

DISCUSSION PAPER

BOTTLED WATER: UNDERSTANDING A SOCIAL PHENOMENON

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1. Executive Summary

The objective of this discussion paper is to provide an overview of the bottled water market situation. **Bottled water** is the most dynamic market of all the food and beverage industry. The term *bottled water* doesn't refer to one single product (section 3.1) and the same designation can be used to qualify different products, depending on countries. Three major types of bottled water can be identified:

- ↳ *Natural mineral water* is, in the European Union, an extremely specific product responding to strict criteria. It is wholesome underground still or aerated water, protected against pollution hazards and characterised by a constant level of minerals and trace elements. This water cannot be treated, nor added any exogenous elements, such as flavours or additives. United States require for natural mineral water to have a minimum level of 250 ppm total dissolved solids.
- ↳ *Spring water* in Europe is also underground water protected against pollution hazards. It cannot be treated but it doesn't need to have a constant mineral composition. Water from different springs can be sold under the same brand name. In United States, spring water is derived from an underground formation from which water flows naturally to the surface of the earth.
- ↳ *Purified water* is surface or underground water that has been treated in order to be suitable for human consumption. It differs from tap water only through the way it is distributed (in bottles rather than through pipes) and its price.

In addition to these three major categories, the International Bottled Water Association (IBWA) considers four other categories of bottled waters: artesian water / artesian well water; drinking water; sparkling water and well water. So many different categories do not facilitate consumers' identification of the product they buy. In some cases, bottled water is actually bottled tap water.

Different materials are used for the packaging of bottled water: glass; plastic (PVC and PET) and aluminium or steel cans (section 3.2). These packaging have different shapes, colours and capacities. They are an essential part of the bottled water marketing. In some cases, it is even possible to recognise the brand of the bottled water only thanks to the shape and colour of its packaging (e.g.: Perrier).

The **bottled water industry** is very dynamic: numerous bottled water companies compete on this market. Although they can be extremely different, it is possible to identify three major categories of bottled water companies (section 4.1):

- ↳ *Smaller or larger firms* that were created to run and market one specific brand of bottled water. Some of them are century-old and family-owned, but most of them have now grouped or are under control of major multinational food companies, in particular Nestlé and Danone.
- ↳ *Sodas or soft drinks companies* now turn to the very promising bottled water market. Coca-Cola and PepsiCo, for example, take advantage of their large world-wide network of bottlers to sell purified water.

- ↳ *Companies providing tap water*, with extensive know-how in water purification now turn to a more lucrative distribution of water. Suez-Lyonnaise des Eaux and Vivendi, for instance, develop water services, such as home and office delivery of carboy water.

The world bottled water market represents an annual volume of 89 billion litres (section 4.2), and is estimated to be worth US\$ 22 billion. Western Europeans are the world's major bottled water consumers (85 litres/person/year), but the most promising markets are in Asia and the Pacific, with an annual increase of 15% for the period 1999-2001. The average world consumption grows by 7% each year. 75% of the world market is still controlled by local actors. Evian is n°1 in the world for still water, with 1'441 million litres sold in 1999.

Bottled water is a particularly competitive market, hence companies need to develop diverse marketing strategies, such as accessing new markets by owning or developing partnership with regional brands, developing new products (e.g.: flavoured water) or by-products (e.g.: cosmetics) and developing services (e.g.: home and office delivery of carboy water).

Bottled water consumption reflects a certain way of life (section 5). There is a long tradition in Europe for drinking bottled water. Nowadays, this habit has reached the rest of the world. Why do consumers choose to drink bottled water? In many cases, bottled water is an alternative to tap water. Consumers think it tastes better than tap water (no chlorine taste), they perceive it as being safer and of better quality. They also look for security: food scandals in industrialised countries and water-borne diseases in developing countries have a great impact on their attitude. Bottled water is perceived as pure and safe, although it is not necessarily the case. Consumers care for their health and their well-being: they buy bottled water to feel well, to lose weight. Bottled water is a healthy alternative to other beverages.

Changes in ways of life also explain this boost of bottled water sales. Increasing urbanisation, causing tap water quality to decline, can explain this situation. In particular, natural mineral water cannot be treated, nor added any element. It is therefore perceived as "natural" by city dwellers looking for genuine products. Increasing standards of living and greater use of cars enable people to bring home without pain a higher number of heavy and expensive bottled water: the price of bottled water is an average 500 to 1000 times higher than the one of tap water. The use of plastic (PVC, then PET) makes bottles lighter and easier to carry than when they were only made of glass. The expansion of shopping centres, outside city-centres, provide consumers with a greater choice in bottled water brands. Working habits change in developed countries, with the decline of agriculture and industry. Most people have office works and the bottle of water is now a common element on a desk, next to the computer and the telephone. Drinking bottled water is a sign of a rise in the social scale. Above all, bottled water is a huge marketing success.

Bottled water, like any other industries, is not exempt of ***environmental impacts***, either positive or negative. Natural mineral water and other bottled waters, as well as regular drinking water, must meet strict quality requirements. However, this doesn't necessarily imply an improvement in general water quality: natural mineral water springs are indeed protected against pollution hazards, but this has an impact on a limited area; purified bottled water doesn't need extremely good quality water prior to being treated, although this could reduce treatment loads and costs. Protection areas are often established around water abstraction points, locally protecting the environment.

The choice of bottled water packaging material is increasingly done taking into account environmental considerations. PET is increasingly chosen instead of PVC because of its

properties: it is light, easy to work on and very transparent. It can be re-manufactured into many different products, such as fibres for the clothing industry. When burnt, it doesn't release chlorine into the atmosphere, contrary to PVC, whatever type of incinerator is used. Negative environmental impacts, in particular energy consumption, are reduced if PET, aluminium and glass packages are washed and re-filled rather than re-manufactured. Emerging and developing countries may not have the necessary infrastructure to incinerate or recycle the bottles.

Trading and transporting bottled water all over the world also has an important environmental impact, in particular on atmospheric pollution and climate change because of fuel combustion. This impact varies a lot depending on many factors, i.e.: the type of transport used (train vs. old trucks), the type of fuel used (electricity vs. diesel), the distance to travel, etc. Considering current market trends, transport of bottled water should keep growing; nevertheless, 75% of the world bottled water is produced and distributed on a regional scale, thus limiting transports.

Drinking bottled water has become a trivial habit in many people's lives. Bottled water may even be necessary, for instance in case of temporary tap water contamination. Whatever the reasons, the trend towards consuming bottled water will keep increasing in the coming years.

Bottled water quality is generally good, although it can suffer from the same contamination hazards as tap water. In Europe, bottled water quality is frequently tested, both by independent labs and by companies' internal services. Certainly, controls made by bottled water companies' internal labs may be biased. Yet, it is not in the interest of the companies, who base their marketing strategies on the purity of their products, to hide away occasional contamination and sell bad quality waters, although this may happen. To improve bottled water quality, companies should release their quality tests on a day-to-day basis and make them available to a wide number of people, for instance through the internet. Also, it is essential that consumers have access to major information directly on the bottles' labels, i.e., the "type" of water (natural mineral water, purified water, etc.), its mineral composition, the location of the spring (particularly if the water is derived from municipal networks) or the treatments this water may have undergone.

Developing international standards on bottled water could facilitate consumers' access to this product, for instance simplifying bottled water designations and ensuring its good quality. The standards the Codex Alimentarius Commission is working on could be given more importance in the future due to the increasing bottled water trade. Once mere recommendations, these standards could be referred to in trade controversies under the World Trade Organisation rules.

Negative environmental impacts of bottled water could be further reduced implementing simple solutions, e.g. re-using bottles of water, in adequate sanitary conditions, rather than re-manufacturing them or promoting local springs instead of trading world-wide. Could the current increase in bottled water consumption threaten local water resources, in particular in countries already facing alarming water problems? Either bottled water put an additional pressure on local water resources already under stress, or imported bottled water slightly reduce water stress.

Is bottled water a threat to tap water? Bottled waters should not be considered a sustainable alternative to tap water: they are not exempt of periodical contamination and are less energy-

efficient than tap water. Tap water is and should remain a public service meant to deliver good quality drinking water.

2. Introduction

Bottled water consumption has been steadily growing in the world for the past 30 years. It is the most dynamic sector of all the food and beverage industry: bottled water consumption in the world increases by an average 7% each year, in spite of its excessively high price compared to tap water and although industrialised countries consumers have, in principle, access to cheap good quality tap water. How can we explain this trends and what are the consequences for tap water producers, for consumers, for the environment?

This discussion paper aims to provide background information on bottled water and the bottled water world market, in order to understand the reasons of a trend that goes beyond a simple fashion and turns to be a real social phenomenon. It will first identify existing types of bottled water: although they seem very much alike, bottles of water don't contain the same product. The increase in bottled water consumption has boosted the bottled water industry and market trends show very promising perspectives for the future. This paper will then identify the major reasons why consumers choose to buy expensive bottled water rather than drink tap water. It will finally analyse the impact this industry has on the environment.

3. About bottled waters

When sold in groceries or supermarkets, bottled waters all look like the same. However, there are important differences: all bottles don't contain the same product. There is very little in common between natural mineral water and purified water, as the chemical compositions or the treatments these waters can undergo respond to very different criteria that can change from one country to another. In some cases bottled water is merely bottled tap water.

3.1. Multiple products

Three major types of bottled water can be identified: natural mineral water, spring water and purified water.

1. Natural mineral water corresponds, in the European Union, to an extremely specific product that must meet certain criteria. It is "microbiologically wholesome water, originating in an underground water table or deposit and emerging from a spring tapped at one or more natural or bore exits"¹. Natural mineral water, whether still or aerated, is very different from other types of bottled water, because of:

- its nature, characterised by a constant level of minerals and trace elements. Natural mineral water is particularly wholesome and can have health-benefiting effects;
- its original state, preserved intact because of the underground origin of the water, which has been protected from all risks of pollution. Its composition must remain stable and must not be affected by possible variations in the rate of flow.

¹ Council Directive 80/777/EEC of 15 July 1980 on the approximation of the laws of the Member States relating to the exploitation and marketing of natural mineral waters, OJ L 229, 30.08.1980, Annex I: "Definition".

Natural mineral water has to be recognised as such by a responsible authority in EU member states², assessing their characteristics from geological, hydrological, physical, chemical and microbiological points of view. If necessary, pharmacological, physiological and clinical tests can be conducted.

Natural mineral waters are not sterile water and can contain natural microflora. It is a raw product that cannot be treated, i.e. disinfected, nor have any exogenous element such as additives or flavours put into it³. However, some exceptions are admitted, as long as they do not alter the composition of the water, in particular:

- ↳ the separation of unstable elements, such as iron and sulphur compounds;
- ↳ the separation of undesirable constituents, such as manganese or arsenic;
- ↳ the total or partial elimination of free carbon dioxide by exclusively physical methods.

In United States, the definition for natural mineral bottled water is far less restrictive. According to the International Bottled Water Association (IBWA)⁴, this sort of water should not contain less than 250 parts per million (ppm) total dissolved solids. The water should come from a source tapped at one or more bore-holes or springs, originating from a geographically and physically protected underground water source. Mineral water is distinguished from other types of bottled water by its constant level and relative proportions of mineral and trace elements at the point of emergence from the source, taking into account the fluctuations of natural flows. No minerals can be added to this product. Mineral water sold in emerging countries like India usually don't respect any of these criteria and most of the time it is mere purified waters (José Raphel, 1998).

At world level, the best-known brands of natural mineral water are Evian, Volvic, Perrier, San Pellegrino, etc. All of them are under the control of either Danone or Nestlé (see below, §4.1).

Many bottled water brands base their publicity on the – supposed – purity of their product. However, the only truly pure water is distilled water, which is not suitable for human consumption⁵. Water, whether available in bottles or from the tap, always contains a certain amount of minerals and trace elements, collected throughout their geological course. The mineral composition of each water depends on the geological layers water crosses and on the time spent in the ground. These organic elements and their interaction are essential to the constitution of the human body.

Minerals are composed of electrolytes: anions (chlorine, bicarbonate, phosphorous, sulphur, organic acids, proteins) and cations (sodium, potassium, calcium, magnesium). For instance, sulphates are important for digestion; calcium is essential to the making of teeth and bones; phosphorous is necessary to the assimilation of calcium and contributes to brain activity and teeth protection.

Trace elements are metals and metalloids constantly present in very small amounts in the human body and participating in most of its biochemical reactions. Iron, fluorine, selenium, silicon and vanadium are the main trace elements found in waters, but some waters can also contain iodine, zinc, copper or silver. Fluorine helps preventing tooth decay – WHO recommends to add fluorine in municipal tap water (1 mg to 1,5 mg/litre) –; iron is the main element in haemoglobin, thanks to which blood can carry oxygen throughout the

² For instance in France: the Ministry of Health, upon recommendation from the National Academy of Medicine.

³ When given such treatments, they are not considered natural mineral water anymore, but rather soft drinks.

⁴ Founded in 1958, the International Bottled Water Association (IBWA) is a trade association, representing the bottled water industry. Its members – more than 1'200 US-based and international bottlers, distributors and suppliers – produce and distribute 85% of the bottled water sold in the USA.

(IBWA, <http://www.bottledwater.org/public/whatis.htm>).

⁵ However, Calistoga, an American water belonging to Nestlé, bottles distilled water.

body. However, iron is unstable in water and is removed prior to bottling. Natural mineral water can often be highly concentrated in minerals, much above the limits generally admitted for tap water. Excessive drinking of such waters could, in the long run, be harmful to human health.

Box 1: Water, minerals and trace elements

2. Spring water is underground water, protected against pollution hazards, microbiologically safe, suitable for human consumption without any additional treatment, except those authorised such as aeration (Evian, 2000). In Europe, spring water is different from natural mineral water as it must stick to the same standards applicable to drinking water. It doesn't need to have a constant mineral composition. The consumption of this type of water is increasing, as it is generally cheaper than natural mineral water.

In United States, the IBWA understands spring water as “water derived from an underground formation from which water flows naturally to the surface of the earth”. Spring water must be collected only at the spring or through a bore hole tapping the underground formation finding the spring. Spring water collected with the use of an external force must be from the same underground stratum as the spring and must have all the physical properties, before treatment, and be of the same composition and quality as the water that flows naturally to the surface of the earth (IBWA, 2000).

3. Purified water or *drinking water* is water taken from rivers, lakes or underground springs that has undergone some form of treatment. It can be produced by “distillation, deionisation, reverse osmosis or other suitable processes” (IBWA, 2000). It can be chemically treated in order to have some components disappear. Waters with different components can be mixed. Considering the way it is produced, there is little difference between purified water and municipal tap water, except in the distribution method and retail price. Some companies also market enriched water, i.e. purified water that was added some minerals: this is the case, e.g., of Nestlé's Pure Life, and Coca-Cola's BonAqua (see § 4.1). Purified water is actually a manufactured product.

The International Bottled Water Association considers four additional categories of bottled waters (IBWA, 2000):

1. Artesian water / artesian well water is bottled water from a well that taps a confined aquifer (a water-bearing underground layer of rock or sand) in which the water level stands at some height above the top of the aquifer.

2. Drinking water is water that is sold for human consumption in sanitary containers and contains no added sweeteners or chemical additives (other than flavours, extracts or essences). It must be calorie-free and sugar-free. Flavours, extracts or essences may be added to drinking water comprising less than one-percent-by-weight of the final product or the product will be considered a soft drink. Drinking water may be sodium-free or contain very low amounts of sodium.

3. Sparkling water is water that after treatment and possible replacement with carbon dioxide contains the same amount of carbon dioxide that it had at emergence from the source.

4. Well water is bottled water from a hole bored, drilled or otherwise constructed in the ground which taps the water of an aquifer.

If these waters contain the minimum required mineral content according to US standards, they can be called “mineral waters”.

So many different categories of bottled water, changing from one country to another, are not easy for consumers to differentiate. In addition, bottled water brands do not ease the identification of the product, often showing misleading images on their bottles' labels, such as lakes and mountains when the water actually comes from municipal networks (see § 4).

The United Nations Food and Agriculture Organisation (FAO) is working on an approximation of standards for natural mineral and drinking water. On its 1997 session, the *Codex Alimentarius* Commission⁶ adopted⁷ a draft standard on natural mineral water, converting world-wide the European regional standards, especially: microbiological purity of the product and bottling at the source. Many non European countries objected that this does not permit antimicrobial treatments of the water, nor its transportation in bulk containers. United States stated that this standard created a barrier to international trade by including "unnecessary and inappropriately restrictive requirements"⁸.

3.2. Multiple packaging

Packaging used for water can have very different shapes and colours and are made of different materials. For a long time, bottled water were only available in glass, a very good but heavy material. At the end of the 1960s, bottlers started to use packaging made of PVC (vinyl polychlorure). In the 1980s, a new kind of plastic started being used: PET (polyethylene terephthalate). PET is progressively replacing PVC because of its numerous advantages (see §6).

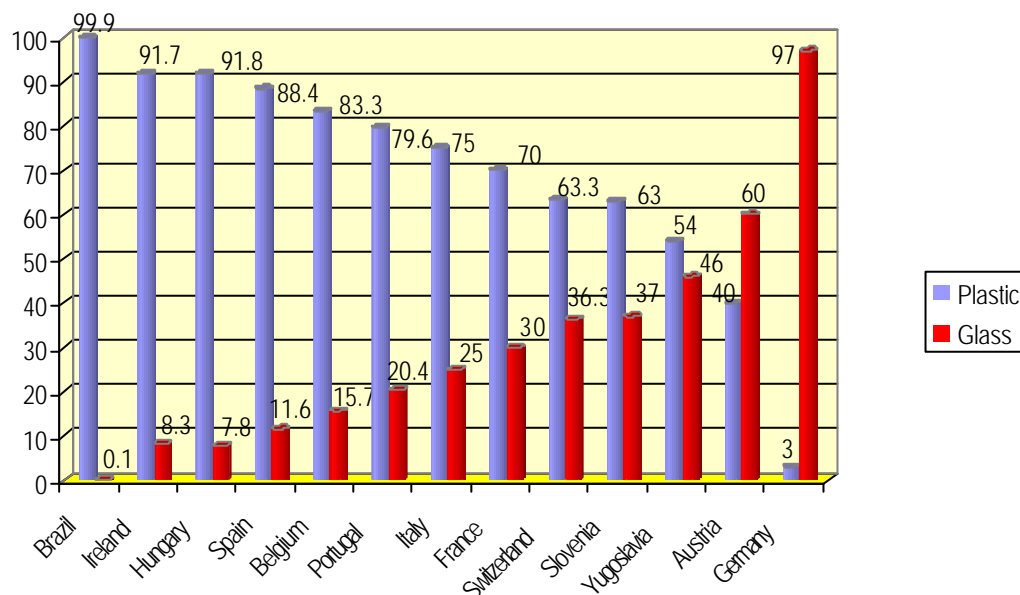


Figure 1: Types of packaging used for bottled water, in percentage, in 1999, (Source: UNESEM, 2000)

Plastic, either PVC or PET, is the most frequently used material to make bottles of water: about 70% of the bottles used for natural mineral water are made of plastic (see Figure 1). We

⁶ The *Codex Alimentarius* Commission, founded in 1962, is a common organ to FAO and World Health Organisation (WHO), in charge of elaborating international standards to ensure food safety.

⁷ By 33 votes in favour, 31 against and 10 abstentions.

⁸ FAO, <http://www.fao.org/docrep/w5979e/w5979e09.htm>

can estimate that roughly 1.5 million tons of plastic are used world-wide to make bottles of water⁹. Indeed, plastic bottles are more expensive than the liquid they contain. Their price can fluctuate according to oil prices. In Germany, though, water is almost exclusively bottled in returnable glass packaging. There is therefore a lesser need for disposable plastic. In addition, Germans prefer (and mostly produce) aerated waters. Even if special PET bottles can resist gas pressure, they tend to be more porous than glass. In other countries, glass bottles are used mostly for the catering industry. Still or aluminium cans are marginal in most countries; in Belgium, Switzerland and Hungary they account for respectively 1% and 0.4% of bottled water packaging. Cans are a practical packaging to sell through automatic distributors. They are mostly used for carbonated waters.

Bottles usually contain 33cl, 50cl, 1 litre, 1.5 litre, 2 litres or 5 litres. The biggest packaging for bottled water is a 5-gallon carboy (about 20 litres), sold in the USA mostly through home and office delivery. 28% of the bottled water drunk in the world is distributed through home or office carboy delivery services. 72% of the bottles used contain less than 5 litres (Belot, 2000). American consumers tend to drink more and more water in smaller packages (less than 5 litres): +16% between 1996 and 1999.

Packaging is an essential part of bottled water marketing strategies. “The packaging makes the brand. The brand makes the packaging. A product must have visibility to sell, its presentation refers to notions such as service, security, hygiene” (Miquel, 1999). In some cases, such as Perrier, it is even possible to recognise the brand of the bottled water thanks to the shape and colour of its packaging. Some brands have reshaped their bottles in order to make them look like the marketing message they are supposed to carry. Evian bottles, for instance, now figure high mountains not only on the labels but also on the plastic itself (see § 4.2 and 5). Bottles of water are becoming aesthetic objects, that can be collected.

4. The bottled water industry

Bottled water is the fastest-growing beverage category in the world: it “has expanded from a tap water substitute into the beverage arena” (Lenzner, 1997). The bottled water industry is extremely prosperous, involving companies with different histories and approaches to water. Which are the major companies and brands in this sector? What are main trends of the bottled water market?

4.1. Bottled water companies

Bottled water is a booming and very competitive market involving numerous companies: in 1992 in the United States, there were 700 brands of bottled water produced by 430 bottling facilities (Olson, 1999). Although bottled water is a world market, with companies present world-wide, 75% of it is still controlled by local actors. Three major types of bottled water companies compete on this market:

1. Companies that were created to run and market one specific brand of bottled water, for instance Perrier or Evian. Some of them are century-old and family-owned, but most of them

⁹ Considering that a PET bottle nearly weighs 25g / litre, that the world consumes 89 billion litres of bottled water each year and that 70% of it is distributed in plastic containers.

have grouped or are now under control of major multinational food companies, in particular Nestlé and Danone.

Danone and Nestlé have a long tradition in selling natural mineral waters. Nestlé is number 1 on the world market of bottled water with a turnover of about US\$ 3.5 billion in 1999 – representing 15.3% of the world market share – and 67 bottling factories employing over 18'000 people in the world¹⁰. Nestlé/Perrier-Vittel SA¹¹ owns well-known brands in 17 countries, like Perrier, Contrex or Vittel (France), Arrowhead, Poland Spring, Calistoga (United States), Buxton (UK), Fürst Bismarck Quelle, Rietenauer (Germany) or San Pellegrino (Italy). Danone, holding 9% of the world market share with a turnover of about US\$ 1.5 billion, challenges Nestlé. Danone comes first in some regions: Latin America and Asia-Pacific. Its best-known brands are Evian (see box 2), Volvic (n°3 in the world with 937 millions litres sold in 1999) and Badoit. Danone and Nestlé only recently started to consider marketing purified water (see § 4.2).

The first bottle of Evian appeared on the market in 1830. At the time, the water was sold in earthenware jugs. Evian received its first ministerial approval as a natural mineral water in 1878. In 1892, the city of Evian leased the company the water springs and the casino until 2027 (Evian, 2000).

Evian is now world number 1 for natural mineral still water, with 6 million litres produced daily¹², 1'441 million litres sold in 1999 to 130 countries. The company has subsidiaries in Belgium, UK, Germany, Switzerland, USA and Canada. Evian was employing 1'632 people by the end of 1999, including 900 at the bottling factory. The company had a turnover of US\$ 500 million in 1999 (Danone, 2000).

Box 2: Evian

2. Sodas or soft drinks companies now turn to the very profitable bottled water market. Coca-Cola and PepsiCo, for example, take advantage of their large world-wide network of bottlers which provides them with immediate access to the markets. To purified and aerated water used to make sodas is added a concentrated solution of minerals and sold as purified, enriched water, on the same principle as Coca-Cola and Pepsi. Like for colas, benefits for the company come from the sale of mineral concentrates to local bottlers. Coca-Cola markets BonAqua and Dasani: launched in 1999 in the USA, it is now in the 9th place for bottled water in this country.

PepsiCo's Aquafina was launched in 1995 in the USA where it has a turnover of US\$ 600 million (Belot 2000). According to Olson (1999), Aquafina "has taken Pepsi into the top 10 sellers of bottled water in the United States, with sales jumping 126 percent in one year to more than US\$52 million in 1997". Although Aquafina labels "picture beautiful stylized mountains", the water is actually "derived from municipal tap water. The water reportedly is treated tap water taken from 11 different city and town water supplies" across the USA. PepsiCo targets the world market and launched Aquafina in India in 1999.

3. Companies providing tap water, with extensive know-how in water purification and pipe distribution now turn to a more lucrative way of distributing water.

Suez-Lyonnaise des Eaux and Vivendi, for instance, are specialists for public water treatment and distribution. They now develop water services, such as home and office deliveries of water carboys. Vivendi recently bought USFilter, producer of Culligan, a purified water sold

¹⁰ <http://www.jobpilot.fr/profile/vittel/>. Bottled water activities amount to around 25% of Nestlé's beverage activities, and 7% of the total turnover of the group (Fabre-Pujol, 1999).

¹¹ Perrier-Vittel SA is the world "water" division of Nestlé. Its headquarters are in France.

¹² Except at night, during week-ends and public holidays.

in carboys. Roche Claire, a subsidiary company of Suez-Lyonnaise des Eaux, is specialised in carboy water. Water production, treatment and services can now be covered by the same company. Suez and Vivendi own the techniques, the equipment and the know-how to treat water. They don't want to lose ground on Coca-Cola, PepsiCo, Danone and Nestlé on the purified water market, particularly since they provide the water to sodas and soft drinks companies (Belot, 2000).

However, Suez and Vivendi are facing a dilemma: how to sell water in carboy and at the same time distribute water through public municipal distribution networks, without giving more way to the idea that tap water is of bad quality? Moreover, water in carboy is much more expensive than tap water. Suez-Lyonnaise des Eaux intends to distribute only spring water through carboys in Europe. Vivendi Water concentrates on the market of purified water with Culligan. Vivendi wonders how to apply marketing techniques for carboy water to tap water, in order to sell water filters or water refrigerators.

Even municipalities turn to the bottled water market. In United States, "some cities recently have announced that they plan to enter the bottled water market by selling their water untreated in bottles. Houston, for instance, has announced that it will sell its self-proclaimed "Superior Water" – city water taken straight from the tap and pumped into bottles. Other cities including Kansas City and North Miami Beach are said to be evaluating plans to sell their water in bottles" (Olson, 1999).

4.2. Bottled water market trends

The world bottled water market amounts to an annual volume of 89 billion litres, which represents an average 15 litres of bottled water drunk yearly per person (Danone, 2000). Western Europeans are the major consumers, drinking nearly half of all the world bottled water, with an average of 85 litres/person/year (see figure 2). Within Europe, Italians drink more bottled water than anybody else: 107 litres per year per inhabitant in average (Sollberger, 1994). In United States, 54% of Americans regularly drink bottled water (Olson, 1999). More than half (59%) of the bottled water drunk in the world is purified water, the remaining 41% being spring or mineral water (Belot, 2000).

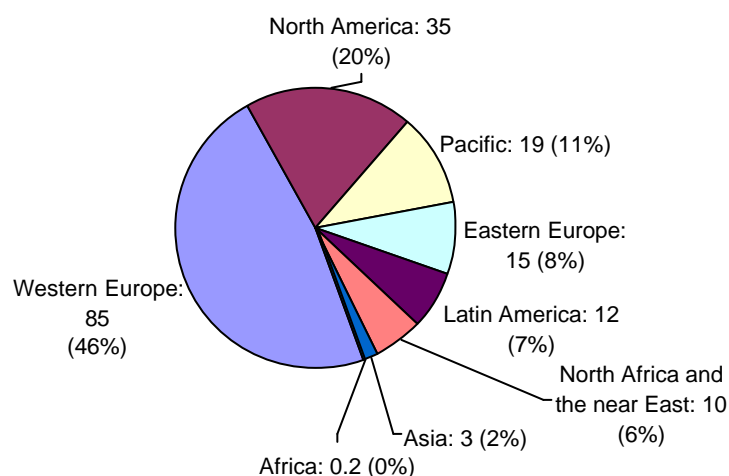


Figure 2: World bottled water consumption in 1999, in litres/year/person and (in%).

Source: Belot, 2000

Bottled water consumption has been growing steadily over the last 30 years – e.g. in 1976, an average 5.7 litres of bottled water were drunk per person in United States, as opposed to 17 litres in 1986 and 35 litres in 1999. The world consumption now grows by an average 7% each year. Although major consumers are located in Europe and North America, the most promising markets are in Asia and the Pacific, with an annual growth of 15% for the period 1999-2001 (see figure 3). In India for instance, the bottled water industry, with more than 100 companies, has a turnover of about US\$ 70 million, growing at an average rate of 50% every year. This sector employs 15'000 to 20'000 people in the country (Jose Raphel, 1998). The important increase in this region can be easily explained through the growth of the population and problems of water quality and water supplies (Fabre-Pujol, 1999, see § 5.1). Until 1992, the demand for bottled water in India was mostly limited to foreign tourists, corporate meetings, conferences, etc. The introduction of bulk packaging extended the market to new and numerous consumers (Jose Raphel, 1998). This increase of bottled water consumption is the major of all the beverage industry. In United States, “sales have tripled in the last decade to about \$4 billion in 1997. Globally the market was estimated in 1995 to be worth more than \$14 billion annually in wholesale sales¹³. (...) According to industry stock analysts, “the profit margins in the business are really pretty good” – for some bottlers in the neighbourhood of 25 to 30%” (Olson, 1999). The world bottled water market is estimated to be worth US\$ 22 billion (Danone, 2000).

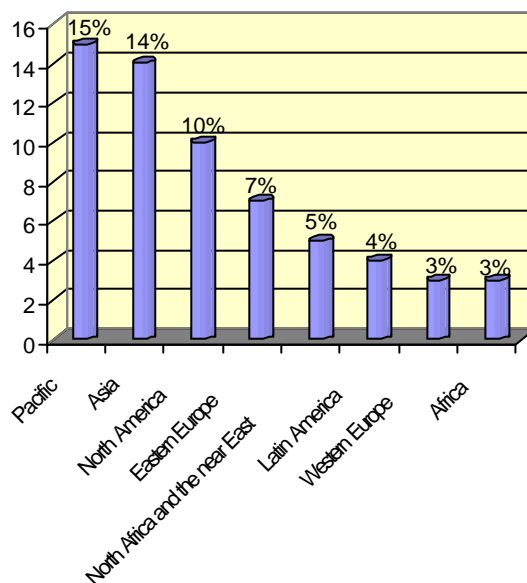


Figure 3: Annual increase of bottled water consumption, 1999-2001, per region
(source: Belot, 2000)

Bottled water is an extremely competitive market, hence companies need to develop diverse marketing strategies.

1. Accessing new markets, by owning or developing partnership with regional companies is a major marketing strategy. For instance, Danone’s Volvic, a natural mineral water produced in France, is n°1 for still waters in Germany, n°1 for imported waters in Japan, Taiwan and

¹³ However, sales of bottled water in United States is still relatively small compared to soft-drinks: the bottled water business represents US\$3.4 billion, compared to US\$ 30 billion for soft drinks, but it has an annual growth of 9% (Olson, 1999).

Thailand, n°2 for natural mineral water in UK and Ireland. Danone is also well-positioned on the purified bottled water market, in North America and, above all, in some emerging countries, i.e. China, Indonesia, Mexico and Argentina. In January 2000, Danone bought McKesson Water Products Company, an American bottler, and became n°2 for bottled water in United States with a market share of over 16%. Danone's Wahaha water – manufactured by a Chinese bottled water company – ranks world n°4 for still water, with 836 millions litres sold in 1999 in China and a turnover of 375 million US\$ (Danone, 2000).

Nestlé also targets emerging countries' markets with Nestlé Pure Life, a purified and mineral-enriched water developed for them. Its concept consists in associating a local spring, located in the outskirts of a big city, to a bottling facility in order to supply consumption areas within a limited region, thus reducing transportation costs. Launched in Pakistan in December 1998, Pure Life targets other emerging countries, in particular China and India, where bottled water consumption per inhabitant is still very low due to weak purchasing power (Fabre-Pujol, 1999). Nestlé is present in Brazil, China and Mexico and expects to be in six to eight more countries before the end of 2001. However, such agreements between local bottlers in emerging countries and international brands do not necessarily imply that strict quality controls are conducted at the bottling plants. Local brands can pretend the water they bottle is as good as their partner's abroad even though they may not pay maximum attention to the quality of the water or hygiene conditions when bottling, nor to the additional pressure they put on water resources.

Europeans are traditionally keener on natural mineral water than on other types of bottled water. However, spring waters are very successful there. They are considered as safe as natural mineral water while being much cheaper: water from different springs is sold under the same brand, reducing transportation costs. "Multi-spring water" is a new and promising strategy for companies in Europe, although this practice is long-established in North America. In May 2000, Nestlé launched its Aquarel spring water; Danone counterattacked with Danonn Water, to be launched by the end of 2000 in two or three European countries.

The same evolution can be noticed for purified water: according to Coca-Cola, there is an existing demand for this type of water in Europe, because of an increasing demand for water safety. Coca-Cola bets on the fact that some springs, now producing mineral or spring water, will have security problems in the long run. Coca-Cola is already selling its BonAqua purified water in 11 Eastern European countries and in Germany.

Companies tend to invest abroad and create local bottling facilities so as to reduce transportation costs, rather than directly exporting the water. With so positive market trends, they can expect to recover their investment and generate profits in a rather short period.

2. Developing new packaging and products.

The packaging is an important part of the bottled water marketing success (see §3.2). All types of bottles coexist and are regularly reshaped in order to better catch consumers' attention. The most recent trends in the small bottles category goes for supposedly handier bottles, e.g. 50cl bottles with a sport-type cap or 1 litre bottles for desk use. Advertising investments and a new PET bottle enabled sales of Badoit to grow by 6% in France (Danone, 2000). Danone developed in this country a new 1 litre bottle for Volvic and Evian, its two major still natural mineral water brands. Bigger-sized containers also sell very well, in particular 2-litre bottles (e.g.: Danone's Ferrarelle in Italy) and water carboys over 5 litres, for home and office consumption. In Japan, over 2 million bottles of water are sold through

automatic dispensers, which led Danone to design a special bottle for Volvic water to fit to these machines. Companies, e.g. Perrier, often design special glass bottles for particular events. Evian did so for the winter Olympic games in Albertville (France) in 1992, and has since gone on with a special glass Christmas bottle. In 1999, the “Millenium” bottle shaped a drop of water.

New products such as flavoured water (e.g.: Volvic orange, lemon or mint), waters enriched with minerals (Nestlé’s Pure Life) and health-benefiting water¹⁴ tend to develop. Danone launched Talians in France at the end of 1999. Produced in Italy, Talians is a still natural mineral water highly concentrated in minerals (2590 mg/litre), in particular calcium (596 mg/litre), and is mainly intended to pregnant women. Neptune’s Courmayeur and Danone’s Vistanella are supposed to help people lose weight.

Brands also diversify by creating numerous by-products, e.g. Evian’s atomiser for facial care and isothermal bag for the 1.5 litre bottle. The 33cl Evian bottles can be adapted a teat, to turn into a babies’ bottle. Natural mineral water springs in Europe are often related to a spa offering water cures and beauty care products (e.g.: Vichy).

Marketing and advertising campaigns are essential to differentiate the product and attract consumers. Brands tend to associate with specific activities: sport, fitness, slimming, fashion, etc. For the last 50 years, Evian has been the water of babies, emphasizing that its low mineral concentration is suitable for them. The brand’s marketing strategy capitalises on infants, from the pink colour of its labels to advertising campaigns. Evian also sponsors paediatric research and gives prizes to the best students in French midwives’ schools.

3. Developing services.

Home and office delivery of spring or purified carboy water is the most frequent service already developed for bottled water. Nestlé is number 1 in the USA for this service, closely followed by Danone. Both companies now want to develop world-wide this know-how: Danone in Canada, Argentina, Mexico, China and Indonesia and Nestlé in Argentina and Vietnam (Belot, 2000). Coca-Cola is testing a service of water carboys delivery in Hong-Kong.

Nestlé is also studying models for “water-shops” and “water stations”, where customers can buy returnable bottles they fill themselves. On-line sales of bottled water also develop, in particular in North-America. The Bottled Water Store¹⁵ markets in United States, through the web, water produced all over the world from New-Zealand to Jordan using the most imaginative, and sometimes questionable, marketing arguments: *Pure Pet Water*, for instance, is specially intended for pets, because of its low mineral concentrations; *Love water* is supposed to be “one of Nature’s best aphrodisiacs” because of its lithium component.

¹⁴ Or supposedly health-benefiting! LifeO2 International, an American company, markets water enriched with oxygen, supposed to help athletes, people recovering from an operation or anyone doing much exercise to regain faster their energy... (<http://www.lifeo2international.com>).

¹⁵ <http://www.bottledwaterstore.com>

5. Bottled water consumption: a certain way of life

Some consumers choose to only drink bottled water: in France, they are 39%, mostly women and elderly people (IFEN, 2000). We can identify several reasons for drinking bottled water.

5.1. Consumers care for their health and safety

Bottled water is often an alternative to tap water. Consumers often object to the taste of chemicals, particularly chlorine, used to purify tap water. In France, nearly half of them don't usually drink tap water because of its bad taste (IFEN, 2000), as opposed to only 7% in United States (Olson, 1999). Tap water taste varies depending on the location, on how water is treated or processed and on chlorine concentrations.

Consumers also look for security, in emerging as well as in industrialised countries. They often mistrust their tap water, because of previous bacterial contamination for instance, and perceive bottled water as being safer than tap water. In India, the suspicion of bad tap water quality, in addition to general and seasonal shortages of tap water, lead people to turn to bottled water. "Only 72% of the urban population receives organised piped water supplies. The rest have to depend on surface or ground waters which are mostly contaminated and untreated" (Jose, Raphael 1998). In industrialised countries, they fear faecal contamination or high nitrate levels in areas of intensive agriculture and cattle-breeding. Recent food scandals probably had an important impact on consumers' attitude. "People are scared of water running in rusty urban water pipes" (Lenzner, 1997). In France, 22% of consumers think their tap water is too hard and another 22% fear health or sanitary hazards or contamination by toxic substances: this rate is rather low, but it has doubled between 1989 and 2000 (IFEN, 2000). Concern for sanitary water situation is much higher in the United States, where nearly half of bottled water consumers do so out of health and safety reasons. In United States, 35% of people drinking bottled water are concerned about tap water quality. Another 35% chose bottled water as a substitute to other beverages and 12% for both reasons (see Figure 4).

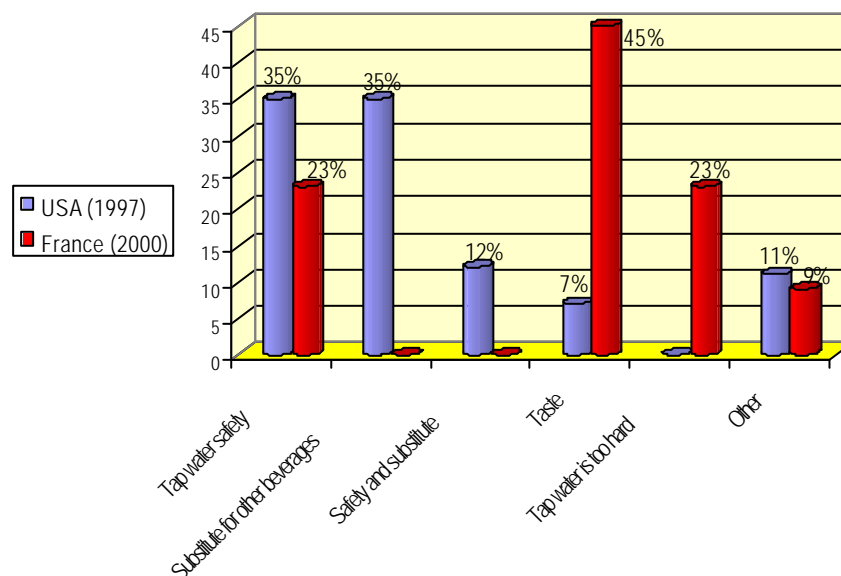


Figure 4: Reasons for drinking bottled water (source: Olson, 1999 and IFEN, 2000)

A 1997 survey revealed that 32% of US consumers use a home water treatment device other than bottled water, compared to 27% in 1995. "The use of "entry level" devices such as pour-

through pitchers with filters has grown more than any other type of water treatment device on the market. In addition, households earning between \$15'000 and 25'000 were two times more likely to purchase water treatment equipment than two years ago¹⁶.

However, bottled water is not necessarily safer than tap water. In 1986, an EPA survey of 25 bottlers showed that none of them had ever had a complete analysis of their water. Bacteriological surveillance was inadequate in most cases. 8% of the water tested showed evidence of some bacteria. Plastic bottles arrived at bottlers without caps in cardboard boxes and weren't washed or rinse prior to filling, thus not respecting necessary sanitary precautions¹⁷.

According to NRDC, bottled water is generally safe to drink. However, some "contamination incidents – whether bacterial, industrial-chemical, algae, excessive-chlorine, or other contamination problems – have sometimes been quietly dealt with by bottlers, generally with little or no public fanfare". In 1990, Perrier had to withdraw 280 million bottles from 750'000 sale points in the world because of benzene concentrations above US standards (8 to 17 micrograms, instead of 5 µg). This cost Perrier US\$ 133 million. "Although most of the bottled water on the market seems to be of good quality, some of these products are not as absolutely pure and pristine as many of their consumers may expect". In the US, there are some problems with tap water: "in 1996, almost 10% of community tap water systems (serving 14% of the US population) violated federal EPA tap water treatment or contaminant standards" (Olson, 1999). This doesn't necessarily mean that bottled water is any safer.

Consumers also drink bottled water because they care for their health. In Europe, there is a long tradition, dating back to Roman times, of spas and of drinking mineral waters for medical purposes. In the XIXth century, this activity developed with the fashion for upper classes to go to spas in order to improve their health. Spas owners weren't long in understanding that they could increase the wellness of their customers – and their own benefits – directly supplying them their water in bottles. Until the 1950s, mineral water was sold in drugstores as a health product. It has now become an everyday product.

Natural mineral water, now sold in supermarket, doesn't carry along anymore this medical image. People now buy bottled water to feel well, responding to advertising campaigns based on well-being, energy, slimming, fitness etc. Bottled water is a healthy alternative to other beverages (sodas, alcohol, beverages containing artificial sweeteners or colouring). It is calorie-free and attractive for people willing to lose weight: "one of the sparks that ignited the bottled water fire was the fitness craze that skyrocketed in the early 1980" (Sullivan, 1996). Indeed, bottled water consumption is closely linked to the way consumers face their nutrition, i.e. the current trends for healthier eating.

In United States, the bottled water industry openly admits that "it has substantially benefited from labelling requirements for beverages such as diet soda, which have caused concern among many consumers about the ingredients in these drinks. The IBWA's primary spokeswoman recently noted that "the more people realise what's in some of these drinks, the more they turn to water for what it doesn't have..." (Olson, 1999). Bottled water is a more female and adult market than sodas.

¹⁶ <http://www.wqa.org/Consumer/survey-summary.html> (downloaded 06.02.98).

¹⁷ <http://www.doulton.ca/chap5.html> (downloaded 06.02.98).

However, according to the United Nations Food and Agriculture Organisation (FAO), bottled waters haven't got greater nutritive value than tap water. "There is almost a craze to drink "natural" or "spring" waters, either aerated or still. Many consumers believe that these waters, coming from springs, lakes, rivers or wells, have near-magical qualities and great nutritive value. This idea is false. Bottled water may contain small amounts of minerals such as calcium, magnesium and fluoride, but so does tap water from many municipal water supplies. A study comparing popular brands of bottled water showed that they were in no way superior to New-York tap water. They have only the advantage of being safe in areas where tap water may be contaminated. However, for low-income people bottled water are very expensive, and boiling local water renders it safe at a much lower cost" (Latham, 1997).

5.2. Changes in ways of life

Increasing urbanisation can also explain this trend for bottled water consumption. In France in 1971, mineral water consumption reached an average 52 litres per inhabitant compared to 85 litres per inhabitant in Paris and its suburban areas. In less urban regions, consumption was only 21 litres per inhabitant. Increasing urbanisation, causing tap water quality to decline, can also explain this situation. In numerous European cities, many old pipes for tap water distribution are made of lead: consumers may prefer bottled water rather than damaging their health by drinking water thought to be contaminated with lead¹⁸. Natural mineral water, in particular, cannot be treated, nor added any element. Therefore, it is perceived as "natural" by city dwellers in search of genuine products. This trend goes along the fashion for "green" food products (Auby, 1994).

Increasing standards of living and greater use of cars enabled people to buy water in supermarkets and to bring home higher number of bottled water, without difficulty. The use of plastic (PVC, then PET, see § 3.2) makes bottles lighter and easier to carry than when they were made of glass. The expansion of shopping centres, outside city-centres, provide consumers with a greater choice in bottled water brands.

The explosion of bottled water consumption also reflects deep changes in working habits in industrialised countries, with the decline of the agriculture and industry sectors. In these countries, most people have office works and the bottle of water is now a common element on a desk, next to the computer and the telephone. Drinking expensive bottled water (compared to tap water) is a sign of a rise in the social scale.

In addition, bottled water is the result of a huge marketing success. Marketing and advertising are of primary importance to make the difference between brands selling such a similar product, a product that is colourless, (nearly) tasteless and odourless. Advertising costs are covered through the price of bottled water, comprising 10% to 15% of the price of one bottle of water. "Bottled water marketing seeks to emphasise the supposed purity of bottled water, in many cases contrasting "pure" and "protected" bottled water with "inconsistent" or unpredictable tap water quality. In the words of a leading industry consultant, "Water bottlers are selling a *market perception* that water is 'pure and good for you'..." "(Olson, 1999). In France, sales of Evian water have grown by 5% in 1999, thanks to a successful advertising campaign.

¹⁸ The 1998 European drinking water directive reduced maximum-allowed lead levels in tap water. A high number of pipes in urban areas, mostly in the UK and in France, will have to be changed, which implies an estimated cost of around 34 billion euros (Lawrence, 2000).

5.3. Drawbacks

Information to consumers is key but maybe insufficient or not accessible enough, written in too small characters on the bottles' labels. In United States, a 1997 survey showed that "nearly half of those surveyed (47%) claim to want additional information about their water, yet 23% do not know who to contact to obtain that information"¹⁹. Regulations have bottled water mention their composition, origin of the water, but this depends from one country to the other. The European Union requires natural mineral water's labels to state the waters' "analytical composition, giving its characteristic constituents" and the specific water source and name, and information on certain treatments used²⁰. The EU mineral water rules further forbid the use of more than one brand label per source of water²¹ and generally prohibit labels from making any claims about the prevention, treatment or cure of human illness²². In United States, "water with one brand name can come from numerous different sources, depending upon the time of year, location of sale, or other market factors. Moreover, water from one source can be used and labelled for a half-dozen or more different labels and brands" (Olson, 1999), not facilitating product identification.

The price of bottled water is tremendously high, compared to tap water. The production cost of one bottle of water, whatever its capacity, is extremely low: under 0.05 FF for one bottle of Evian. Most of the price of a bottled water consumers actually pay corresponds to its transport, marketing and retailers' profits. Bottled waters end up being an average 500 to 1000 times more expensive than tap water. In the USA, bottled water prices range from US\$ 0.20 per litre to more than US\$ 1.50 per litre. Tap water generally costs between US\$ 0.12 per cubic metre to US\$ 0.75 per cubic metre. "Thus, the ratio for bottled water to tap water ranges from a low of about 240 times more expensive (cheap bottled water: expensive tap water) to over 10'000 times more expensive (expensive bottled water: cheap tap water)". According to Olson, "every \$1.50 bottle of water brings around \$0.50 in profit. The actual cost of the *water* in the bottle purchased off a store shelf is generally just a fraction of a cent to a few cents. Thus, typically 90 % or more of the cost paid by bottled water consumers goes to things other than the water itself -- bottling, packaging, shipping, marketing, retailing, other expenses, and profit. As the then-chairman of the board of the Perrier Corporation stated in a remarkable moment of candour, "It struck me... that all you had to do is take the water out of the ground and then sell it for more than the price of wine, milk, or, for that matter, oil."

6. Environmental impacts

Like any other industrial activity, bottled water is not completely innocuous to the environment. On the one hand, quality standards and controls as well as spring protection could help better protecting water quality at a larger scale. The choice of packaging materials increasingly considers environmental parameters. On the other hand, manufacturing, recycling or incinerating bottles of water implies energy needs and some outlets in air and water of polluting particles. Transporting bottled water throughout the world also implies energy needs as well as fuel combustion.

¹⁹ <http://www.wqa.org/Consumer/survey-summary.html>, downloaded 06.02.98.

²⁰ EU Council Directive 80/777, article 7.2.

²¹ Otherwise they wouldn't be categorised as natural mineral water anymore, but rather as spring water. EU directive 80/777, article 8.2.

²² EU directive 80/777, article 9.2.

6.1. Protecting water quality

The 1980 European Directive on natural mineral water sets very strict quality standards for the water, its bottling and transport conditions: the equipment for exploiting the water must be so installed as to avoid any possibility of contamination and to preserve the properties which the water possesses at source. In particular, the catchment, pipes and reservoirs must be made of materials suitable for water and so built as to prevent any chemical, physico-chemical or microbiological alteration of the water; the conditions of exploitation, particularly the washing and bottling plant, must meet hygiene requirements. Water must be transported in authorised containers²³. The European Union's bottled water standards set limits for total bacteria count²⁴ and ban all parasites and pathogenic micro-organisms, *e.g.* coliform bacteria²⁵.

In Europe, natural mineral waters undergo frequent quality tests, both carried out by companies' internal labs (up to three times a day for Evian) and by independent labs (every two months). Physico-chemical characteristics and bacteriological parameters are controlled on the catchment, the reservoirs, the factory and the bottling lines. In comparison, tap water is tested every two days in urban areas. The results of the tests companies' internal labs perform can be made available to sanitary authorities upon request. Certainly, controls made by bottled water companies' internal labs may be biased. Yet, it is not in the interest of the companies, who base their marketing strategies on the purity of their products, to hide away occasional contamination and sell bad quality waters, although this may happen.

Other drinking waters, including bottled spring or purified water and tap water, must meet the quality requirements set by the drinking water directive²⁶. Waters intended for human consumption are drinking water for everyday uses. On the contrary, natural mineral waters are high quality products. Still, the requirements of the natural mineral water Directive are not as strict as the rules of the drinking water directive applying to tap water: quality controls for regular drinking waters are based on 62 parameters, whereas controls for natural mineral water include only 26 parameters (Bertier, 1999 and Lawrence, 2000).

In United States, bottled water is considered a food product and must meet all applicable food packaging and quality regulations of the Food and Drugs Administration (FDA). Tap water, on the contrary, is regarded as a utility and must meet Environmental Protection Agency (EPA) standards. In a test it conducted over 1000 bottles of 103 brands, the Natural Resources Defense Council (NRDC) found that most of them were of good quality although levels of chemical or bacterial contaminants exceeded those allowed in about one third of the bottled waters tested. FDA's rules for bottled water are often weaker than EPA regulation applying to big city tap water: bottled water is required to be tested less frequently than city tap water for bacteria and chemical contaminants²⁷; the regulation for bottled water doesn't ban faecal

²³ EU directive 80/777, Annex II

²⁴ EU directive 80/777, article 5.1

²⁵ EU directive 80/777, article 5.2

²⁶ Council Directive 80/778/EEC of 15 July 1980 relating to the quality of water intended for human consumption, OJ L229, 30/08/80.

²⁷ In particular, tests for coliform bacteria are done once a week for bottled water, vs. an average 100 times per month for tap water; tests for common parasites such as viruses *Giardia* and *Cryptosporidium* are compulsory for big cities using surface water for tap water, but not for water bottlers; tests for organic chemicals such as industrial chemicals, some pesticides and trihalomethanes are done four times a year for tap water, once a year for bottled water (Olson 1999).

coliforms, contrary to municipal tap water. This regulation “completely exempts 60-70% of the bottled water sold in USA”, particularly water bottled and sold within the same state, carbonated, or disinfected water.

The 1980 European drinking water directive provides for spring protection: “the spring or outlet must be protected against the risks of pollution”²⁸, which implies a strictly regulated abstraction period, allowing for the spring to naturally renew, thus preventing excessive pressure on water resources. However, the natural mineral water directive doesn’t refer to specific measures for reducing the use of pesticides in agriculture, for instance, nor to protection areas around water abstraction points, contrary to ordinary drinking water. This last issue is solved at national level. Indeed, natural mineral water companies have an interest in protecting their springs from pollution on their own initiative as this water cannot be treated, but this has a positive environmental impact only on the concerned catchment area and does not extend to other water resources. Evian, e.g., has been able to “control” over the past 200 years the development of economic activities on the spring’s catchment area, where no industrial settlements or intensive agriculture and cattle-breeding are allowed. Evian pays the difference between the cost of chemical fertilisers and green manure. In Switzerland, Henniez planted trees on its spring’s catchment area because of too high levels of nitrates in its mineral water.

The situation is not so clear in emerging countries. India, for example, lacks standards on bottled water, hygiene requirements for the containers and a mandatory system for testing and monitoring bottled water quality and safety (Jose Rahel, 1998). Indeed, 65% of Indian bottlers simply pump water from any bore well or even municipal water supplies. This results, in addition to poor bottled water quality, in threatening ground water resources because of over-exploitation and pollution due to purification and processing.

Indeed, bottled waters are generally of good quality, although they are not exempt of some contamination incidents (e.g.: Perrier in 1990). Yet, good water quality for bottled water doesn’t induce good water quality on a broader scale; purified bottled water, as a manufactured product, doesn’t need to be of the highest quality prior to being treated, although good quality water at spring would reduce treatment loads and costs.

6.2. Bottled water packaging materials and transport

Increasingly, major material used by companies to bottle water are plastic (PET and VC), aluminium and glass (see §3.2).

Plastic is widely used for bottled water packaging (see Figure 1). Although PVC is still used, PET is increasingly used for many reasons: it is brighter than PVC, very transparent and it almost looks like glass. PET is shatter-resistant and easy to work on. Its light weight (20% lighter than PVC) enables to reduce plastic quantities needed to make a bottle. It is compressible, so volumes of waste are smaller. PET is in addition easy to recycle or re-manufacture: it can be turned into polyester carpets, fabrics and fibres for the textile and clothing industry, plastic films, eggs boxes, industrial strapping and new PET bottles. When burnt, it doesn’t release chlorine into the atmosphere, contrary to PVC, whatever type of incinerator is used. According to Ekvall (1998), 50cl refillable PET bottles have much lower environmental impacts than other 50cl packaging, regarding potential global warming,

²⁸ EU Directive 80/777.

acidification and nitrification. However, this depends on different factors, in particular if the bottles are actually refilled and how many times. In United States, 22% of PET was recycled in 1997, up to 80% in Switzerland.

Aluminium: when recycled, aluminium doesn't lose its properties, no matter how many times it is re-used. Treating used aluminium enables to reduce by 95% energy needs, as compared to directly producing new aluminium from bauxite. Cans account for 50% of used aluminium. About 25% of the aluminium produced in the world is recycled.

Glass: as aluminium, glass doesn't lose its properties when recycled. Glass bottles can be washed and re-filled about 80 times. In Switzerland, 85% of glass is recycled and 77% of new glass produced comes from used glass. Introducing used glass in the manufacturing of new glass products enables to reduce by 25% energy needed.

The three environmental factors considered in Table 1 show that PET is better than aluminium, in turn better than glass. PET requires less energy than aluminium and glass when recycled, it releases fewer emissions into the atmosphere and leaves less solid waste, in particular when not at all or only half recycled. Indeed, energy consumption, atmospheric emissions and solid wastes decline in quantity as the recycling rate increases for the three materials. Still, the manufacture of plastic bottles also can cause release of phthalates, and other by-products of plastic-making, into water, air, or other parts of the environment.

Container type	Recycling rate		
	0%	50%	100%
	<i>Energy required (GJ per 1000 litres)</i>		
PET (64 fl oz bottles) ²⁹	5.9	5.0	4.1
Aluminium (12 fl oz cans)	13.9	9.2	4.4
Glass (16 fl oz bottles)	13.7	9.8	5.8
	<i>Atmospheric emissions (kg per 1000 litres)</i>		
PET (64 fl oz bottles)	7.4	6.4	5.4
Aluminium (12 fl oz cans)	16.4	11.0	5.8
Glass (16 fl oz bottles)	26.1	17.5	8.8
	<i>Solid waste (kg per 1000 litres)</i>		
PET (64 fl oz bottles)	61.6	42.2	22.7
Aluminium (12 fl oz cans)	232.6	128.2	23.8
Glass (16 fl oz bottles)	840.0	465.7	91.5

Table 1: Energy and environmental impact for soft drinks containers (source: Crittenden, 1997)

“The energy demand, potential global warming, acidification, nitrification and photochemical ozone formation, are all significantly lower for the refillable glass bottles than for the disposable glass bottles of the same size. The reason is that recycling of glass demands more fuel and electricity than washing and filling of refillable bottles” (Ekvall, 1998). The difference in potential environmental impact of refillable glass bottles and aluminium cans is not significant. Refillable PET bottles are potentially less harmful to the environment than disposable PET bottles: as for glass, recycling of PET demands more fuel and electricity than washing and filling refillable bottles.

²⁹ About 2 litres

Environmental impacts due to fuel combustion and energy needs are lower if the returnable bottles are simply washed and re-filled. Mostly glass bottles are treated this way, while plastic and aluminium packages are generally recycled or remanufactured. However, if we consider transport requirements, the solution of refilling the bottles may be environment friendly only for water bottled and distributed locally. Evian, with a wide distribution network in France and in the world, estimates that using returnable glass packaging would double transport needs, with a smaller volume of water transported per pallets and the return of empty bottles. This would lead to a significant increase in emissions of NO_x, SO_x and CO₂. This solution also requires large volumes of clean water to wash the bottles (Evian, 2000). Considering this, Evian does not envisage to deliver water in big returnable packaging.

The choice of recycling or re-manufacturing used materials also depends on the cost of new raw material: it is more interesting to recycle plastic products when oil prices are high. In addition, recycling of used packaging requires some necessary infrastructure, public-awareness and know-how to organise their collection and to transform them. This is not possible everywhere in the world. In developing countries, these packaging may as well be burnt, end up on rubbish dumps or be re-used or refilled in poor hygienic conditions. Often, bottled water is sold in packs of 6 bottles, wrapped into an “over-packaging”. This produces additional plastic waste.

Trading and transporting bottled water all over the world has obviously a negative impact on the environment, mainly through fuel combustion and the release of polluting particles into the atmosphere. However, this impact is not simple to evaluate as many factors have to be taken into consideration (Ekvall, 1998), particularly:

- ↳ the type of transport used: trucks, boats, trains, private cars;
- ↳ the age and model of the transport mode (old diesel trucks vs. more recent vehicles using unleaded fuel);
- ↳ the distance to travel: producer-retailer-final consumer, or producer-wholesaler-retailer-final consumer (these routes can be covered by different types of transport);
- ↳ the driving modes: urban areas, rural areas, highways.

Depending on all these factors, the impact of the trade and transport of bottled water on, in particular, atmospheric pollution and climate change, can be different. Limiting the transport of bottled water would help reduce negative environmental impact. Indeed, 75% of the world bottled water is produced, bottled and distributed locally. International companies could further limit negative environmental impacts due to transportation by investing, under international brands, in local bottling facilities aimed at providing a local market. Transporting bottled water in bulk containers could also reduce transport needs, although rules should be very strict concerning the sanitary conditions of such transports. In Europe, the regulation on natural mineral water limits bottles' volumes to a maximum 8 litres in order to ensure, among other reasons, the best possible sanitary environment.

7. Conclusion

Drinking bottled water has become a trivial habit in many people's everyday lives. Bad tap water taste or quality, fitness objectives or safety purposes, numerous reasons lead consumers to buy bottled water. Bottled water may even be necessary, for instance in case of temporary

tap water contamination. The trend toward consuming more and more bottled water will keep increasing in the coming years. This flourishing market is profitable for a high number of companies, and employs thousands of people world-wide.

Bottled water quality is generally good, although it can suffer from the same contamination hazards as tap water. In Europe, natural mineral waters quality is frequently tested, both by independent labs and by companies' internal services. These latter controls may not be fully reliable. Yet, it is not in the interest of the companies, who base their marketing strategies on the purity of their products, to hide away occasional and traceable contamination. To make sure bottled water quality is as good as it is claimed to be, companies should release their quality tests on a day-to-day basis and make them available to a wide number of people, for instance through the internet. It is essential that consumers have access to major information, directly on the bottles' labels, i.e., the "type" of water (natural mineral water, purified water, etc.), its mineral composition, the location of the spring or the treatments this water may have undergone. International companies locally investing in bottled water businesses should make sure that the products are of good quality and packed in hygienic conditions, particularly in emerging and developing countries. They should also be careful to the additional pressure they put on local water resources.

International standards could facilitate the access to bottled water products, for instance simplifying bottled water designations. The standards the Codex Alimentarius Commission is working on could be given more importance in the future due to the increasing bottled water trade. Once mere recommendations, these standards could be referred to in trade controversies under the World Trade Organisation rules.

Negative environmental impacts of bottled water could be reduced implementing simple solutions, e.g. re-using bottles of water in adequate sanitary conditions on a local basis, rather than just recycle or re-manufacture them into new products. Certification of local supplies under international brand names could reduce environmental impacts due to world-wide transportation of some bottled water brands. Could the current increase in bottled water consumption threaten local water resources, in particular in countries already facing alarming water problems (i.e. in Asia and the Pacific, where the major increase in bottled water consumption is taking place)? Either bottled water put an additional pressure on local water resources already under stress, or imported bottled water slightly reduce water stress.

Is bottled water a threat to tap water? Some proposals suggested that, considering that using tap water for drinking or cooking represents only a minor part of households' tap water consumption, it would not be necessary anymore to provide them with fully drinking quality tap water. Tap water could be of lower quality, and replaced, for drinking purposes, by carboy-delivered purified water. Nevertheless, bottled water should not be considered a sustainable alternative to tap water, as it is not exempt from periodical contamination. In addition, tap water is more energy-efficient as it is provided through underground pipes, compared to fuel and energy needed for filling bottles and transporting them around the world. Tap water is and should remain a public service meant to deliver good quality drinking water.

References

- Auby, J.-F. (1994): “Les eaux minérales”, Presses Universitaires de France, collection Que sais-je?
- Belot, L. (2000): “L'eau en bouteille, bataille des géants de l'agroalimentaire”, in *Le Monde*, 23 May 2000
- Bertier, V. (1999): “L'exploitation des eaux minérales naturelles est-elle durable au regard du droit communautaire?”, Faculty of Law and Economic Sciences, Limoges
- Council Directive 80/777/EEC of 15 July 1980 on the approximation of the laws of the Member States relating to the exploitation and marketing of natural mineral waters, OJ L 229, 30.08.1980
- Council Directive 80/778/EEC of 15 July 1980 relating to the quality of water intended for human consumption, OJ L 229 30.08.1980
- Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, OJ L 330, 05.12.1998
- Crittenden, B. (1997): “Environmental life cycle analysis: a tool for waste minimisation”, Institution of Chemical Engineers, *Environment97*
<http://www.environment97.org/text/reception/r/techpapers/papers/g12.htm>
- Danone (2000): “Annual report 1999”, Groupe Danone
- Ekvall, T. (1998): “Life cycle assessment of packaging systems for beer and soft drinks”, Danish Environmental Protection Agency, Project n° 399
- Evian (2000): “Water... it's life”, SA des eaux minérales d'Evian
- Evina, E. (1992): “Le guide du buveur d'eau”, Solar
- Fabre-Pujol, A. *et. al.* (1999): “Rapport fait au nom de la Commission d'Enquête sur certaines pratiques des groupes nationaux et multinationaux industriels, de services et financiers et leurs conséquences sur l'emploi et l'aménagement du territoire”, Tome III: “Etudes des comptes de dix groupes et auditions des directions et syndicats”, Rapport n°1667, 2 June.
<http://www.assemblee-nat.fr/2/dossiers/grindus/3petu.htm>
- IBWA (2000): “Frequently asked questions”, <http://www.bottledwater.org/public/faqs.htm>
- IFEN (2000): “La préoccupation des Français pour la qualité de l'eau”, in *Les données de l'environnement* n°57, August
- José, Raphel (1998): “Bottled water entreprise in India” un-published study 39 pages.
- Latham, M. (1997): “Human nutrition in the developing world”, in *Food and Nutrition Series*, n°29, Food and Agriculture Organisation of the United Nations (FAO)
- Lawrence, G. (2000): “European water policy: what's in the pipeline?”, The ICE Annual European Lecture, 16 May 2000

- Lenzer, R. (1997): “A monster beverage event”, in *Forbes Magazine*, 20 October 1997
- Miquel, G. (1999): “Recyclage et valorisation des déchets ménagers”, Rapport 415 (98-99), sénat – Office Parlementaire d’Evaluation des Choix Scientifiques et Technologiques, <http://www.senat.fr/rap/o98-415/o98-415.html>
- Olson, E. (1999): “Bottled water: pure drink or pure hype?”, Natural Resource Defense Council (NRDC)
- Sollberger, E. (1994): “Soif d’eau minérale”, in *Bilan 10/94* at 93-94
- Sullivan, E. (1996): “Bottled water”, *The Food Channel*, <http://www.foodchannel.com/ifc/pros2/stories/bottledwater.html>
- UNESEM – GISEMES (2000): “Eaux minérales naturelles. Statistiques 1999”, Union Européenne et Groupement International des Industries des Eaux minérales Naturelles et des Eaux de Source