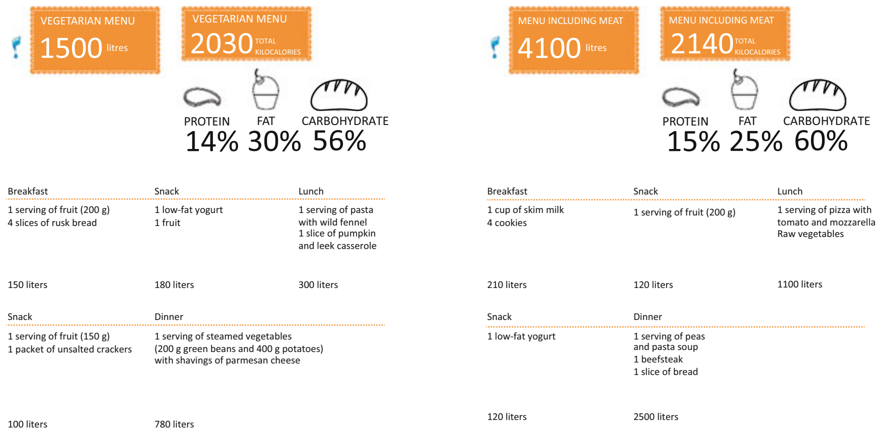


Fig. 3 A sample vegetarian menu and one including one meat dish, with their respective environmental impacts and water footprints. *Source Doppia piramide*, BCFN (2012)

intake of animal products, like dairy and meat, causes the consumption of water resources to nearly treble.

Indeed, milk and meat have a greater virtual water content than fruits and vegetables, due to the high consumption of agricultural products used to feed farm animals with the goal of transforming them into sources of food. Animals raised on pasture do not pose the same problems, as raising them does not require large amounts of high-energy foods such as corn.

These examples clearly show that changes in individual eating habits can have a very significant impact on the availability of water resources. Suffice it to say that if everyone on the planet adopted the average Western diet, which is characterized by high intakes of meat, we would need 75 % more water than what is currently used in the world to produce food.[3]

While fifty years ago the global population's size and lifestyle determined lower levels of water consumption, today the competition for increasingly scarce water resources has become much more intense: Many basins are now unable to satisfy the local demand for water, and others have been completely drained. In perspective, the water shortage will be a constraint on food production for millions of people, forcing them to import food from other countries (Fig. 3).

[3]Zimmer D. and Renault D. (2003), "Virtual Water in Food Production and Global Trade: Review of Methodological Issues and Preliminary Results", Hoekstra A.Y. (editor), *Virtual Water Trade: Proceedings of the International Expert Meeting on Virtual Water Trade,* Value of Water Research Report Series n. 12, Delft, UNESCO-IHE, Institute for Water Education.

The situation clearly requires a drastic turnaround, in which the responsibility of institutions and businesses (both in agriculture and the industry) must be bolstered by citizens' personal commitment to contribute to the progressive reduction of consumption and waste.

This could be achieved by simply improving our eating habits, choosing diets that are healthier for us and help significantly reduce our water footprint. In order to educate people on this issue, the Double Pyramid model was selected for a presentation at the Village of Solutions during the Sixth World Water Forum (see "The Double Water Pyramid at the Village of Solutions during the 2012 World Water Forum").

But does eating in a healthy and sustainable way cost more?

According to the results published by the BCFN in the third edition of the *Double Pyramid* report, choosing a diet that is nutritionally balanced and environmentally sustainable does not necessarily entail an additional expense for the consumer: Indeed, in some cases, there might be added savings.

In Italy, for example, the information provided by the Ministry of Economic Development's Price Observatory has allowed the BCFN to determine that the weekly cost of food for someone cutting back on meat in favor of fruit, vegetables, and grains can decrease by as much as 10 %. However, this is not true for all countries; for example, in the United States, a diet rich in animal protein is cheaper, and the data regarding France and the United Kingdom are conflicting, with some studies coming up with higher and others with lower estimates.

Box: The Double Water Pyramid at the Village of Solutions During the 2012 World Water Forum

In March 2012, the sixth World Water Forum—the largest global conference on water promoted by the World Water Council and the International Forum Committee—was organized in Marseille. The event developed through the work of various committees, which addressed and proposed solutions for 12 global priorities, including the need to ensure the world population's health and well-being and the implementation of sustainable economic development that allows the planet to remain "blue." The aim was to foster dialog on these issues and to suggest solutions that may be considered by international policy makers.

For the debate on water economy and the management of water resources, the World Water Forum Committee selected the BCFN's Double Food-Environment Pyramid and Water Pyramid as one of the most effective ideas among the many proposals received; the models were showcased in a dedicated space called "Village of Solutions." The concept underlying the double pyramids was also presented in the Agora of the Village, gaining great response from both the general public and experts (World Water Forum 2012).

1.1 Barilla's Efforts for Its Products' Sustainability Certification, and for the Reduction of Water Consumption in Its Facilities

So far, we have seen the activities of the Barilla Center for Food and Nutrition as a think tank and independent research center. In this second part of the chapter, we will analyze the steps taken by Barilla itself to streamline and reduce water consumption at the company's pasta factories and bakeries, and along the products' entire life cycle, also in order to reliably estimate their water footprint.

Since 2000, the company has been conducting LCAs on its products, with the aim of improving their environmental performance year after year. These analyses follow objective procedures for the evaluation of energy and environmental impacts related to a process or activity, carried out by identifying the energy and materials used and any waste released into the environment. The assessment encompasses the entire life cycle of the process or activity, including extraction and processing of raw materials, manufacturing, transportation, distribution, use, reuse, recycling, and final disposal.

Since 2008, Barilla has begun to evaluate its products' water footprint, based on LCAs and on the calculation protocol developed by the Water Footprint Network.

In 2012, life cycle analyses covered over 53 % of Barilla's production (in terms of volume).

In February 2011, Barilla was the first private company in the food sector to certify a system for the calculation of products' environmental impact according to the guidelines provided by the Environmental Product Declaration (EPD®) International System.

The EPD® is a public document reporting a product's environmental impact over its whole life cycle, from the production of raw materials up to distribution and disposal, if applicable, once the product has exhausted its function.

The statement provides data on key environmental impacts, such as the carbon or water footprint, as well as qualitative information about the processes and policies implemented by the organization that produces and markets the product.

Barilla has decided to adopt the EPD® as a tool for the calculation and communication of its products' environmental impacts because the validation by an external subject ensures that the information is fair, accurate, and reproducible. The EPD® is also the only system that fully complies with ISO standards, which require public assessment of calculation methods.

Barilla believes there are several reasons why it is important to know the impact of its products: first of all, to identify possible improvements that may be implemented along the supply chain; secondly, so that all levels of the organization are on the same page when discussing environmental matters; and finally, to have the most reliable and solid information to communicate outside of the company.

Box: The Environmental Product Declaration of Barilla's Durum Wheat Flour Pasta

The factory and process

Durum wheat flour pasta is made "by extrusion, rolling and drying dough that has been prepared with durum wheat flour and water." The Barilla products that fall within the scope of this EPD® are classic pasta shapes (penne, rigatoni, spaghetti, etc.); "Piccolini" (miniatures of the classic shapes); "Specialità" (special shapes like barbine, castle, and bowties); and "Regionali" (traditional shapes from different Italian regions, such as gnocchi, orecchiette, and reginette). These products differ only in shape, as they are all made using solely water and durum wheat flour.

Every year, the Barilla group produces approximately 1,000,000 metric tons of pasta in the eight factories it owns in five countries (Italy, Greece, Turkey, United States, and Mexico).

The product

The results presented here regard Barilla durum wheat pasta manufactured and consumed in Italy, packed in cardboard boxes.

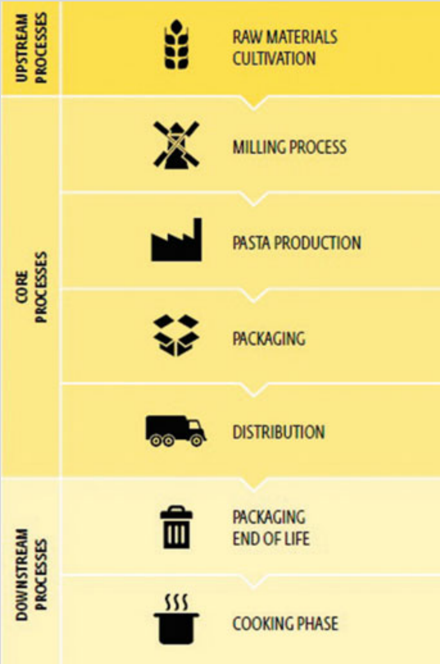
The study was carried out according to EPD® rules for the product category "Code CPC 2371—Uncooked pasta, not stuffed or otherwise prepared."

The assessment considered all the following stages of production:

1. Wheat cultivation;
2. Flour production;
3. Pasta production;
4. Raw materials and products transport to distribution platforms.

Subsequent steps, related to cooking the pasta and disposing of its primary packaging, are closely connected to consumer behavior and therefore subject to greater variability. Thus, the impacts were estimated assuming that the amount of water used for cooking is exactly as recommended by Barilla and that the cardboard box is disposed of in average conditions.

The assessed system is broken down in the figure below, in which we can identify three different phases.



1. Raw materials (upstream processes), including the following:

   the cultivation of wheat, with specific information about the areas where wheat used by Barilla to make pasta is produced.

2. Pasta production (core processes), including the following:

   the production of flour by milling durum wheat, which takes place at facilities owned either by Barilla or by accredited suppliers. As regards this report, we considered only proprietor mills, which contribute 70 % of production. We assume that the impacts generated by the remaining 30 % provided by other manufacturers are equal to proprietor mills, since the production system and level of efficiency are the same;

   activities and processes for the production of Barilla pasta in Italian factories (Pedrignano, Foggia, and Marcianise);

   the processing of materials for packaging, mainly cardboard for primary packaging. The environmental performance associated with the production of packaging was evaluated per kilo of product, considering the heaviest pasta shape (all other shapes will have a relatively smaller impact in this phase). We used primary data (provided by the unit in charge of packaging design) to determine the amounts produced, and secondary data (from the Ecoinvent database) for the environmental aspects related to packaging production;

the environmental performances associated with distribution were evaluated by making specific assumptions for each production area. We used primary data about the distance covered by road, rail, and sea, as well as secondary data (from the Ecoinvent database) as regards the means of transportation.

3. The subsequent stages (cooking and packaging disposal) depend on consumers' behavior and are, therefore, beyond the scope of the assessment (downstream processes); we made assumptions, and based on those assumptions, we estimated the impacts associated with these activities.

The results show that the agricultural phase of growing wheat and cooking have the greatest impact on the environment in terms of ecological, carbon, and water footprint.

The results of the LCA for Barilla pasta manufactured in Italy for the Italian market

Source Barilla (2011a, b).

Box: The Environmental Product Declaration of Mulino Bianco-Barilla's Tarallucci

The Mulino Bianco brand was founded in 1975 and offers a variety of simple and wholesome baked goods. Tarallucci are one of the historic Mulino Bianco biscuits.

The factory and process

Tarallucci are produced in two Italian factories in Italy (Castiglione delle Stiviere, in the province of Mantova, and Melfi, in the province of Potenza). The production process includes the following stages: preparation of the dough, forming, cooking, cooling, and packaging. Packs of Tarallucci are available in two sizes: 400 and 800 g. In the analysis, we considered the 400 g format, since it uses a relatively larger quantity of packaging material (per kilo of product).

The environmental performance of Tarallucci was evaluated through the LCA method, starting from the production of raw materials and including every step until delivery to the main distribution platforms.

The study was carried out according to EPD® rules for the product category "Code CPC 2349—Bread and other bakers' wares."

All results and data refer to a functional unit of 1 k of finished, ready-to-use product.

The analysis includes all the processes that are part of the system subject to assessment, which were grouped into three phases, in compliance with the EPD® system's requirements.

The upstream processes include the following:

- growing and processing raw materials (flour, sugar, vegetable oils, and eggs);
- producing fertilizers and other substances used for agricultural processes;
- transporting raw materials to the manufacturing plant.

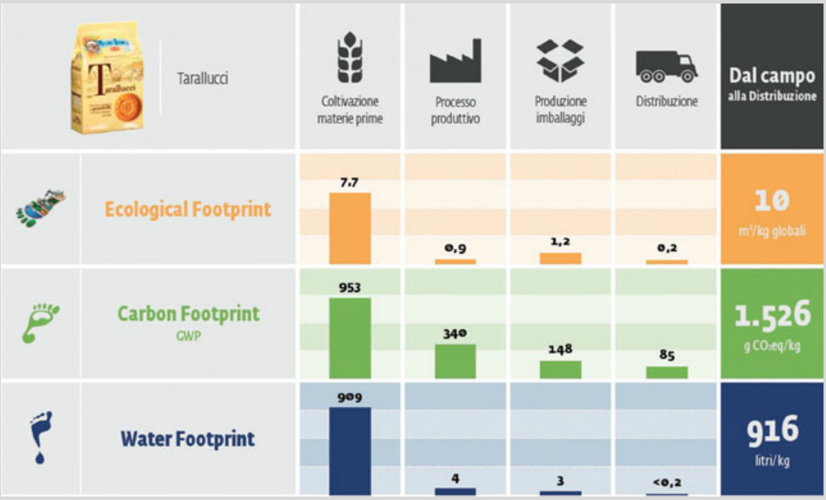
The core processes include the following:

- shaping, by means of a rotary cutting/molding machine;
- cooling and packaging;
- transporting products to distribution platforms.

The downstream processes include general information on end-of-life packaging. The evaluation of the environmental aspects linked to these processes is beyond the scope of the system.

The results show that even for Tarallucci the phase that has the greatest environmental impact by far is the one related to agriculture.

The results of the LCA for Mulino Bianco Tarallucci



Source Barilla-Mulino Bianco (2011).

In August 2012, 21 environmental product declarations regarding Barilla pasta and bakery products were published on the www.environdec.org web site. In particular, the company published the EPD® for Barilla durum wheat pasta, four Wasa products, five Pavesi products, and eleven Mulino Bianco products.

As regards energy-saving efforts in factories and bakeries, it should be noted that 72 % of Barilla’s products are placed on the market by facilities that are ISO 14001 certified, and thus comply with an international standard that ensures the proper management of all environmental aspects.

Programs and activities for the reduction of water consumption have been implemented for years, with significant results. Indeed, in 2011, Barilla factories consumed about 2.5 million cubic meters of water, saving about 800,000 m^3 compared to 2008 (approximately 19 %). Comparing 2011 with 2006, the percentage of water saved rises to 30 %. Furthermore, the new plant in Rubbiano uses 47 % less water compared to the average of factories that make pasta sauce (see “Saving water in Barilla’s new pasta sauce factory in Rubbiano”).

Let us not forget that water, in addition to being used as a raw material in some recipes, is also used for different purposes, such as washing and/or cooling off equipment, activating fire systems, irrigating green areas, allowing employees to wash, and preparing food and beverages for the cafeteria (Fig. 4).

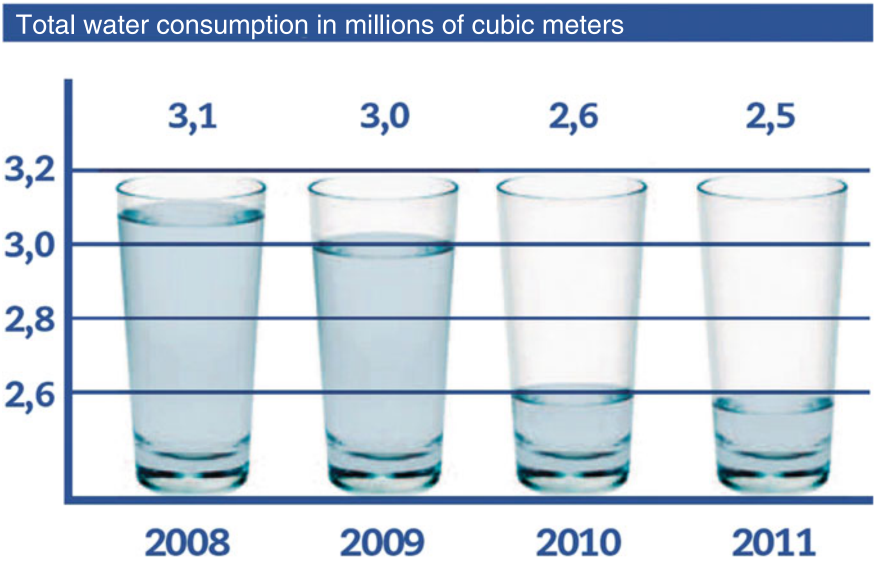


Fig. 4 Total water consumption in Barilla factories, in millions of cubic meters. *Source Barilla Sustainability Report*, 2012

In 2011, the pasta factories that recorded the greatest reduction in water consumption (per unit of finished product) were the ones in Caserta and Pedrignano in Italy, and the one in Ames in the United States.

The bakeries in Novara, Valenciennes, Castiglione, and Plain de l'Ain were able save at least 10 %.

The following activities contributed to the reduction of water consumption in Barilla factories:

- Eliminating the cooling systems that did not recycle water;
- Optimizing cooling tower management;
- Installing water flow regulators;
- Water recovery for the cooling towers in the plant in Cremona.

In addition, 60 % of Barilla manufacturing plants are equipped with a wastewater treatment system, which considerably reduces the impact of wastewater before disposal. In 2011, approximately 800,000 m^3 of water were discharged in the public sewerages (just over 80 %), while the rest was drained directly in surface water.

Box: Saving Water in Barilla's New Pasta Sauce Factory in Rubbiano

In October 2012, Barilla opened a new factory for the production of pasta sauces in Rubbiano di Solignano, in the province of Parma.

In the face of the current difficult and unstable economy, Barilla demonstrated its commitment to the Italian productive system with the creation of 120 jobs at the new factory, which will have a productive capacity of 60,000 metric tons per year.

Rubbiano will produce 160 metric tons of tomato-based sauces and 75 metric tons of pesto sauces, which will be exported all over the world. The plant was designed according to the highest technological standards and will be one of the most energy- and water-efficient factories for the manufacturing of pasta sauce in the world. In line with Barilla's commitment for environmental sustainability, it will produce 32 % less carbon dioxide and consume as much as 47 % less water compared to the average of pasta sauce factories.

A water footprint can be calculated for any product or activity, as well as for any specific group of consumers (an individual, a family, the residents in a city, or an entire nation) or manufacturers (private companies, public organizations, entire economic sectors (Hoekstra and Hung 2002).

The global water footprint is approximately 7.45 trillion cubic meters of freshwater per year, equal to 1240 m^3 per capita per year, i.e., more than twice the annual flow rate of the Mississippi river.[4]

Considering the water footprint in absolute terms, the country that consumes the largest volume of water is India (990 billion cubic meters), followed by China (880) and the United States (700).

[4]Barilla Center for Food and Nutrition (2011), *Water Economy*, available to view or download from Freebook Ambiente (freebook.edizioniambiente.it/libro/55/Water_Economy), Chap. 4.1 (in Italian).

However, if we take into account per capita values, the United States ranks first, with an average water footprint of approximately 2480 m^3 per year, followed by Italy (2230) and Thailand (2220). The differences between countries are dependent on a range of factors. The four main ones are the volume and pattern of consumption, climate, and farming practices.

Since raw materials, goods, and services all have a certain amount of virtual water embedded in them, trade between countries entails a transfer of virtual water flows (virtual water trade). Indeed, the water footprint or virtual water embedded in a product (whether it is a physical good or an intangible service) is determined by the total volume of freshwater consumed to produce it, considering all the various stages of the production chain. Water footprint can be subdivided into two elements: internal (i.e., domestic consumption) and external water footprint (the consumption of virtual water coming from other countries (Hoekstra 2008; Hoekstra et al. 2011).

Europe is a net importer of virtual water, and its water security is highly dependent on external resources. Water globalization seems to involve both opportunities and risks, as the degree of interdependence between countries in the exchange of virtual water is destined to grow, due to the ongoing process of international trade liberalization.

One of the main opportunities in this context is represented by the fact that virtual water can be considered as an alternative source of water, allowing a country to preserve its local resources.

Barilla published its first report on water during the World Water Week, held in Stockholm in August 2012. The report highlights the water footprint of the pasta manufactured by the company and assesses the amount of virtual water involved in the wheat and pasta trade among the nations in which Barilla operates.

The water footprint of Barilla pasta ranges from only 1350 L/kg, when produced in Italy, to over 2850 L when produced in Turkey or the United States. Therefore, it positions itself at the lower end of the pyramid of water, just above cereals and bread, but abundantly below rice and beans.

The water footprint of pasta comes almost entirely from the water used in the cultivation of wheat in different countries. Barilla buys durum wheat not only in Italy but also in other countries in Europe (France, Greece, and Spain) and outside of the continent (Canada, United States, Australia, and Mexico).

The water footprint of durum wheat cultivated in different geographical areas varies depending on the availability of water, climate conditions, and crop yields. The value ranges from 1000 L/kg in northern Italy and France to 2000 L/kg in Australia and Turkey.

In 2011, the total water footprint of durum wheat used by Barilla was about 2,000 million cubic meters, 5 % less than in previous years.

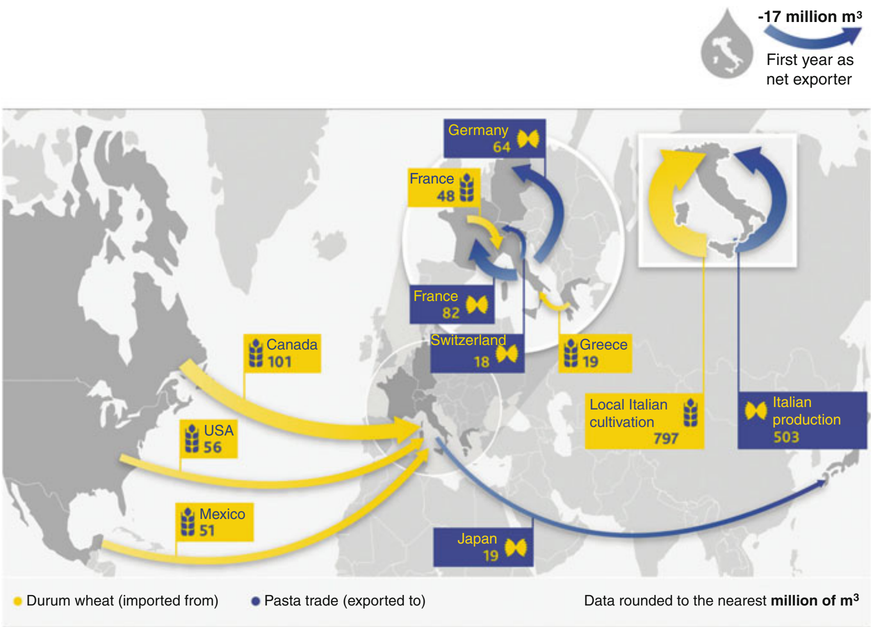


Fig. 5 Pasta and durum wheat, Barilla Italia 2011. *Source Water Report Barilla*, 2012

1.3 Virtual Water Flows for Barilla Pasta and Durum Wheat

The *Water Report* details virtual water flows from the last three years, from 2009 to 2011, for all the countries in which there is a Barilla factory.

Figure 5 summarizes the virtual water flows related to Barilla pasta and durum wheat in Italy. In this country, wheat production does not use "blue water"—the blue water footprint is the volume of water that is used (for irrigation, in the case of wheat) and not returned to its source downstream in the production process. Furthermore, the amount of imported blue water is small compared to the total volume of virtual water inherent in the importation of wheat (blue water represented about 9.9 % of the total in 2009 and 12.8 % in 2011). The amount of blue water in the trade of pasta is even lower, and amounts to about 5 % of total water flows per year in the period considered.

As regards the use of green water (the green water footprint is the volume of rainwater used by crops during the growth phase for evapotranspiration), importations from abroad represent a percentage ranging from 32.5 % in 2009 to 35.4 % in 2010 and 23.4 % in 2011. The decline in imports over the years is at least partly due to the introduction and development of Aureo durum wheat in Italy (see "The Aureo wheat project: 35 million cubic meters of blue water saved"). Saving blue water is very important because it decreases water consumption directly. In this case, indeed, moving wheat fields to a different area (from the desert region of Colorado in the United States to southern Italy) cut the need for irrigation water.

Box: The Aureo Wheat Project: 35 Million Cubic Meters of Blue Water Saved

Barilla, with the support of Italian breeder, Produttori Sementi Bologna, has initiated a program to use traditional methods to develop a variety of high-quality wheat that can be grown in Italy.

This led to Aureo wheat, which in terms of quality is similar to the high-quality Desert Durum® variety that Barilla grows in the desert region in the southwest of the United States. The project's aim is to phase out Desert Durum® wheat in the United States—which requires extensive irrigation—in favor of Aureo wheat grown in central Italy, with considerably smaller use of water; this would decrease both the water footprint of Barilla durum wheat and the environmental impact due to transportation of the product from the United States.

In 2011, more than 41,000 metric tons of Aureo wheat was cultivated in Central Italy, with a total blue water savings of about 35 million cubic meters. At regards transportation, approximately 1000 metric tons of CO_2 equivalent was saved.

Northern and Central Italy contribute in a similar way, respectively, with 35.4 and 38.7 % in 2010, while Southern Italy (mainly Puglia and Sicily) has a slightly lower share of (25.9 %).

The rest of the virtual water embedded in durum wheat comes from other countries, most importantly the United States, Canada, Mexico, and France.

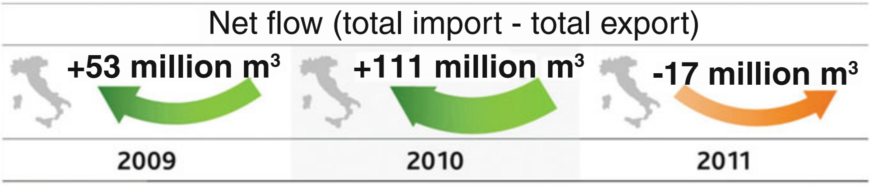
Regarding virtual water exportations, 63.2 % of the pasta manufactured in Italy is destined to the domestic market, and the main countries in which Barilla exports are France (28.0 %), Germany (21.7 %), Japan (6.5 %), and Switzerland (6.2 %).

Moreover, approximately 62 % of total virtual water embedded in durum wheat used by Barilla for the production of pasta comes from local crops.

Figure 6 summarizes the incoming flows of water embedded in durum wheat and pasta used for Barilla's production in 2011. Flows labeled as "input" represent virtual water entering Italy through the wheat imported from abroad to produce Barilla pasta in Italy.

Flows labeled "output" (regarding pasta) represent virtual water leaving the country through the pasta that is exported to the countries listed. Unlike previous years, in 2011, the export of virtual water in Barilla pasta produced in Italy exceeded the amount of imported water linked to the production of durum wheat.

Should the scenario of virtual water trade continue along this trend in the coming years, a well-balanced water saving policy might be implemented. Therefore, pasta manufacturers and the sector revolving around them could make a significant contribution to virtual water trade, also considering the fact that Italy is a major importer of virtual water.



			2009 INPUT [.000 m³]	2010 INPUT [.000 m³]	2011 INPUT [.000 m³]
Durum wheat	Local production		707.141	697.748	796.757
	imported from	France	15.578	28.046	47.643
		Greece	-	27.558	19.452
		Australia	120.254	66.700	-
		Mexico	41.687	64.548	50.670
		USA	138.562	101.999	55.772
		Canada	34.585	98.340	101.449
		other	14.069	33.859	-
		Total	364.735	421.051	274.986
	Total quantity		1.071.876	1.118.798	1.071.743

			2009 OUTPUT [.000 m³]	2010 OUTPUT [.000 m³]	2011 OUTPUT [.000 m³]
Pasta	Local production		536.831	534.353	502.887
	exported to	France	87.513	87.109	81.979
		Germany	68.063	67.748	63.759
		Japan	20.497	20.403	19.201
		Switzerland	19.299	19.210	18.079
		other	116.578	116.040	109.207
		Total	311.950	310.510	292.225
	Total quantity		848.781	844.862	795.112

Fig. 6 Virtual water imported with durum wheat (*top*) and with pasta (*bottom*). *Source Water Report Barilla*, 2012

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