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Coffee: A Popular Commodity and its Impact on the Physical, Social and Economic Environments

Abstract

This paper was prepared as a thorough analysis and critical evaluation in regards to popular commodities and their effects to the physical, social and economic environments. It employs the Need Model and other geographic methods to focus on the coffee industry. It highlights how demand for coffee beverages shapes the supplying technologies and what effects of the production methods and consuming habits have on different spheres and sectors. It reflects on the connections that stretch between demand and supply, and it also shows how each environmental segment links with each other and altogether. This paper shows facts, share ideas, increases responsibility and sensibility, and teaches methods to initiate further individual actions in understanding of the importance of locality and sustainability.

Key words

Sustainability; Luxury commodities; Coffee; Environmental effects; The Need Model

"If the Chinese were to consume on average one beer per day, this would match the consumption of the Japanese, Germans and half of the Americans, and would lead to the Chinese cornering the world market for barley. The prices for barley and hops would rise twofold, fivefold. How many fold? We do not know. However, it has been predicted that, if all the Chinese were to drink only one extra beer a week, the price for barley could double."
PAULI, G. (1998)

1. Introduction

Beginning this article with a quote from PAULI, G. (1998), the reader might think there is a mistake here since this research, as the title indicates, is supposed to discuss coffee related environmental issues. We, however, wanted to specifically use coffee as an example only; thus in this quote above, 'beer' could simply be replaced by 'coffee' or any other popular consumable. There is always a product (in this case beer or coffee), and that product has effects on other things, and in this article, we show aspects and methods how this can be thoroughly analysed. By the end of this paper, the reader will have a wider understanding in the needs–consequences relations.

Pauli's quote expresses how beer impacts its physical environment (i.e. barley), and how this affects the social and economic spheres, and vice-versa. In this paper we present a thorough analysis on coffee, and through that we are going to address environmental, social and economic situations and issues related to sustainability and locality. During this journey, we may pick up other consumables (such as water) and reflect on their importance, and we are also going to pay more attention to the *Need Model* and use it in accordance to the impacts of coffee.

2. Aims of the study

By carrying out this research, our principal aim was to write a thorough overview on commodities that have strong effects on us and our environment, and set the spotlight on their importance in (and impact on) our everyday lives. By 'us' we mean general consumers and another of our aims is to make everyone aware of what they consume, where they

shop, what they buy and how products—like coffee, or for example sugar or petrol (or beer)—have a key role in our societies. We have put this paper together with the information researched to educate university students and achieve real changes in environmental awareness among them. We, however, think that this research can be useful to anybody at any age and profession who wants to learn more on sustainability and environmental issues to reduce their impact on the environment and live by a smaller ecological footprint. According to this educational aim, we have also amalgamated explanatory information on general topics (such as the geography of coffee, what coffee is and where it comes from) to develop understanding and knowledge.

3. Research methods

Between 2013 and 2015, the lead author was asked to organise several debates and also to produce information resources and online PDFs[22]. For these events and works, the author had to look up on information that we eventually built into our own knowledge development and researches.

Most of the data comes from 'second-hand' resources which means they were already researched once and can now be used as generally accessible information (e.g. definition of sustainability, statistical data). These can be found in prints and online on the internet. Most of the resources we used we could access through the database of the British and also the Hungarian library systems; and particularly for this project, we ordered plenty of books and other paper-based materials, too. We also used the *Google search engine*, *Google Scholar*, and websites and pages related to our research criteria (e.g. *United Nations*, *International Coffee Organization*). This research project also has its bases and evolution that can be traced back to the previous articles of the lead author's repertoire (BOKOR, L. 2013; BOKOR, L. – SZELESI, T. 2013; BOKOR, L. – NEMES, V. 2014)—so we can now say, what appears here in this paper, is a small segment of everything we have learned and researched in the past few

[22] These resources can be found on our website at www.bcusu.com/eco

years. There is a high number of publications in the topic related to sustainability, so here we present a detailed summary on it to help the reader understand the meaning and relation according to 'luxury' commodities. This time we only have a deep look into coffee production and consumption, and we will try to reflect on other, similar products and their effects on the environment—such as tea, sugar, milk, but this 'product' or 'item' could be replaced by literally anything; by using methods (or a series of aspects) explained in this article, we would like to encourage the reader to do so.

4. Sustainability and environment

First of all, we have to have a summarised look into *sustainability* itself. Once we have learned the details of it, we will see how coffee (and any other 'addictive' consumables) have a great impact on the physical and human world—physical, social and economic regardless. Anybody intending to carry out sustainability related researchers will find a high number of books and other publications. When we define sustainability, we are heavily influenced by the works of CARSON, R. (1972[23]); the WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1987); WACKERNAGEL, M. – REES, W. (1996); PAULI, G. (1998); PEARCE, F. (2006); BERNERS-LEE, M. (2010); PAULI, G. (2010); and GOODALL, C. (2012). To understand sustainability in human circumstances, we have to learn how it works in its normal (i.e. natural) environment. Since in nature it has always existed naturally, the human society had to develop a deeper knowledge and understanding on its physical background and the meaning of its phenomena, and then adapt this concept to the human sphere. In a very general sense, it means *"how biological systems remain diverse and productive over time"* (YOUNG, S. T. – DHANDA, K. K. 2013). Nature inherently strives to be sustainable at all times which, in fact, can also be adapted to human conditions. This can be approached from different aspects which only depend on how it relates to the human sphere.

[23] Originally published in 1962 by *Houghton Mifflin*, but we have got the reprinted edition.

The word *sustainability* (in *sustainable development*) was used for the first time in 1987, in the *Brundtland Report*, which was drawn up by *the World Commission on Environment and Development*, created in 1983 by the *United Nations Assembly*. According to the report, the most commonly used definition for sustainability is described as: *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. This means enabling people, now and in the future, to achieve a satisfactory level of social and economic development, at the same time making reasonable use of the *Earth*'s resources and preserving the natural species and habitats (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, 1987).

The *Earth* is a complex system and in this structure everything is connected: environment, society and economy; therefore, in human relations, sustainability can be conceptually divided into three components: *physical sustainability*, *social sustainability* and *economic sustainability* (BOKOR, L. – NEMES, V. 2014).

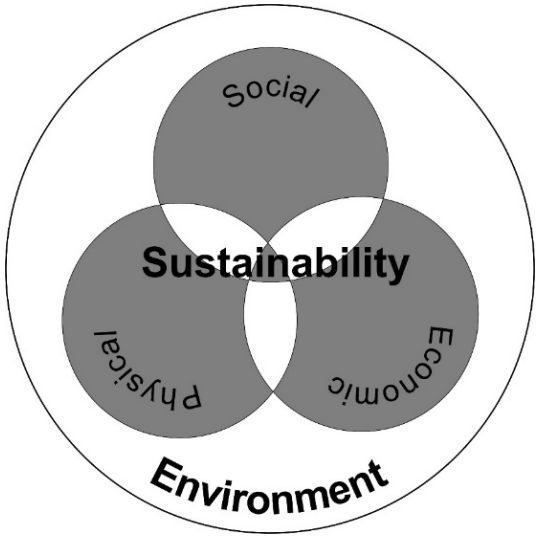

Figure 1 – Cake of sustainability and environment
Designed by BOKOR, L. (2015)

All these come from the backbone of human sphere which is geographically based on physical conditions. In this article, we think that an environment consists of the planet's physical sphere and the processes that form and shape it, hence we call it 'physical sustainability'. We, however, also think that social and economic aspects are part of the same environment; therefore, breaking it up as environmental sustainability is arguably not necessarily needed since the latter two aspects are part of the same, bigger cake. We can certainly talk about these three parts as one, just as well we can talk about physical, social and economic environments individually, too *(Figure 1)*.

4.1. Physical sustainability

Often referred as *environmental sustainability*, it is majorly about preserving the functions and components of the ecosystem in a sustainable manner (GARCIA, S. M. 2011). It is also the capacity that the natural environment has to maintain, e.g. living conditions for humans and other living beings. This sustainability is what nature inherently does: keeps everything moving, looks after the balance of life without major risks and compromising factors. This is the process that we cannot see, but according to several researches (for example FRICKER, A. [1988]; LYNAM, J. K. – HERDT, R. W. [1989]; DAHL, A. L. [2000]; EKINS, P. [2002]; BOKOR, L. – NEMES, V. [2014]), we can recognise, identify and measure. And this is what is important to us, humans, because the physical sphere is where all our resources come from (e.g. water, air, food) (BOKOR, L. 2013); therefore, if there is a higher risk factor regarding maintenance of life and its essential resources, the level of sustainability will fall back—this is the situation when something goes out of control and then becomes *unsustainable*. This can be well illustrated by the *Need Model* which is a simple way to measure a certain entity's sustainability by analysing different factors (either from physical or human perspectives) that have effects on it (BOKOR, L. – NEMES, V. 2014). As an example for these factors in regards to physical resources is the consumption of crude oil or natural gas, but it can be anything—and it can be in regards of any entity: a person, a group of people or even a settlement *(Figure 2)*.

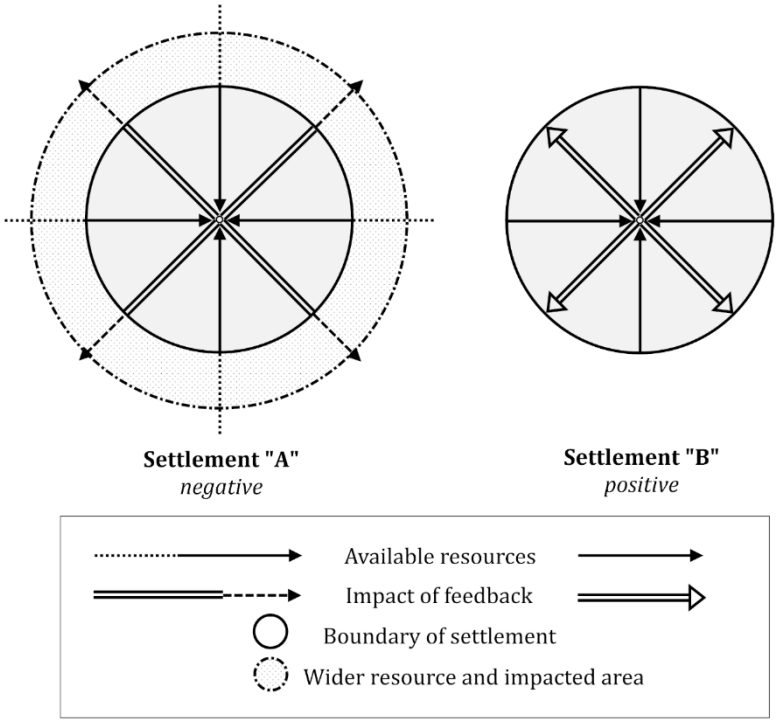

Figure 2 – The 'Need Model' based on a settlement
Source: BOKOR, L. – NEMES, V. (2014)

4.2. Social sustainability

It is the ability of a *social system (human sphere)*, such as a country, to function at a defined level of social well-being indefinitely (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, 1987). According to STERN, R. E. – POLÉSE, M. (2000), it refers to *"policies and instructions that have the overall effect of integrating diverse groups and cultural practices in a just and equitable fashion"*. This concept is strongly based on the balance of *physical sustainability (4.1.)*. This has to be a more than obvious point of view: if the crude oil is used up, there are certain social fields deeply

affected—for example the entire sector of *petrochemistry*[24]. But if one sector is affected, that might lead to a so-called 'domino-effect', where one knocks down the other one, or it might become a 'butterfly-effect', which in this case means the different sectors levelled upon each other would face more and more dramatic effects and these effects would have a bigger impact on other sectors, and also on the social life and economy in overall. At this point quote from PAULI, G. (1998) becomes more understandable, as if there is a higher demand for beer, it will also increase the demand for barley, and this process may have serious consequences.

4.3. Economic sustainability

It is a good combination of physical and social sustainability, but its importance goes much beyond these two. It forms the third pillar in the system *(Figure 1)*. The most recent textbooks on this topic written by HUSSEN, A. (2012) or IKERD, J. (2012) are useful pieces here to understand economic sustainability. Although when we try to define it, the *Brundtland Report* is probably the most comprehensive source: *"the ability of an economy to support a defined level of economic production indefinitely"* (WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, 1987). So, its bases lie in the physical environment and also in the social one. What does this mean? It means that there is the crude oil which is a natural resource and then this crude oil is produced (exploited) by companies (people) that—after a certain refinery process becomes petrol or another petrochemical product—feeds our machines and cars, etc. First is physical, the second is social. What comes between or above these two is the economy—the way as it is traded. For example, there are countries on the planet where the economy is entirely based on crude oil (e.g. *Venezuela*, *Iran*, *Nigeria*—GALLUCCI, M. 2014). If, for any reason, the

[24] It is a branch of chemistry that studies the transformation of crude oil (petroleum) and natural gas into useful products or raw materials. The products are known as petrochemical products and they are strong part of human's everyday life. Such well known adhesives and sealants, cosmetics, fragrances, inks and dyes, packaging and bottles, paints—generally all plastics.

crude oil production is stopped, that would technically sentence any country to death—economically of course, but that would affect the society and so on, anything that is connected in this system.

Crude oil and other petroleum products can be classed as 'luxury commodities'—in a different sense what 'luxury' normally means; it is more from an environment/sustainability aspect as we see it. The reason is simple: it is a finite resource that is used by everyone at a very large scale, relatively expensive and the effects of running out would have on the society and economy are very high. There are similar items that can be used here and coffee is one of the most important in this category.

4.4. Needs and wants

Under 'luxury commodities' we also mean that a human does not require these items for one to function. We could mention millions of items that would fit into this category, but that importance is defined by how that certain product affects the environment and sustainability. If we take the definition of 'sustainable development'—that is credited to the *Bruntland Report*—into a deeper analysis, there is one certain word that has to be highlighted and further analysed. Let us see the definition one more time: "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* Our word is: 'need'. What is need? According to SOANES, C. (2003), the *Oxford English Dictionary* describes need as *"require (something) because it is essential or very important rather than just desirable."* Water is essential for life, therefore it is a need. In contrast to that, crude oil or coffee (for example) is not essential for life, therefore it is a 'want'. The *Oxford Dictionary* describes 'want' as *"have a desire to possess or do (something); wish for".* The difference between the two words are very little, thus they are often used as synonyms. Moreover, coffee is produced by using water. It is another contrast if we see that water is normally a freely accessible, naturally occurring

Figure 3 – The difference between 'need' and 'want'
Drawn after COLOSSAL (2011) by ECCLESTON, K. (2015)

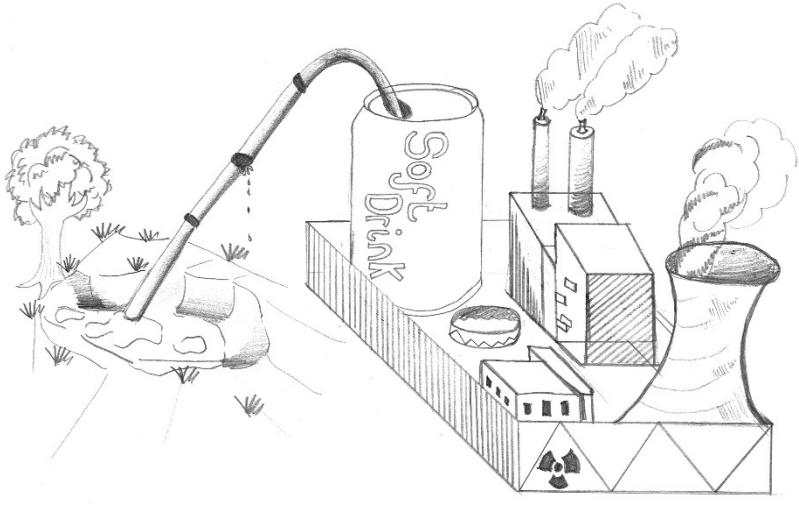

Figure 4 – Companies use up the Earth's resources, make products and sell them for profit.
Drawn after ISLAND BREATH (2011) by ECCLESTON, K. (2015)

chemical compound (fluid), but we can easily pay an average £2–3 for a cup of coffee at a café in the *United Kingdom*. Also, international companies like *your nearest café*, or others, use water as a profitable 'item'—but if we have a look at other similar products, like soft drinks or alcohols for example, companies use water that naturally occurs and turns it into a product for profit. The need/want interference can easily be understood by studying *Figure 3* which has a lot of common with *Figure 4* and *Figure 2* (BOKOR, L. – NEMES, V. 2014).

5. What is coffee?

Coffee is well-known as a brewed beverage prepared from the roasted or baked seeds of several species of an evergreen shrub of the genus *Coffea* (CANYON COFFEE ROASTERS, n.a.). The most common types of coffee plants are believed to come originally from *East Africa* and its history on production and consumption goes as far back in time as the thirteenth century. The coffee drink itself was probably first prepared and drunk in *Abyssinia* (today *Ethiopia*), however, its first cultivations were made by the *Arabs* (PENDERGRAST, M. 2010). This plant is an evergreen species and it only grows where hot and moisture air is sufficiently provided (its cultivation however depends on a high number of other factors). Therefore, its origin and possible cultivation zones may easily be identified around the globe among certain countries (QUIST, R. n.a.). There are two common types of coffee cultivated: *Arabicas (Coffea Arabica)* and *Robustas (Coffea Canephora)* (SCIALABBA, N. E. – HATTAM, C. 2002; ICO, 2015).

5.1. Where does coffee come from?

Coffee is a tropical plant which grows between the latitudes of 25 degrees north and 25 degrees south and requires very specific environmental conditions for commercial cultivation: temperature, rainfall, sunlight, wind and soils are all important (SHARMA, R. 2014).

According to CANYON COFFEE ROASTERS (n.a.), coffee plants are cultivated in more than 70 countries, primarily in equatorial state formations of *Africa*, *Asia & Oceania*, *Central America* and *South America*.

Most of these countries however are colloquially known as the 'third world'[25].

- *Africa*: *Ethiopia* is the largest producer in the region, followed by *Uganda* and *Côte d'Ivoire*. Among the other *African* producers *Tanzania* and *Kenya* are the two major coffee countries in the region (ICO, 2014).
- *Asia & Oceania*: *Vietnam* is the second largest producer in the world and the biggest in *Asia* followed by *Indonesia* and *India* (ICO, 2014).
- *Central America:* This region is highly depending on coffee production and technically all of the countries contribute to the global market. The largest producer in the region is *Honduras*, followed by *Mexico*, *Guatemala*, *Nicaragua*, *Costa Rica*, and *El Salvador* (ICO, 2014).
- *South America:* This region produces 46% of the world total. It is led by *Brazil*, and *Columbia* and *Peru* are the largest ones (ICO, 2014).

5.2. Coffee production/consumption in numbers

Table 1 – Global coffee production and consumption
Source: ICO (2015)

Global coffee production (August 2015)	
141.7 million	Estimated number of 60 kg bags of coffee produced in 2014/15
3.5% reduction	Estimated reduction in global coffee production in 2014/15 compared to 2013/14
3.9% reduction	Estimated reduction in global production of Arabica coffees in 2014/15
3.7% reduction	Estimated reduction in global production of Robusta coffees in 2014/15
Global coffee consumption (August 2015)	
149.2 million	Estimated number of 60 kg bags of coffee consumed in calendar year 2014
2.3% increase	Average annual growth rate in global coffee consumption since 2011

[25] It is a loose term for all developing countries.

5.3. Where is the coffee berry produced?

According to the previous sections, in 2014 and 2015 *Brazil* is still the world leader in production of green coffee, followed by *Vietnam*, *Colombia* and *Indonesia* (ICO, 2015)—*Figure 5* (data in figure is based on *Worldmapper* data of 2006 by SCHOLER, M. [2006a], so that is representative only, although there is no change in the top producers. We only use this to correlate with *Figure 6*.). Seeing only the top 10 producers, it can certainly be stated that coffee comes from relatively poor countries (defined by their GDP). *Figure 6* illustrates the impact these countries have on the coffee production.

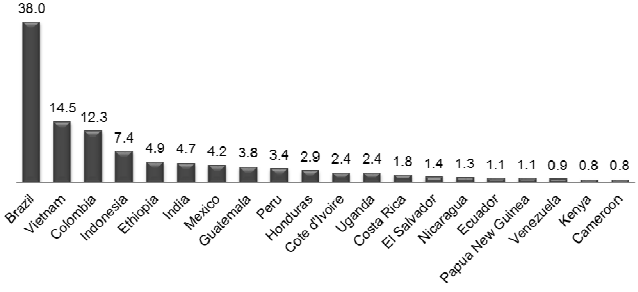

Figure 5 – Coffee producers
(The chart represents coffee production in millions of 60-kg bags.)
Designed by BOKOR, L. 2015; Source: SCHOLER, M. (2006a), ICO (2015)

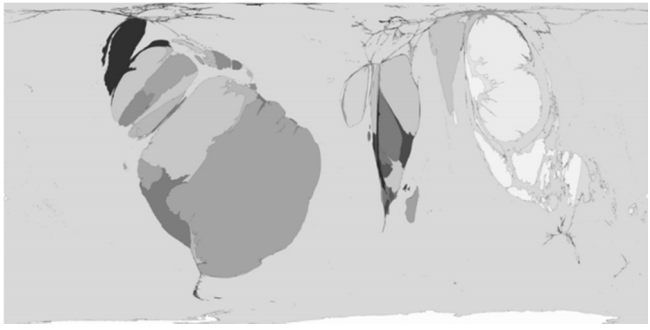

Figure 6 – The weight of coffee producer countries on the global market
Source: SCHOLER, M. (2006a)

5.4. Where is the coffee imported to?

As *Figure 7* clearly shows, *European* and *North American* countries rated for the most of the coffee consumption; however, among the emerging markets there is *Japan*, *China* and even the producer *Brazil*, too. Comparing this data to the information on production *(Figure 5–6)*, coffee is majorly exported by rich (according to their GDP), *Western countries*. Their dominance is highlighted by *Figure 8* (similar to *Figure 5–6*, the data in these figures is based on *Worldmapper* data of 2006 by SCHOLER, M. [2006b]).

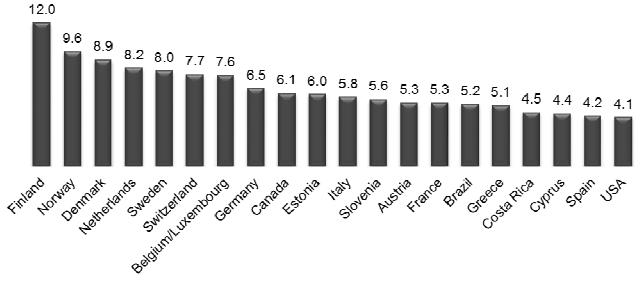

Figure 7 – Coffee consumption
(The chart represents data in kg per capita.)
Designed by BOKOR, L. 2015; Source: SCHOLER, M. (2006b), ICO (2015)

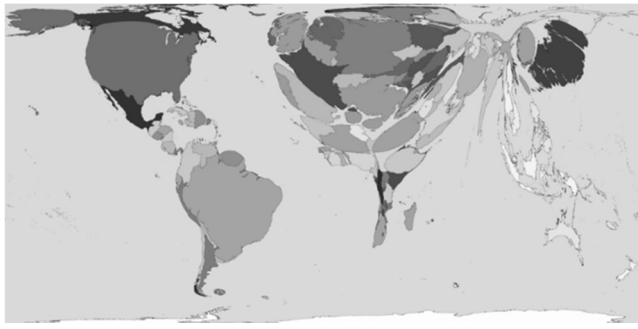

Figure 8 – The weight of coffee consuming countries on the global market
Source: SCHOLER, M. (2006b)

According to the INTERNATIONAL COFFEE ORGANIZATION (2014), the total demand in 2013 was estimated at 146.1 million bags, and had been growing at around 2.1% per annum for the past four years. This growth has mostly been driven by the increased demand in exporting countries and new consuming countries. The global demand keeps increasing which is now at a rate of 2.3% annually (ICO, 2015). This is mainly related to countries, particularly to traditional markets (*Canada*, *EU*, *Japan*, *Norway*, *Switzerland*, *USA*, others), but the biggest potential is in emerging markets (*Algeria*, *Australia*, *Russia*, *South Korea*, *Turkey*, *Ukraine*, others) and coffee exporting countries. The demand is strong whilst the production is getting heavily affected by environmental issues and climate change (ICO, 2015).

6. The effects of coffee production on the natural environment

Decades or even centuries ago, coffee consumption was a local commodity in several areas of the planet—mainly among the coffee producers in *Africa*. Nowadays, however, it is a very popular habit as it is one of the world's second most valuable and most tradable commodities (PENDERGRAST, M. 2010)—its fame can only be compared to crude oil's which is the first (CSERESNYÉS, M. 2010). This certain type of product has a major impact on all segments of the environment, and it is one of those consumables that strongly defines the consumer's ecological footprint (WATSON, K. 2001). In the following, which is loosely based on MOORE, V. (n.a.), we will have a look at the most important global issues associating with the information we have touched so far regarding coffee. The order from *6.1.* to *6.6.* reflects on how a local problem goes bigger and has effects on other things, thus deforestation → use of fertilisers → degradation of soil → waste accumulation → pollution of land and waterways → effects on climate.

6.1. Deforestation

Coffee is a typical product of the tropical and subtropical areas. According to SHARMA, R. (2014), the traditional method of coffee cultivation and production is commonly referred to as the *shaded method* which means

that the coffee plant generally and simply is grown in woodlands under the shades of trees which is the most natural way possible. However, the increasing market demands has been requiring more space and quicker yielding processes, therefore since the 1970s, a method *called sun cultivation* has been used among the most common production techniques (FRIDELL, G. 2007). This method creates the highest yield of coffee bean, but eliminates biodiversity of the region and harms the environmental by the clearing of forests. The result is massive deforestation in many of the producing countries, since the great majority of them are tropical, therefore affect the rainforests and their diversity (LANG, C. R. 2001; WATSON, K. 2001; BLACKMAN, A. *et al.* 2005).

6.2. Increase in the use of fertilisers and other chemicals

Since the traditional shaded method provides a natural way of coffee production with effective sustainable upkeep, sun cultivated coffee often employs intensive pesticides and chemicals that present serious health and ecological concerns (SHARMA, R. 2014), not only in the producing environment, but also through coffee drinking as, the chemicals remain in the coffee bean throughout the process. According to WATSON, K. (2001), due to the poor soil nutrient base found in cleared land, the average productive life of a coffee plantation is less than 20 years without the intensive use of fertilisers. Increasing sun cultivation requires the clearing of trees and increased use of fertilisers and pesticides which damage the physical environment and may cause further health problems.

6.3. Soil degradation

According to LANG, C. R. (2001), deforestation has several impacts on the environment. Among these one of the most common issues is erosion. This is caused by the elimination of shade cover which pushes the rates of erosion higher. The process of deforestation, cultivation, and degradation is a cycle (WATSON, K. 2001). Since the surface of easily degradable soil is not covered with strong vegetation any longer, the regular

heavy rains easily wash down the surface and can cause further disasters (e.g. landslides, mudflows) in human living areas, too (GLADE, T. 2003).

6.4. Waste

Unsurprisingly, there is also an enormous amount of waste and by-products generated throughout the route of coffee (ESQUIVELA, P – JIMÉNEZB, V. M. 2012). The process of separating the beans from the coffee cherries generates high volumes of waste material in the form of pulp, residual matter and parchment. Production and yet the coffee consumption and consuming habits deliver even more waste through other types of waste, e.g. the coffee grounds, although, according to PAULI, G. (2010), there are ways to reprocess these materials and revitalise global economy based on coffee. To produce the beverage it requires more water, energy and, if the coffee is taken away, the plastic containers mean extra wastage. Also, the high energy demands that containers require to be produced have not even been mentioned yet.

6.5. Water pollution and degradation

Among and beside the above mentioned issues, the contamination of waterways is a serious environmental threat from the processing of coffee beans (MOORE, V. n.a.)—which in fact, it is purely the most important factor out of all. Largely irrespective of how coffee is grown, discharges from coffee processing plants represent a major source of pollution of waterways and also natural reservoirs (MOORE, V. n.a.; SHARMA, R. 2014).

As we know now, coffee is one of the world's most commonly drunk beverages which indicates a high number of consumers every year (ESQUIVELA, P – JIMÉNEZB, V. M. 2012). According to TAYLOR, D. W. (2013), approximately 400 billion cups of coffee is drunk worldwide every year, which is, according to ICO (2015) means 149.2 million of 60-kg bags of coffee (2014). Producing this beverage requires two things only: ground, roasted coffee beans and water. But, how much water is needed to produce a cup of coffee?

The water footprint concept was introduced by REES, W. (1992) and WACKERNAGEL, M. – REES, W. (1996). The ecological footprint denotes the area needed to sustain a population, the water footprint represents the water volume (cubic metres per year) required. PEARCE, F. (2006) made a calculation on water footprint required to grow coffee berries:

- 1 kg of coffee requires 20,000 litres (or 20 tonnes) of water.
- 140 litres of water is needed to grow one coffee plant.
- 140 litres of water equals 1,120 cups of water = 1 cup of coffee drink.
- The processing of coffee requires extra water.
- To make a drink out of the coffee needs a cupful more water. (Spiral effects.)

It is a concern where this 140 litres of water actually comes from to grow the coffee seeds as PEARCE's calculations are certainly arguable. However, its origin is not an important factor, but the amount of water used is irrespective as this water is to produce the coffee beans only. The extra water and energy required by coffee drink preparation has not even been mentioned yet. (This 140 litres of water also appears in other research papers, such as in HOEKSTRA, A. Y. – CHAPAGAIN, A. K. [2007] and where they also mention an extra 34 litres which amount represents the consumption.)

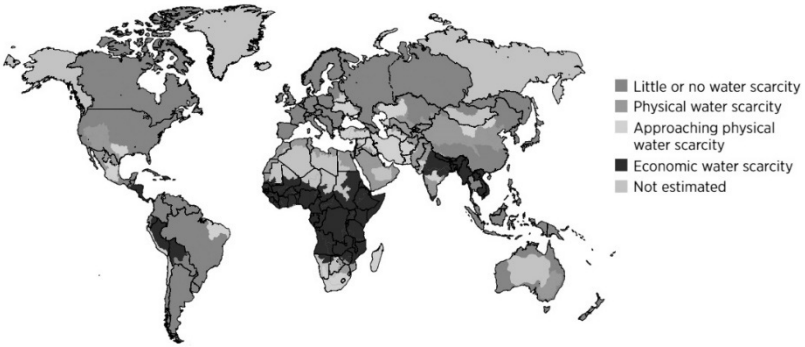

Figure 9 – Water scarcity
Source: UN WATER REPORTS (2012)

So, the water that certainly could be used for plenty of other things is actually exploited to grow coffee beans. It is important to link the water usage to the countries where the coffee seed is grown as it is often grown in countries where there is a water (or food) shortage *(Figure 9)*, such as its birthplace, *Ethiopia*, or there is a serious water scarcity, not necessarily related to the lack of precipitation or natural water resources, but it can have economic reasons, too. Coffee is among the most water-required luxury commodities with, e.g. tea, sugar, corn, etc. (HOEKSTRA, A. Y. – CHAPAGAIN, A. K. 2007; SHARMA, R. 2014).

6.6. Coffee and climate relations

The coffee plant is very sensitive to climate conditions and it has to have a certain combination of sunshine, warmth and precipitation to yield according to current market and consumer demands (UCSUSA, n.a.). It is also known that these demands are increasing year after year (ICO, 2015). But the changing climate means changing mean temperature and precipitation regime which can result in the disappearance of the traditional coffee growing regions which would heavily affect the global production that delivers coffee to café houses and general consumers. There are already signs of these effects which can be traced in the decrease of global production and the impact on food security (SCIALABBA, N. E. – HATTAM, C. 2002). According to ICO (2015) and also data shown earlier in *Table 1*, the production has been decreasing *(Table 2)*.

Table 2 – Total coffee bean production between 2012 and 2015 (in 60 kg bags of coffee)
Source: ICO (2015)

2012–2013	2013–2014	2014–2015
147.5	146.8	141.7

According to ICO (2015), among these reasons we have to mention:

- the drought in *Brazil* came after the end of 2013–14 harvest, but has had a significant impact on production since 2014–15 which is also predicted for 2015–16.

- in *Central America*, production was badly affected by the outbreak of *coffee leaf rust*, which drove output down to 16.8 million bags compared to 18.5 million in 2012–13 and 20.2 million in 2011–12, before the rust outbreak.
- (There may also be economic reasons behind the difference of these number—see *Chapter 7*)

It can also be highlighted that climate change may also generate new regions that is suitable for coffee production; however, the overall growing population of *Earth* might bring along the growing food demands which would affect the amount of coffee that can be grown and produced in one certain area and at overall global level (LADERACH, P. *et al.* 2010).

The impacts on climate can also be related to the emission of *Carbon dioxide* (CO_2). The more CO_2 is concentrating in the atmosphere, the higher impact it has on the global environment as it is a greenhouse gas which plays a vital role in regulating *Earth*'s surface temperature—i.e. radiative forcing and greenhouse effect. Regarding coffee (or tea), according to BERNERS-LEE, M. (2010), the following breakdown applies:

- 21 g CO_2e black tea or coffee, boiling only what needs to be prepared the drink,
- 53 g CO_2e above with milk, boiling only what needs,
- 71 g CO_2e average, with milk, boiling double the water that needs,
- 235 g CO_2e a large cappuccino,
- 340 g CO_2e a large latte.

These numbers will only be more emphasised, if compared to other things at similar level: for example,

- 80 g CO_2e a banana (each),
- 150 g CO_2e a mile by bus as a typical London bus passenger,
- 160 g CO_2e a mile by train on London Underground,
- 160 g CO_2e an average 500 ml bottle of water,
- 500 g CO_2e a pint of locally bottled beer from the shop or a pint of foreign beer in a pub,
- 723 g CO_2e a pint of milk,
- 1800 g CO_2e a box of eggs (BERNERS-LEE, M. 2010).

As we have seen it so far, coffee production—which is generated by constant global demand—has a significant impact on the physical environment. At *Chapter 7*, we will look at how coffee related issues affect the social and economic spheres.

7. Wider social and economic effects

The analytical aspects and theoretical framework to evaluate the social and economic impacts of coffee consumption are provided by a three-component model shown in *Figure 10*.

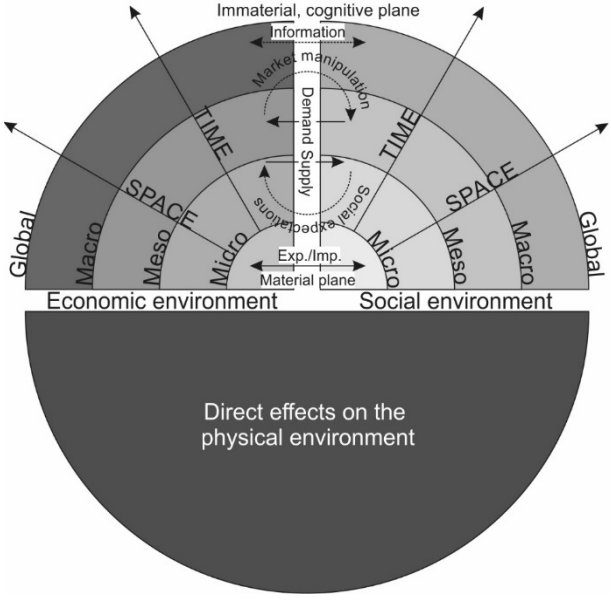

Figure 10 – Mechanism of actions of the coffee consumption in the social–economic space
Designed by ALPEK, B. L. (2015)

According to this, the effects of coffee consumption—among several other approaches—may be evaluated by breaking it down into three segments: the physical environment, and also social and economic ones

respectively. Each segment marks a different focal point, and within each of them the specificity of the micro, meso, macro and global levels can be distinguished. This present paper under an economic environment means the broader range of businesses as participants in supply involved in the coffee production;

- this at micro level determines typically a few companies and their suppliers,
- at meso level a broad range of businesses competing on the market are delineated to a specific criteria, and
- at macro and global level, it goes around questions and issues related to the national and worldwide co-operations and acquisitions, and sectoral specificities.

The micro level of the social environment is composed of the individual, the meso is of the family and its wider societal connections. At macro level the national and international characteristics and cultural features appear; the global scale analyses the implications of humankind's coffee culture. Both the social and economic subdivisions *(Figure 10)* can be interpreted in the horizon of space and time (spatial and temporal aspects) which typically spreads significantly from the micro stepping stone towards the global one. According to this, at human level practically from the ages of 0 to 100, whilst at global level from the coffee's first appearance to present days questions can be expressed.

The specificities of the physical environment in this paper have been discussed thoroughly, thus in this chapter the characteristics of the interaction of the social and the economic spheres will be highlighted. These two environmental factors have a lot of mutual features in common which interactions can be interpreted in two planes (dimensions): material and immaterial/cognitive. Materials flow in the first, information in the latter one, in which forms the system of coffee demand and supply. These connections are highly affected by both parties: the economic sphere by the tools of marketing (in a broader sense by market manipulation) whilst the society by the articulation of such expecta-

tions which sends needs towards the producers, processors and retailers (for example the *Fairtrade* movement—which is going to be described in the following paragraphs).

The focus of this chapter is set at the global and macro levels where we are looking for a specific answer that explains what effects of coffee consumption have on the culture and vice-versa, and how it impacts the economies of the exporting and importing countries.

The coffee is traded on the international stock exchanges, on which a 10 to 15 years periodicity may be observed. It is implicated in the mechanism of demand–supply cycle that the coffee plant only turns into productivity after an average of 5 years (thereafter, it continues to be yielding for 20–25 years), which not or just with limitation makes possible the continuity of production and its adjustment to the demand. Behind that periodicity that is resulted by the mechanism of actions there are the temporal alternations of excess demand and oversupply, and the answers given for them. In the case when supply exceeds the demand—partly because of better yielding periods—traders react, on the one hand, by the alternative use of crops (not with food consuming purposes), and, on the other hand, by the cut of export; according to their actions, the fall in prices—together with appropriate control—applies to a milder rate. Although, due to the dropping prices, producers might exterminate their crops which results in the downfall of supply. There is no official, trustworthy statistics in this question, but at the establishment and during the upkeep of the coffee plantations, it is not negligible for the competition of concurrent products which with high prices and continuous demand may erect a competitive advantage against the sustainability of the coffee production. Due to the disinvestment, the supply is decreasing.

A while later, the market meets an aggregate excess demand, but because the time scale of the 5-year productivity period, the reflection also delays, the prices begin to rise rapidly, many new plantations are established—but due to the extension of the reaction period, these possibly exceed the needs—which are once productive will be the drivers of the oversupply. In the coffee production, such end points were observed at

the peaks of excess demand in 1994 and the oversupply in 2002 (LETENYEI, K. 2006). An excess demand high point was also seen—more or less as scheduled—in 2011 when the coffee's price reached a 34-year record (ICO, 2014).

One of the key issues of the transition towards the social effects is the analysation of the coffee sector-related employment questions. According to estimations, there are about 25 million people provided with work by the coffee production industry (dominantly in the *South American countries*), thus its effects on the global labour market is significant (GOLDSCHEIN, E. 2011). It is an important fact that coffee—according to their cultivation areas—practically provides employment (from the production aspects) dominantly for the developing countries (90% of the produced coffee comes from these areas). The type of work requires low skills, but a significant amount of human labour, even though the machine harvesting technology is becoming more widespread. The latter one cannot compete in quality with hand selection. The coffee production has a highly positive impact on the socialisation of labour which can be traced back to—in regards of the investment of the huge amount of energy and the attitude towards picking of the continuously growing 'capitals'—the acquiring of an outstanding expert behaviour. The world's biggest coffee producer, *Brazil*, is typically specialising and producing in large scale farming with a high level of mechanisation. Among the producers stand out *Columbia* and *Vietnam*, which two together with *Brazil* are able to have a significant impact on the global coffee market. Among these two, the most decisive difference is that the first one produces majorly *Arabica* type coffee beans, the Indochinese—as a relatively new producer on the market—is specialising in *Robusta* types.

Without any doubt, a significant rate of income can be generated by the sale of a cup of coffee drink, to produce this beverage averagely 7 gram is needed which realises a 60–70% profit on one cup. Towards the coffee producers, however, this rate falls back rapidly and, even if some of the large traders operate with a triple profit rate, they sell a kg of coffee bean for averagely about 30–50 eurocent. To reduce this economic gap, international movements who also play a key role in the trade of

tea, such as *Fairtrade*, have been initiated; one of its prominent, registered members is *ASUVIM (Asociación Integral Unidos para Vivir Mejor)* which, by its self-determination, is a small community with about 130 members in *Guatemala* around the *Lake Atitlan* for the organisation of the coffee producers' safeguarding of interest (CAFE IMPORTS, n.a.). Its declared goal is that the producers besides fair pricing could send the highest quality coffee into the market, and also to preserve the production's local traditions. The coffee sold within the framework of the *Fairtrade programme* may even be double price compared to the market's buying-in price. The market nowadays is also affected by the *Zeitgeist* movement (an establishment that advocates a transformation of society and its economic system) which takes actions to propagate and promote the bio-coffee culture which is chemical and GMO free, traditional, and confers natural production methods by local, holistic communities. The bio-coffee production also works efficiently as a marketing tool, because most of the producers—when it comes to plantation technologies and due to the nature of the plant—in many cases, are not able to choose any other method, but bio. For example, the producers in *Yemen*, where poverty does not allow the development of any modern machinery or the use of technology, and nevertheless the coffee plant itself naturally does not require any chemicals, or the *Galapagos Islands* where the governmental regulations refrain from methods other than bio. Another typical example is *Papua New Guinea*'s where the specific features of localised production (80–90% indigenous people handpick the coffee berries naturally grown in the heart of the rainforest) exclude mechanisation and fertilisation. Nonetheless, the strengthening of bio from social and ecological aspects is of paramount importance.

The overview of questions of employment and the human side leads to the analysation of the prime aspects of coffee's social impacts. The coffee consumption is a significant cultural segment, spiced with national or even with continental traditions, local specialities. Its motivational system defines what trends will dominate a certain area. According to this, people consume coffee for

a) physiological and nutritional benefits,

b) habitual or routine reasons,
c) ad-hoc experience,
d) or socialisation.

The cultural features of coffee consumption can also be categorised, according to which it may be (or range from) espresso or (to) lungo (long black). It is among other aspects when the coffee cultures are dominantly affected by national specificities; therefore, it may be *Arabic*, *Viennese (Austrian)*, and *Italian*, *German* or *American* types.

The drivers of coffee drinking according to the quality segment are between the status and hedonist consuming habits that are served by a range of different, quality coffee houses (cafés). In both cases the quality is important which does not only apply to the coffee beans, but more significantly to the preparation of the beverage itself. According to this, beyond the production, the coffee sector–similarly to the chefs in food production–has invented an individual qualification known as the 'barista' which is a popular profession in the field of quality coffee consumption.

In spatial dimensions, coffee drinking shows a series of continental, national and, in some cases, local characteristics. At places like the *Galapagos Islands*, where the coffee is produced under *UNESCO* protection and this involves indigenous, geographically local specific coffee plants, and the plantations are owned by small family businesses, the special characteristics of this area are obvious; whilst these cultural specifications differ significantly in the coffee culture of *Africa*, *South America* and *Japan*. Coffee drinking is as organic part of the life style of Western civilisation as it is of the Eastern, it is connected with national traditions, and affected by the climate. This latter mechanism of actions is an excellent example in the case of *Finland* where there is the highest coffee consumption per capita in the world. According to statistics of 2013, each Finnish consumed about 12 kg of coffee *(Figure 7)*, compared to the *United Kingdom* where this was only 2.8 kg (GOOGLE FUSION TABLES, 2013). The success of coffee in this *Scandinavian country* is also backed by its northern situation, which is the conclusion of the coffee consumption's spatial analysis. According to this, the more northern a country is

situated, thus the hours of sunshine is low, the higher volumes the coffee consumption gets—due to this beverage's caffeine content, it promotes awakeness. The Finnish infatuation to coffee by others is connected with, for example, Lutheran work norms or alcohol prohibition (WORLDATLAS, 2015). This latter one is an excellent example which demonstrates that, over against tea, coffee could be a perfect alternative to the consumption of alcoholic beverages. At the bottom of the list—presumed to be due to climatic rather than financial reasons—there are mostly developing countries. Regarding coffee consumption, the financial aspect is also significant as, even though coffee nowadays is widely available, the premium category is only available with effective consumer demand, thus for people who can afford it. This also affects the competition for coffee as it ranks top countries with high income. In these nations, the change in consuming habits can also be tracked: instead of simple, coffee making at home, the preference has been moving towards local cafés which couples with services resulting in higher prices—and expectations. The demand for coffee at product line level is price-inflexible and it is hardly replaceable, but among the types of coffee the substitutability is very high—the small aromatic differences can hardly be felt be the customers, therefore they differentiate by brands. Notwithstanding this, the coffee, according to its addictional affects, it is income inflexible, thus who has never consumed it will not get into the habit due to any rise in income; and the one who is a regular consumer will always saves a certain amount for coffee from its income (LETENYEI, K. 2006). Among the current trends, the differentiation of coffee products is predominant which not only includes the instant coffees becoming conspicuous and their effects, but also the wider domestic utilisation of coffee machines and the domination of the American coffee culture.

As a whole, the coffee production/consumption has significant cultural/social/economic effects, influences the direction of the global capital flow and provides income to a wide range people in the developing countries. After all it is not surprising that the species of coffee plants

are kept in strictly protected biorepositories (gene banks) from environmental damages that would threaten their upkeep. If coffee disappeared overnight, at least about 25 million people would lose their jobs, over a billion coffee event would never happen, a 20 million USD worth sector of the world economy would turn into nothing, there would go at least 60% less caffeine into people's body, and the catering industry's fastest developing sector would cease to be along with all noble cafés.

8. Summary: The route of the coffee

Summing up what we have discussed in this paper is to understand clearly how coffee cultivation/production/consumption affect the sustainability circles and all of the three aspects of the environment. According to this aim, we have prepared a short but thorough overview on the steps from a bean berry to a coffee drink *(Figure 11)*. This summarised look is loosely based on a few resources that we have used (NCA, n.a.; WINTGENS, J. N. 2009) and gives an overview of how the coffee bean takes its journey from a seed to a brewed beverage.

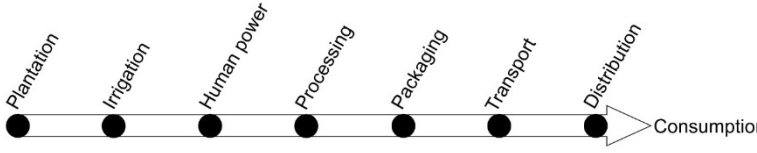

Figure 11 – The route of the coffee
Designed by BOKOR, L. (2015)

8.1. Plantation

Coffee bean is a plant typically cultivated in tropical and subtropical areas at high elevations (see examples in *Figure 5*). The higher yielding technique has severe impacts on the environment, such as *deforestation*, *habitat destruction*, *and soil and land degradation*. The majority of coffee produced comes from relatively poor countries and mostly sold to *European* and *North American* consumers. The high (and still increasing) economic demands require high productivity techniques which results

in more an increasing use of fertilisers and synthetic chemicals, and may also involve more land to be utilised for the demand.

8.2. Irrigation

Coffee is among the most water-required luxury commodities besides, for example, tea, sugar, and corn (SHARMA, R. 2014). According to PEARCE, F. (2006), an approximately 140 litres of water is needed to grow a coffee plant which is only enough for one cup of coffee drink. This requires huge lands to be watered, although, the coffee bean is often grown in countries where water shortage causes regular environmental problems, such as in *Ethiopia*. Due to high productivity demands, the natural water resources may also be contaminated.

8.3. Human Power

The coffee production and its processing require a huge amount of human care and effort that includes, for example sowing, plotting, harvesting, bagging and transportation. Nevertheless the importance that the human power represents in order to produce the coffee beans, most of the coffee workers worldwide are not guaranteed their basic labour rights and they are also vulnerable to the plantation owner. Coffee pickers, for example, have to pick a certain quota in order to get the minimum wage (averagely less than £2/day) (PAIGE, J. M. 1998; JAFFE, D. 2014).

8.4. Processing

The industrial process means converting raw fruit of coffee plant into finished coffee. The process begins with picking of the berries and then the beans have to be removed from their protective fruity shell. This is done by sun drying (dry process). However, to achieve a more efficient quality selection, the coffee fruits are often pre-washed (wet process); its method requiring the use of specific equipment and substantial quantities of water. Among these examples, other processing methods can be mentioned, for example cleaning, polishing, which requires extra

energy, water and human effort. (Roasting is often in this process cycle, too.) (NCA, n.a.).

8.5. Packaging

Once the processing of the raw coffee material is finished, the green coffee beans are normally bagged and preserved until further use. Before transporting, the coffee is kept in canvas bags or paper sacks and stored which requires the trader to build—sometimes very large—storage houses. These warehouses have to be built according to strict temperature and humidity control which also requires more energy. Storing coffee beans is a great investment of human power, energy and money.

8.6. Transport

Most of the coffee producers have only a small local market which they can reach by rail or on road, the great majority of the coffee is therefore transported to far distances to be sold, mainly by cargo ship to *European* and *North American* markets. Since the consuming demands are high, the coffee is transported in huge amounts, but the storage of coffee requires special atmosphere (cool, dry and good ventilation), therefore special containers are designed and used for transportation. The environmental impact of transport is significantly high.

8.7. Distribution

The green coffee beans represent a major export commodity and one of the world's largest agricultural export value. The coffee that is distributed in the Western markets have a great ecological footprint by the time it arrives to its distributor and will also use more natural resources (mainly energy) by the time it becomes a coffee drink. The distribution of coffee also includes selling the green coffee beans to leading companies who prepare them for the market (for example roasting, flavouring, packaging, and then further distribution to the stores, retailers and café shops) (BATES, R. H. 1997).

8.8. Consumption

From this step, consuming habits have a further impact on coffee's ecological footprint. Under consuming habits we understand how the coffee is prepared and then consumed (how it is made and drunk).
To produce a cup of coffee drink, first we need to have coffee itself which can be purchased from any local shop in the *United Kingdom*. It is normally sold as a certain weight pack that in most cases contains ready roasted and ground coffee. To make this coffee drink, we need certain kitchen equipment that in one way or another consume energy (electricity or gas or both). The coffee drink also requires extra water, and it is heavily depending on consuming habits, but it is normally prepared with added sugar and milk and other ingredients. So one of the educative advantages of this article is that anybody who reads it might learn and be able to replace coffee with sugar or milk, or could further think or evaluate other products like tea, or just think of water resources or electricity production and analyse their individual impact on the physical, social and economic environment and their sustainability respectively. It is also important to highlight the consumer's ecological footprint in this case, as the size is again heavily defined by how that coffee is actually consumed: see how much water is used, how much electricity is utilised, what type of cup we use to drink our coffee from, etc.—this list can easily become like a never ending spiral *(Figure 12)* that would affect other things and generate other spirals. So, drinking coffee has a lot of effects and impacts on a high number of things that is usually not considered by consumers when consuming.

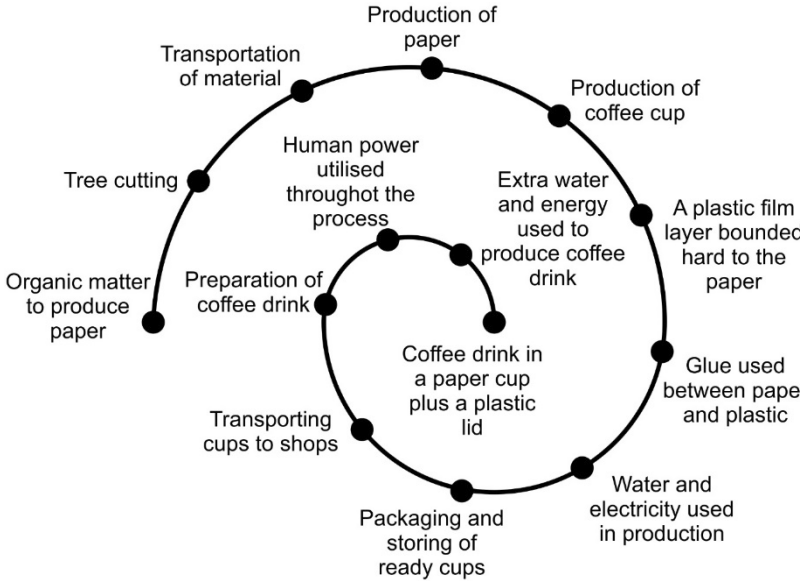

Figure 12 – Spiral of effects – a simplified and schematic idea of how one thing generates another – an example on the coffee cup.
Designed by Bokor, L. *(2015)*

9. Conclusion

As a conclusion it can be drawn up that consuming coffee is not environmentally friendly and in a long run—with constant increase in demands and the acceleration of disappearance of grow areas—it can hardly be said to be sustainable. As long as there is a sufficient amount of water available for grow purposes, it may be sustainable, but increasing needs require more lands, water and energy, etc. which may lead to higher beverage prices and sever effects on other products. Based on recent researches of Allegra Strategies (2013), current trends indicate that the coffee consumption is growing. It is also known that the number of newly opened coffee shops in the UK are rising which assumes a direct uplift in coffee cups to be used. According to ICO (2015), since 2011, the average annual grow rate in global coffee consumption is 2.3% whilst—due to mainly environmental and climate factors—the production is in

decline (estimated reduction in global coffee production in 2014–15 compared to a year earlier is 3.5%).

In the spotlight of this knowledge, it can be clearly said that the most sustainable and environmentally friendly coffee drinker is probably the one who does not drink coffee at all or has the capacity to produce the coffee and all the accompanying needed ingredients including water and energy fully independently. Changing our individual world to become more environmentally friendly and sustainably does not start by repeating common cliché phrases heard through the media regarding climate change, environment pollution and many other similar things, but by individual actions taken to change traditions and habits including for example coffee culture. Today however coffee is deeply part of our social life, cultural heritage and a lots more that could hardly be changed without any significant effects on other parts of the physical, social and the vulnerable economic environment and spheres. To change global thinking for a better global response to environmental issues, every individual has to make contributions by oneself. Everything starts at local levels: *"think globally, act locally"* (BALL, J. 2014).

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