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Is Their Consumption Sustainable? An Inquiry into the Consumption Habits of Citizens and University Students of Szeged

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The unsustainability and the potentially self-destructive character of the current socioeconomic processes have become a problem to be considered by public opinion and the researchers of environmental issues. The paradigm of sustainability emphasizes importance of the ecosystem that generally apprehends in economics through the notion of natural capital. It is a scientific fact that these processes can restrict the socioeconomic options in the near future by irreversibly ruining certain unsubstitutable ecosystem services. Since the publication of the Stern Review these facts have also been recognized in economics. Regarding these tendencies, even more authors emphasize that it is necessary to reduce the environmental effects of the personal consumption of the citizens in developed countries, including Hungary.

In the first part of my study, I examine whether the ecological footprint is an appropriate measure for environment-conscious consumer behaviour. I conclude that it can be an important tool since it measures the real environmental effects of consumer behaviour. There are several criticisms regarding EF because the measure has some weaknesses, but presently there is no tool for sustainability which is complete and none will satisfy everyone perfectly. The size of the ecological footprint is in connection with the following factors: population, consumption per capita and technological efficiency. From these factors the individuals can have an effect on their own consumption. Therefore, in my study I investigate what influences the environment-conscious consumer behaviour of the inhabitants of Szeged based on my former research.

Keywords: sustainability, sustainable consumption, ecological footprint, Value-Belief-Norm Theory (VBN Theory)

1. Introduction

The concept of sustainable development has become an integral part of current political and scientific discourse. Nowadays the unsustainability of our social-economic system has been reinforced by influential documents (IPCC 2007, Stern 2006). The *paradigm of sustainability* emphasizes importance of the ecosystem that generally apprehends in economics through the notion of natural

capital[1] (Ekins et al 2003, Gutés 1996). Nature provides vital ecosystem-services for the economy through ecological processes supported by biodiversity (Ekins et al 2003). Humanity damages biodiversity and ecosystem-process, therefore *human transformation of the biosphere* (Takács-Sánta 2004) is becoming a severe problem from the aspect of future consumption possibilities and life circumstances (Stern 2006). Thus, the restraint of human effect on biosphere is essential for sustainability. Consequently, examination of the effects of consumption and the chances for reducing consumption is an essential field of study. It is important to examine which factors influence consumption and consumer behaviour.

Neoclassical economics, considered as the mainstream paradigm of economics, assumes that resources (thus the natural capital) can be divided and available infinitely, which assumption does not hold its own since changes in natural capital are often irreversible (Norgaard 1995). Neoclassical economics treats nature as a subsystem of economy, however, this question should be viewed quite the contrary, that is defining economy as a subsystem of nature since human economy cannot be imagined without the services of the natural capital. Thus I agree with the latter approach – the economic system embedded in nature. Literature differentiates between weak and strong sustainability. Supporters of *weak sustainability* consider artificial and natural capital replaceable with each other. According to this opinion the stock, that is the joint value of the natural and artificial capital, cannot decrease. In the case of *strong sustainability* one of the main criteria is that the natural capital should remain on a certain level, irrespectively of the artificial capital. Thus the natural and artificial capitals are not perfect substitutes. So the three keystones of sustainability – economy, society and environment– cannot be substituted for each other, but they are interwoven.

Hereafter, from the differentiated strong and weak sustainability I consider the former and the approaches of ecological economics as determining. In the following part I present the ecological footprint, a tool which can help transfer the above mentioned strong sustainability to planning.

2. Background and methods

In my study, I investigate what influences the environment-conscious consumer behaviour of the inhabitants of Szeged. I use the ecological footprint (EF) measure which can be an important tool since it measures the real environmental effects – and not only environmental intentions – of consumer behaviour. *The ecological footprint measures humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste* (in global hectare – gha) (WWF 2006). According to the data

[1] Natural capital is defined as the stock of environmentally provided assets, which provide a flow of useful goods and services (renewable, non-renewable and generally non-replaceable) (Goodland 1995).

of 2006, an "ordinary citizen" has an EF of 1,8 gha. But we can also find huge differences. The EF of Western countries is extremely high, within this category, the North-Americans have 9,4 gha and the Canadians have 7,6 gha of EF. These are followed by the East-European countries, the Hungarian citizens' average ecological footprint is 3,7 gha. It is worth noting that nowadays the ecological footprint of humanity exceeds the biocapacity of the Earth (1,8 gha) with 25 % (this is the so called global ecological deficit). *This means that humanity's demand on the biosphere exceeds the carrying capacity of the biosphere* (WWF 2006). For this reason, the ecological footprint of humanity has to be reduced below the present world-average. According to present estimations, *by 2050, an overshoot of 200%* will be reached if humans do not change their lifestyles and initiate new, environment-friendly technologies.

The size of the ecological footprint is in connection with the following factors: *population, consumption per capita and technological efficiency*. The ecological footprint calculation is a multiple-stage process and the indicator can be determined with a simple formula (Ekins 2004):

$$I = P \bullet C \bullet T$$

where I is Impact, P is Population, C is consumption per capita and T is technology, which is used for consumption and production. The ecological footprint is similar to the formula which illustrates the humans' effect on the environment, whereby the scale of humans' biosphere-transforming activity depends on three factors, which are in close connection: population number (P), consumption per capita (C – GDP per capita), and environmental effect of consumption unit (T – environmental effect). The latter is the technological component (T) in the EF, because production technology determines the environmental effects of a given scale of consumption to a great extent.

There are several criticisms regarding EF because the measure has some weaknesses, but presently there is no tool for sustainability which is complete and none will satisfy everyone perfectly. Furthermore, the ecological sustainability is not absolutely measurable, especially not with a one-dimensional indicator (van den Bergh–Verbruggen 1999, Costanza 2000, Moffatt 2000). Nevertheless, based on our present knowledge, I regard *EF as the most comprehensive sustainable indicator*. "Since 2003, a prestigious academic and science political advisory council (Global Footprint Network Advisory Council) has been dealing with this index (since 2005 with José Manuel Barroso's support, President of the European Commission) and the footprint is already an officially accepted sustainability index in several countries (Switzerland, Germany and Finland)" (Vida 2007, p. 1603.).

The development of the ecological footprint can be influenced by many factors, for instance choosing *residence*, that is the type and location of the dwelling, the size of the house and usage of different means of transport. Obviously, if someone lives on the outskirts and drives to work every day, they leave bigger

footprint behind than if they lived in the city and covered the distance between their house and workplace on foot ceteris paribus. It is worth emphasizing the fact that in contrast to the poor, the well-to-do people have more options (for example, they can move to an expensive urban house), they can change their way of living more easily, decreasing their ecological footprint. It is questionable how much they are willing to make changes. In addition, the growing number of divorces may also contribute to the increase of ecological footprint, because two houses are needed instead of one, with double building material and expenses.

The result of EF indicator is affected by the standard and character of consumption, the technology, the population density and the size and quality of the area available for society (Wackernagel–Rees 2001). The former factors can be paralleled with the I = P • C • T formula, on the basis of which I present the elements that influence the value of ecological footprint in the following.

It is important to highlight the problem of *overpopulation*, since without solving it the ecological footprint of humanity cannot be decreased to an appropriate level. The ecological footprint of poor countries would be high in result even if rich countries reduced their consumption. If "the growth of population cannot be controlled and harmonised with basic human needs, malnutrition, wars and diseases will cause the mass destruction of people, resulting in a drastic decline in number." (Buday-Sántha 2006, p. 27.)

Analyses regarding ecological footprint point out an extremely important problem, namely while the *consumption* of rich countries exceed threefold over the Earth's biocapacity, the inhabitants' basic needs in poor countries (food, drains, electricity) are still not satisfied. Consequently the question arises about who should be urged to reduce their ecological footprint and who could increase theirs for the sake of satisfying their basic needs. 20 % of the world's population living in rich countries consumes 80% of the resources, exceeding the global carrying capacity (Wackernagel–Rees 2001). Industrial production has grown fourteen times since the 1920s; however, besides the fact that this growth has made many people rich, it has not put an end to poverty.

In developed countries the ecological footprint may be reduced by introducing *new technologies*, on the other hand, the Earth's biocapacity cannot be increased to a great extent by it. Although new technologies may seem to increase our planet's capacity, it actually stagnates and remains unchanged. Here it is worth mentioning the concept of *rebound-effect*[2], because efficiency improvement resulted by the introduction of a new technology may work against resource conservation. So the ecological footprint per capita is determined by technology and personal consumption. Thus, the ecological footprint per capita can be reduced by introduction of new technologies. In the literature of sustainability, eco-efficiency

[2] According to rebound-effect efficiency, sale and growing use of resources are closely connected to each other (Alcott 2005). E.g. in spite of the increasing fuel efficiency of cars, the total consumption does not decrease, because more and more consumers use their car more and more often.

has a significant role in relation to technological change; increasing of eco-efficiency is regarded as the principal tool for moving in the direction of sustainability. A unit (enterprise, national economy, etc.) is more eco-efficiency than the others if it produces a certain output with less environmental effect.

The reason for this is that a (relative) increase in eco-efficiency enlarges the scale of human transformation of the biosphere in absolute terms instead of decreasing it (Alcott 2005). The rebound-effect is observable both at micro and macro level. In case of households, the increased technological efficiency is typically used to enhance comfort and the standard of living instead of decreasing of resource-consumption. For example, improvement of households' energy saving leads to the increase of the size of residence, higher room temperature or the use of electric domestic tool (Hanssen 1999). In the case of enterprises it can happen that eco-efficiency improvement is followed by an increase in production so enterprises' absolute resource-use is entirely growing (Dyllick–Hockerts 2002). At the macro level, in the case of public transport in Great Britain for instance, the increase of fuel-efficiency was followed by expansion of number of cars and car-use per capita (Hanssen 1999).

Due to more efficient use of energy and material, companies can raise pay and bonus while reducing prices, which can lead to a growth in consumption. Improvement of energy-efficiency can increase energy consumption, partly by making it appear as cheaper than other input, partly by intensifying economic growth, which increases the use of energy (Alcott 2005). It is worth mentioning the advantageous consequences of the technologies based on renewable energy (e.g. solar energy). The use of solar collectors is quite expensive for the time being, but an environmentally friendly solution. It is demonstrated by the example according to which warming up a given amount of water with solar collectors leaves a hundred times smaller footprint than heating it with fossil energy (Wackernagel–Rees 2001).

It turns out that quite many components have to be considered and changed in the interest of reducing EF. Individuals (with changes in their environment, residence and consuming habits), experts and countries (with working out appropriate technologies) can contribute to the decrease, in addition they have to face such serious and hard to handle problem as overpopulation.

During my studies I familiarised myself with several indexes and procedures ISEW, HDI (Human Development Index)[3], material flow analysis (Material flow accounting and analysis – MFA), but it can be established that all methods we know at present have limited information in connection with sustainability. There has not been a procedure so far which can be accepted without criticism, covers all details and can be used with maximum precision. However, from among the existing

[3] The aim of HDI is to make economies rankeable on the basis of important values that are not measured by GDP (Kerekes–Szlávik 2003).

calculation methods, the ecological footprint has become widely accepted and used in several fields as an index to define the extent of the burden on the natural ecosystem. It is proven by the fact that WWF's Living Planet Report calculates the ecosystem burden data of the world's countries based on EF year after year (WWF International 2006). In addition, Meadows et al (2005) also use the EF for presenting the potential negative consequences of overshot, and emphasise the necessity of reducing EF.

Through moderating consumption, the development of environment-conscious consumer behaviour can contribute to decreasing ecological footprint. There is not a standard definition of environment-conscious consumer behaviour; different names exist in the literature with regard to it (pro-environmental behaviour, environment-conscious behaviour, environmentally significant behaviour).

According to Kaiser (2003), environment-conscious behaviour is all the actions that contribute to conservation and/or sustaining of nature. This, among others, includes recycling, the economical use of energy and water and commitment to the activity of environmentalist organisations.

Stern (2005) examines environmentally significant behaviour (ESB) that can be defined by its impact: the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself (Stern 2005). Paul Stern (2000, 2005) differentiated four types of ESB:

1. environmental activism,
2. non-activist behaviour in the public sphere,
3. private-sphere environmentalism,
4. other environmentally significant behaviour.

Active participation means that individuals take part in the work of environmentalist organisations and demonstrations. Active citizenship (for instance membership of environmentalist organisations) is distinguished from the support or acceptance of public policies (for the willingness to pay higher taxes for environmental protection). Private-sphere environmentalism examines to what extent individuals take the preservation of environment into consideration during consumption, e.g. the use of domestic products. Thus private-sphere environmentalism has direct environmental consequences. Finally, individuals may affect the environment through other behaviour, such as influencing the actions of organisations to which they belong. From these types of behaviour I examine the private-sphere behaviour, whereas individuals' environmental effect depends on their decisions as consumers.

Environmentally significant behaviour has several versions, but Stern (1999) differentiates three fields, which show the effects of individual behaviour on environment, namely the personal, the behavioural and the contextual fields. The personal field includes the basic individual values, and Schwartz's (1992) norm-

activation theory, the value-belief-norm theory (Stern et al 1999), the theory of reasoned action (Fishbein, quoted by Stern 1999) and the planned behaviour model (Ajzen, quoted by Stern 1999). The behavioural field covers the four fields mentioned above, that is environmental activism, non-activist behaviour in the public sphere, private-sphere environmentalism and other environmentally significant behaviour. Finally, the contextual or structural field includes the individual characteristics that are typically defined from birth (cultural background, religion, social class), acquired skills (qualification), living conditions (residence in the country or in the city; tenant or owner; having a car or not), opportunities and restrictions of community politics (regulation, tax, motivation programs), economic factors (income, access to financing sources) and other factors.

On the whole, the definitions are identical in emphasising primarily the preservation of environment. The most accurate definition was given by Paul Stern (2000), so I also accept his one, which I later describe in details.

Regarding the models of environment-conscious behaviour it can be stated that almost all the models emphasise different factors which influence the behaviour. One of the oldest models (the linear flow model of environment-conscious behaviour) considered environmental knowledge and environmental attitude determining (Kollmuss–Agyeman 2002). According to others there is a contradiction between environmental attitude and environment-conscious behaviour (Rajecki 1982, quoted by Kollmuss–Agyeman 2002). In addition, among the early models Fishbein and Ajzen's (1980) theory of reasoned action appears, which has a huge influence in social psychology, one of the most frequently quoted models. Furthermore, Hines, Hungerford and Tomera's (Hungerfold–Volk 1990) model of responsible environmental behaviour can be highlighted, which is the improved version of the Fishbein-Ajzen model. The altruism, empathy and prosocial behaviour models are next ways of approaching the study of environment-conscious behaviour. The prosocial behaviour is a voluntary behaviour which appears in the form of good deeds towards other people and society. Altruism[4] itself is a subsystem of society sensitive behaviour. Several researches have built their assumptions on the theory of altruism, according to which altruism is needed for developing environment-conscious behaviour.

The most known models are Schwartz's "norm-activation model", and Stern's et al "value-belief-norm theory" (VBN Theory). Schwartz examined the general structure of values in several countries. Schwartz's value structure became current in the literature, thus this system also forms the basis of Stern's et al (1999) study. During his works, Schwartz explored human values in the field of psychology, then he divided them into ten value types (power, achievement, hedonism, stimulation,

[4] Altruism is a prosocial behaviour which is based on considering the other people's needs. It can be observed in the case of people who think that certain problems and harmful effects threaten the others, their well-being and health, and they think they are able to ease these consequences (Piliavin–Charng 1990).

self-direction, universalism, benevolence, tradition, conformity and security) and further four value categories (self-transcendence, self-enhancement, openness to change and tradition).

Stern's et al (1999) flow model takes Schwartz's model as a starting point and draws the attention to the fact that it takes a long process to develop environment-conscious behaviour. My questionnaire is also based on this model and the factors presented in it. Stern et al (1999) assumed that actions taken for the sake of a successful environmental protection are in connection with personal values, belief and norms, which motivate people to do something to achieve their aims and to protect the environment.

The authors in the course of creating VBN Theory started out from that the norm-based actions derived from three factors:

- acceptance of certain personal values,
- belief concerning that the realisation of this values may be hindered by certain factors and
- belief that actions initiated by the individual can ease the obstacle and restore the values

Stern et al (1999) examined the following five variables and the connection among them: *values* (especially environmental-altruist values), *New Ecological Paradigm* – NEP, *Awareness of consequences* – AC, *Ascription of Responsibility* – AR and *pro-environmental personal norms*.

The elements are in close connection with each other and one element affects the variable that follows it. The model starts out from the assumption that environment-conscious behaviour is in close connection with certain basic values. Stern differentiated *four value categories* based on Schwartz's work: altruist, egoist, traditional values and the openness to change. The egoist and altruist value categories in Stern's model are equal to Schwartz's self-transcendence and self-enhancement categories. The altruist behaviour appears as a response to personal ethical norms, which can be observable in the case of people who think that certain problems and negative effects threaten the others, their well-being and health; in addition, they think they can ease these effects. The egoist values include such elements as wealth, prestige and money. The traditional values include honesty and respect. The openness to new things emphasises exciting and varied life. The environmental values are in connection with the development of environment-conscious behaviour.

According to the *New Ecological Paradigm*, humanity has a significant impact on the more and more vulnerable biosphere. The NEP scale is one of the most wide-spread social psychological measuring instruments that examine the effect of humanity on biosphere, to which the harmful consequences of ecological changes can be traced back. In 1978, Dunlap and Van Liere worked out the New Environmental Paradigm – NEP, and then in 2000 it was rewritten so the New

Ecological Paradigm was created. The authors found it necessary to renew the former NEP scale, because they thought environmental problems had changed in a respect; they had become more and more global. Although certain elements, such as pollution caused by household refuse, are still local problems, the consequences of narrowing of the ozone layer, deforestation, decrease of biodiversity and climate change have global effects. (Dunlap et al 2000).

The original theory emphasises that one should be *awareness of consequences* (AC) of certain events on other people (as the main feature of altruists' values). Schwartz's general theory stresses being threatened, no matter what kind of intention stands in the centre of the values founding norm. In case of environmental protection the threatening of not human species and the biosphere can be important.

Finally, in Schwartz's theory, the activation of norm depends on the *Ascription of Responsibility* (AR), by which he means that people ascribe to themselves the causing of undesirable consequences for others, that is the belief or denial of the fact that individual people's actions contributed or eased the consequences. The generalised theory emphasises the belief in taking responsibility in connection with anything considered as value or in the ability to ease the threatening.

The authors started out from that personal norms directly affect the three forms of environment-conscious actions. All types of supporting the actions can have an effect on the individual's abilities to take the necessary steps to provide the appropriate type of support. Thus the certain types of supporting the actions are based on personal values and belief.

Stern et al (1999) also studied the theory of *cultural biases*; they differentiated four groups in their research: *hierarchy*, egalitarianism, individualism and *fatalism.* The above mentioned four categories appear in the questionnaire of my own making and I give details about the results of my research in the following.

It turns out from the results measured on NEP scale that the altruist values are in positive while the egoist values are in negative connection with environment-conscious beliefs

The third large group of environment-conscious behaviour models is models classifying social and psychological factors. Fietkau and Kessel (1981), quoted by Kollmuss–Agyeman (2002) examined environment-conscious behaviour and its lack with the help of social and psychological factors. In their "model of ecological behaviour" they studied five independent variables, which affected directly or indirectly the environment-conscious behaviour: possibilities to act environmentally, environmental attitudes and values, incentives for pro-environmental behaviour, perceived consequences of behaviour and environmental knowledge. Blake (1999) writes about an attitude-behaviour gap that he calls Value-Action Gap. According to the author, the models of environment-conscious behaviour are restricted because they ignore the individual, social and institutional restrictive factors. In addition, they assume that people are rational and they use information available for them, so

they do not care about collecting information separately and deal with only what reach them. Blake (1999) differentiates three obstacles which stand between environmental responsiveness and real action: individuality, responsibility and practicality.

Within environment-conscious behaviour we can speak about environment-conscious consumer behaviour, which is a narrower category.

Princen (1999) emphasises the harmful effects of *overconsumption*[5]. Consumption raises important questions from the point of view of both researchers and decision makers, still neither side deals with the problem adequately. Consumption is close connection with environmental problems, since people use energy and raw materials in the highest degree so far, causing serious consequences in global climate, biodiversity (diversity of species, biomes and regions), soil and further environmental factors. Beyond that, certain activities intensify the problem: the more and more widespread shopping fever, vehicles consuming a lot of fuel, luxury consumption and buying disposable products. Kollmuss and Agyeman (2002) examine three large groups in their model of environment-conscious behaviour: demography variables, external factors (institutional, economic, social and cultural factors) and internal factors (motivation, environmental knowledge, consciousness, values, attitudes, locus of control, responsibility and priorities).

According to Christensen et al (2007) three factors can lead to increased consumption if they co-exist with economic growth and increasing disposable incomes, they are: rapid production innovation, individualization and spreading of stress and time pressure. Production innovations are increasingly urging people to replace consumer goods more and more frequently with newer and more attractive ones, complying with the constantly refreshing fashion and other trends (Röpke 1999). The information and communication technology (ICT) plays an important role in the increase of consumption. Constant innovations appear in the field of computers, due especially to the continuous development of hardware. It is likewise present in the case of communication technology, mobile phones have newer and newer functions (electronic calendar, MMS, camera), which generates more consumption. The average lifespan of a mobile is about 18 months.

Countless researches can be found regarding the question: who are the environment-conscious consumers? Straughan and Roberts (1999) first examined the demographic variables which can be in connection with environment-conscious behaviour and/or consumption, these are:

- age,
- sex,
- income,
- qualifications.

[5] Overconsumption is the level which destroys the system of species' subsistence (Princen 1999).

In the case of age, the general assumption is that younger consumers are more sensitive to environmental questions, because they have grown up in times when environmental problems have already come in the fore (Straughan–Roberts 1999, Diamantopoulos et al 2003). However, researchers' opinions differ on this question; according to some researchers there is a significant positive connection between age and behaviour, others say that there is a negative correlation. In the case of sex, most researchers agree that women's attitude to environment is more positive than men's, which can be explained by that women consider the effects of their actions on others more, and they do environmentalist activities more often (Straughan–Roberts 1999, Diamantopoulos et al 2003). In the case of income, the general view is that consumers having higher income are willing to pay the higher prices of environmentally friendly products. However, in this case opinions differ; according to some researchers there is a negative connection between income and environment-conscious behaviour. Willingness to pay does not necessarily mean actual purchase (Majláth 2005). As for the study of qualifications, they draw the conclusion that qualifications correlate positively with environmentally friendly behaviour, which may be explained by that people with higher education have more information relating environmental problems and the importance of environmental consciousness.

Besides demographic variables, factors such as values and the effect of environmental knowledge have to be taken into consideration (Majláth 2005). Probably the consumers who find environmental values important pay more attention to environmental protection and prefer environmentally friendly goods to imported products.

3. Results and discussion

In my study I present the results of my quantitative survey, which was done in May 2009. The sample consists of 225 inhabitants of Szeged, Hungary[6]. My questionnaire consists of three major parts (see in Appendix):

1. ecological footprint (18 questions),
2. questions based on the VBN Theory (5 questions),
3. general demographical data (5 questions).

In the first part of this section I introduce some descriptive demographical data of my sample. Afterwards I explore the relationship between the examined variables and EF (Table 1).

[6] In 2008 we made a survey among university students of Szeged and our actual study based on the former examinations.

Table 1. Structure of my examination

Descriptive statistics	Measurement of relationships
Ecological Footprint (EF)	EF + 5 types of values
Environmental philosophy and values	EF + cultural biases
General demography	EF + NEP
	EF + adverse
	EF + responsibility
	EF + demography, especially income

Source: own construction

First I set up five hypothesis based on the literature, especially on the basis of the examinations of Paul Stern (2000, 2005), Stern at al (1999) and the literature of ecological footprint (e.g. Bagliani et al 2006). Furthermore, the hypothesis covers my former examination among the students of University of Szeged.

- H1: Respondents who prefer egoistic values have higher EF.
- H2: Respondents who think that global climate change have negative consequence for themselves have smaller EF.
- H3: Respondents who believe that single persons and small communities may play an important role in the solution of environmental problems have smaller EF.
- H4: Respondents who prefer egalitarianism (as a cultural bias) have smaller EF.
- H5: From the demographical variables income has a significant role in influencing personal EF. That is respondents whose monthly net income per capita is high have higher EF.

In the first part of my questionnaire I measured the ecological footprint of the inhabitants. There are several EF-calculators but none of them fulfilled the requirements of preciseness and intelligibility simultaneously and in addition, each of them showed different results when I tested them. First, I chose Earth Day's and Global Footprint Network's common EF method. However, in the course of the test survey the calculator proved to be difficult to understand for the students in my former examination and the questions were also too long. Therefore, in my study I used Eric Krause's ecological footprint calculator, which is intelligible but the result are not precise, it only determines the EF approximately. Moreover the major problem is that the calculators present rather different results. According to my experience, Eric Krause's calculator shows essentially higher EF results than the one of Earth Day's and Global Footprint Network's. Therefore, in our analysis I do not analyse absolute levels of EF only the relative effects of the influencing factors within our sample. Eric Krause's calculator measures the EF with 18 questions that are divided into 5 parts.

3.1. Testing the hypotheses

The average ecological footprint of the inhabitants of Szeged is between 6-7,8 gha. This number is incredibly high, it is approximately twice as large as the Hungarian average (3,7 gha).

As I mentioned above, Stern et al (1999) link five variables to environmentally significant behaviour: values (especially altruistic values), new ecological paradigm (NEP), adverse consequences (AC), ascription of responsibility to self (AR), and personal norms for pro-environmental action. In my study I measured five types of values (four from the VBN Theory completed with nepotistic values), NEP, AC, AR, and cultural biases based on VBN Theory. Later Stern (2000, 2005) examined only three values (altruistic, egoistic and biospheric values). In my study, however, I chose the first classification and below I show that our values can be divided into five types with principal component analysis – aside from several exceptions regarding the original categories given by Stern (1999).

First I formed five components with principal component analysis[7] from the values based on Stern et al (1999) – nepotistic values do not occur in the original theory. I aimed to get principal components that explain the largest proportion of the variance of the original variables. In the course of examination of the relationship between the five components and the EF, I have found that EF was positively correlated with egoistic values. Likewise EF was positively correlated with openness to change values. T*he results confirmed my first hypothesis, that is* the respondents who prefer egoistic values have higher EF (Table 2). In the other three cases there were no significant correlations.

Table 2. The connection between EF and egosim

	Ecological Footprint	**N**	**Mean**	**Std. deviation**	**Std. error mean**
Egoism principal component	4-6 ha	84	-0,1834	0,8865	0,0967
	6-7,8 ha	93	0,2038	0,9427	0,0978

Source: own calculations

In my study, NEP was measured with a short NEP-scale (consists of five statements) which were valued on a five-grade scale by the respondents. However, there were not any significant connections between EF and NEP. Earlier (among the students) I measured NEP with three statements, which were connected to the role of technology in the solution of environmental problems. The students who consider modern technology as a solution for the environmental problems without the need for changing their lifestyle have higher EF (correlation is significant at the 0,05

[7] According to our expectations the minimum value of the loading variables was 0,7. We expected the principal components to preserve 60% of the amount of the information (communality) (this is the generally expected level in social sciences).

level, Pearson Correlation is 0,126). This finding is consistent with my former hypothesis thus it has been confirmed, that is the students who consider modern technology as a solution for the environmental problems have higher ecological footprint. Consequently, techno-optimism leads to higher ecological footprint. It is easy to see that the individuals who believe development of technology is the best way may not take part in the protection of environment.

Within the category of *Adverse Consequences*, the respondents had to determine how large problem the global warming is going to mean for themselves and their family, for the future generations, for their country, for the developing countries and for other species of plants and animals. I found that the respondents primarily worry about the well-being of country, so *I refused my second hypothesis that the inhabitants who think that global climate change have negative consequence for themselves have smaller EF.* In my earlier examination I found that students think environmental problems have negative consequences principally for the next generation and they have smaller EF. I explain it with the fact that these respondents potentially have more information about sustainability than the others, since the official, scholar definition of sustainability or sustainable development is strongly connected to the well-being of future generations - see for instance the most cited definition of Bruntland (1987).

In my study I measured the *relationship between AR and ecological footprint.* First I divided the agents who may be responsible for the solution of environmental problems into four principal components with principal component analysis. My first component, *"small community principal component"* contains individuals, small communities, civil organisations, local/national environmentalist organisations and smaller settlements. Therefore these respondents expect the solution from the local level. The second one is *"mezzo principal component"* contains cities, regions/counties and countries. The third one is *"international principal component"* contains international organisations and international environmentalist organisations. Finally, the last one is *"business principal component"* contains small-, and medium-sized businesses and multinational businesses. EF was positively correlated with business category. In the other three cases no significant relationship were found. *Thus I refused my fourth hypothesis that the inhabitants who consider locality important regarding the solution of environmental problems have smaller ecological footprint.* In my earlier study I found that EF was negatively correlated with small community category. It is interesting that the inhabitants believe in the category of business.

Finally, *cultural biases* were measured using 8 statements from the research of Stern et al (1999). These items were divided into four groups: egalitarian, individualist, hierarchist and fatalist cultural bias. In the course of principal component analysis I found that my results are consistent with the original theory. I examined the relationship between the four principal components and the EF but there were significant relationships in two cases, namely between egalitarian and

individualist cultural bias and EF there is a significant relationship. *Thus I confirm my fifth hypothesis - the respondents who prefer egalitarianism have smaller EF, in addition, inhabitants who prefer individualism have smaller EF as well.*

I think it is very difficult to measure values and cultural biases based on a model which was tested in another country, because different people and nations have different means of values or, for example, statements of NEP. 'Everyone should have an equal chance to succeed and fail without government interference' statement has a different meaning for an American and a Hungarian. Consequently, it is not possible to adapt and apply models used in other cultures, however, useful information can be obtained, but it may need refinement.

In the last part of my survey I asked general demographical questions about the respondents (age, qualification, income). *My first hypothesis is confirmed since the income of the respondents is correlated positively with EF*. We can say that *higher income means higher EF*. This observation is consistent with my expectations and the results of the literature. Income plays an important role in the extent of EF, because it influences the EF through consumption. The results show that the females have smaller EF than males, furthermore the respondents who have primary education have smaller EF which can be connected with income, because generally lower qualification means smaller income. However, it is an interesting question that among people with lower qualifications diseases are more frequent, which lay considerable expense on the state and the citizens, but its extent does not appear in the course of EF measures, besides it can be measured with difficulty. During examining the age, I created four groups, namely: under 31, 31-48, 49-65 and over 65 (Table 3).

Table 3. The connection between EF and age

		Age			
		< 31	31-48	49-65	> 65
Ecological Footprint	4-6 ha	30,6 % (15)	42,9% (21)	45,8% (22)	80,6% (29)
	6-7,8 ha	69,4% (34)	57,1% (28)	54,2% (26)	19,4% (7)
	Total	100,0% (49)	100,0% (49)	100,0% (48)	100,0% (36)

Note: the number of respondents are in brackets
Source: own calculations

As for the distribution according to age, inhabitants' EF over age 65 is the lowest, while inhabitants under 31 have the highest EF, which also can be related to consumption, as the younger age group consumes much more and they are more open to novelties (see newer and newer mobile phones).

4. Conclusion

Ecological footprint shows that humanity's effect on environment is already unsustainable. From the three factors determining EF, developed countries could make steps in the field of technological development and most of all in the field of consumption. Relying on the literature we can say that the increase of eco-efficiency itself – besides current consumption values – does not lead to the decrease of EF (because of the rebound-effect). For this reason the key issue for the developed, western countries is the transformation of values that is people could move towards the ecological values from consumption values.

In my study I seek answers for the above-mentioned problems with an empirical research. I emphasized some important conclusions from my results:

- Inhabitants who prefer egoistic or openness to change values have higher EF.
- Inhabitants who think that global warming is a serious problem for their country. (Consequently they do not consider it a problem for themselves yet).
- Inhabitants who believe in effect of small and medium sized enterprises and multinational businesses have smaller EF.
- The wealthier inhabitants have higher ecological footprint and from all the examined variables income influences the EF to by far the highest extent.

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