Geographical Locality Studies

Frugeo Geography Research Initiative

MMXIII

LOCALITY

AND THE

IMPACT OF HUMAN CONSUMPTION ON THE ENVIRONMENT

Edited by
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Published by
Frugeo Geography Research Initiative
Shrewsbury, 2015

Geographical Locality Studies – 2015 Volume 3, Number 1
“Locality and the Impact of Human Consumption on the Environment”

Founder and Series Editor: László Bokor

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Cover Graphic and Portrait Art Work: Viktória Nemes
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Technically edited, typeset, improved, designed, published, and distributed by

Frugeo GRI Limited, Company number: 09646391
Frugeo Geography Research Initiative, Shrewsbury, UK
www.frugeo.co.uk; www.frugeo.eu — info@frugeo.co.uk

Produced in association with

Eötvös Loránd University, Budapest, Hungary, www.elte.hu
University of Pécs, Pécs, Hungary, www.pte.hu
Eco, Birmingham City University, Birmingham, England, www.bcusu.com/eco

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Registered and published in the United Kingdom of Great Britain and Northern Ireland
Printed and bound in Hungary by Molnár Nyomda és Kiadó Kft., Pécs

British Library Cataloguing in Publication Data. A catalogue record for this book is available from the British Library.

ISBN 978-0-9576442-5-0 (Paperback) **ISSN** 2052-0018 (Print)
ISBN 978-0-9576442-6-7 (eBook-PDF) **ISSN** 2053-3667 (Online)

Dedication

The editorial board, the authors, and all the helping hands of this present issue of Geographical Locality Studies dedicate this publication to the life and work of Gábor Karátson (1935–2015), an awarded artist, writer and philosopher whose love of the natural environment was limitless.

Contents

(Frugeo Geography Research Initiative reserves the right not to be responsible for the topicality, correctness, completeness or quality of the information provided by the Authors.)

This article investigates the environmental impact of urban cohousing communities. Pro-environmental characteristics that reduce the negative environmental impact of cohousing communities are also examined. The article also explores the factors and processes these pro-environmental characteristics are created by. Many of these are derived from examples of working cohousing communities in Denmark and Austria.

This paper analyses whether the economic growth has a direct effect on the environment. It is particularly focusing on the BRICS countries and gives an overview on sustainable development and consumption, attempts to suggest a literature review on the correlations between the economy and the environment in the these countries, and addresses the environmental effects of economic development on the basis of different statistics.

Publisher's Preface

Another year has gone in the life of *Geographical Locality Studies*, and now we are beginning our new scientific journey with the publishing of written researches that have been gathered during this annum. Fortunately, the journal in the past two years has proven to be a gradual, but continuous growth in recognition and we have received plenty of positive feedback from researchers and research institutes all around the planet. Also, the previous numbers of GLS (*Locality and the Energy Resources* and *Locality and the (un)Sustainable Settlements*) are now available to access freely in a number of libraries among others including *Germany*, *Hungary*, *India*, *Japan*, *Slovenia*, the *United States of America*, and last but not least the *United Kingdom*, of course. In the future we will try to send out more printed copies to libraries to enrich their collections by our contribution. Additionally, the online edition of GLS is an open-source material, so it can be downloaded in PDF format from our official website (www.frugeo.co.uk) free of charge, but the files are also available on other, independent sites, for example at ISSUU.

We are very proud of having this third number fully prepared and published by the support of our editorial team, authors, other contributors and the readers. We also hope that the trust invested in us will attract more writers in the future to send us their papers to be published. We have also recognised that there is a certain confusion according to the conceptual background of GLS; therefore let us clarify a few important points: *Geographical Locality Studies* (or GLS) is the official journal of *Frugeo Geography Research Initiative* (or just *Frugeo*) which is registered in the *United Kingdom* as a printed (ISSN 2052-0018) and electronic (ISSN 2053-3667) serial publication. It is a scientific journal that sets its specialist area in locality, sustainability and environmental topics. At the moment, it is issued and published annually, and each number is planned and developed by a specially selected editorial board that consists of expert researchers, lecturers and independent peer-reviewers. So, everything that we offer is officially recognised as a peer-reviewed scientific journal. We have not been granted with impact factor as of yet which is due to the very young age of the serial publication, but our aim is to fulfil this requirement within a few years. We can, however, only achieve this goal, if our papers are widely accessible, and authors write and publish their own works with us including plenty of citations from the two preceding years of GLS articles. The most important time-weighting factor is therefore publishing articles and make the papers widely available. Once we have overleaped this number and can guarantee the continuity of this yearly appearance, we will hopefully be closer to achieve a wider recognition and be included in the *Journal Citation Reports* (JCR). Another controversy might relate to the name of the journal itself. Yes, GLS's main focus is set in the fields of *Earth Sciences*, but we expect various articles from multidisciplinary participants that may cover many different scientific (and non-scientific) subjects, fields and areas, for example biology, architecture, manufactory, arts, mathematics, catering, fair trade, tourism, etc.; so we would like to encourage any subject and we really do mean any—as long as it interlinks with the keywords in a geographic sense.

The aims of *Frugeo Geography Research Initiative*, according to GLS, have not changed much within these years: we prepare scientific materials, but trying to erect a bridge between academic and the public to develop general knowledge and understanding on important geographical and environmental topics, mostly addressing locality and sustainability. Our principal aim is to support students and improve their skills in research and academic article writing. In the future our aim is to put more effort into propagating this importance among the youth and will support their knowledge development by giving them a wider access to our journal which means no contribution fees and they can even win prizes and awards. In accordance with our improvement plans, the proposed GLS 4 will offer an unmissable opportunity for students to publish their works in a professional and internationally recognised journal. Moreover, we are preparing our next issue with the co-operation of EUROGEO which also guarantees that every contribution will receive all the support that they need including proof-reading, thorough language check-up and general editing. From the subsequent years, the serial will abandon some of its obsolete rules: one of these will allow articles to be written by more than two authors, and in overall, there will be no specifically themed numbers which can guarantee a better interlink between the issues and their articles.

We hardly ever have the chance to talk about how time consuming is to put together a relatively 'small' publication like this. Every project has its own story that tells us about the circumstances that had shaped it. This time has not been any easier: we have been through a lot of structural changes, then delays, more changes, and more delays. But eventually we have done it again, and a lot of thanks go to a number of people who helped us through the process of this GLS issue. We would like to say massive thanks to the modest help of the editorial board, especially to *János Csapó* who had to read every single article, along with *Katie Eccleston*, who—as the official language editor of GLS—has done an excellent job in improving the papers' readability and quality. A 'thank you' goes to *Viktória Nemes* too, who has been our loyal graphic designer since the start of the journal and, with her artworks, she has heavily impacted the look and the personal characteristics of the serial. With her new painting, she has again given thoughtful meaning to the cover. As to fulfil our traditional requirement, we dedicate this issue to the late *Gábor Karátson* (1935–2015) who was an artist, writer and philosopher. In accordance with this, we received plenty of photographs from his wife, *Szilvia Granasztói*, and his son, *Dávid Karátson*, for which we would also like to say thanks. Moreover our gratitude goes to the peer-reviewers including *Dénes Lóczy, János Csapó* and *Mónika Jónás-Berki* from the *University of Pécs*, *Hungary*, and *Béla Munkácsy* from *Eötvös Loránd University*, *Hungary*, who helped us maintain the articles to a high standard.

GLS 3 is the fruit of our hard work throughout 2015, and we hope you will enjoy reading it as much as we enjoyed preparing it for you. Thank you very much for your support.

Shrewsbury, 6 December 2015

László Bokor
Editor-in-Chief

Introduction

This present 2015 issue is the third published number in *Frugeo Geography Research Initiative*'s own periodical. This and the first two numbers published in 2013 and 2014 form the backbone of the 'introductory project' that has been developed to establish the bases of the journal itself. These three numbers are created according to specific topics, thus *GLS 1: "Locality and the Energy Resources"* which addresses energy related environmental problems, and *GLS 2: "Locality and the (un)Sustainable Settlement"* which analyses the sustainability of the human living environment.

This time, *"Locality and the Impact of Human Consumption on the Environment"* is navigating us to the field of everyday consumables and is looking into the habits of society's luxury commodities that have major impacts on both the natural and human environments. In this third number, *Geographical Locality Studies* highlights the global issues behind consumerist necessities and addresses solutions in maintaining human awareness on major environmental problems. This number has therefore been prepared by 3 editors and 10 authors, and has resulted in 7 lengthy papers which are all based on original ideas and research.

The authors in this issue are all from diverse areas of subject specialisms and knowledge. From fine art to environmentalism and architecture to geology, all contributions come with professional researched data as well as personal interest in the topics themselves. One of *Geographical Locality Studies*'s beliefs is that when discussing geography it can be open and can relate to multiple disciplines. Luxury commodities is a broad term which, in this case, means that we have tried to approach this topic through a number of cases according to their environmental effects on nature, society and economy including a wider analytical view over the industrial impact of certain countries (for example BRICS), cohousing and the designs of living spaces, production of items (for example textiles) and commodities (for example coffee), and tourism. Our aim therefore was to reflect on consumerist habits and how these effect the environment, and what methods could be implemented to reduce individual impacts. There are a high number of recommendations on how these issues could be addressed effectively to reduce the human impact on the environment and work towards a less stressed planet. This importance is even more highlighted today just after the *2015 United Nations Climate Change Conference* (known also as COP 21 or CMP 11) which has successfully achieved an agreement on a reduction of the global greenhouse emission, thus to limit global warming and climate change. We at GLS believe that this selection of essays may contribute to this battle against environmental issues and may help people reduce their ecological footprint slowly, but steadily.

With the upkeep of GLS's own tradition of dedicating a new GLS number to a person, *Locality and the Impact of Human Consumption on the Environment* is dedicated to *Gábor Karátson*, an artist, writer and philosopher. He was a highly versatile man and has left a major impact on the Hungarian environmentalism, and fortunately his impacts can now radiate throughout the world in this publication. We are very proud and honoured to be able to dedicate this third number of GLS to his life and achievements.

Shrewsbury, 14 December 2015

László Bokor –János Csapó – Katie Eccleston

A Biography in a Nutshell: Gábor Karátson (1935–2015)

He was born in 1935 into a Hungarian middle-class family; his father's family roots lie in the historical *Székely Land region (Székelyföld)*, in the province of *Transylvania*[1], and his mother's in the *Felvidék*[2] (his paternal grandfather was the first to move to *Budapest*, *Kingdom of Hungary* at the turn of the 20th century). His maternal grandfather was *Viktor Olgyai*, a graphic artist and art collector, with a passionate knowledge of oriental philosophies, by whom *Karátson* was largely inspired—through his mother as he did not know his grandfather personally. His mother died in *World War II* in a heavy bombardment and the loss of her stayed with him throughout his life. He spent his youth at *Gellért Hill*—an attractive, old district on the Buda side—where he was raised with his younger brother by his father and maternal grandmother.

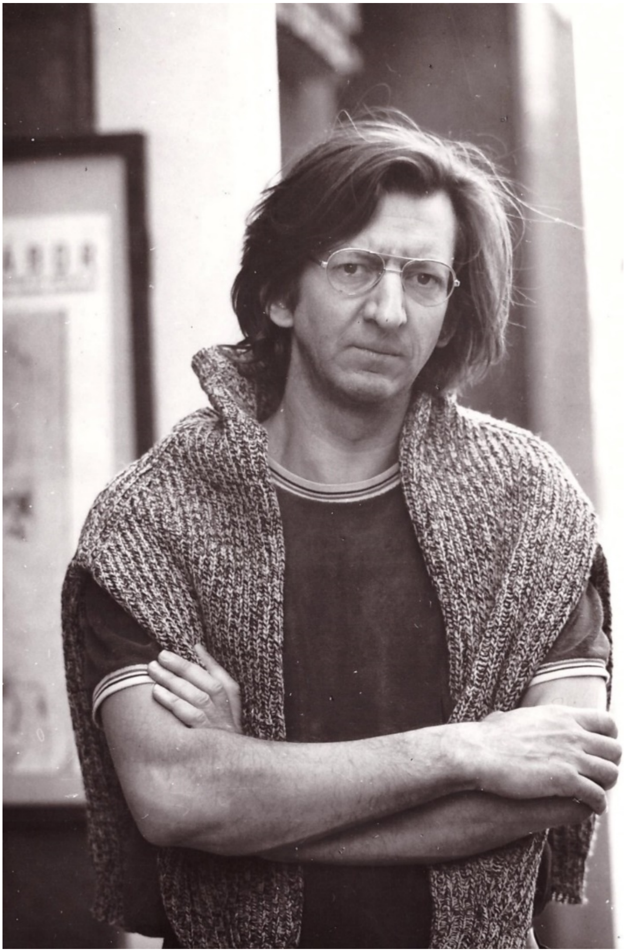
Following his secondary studies, in 1954 he was enrolled into the Hungarian–German dual-subject major training at *Eötvös Loránd University* in *Budapest* (ELTE), but soon after he was directed to the *Faculty of Law*. In 1956, he took an experience-rich trip in the *Székely Land* and *Gyimes*[3] which determined his future interest. In the same year, during the *Hungarian Revolution* he contributed to the work of the *Red Cross*, and then he was one of the founders of the *Union of Free Hungarian Students (UFHS)*[4], additionally he was chosen to be a member of *ELTE*'s *Revolutionary Committee*. Following the repression of the uprising, he helped with the distribution of flyers, for which he was imprisoned in March 1957 and—after a short release—in June. In his trial the *Supreme People's Court* led by the notorious hanging judge, *Gusztáv Tucsek*, ac-

[1] *Erdély*, today it is part of *Romania.*

[2] Meaning 'highlands', which is roughly the same area as the present day *Slovakia.*

[3] *Ghimeș*, part of the *Carpathian Mountains* in present day *Romania*.

[4] Magyar Egyetemisták és Főiskolások Szövetsége (MEFESZ)



Gábor Karátson
Photographed by EIFERT, J. (1986)

cused him of provocation and sentenced him to three years of imprisonment at first instance and, after an appeal, to 18 months. During his sentence, the majority of which was spent in *Márianosztra*, he mostly laboured on boats on the *River Danube*; this experience also enriched his personal relationships with people and nature. Following his release, being forbidden to carry on with his university studies, first he became a physical labourer, and then worked as an extra in the *National Theatre*; which was followed initially by a proof-reading job at *Corvina Press*, and later—until the first years of 1990s—an editorship. After the change of the political system, he was a visiting lecturer on Chinese philosophy and the links between Western and Eastern concepts and thinking at the *University of Miskolc*, at the *Janus Pannonius University* in *Pécs*, at *ELTE*, and at the *Hungarian University of Fine Arts* in Budapest.

Although his artistic versatility became very clear at a young age and even before 1956 he wrote belles-lettres, following the release from prison, he thought that *"in Hungarian one may only lie"*; therefore, besides a paid occupation, he chose a career in painting. After the year of 1968, he produced to the public his tempera and oil paintings, later his aquarelles, but he also published more and more art and philosophical writings. His painting skills were highly acknowledged and because of this, between 1995 and 2002, he was appointed as president of the *Society of Hungarian Painters*. One of his biggest, independent collective exhibitions was held in 2006 at the *Olof Palme House* in *Budapest*.

During the late 1970s, as a backpacker and active river rower, he was deeply affected by the proposed dam project known as the *Gabčíkovo–Nagymaros Waterworks*. From the beginning of the 1980s—among one of the first Hungarian environmentalists—he became a member of *Danube Circle*[5], and later one of the most well-known advocates of the 'Danube case'. Between 2002 and 2015, he was the president of the *Duna Charta* society. In 2000, with his fellows *András Lányi* and *Gábor Vida*, they founded the *Védegylet*[6] *(Protect the Future)* of which he was the president until 2008.

In 1995, he was granted the *Middle Cross of the Hungarian Order of Merit* by the *Head of State* (President of the Hungarian Republic). Also in 1995 he was awarded the *Nagy Imre Plaque* for his resistance during the *Hungarian Revolution of 1956*; in 2005 he received the *József Attila Prize* for his career as a writer, and in 2003 the *Munkácsy Mihály Prize*

[5] In Hungarian 'Duna Kör', is a Hungarian environmental organisation.

[6] http://www.vedegylet.hu/

for his lifework as a painter. For his literature and literary translation works, he was granted the *Kossuth Prize* in 2006 by the *Hungarian National Assembly*, and for his painting lifework he received the *Prima Prize* in 2014. From 2011 until death in 2015, he was a full member of the *Hungarian Academy of Fine Arts*.

Dávid Karátson
Lecturer, Head of department at Eötvös Loránd University, Budapest

Translated by László Bokor

Main works

Books

- Miért fest az ember (1970) / Why do we paint?
- A festés mestersége (1971) / The craftsmanship of painting
- Így élt Leonardo da Vinci (1973) / The life of Leonardo da Vinci
- Hármaskép (1975) / Triptych
- A gyermek Altdorfer (1982) / The child Altdorfer
- Ulrik úr keleti utazása (1992) / Mr Ulrik's Journey to the East
- Világvége után (1993) / After the Apocalypse
- Ötvenhatos regény (2005) / Novel of fifty-six
- A csodálatos kenyérszaporítás (2014) / The amazing breadpropagation

Translations (into Hungarian)

- Tao te king (1990) / Laozi: Tao Te Ching
- Ji King, A Változások könyve (2003) / I Ching: Book of Changes

Illustrations

- Goethe: Három mese (1976) / Goethe: Three Tales
- Goethe: Faust (1980) / Goethe: Faust
- Szent Lukács írása szerint való evangélium (2002) / Gospel According to Luke
- Szent János írása szerint való evangélium (2007) / Gospel According to John
- Szent Jánosnak Mennyei jelenésekről való könyve (2009) / The Book of Revelation

Geographical Locality Studies

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ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 490–529

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Pro-environmental characteristics of urban co-housing communities

Abstract

A great part of the current ecological and social crisis is caused by the socio–economic structure of the mainstream urban society in industrialised countries. This crisis has to be faced with, thus solutions on how we should change this society should be searched for. Alternatively, more ecological, healthy behaviour and lifestyles are offered for urban residents by intentional small communities. Thus, some potential solutions that lead to decreased negative environmental impact of cities might be included.

This article investigates the environmental impact of urban cohousing communities. Pro-environmental characteristics that reduce the negative environmental impact of cohousing communities are also examined. The article also explores the factors and processes these pro-environmental characteristics are created by. According to the findings of this study, urban cohousing communities tend to have less negative environmental impact than conventional urban housing options. All of the indicators for ecological footprint calculations show reduced need for energy and material consumption. Many of these pro-environmental characteristics are derived from four out of the six common characteristics of cohousing communities. Thus, they might be less harmful than conventional urban lifestyle even without strong ecological consciousness of residents.

Key words

Cohousing community; Pro-environmental characteristics; Ecological urban society; Ecological lifestyle; Intentional small community

1. Introduction

By 2030, more than 60% of the world population is expected to live in cities (ALBERTI, M. 2005). With our conventional and industrialised socio–economic system, these rapidly growing cities cause many challenges and much harm to both human and non-human lives on *Earth* (GRIMM, N. B. *et al.* 2008). The material demand to satisfy the ever-growing need of mainstream socio–economic systems for increasing production and consumption is the most powerful demand in urban environments (ALBERTI, M. 2005; SEYFANG, G. 2005).

Urban societies and urban economic activities that transform and transfer food, goods, energy and services are highly dependent on large input of energy and materials, and to absorb emission and waste, a vast capacity is required (DECKER, E. H. *et al.* 2000; ALBERTI, M. 2005). This need for productive and assimilative capacities of ecosystems is met from well beyond the city boundaries (GRIMM, N. B. *et al.* 2008). Thus, ecosystems are altered both locally and globally by our globalised socio–economic processes in urban areas, and became fragmented, isolated, and degraded by them. These processes also decrease biodiversity, disrupt hydrological systems and modify energy flows (ALBERTI, M. 2005; GRIMM, N. B. *et al.* 2008), biogeochemical cycles and climate (DECKER, E. H. *et al.* 2000; GRIMM, N. B. *et al.* 2008). Furthermore, living in urban environment affects the dwellers' well-being, as well. Many health problems are caused by unhealthy environmental conditions such as air pollution, and the atomised social structure of cities might lead to mental disturbances (NEWMAN, P. 2006).

These impacts are results solely of human decisions and actions. Thus, our lifestyle and its material basis determine our environmental effects (ALBERTI, M. 2005). The mainstream society and lifestyle today is based on consuming material goods. However, simply consuming more in most cases will not lead to increased well-being. Thus, we should search for solutions in our society that lead to lifestyles based on values other than material consumption. It seems that an economy that is founded by social processes of *care and connection* and where non-commodity goods are dominant would be more favourable. These goods and services are mostly produced and exchanged locally and depend on social relationships (SEYFANG, G. 2005).

In the last few decades many different kinds of intentional communities have come to life in cities, and different studies indicated that they might be somewhat less harmful on the environment than conventional or mainstream urban lifestyle (GIRATALLA, W. 2010). According to *Meltzer*'s definition, *"an intentional community is a group of mostly unrelated people living together and dedicated by intent to specific common values or goals"* (MELTZER, G. 2005). One of these intentional communities is called collaborative housing, or cohousing (MELTZER, G. 2005). These groups are formed with the intention of creating social cohesion and a mutually supportive community (MELTZER, G. 2005). Members are living together at a site which consists of both private and common spaces, explicitly designed to help create collaboration among residents (STRATMANN, J. *et al.* 2013). These urban communities could offer a solution to escape alienation and social isolation of conventional urban housing solutions and lifestyles, and they might create a way to live with a great sense of well-being and lower environmental impact at the same time (KROKFORS, K. 2012).

The following sections of this paper present the methods and the results of a research that examines the environmental impact and pro-environmental characteristics of urban cohousing communities. Based on literature about ecological footprint and pro-environmental behaviour (GIRATALLA, W. 2010; STERN, P. C. 2000) the *pro-environmental characteristics* here are defined as ones that affect the lifestyle of a community to reduce their negative environmental impact. These characteristics can be both physical and socio-cultural.

2. Aims of the study

The aim of this research is to determine the most significant physical and socio-cultural pro-environmental characteristics and the factors and processes that create these in cohousing communities. Currently active, developing or future cohousing might find these lessons useful when they decide to make some changes to live their everyday lives more ecologically. The study might also be instructive for further research on how small communities could help change the conventional socio–economic system to one which is based on collaboration instead of competition, and which is driven by social and environmental needs rather than financial ones.

3. Research methods

3.1. Questions

During this study the following research questions were asked:

1) Do urban cohousing communities have lower environmental impact than conventional or mainstream urban lifestyle?
2) What kind of physical and socio-cultural pro-environmental characteristics cohousing communities have?
3) What factors and processes create these characteristics in cohousing communities?
4) Is there any significant pro-environmental characteristic which is generally missing from the cohousing communities?

3.2. Methods and answers

To answer the research questions, qualitative data collection and analysis were done. First a desk study was carried out on environmental impacts of cohousing communities. The relevant literature on factors and processes that might create pro-environmental characteristics in these types of communities was also examined. The desk study was done through an extensive literature review of papers that presented findings of research on environmental effects of cohousing (BABBIE, E. 2007). Unfortunately not much academic attention has been paid to this subject so far (BAMFORD, G. 2001; GIRATALLA, W. 2010).

To further support or disprove the answers found during desk study, some cohousing communities were visited *in situ*. At these research sites, besides field observation, semi-structured interviews were carried out with at least one member of each visited community. The interviews were semi-structured because of the diversity of cohousing communities. Regardless the six common characteristics of cohousing (see later) each community is unique. Having structured interviews with fixed questions written in advance would have led to loss of unforeseeable information. Semi-structured interviews are flexible which means that the questioning is redesigned throughout the project (BABBIE, E. 2007). In this case it means that the prewritten interview questions were somewhat changed and they were asked in different order at each site. These changes were implemented to gain the information to answer the research questions, and data collected at the sites remained comparable for cross-case analysis at the same time (BABBIE, E. 2007). The interview questions can be found in the *Appendix*.

In all communities, members were generally friendly and excited about the visit. The interviewees were genuinely honest, interested in the research and they seemed to be trying to answer all questions according to the best of their knowledge.

Five different cohousing communities were visited during this research: *Æblevangen*[7], *Jernstøberiet*[8], *Ibsgården*[9], *Lange Eng*[10] and *Wohnprojekt Wien*[11]. The five visited sites are presented on *Figure 1*.

The first four communities are located in *Denmark*, the fifth is in *Vienna*, *Austria*. The two countries create two different contexts for the researched communities. However, in comparison with other countries, both of them have high average extensive welfare benefits and income per capita (OECD DENMARK, 2007; OECD AUSTRIA, 2013) and they both have high ecological footprint values, as well. Among countries with populations greater than 1 million—where complete data is available—*Denmark* has the 4th and *Austria* has the 17th highest ecological footprint per capita (WWF, 2014). Meanwhile, both countries have numerous policies and economic initiatives to reduce environmental impact, and their

[7] www.aeblevangen.dk
[8] www.jernstoberiet.dk
[9] www.ibsgaarden.dk
[10] www.langeeng.dk
[11] www.wohnprojekt-wien.at

societies have high average environmental awareness (OECD DENMARK, 2007; OECD AUSTRIA, 2013).

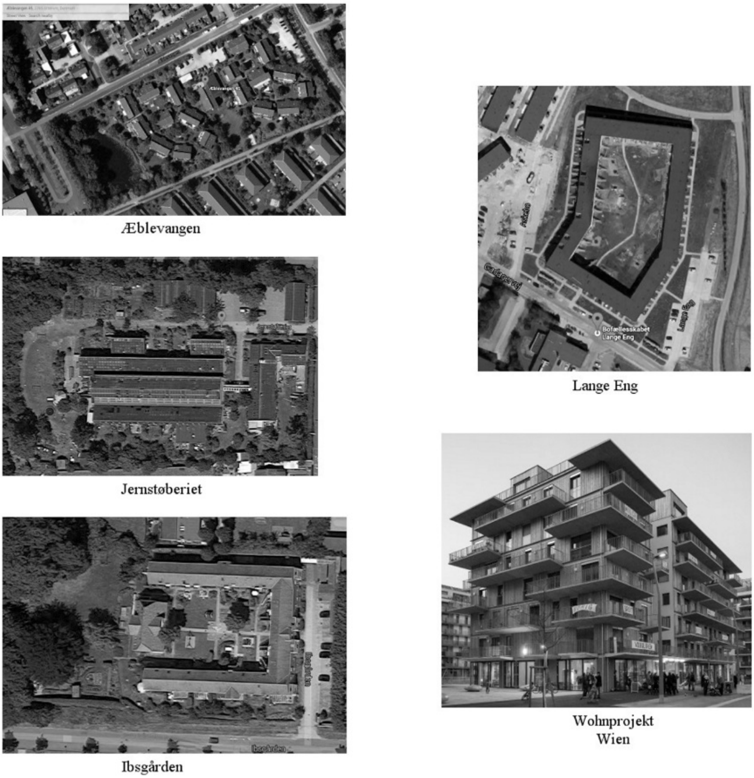

Figure 1 – The five visited cohousing sites
Image sources: GOOGLE MAPS (2015)

As it was mentioned in the *Introduction*, pro-environmental characteristics are defined as ones that affect the lifestyle of a community to reduce their negative environmental impact. This specification is based on *Stern*'s definition of impact-oriented and intent-oriented environmentally significant behaviour: *"Environmentally significant behavior can reasonably 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. [...] Other behavior is environmentally significant indirectly, by shaping the context in which choices are made that directly cause environmental change. It can now be defined from the actor's standpoint as behavior that is undertaken with the intention to change (normally, to benefit) the environment. This intent-oriented definition is not the same as the impact-oriented one in two important ways: It highlights environmental intent as an independent cause of behavior, and it highlights the possibility that environmental intent may fail to result in environmental impact"* (STERN, P. C. 2000).

Accordingly, pro-environmental characteristics are those that are caused by these two environmentally significant behaviours. In this study the intent-oriented behaviour is called pro-environmental behaviour. The differentiation between impact and intent is important because environmentalist intent is only one of the many factors that affect pro-environmental characteristics of communities, and it is often not particularly important. There are many other pro-environmental characteristics that can be derived entirely from non-environmental motives, such as personal habits and household routines (STERN, P. C. 2000). Furthermore, in most cases environmental awareness does not imply pro-environmental behaviour (MELTZER, G. 2005; STERN, P. C. 2000). In fact it seems like the more important behaviour is in terms of its environmental impact, the less it depends on environmental awareness and concerns (STERN, P. C. 2000).

To identify pro-environmental characteristics in cohousing communities, the components of ecological footprint calculation supplemented by water management were used. According to this calculation, the following attributes have the most significant environmental impacts within our lifestyle (GIRATALLA, W. 2010):

- *Built-up land:* the physical land area of a space altered for human usage.
- *Household energy consumption*: attributes of electrical and heating systems.

- *Consumption:* characteristics of buying, using and reusing products.
- *Food:* characteristics of purchasing, storing, and consuming food.
- *Waste management*: habits of disposing and recycling materials.
- *Water management*: attributes of the water-systems and water usage.
- *Transportation*: different means of transportation usage (GIRATALLA, W. 2010).

The analysis was done with the aid of spreadsheets that collect pro-environmental characteristics based on the ecological footprint component and relevant findings of other studies. During the analysis of the pro-environmental characteristics, those impact-oriented and intent-oriented environmentally significant behaviours that implied these characteristics in the communities were specifically searched.

3.3. Limits of this research

Mainly qualitative data based on interviews, literature, and personal observations are presented in this research. For determining environmental impacts of the studied cohousing communities more precisely, quantitative data collection and analysis would be required. Furthermore, during this research only five cohousing communities were studied, therefore, my conclusions might not reflect cohousing communities in general.

4. General characteristics of the visited cohousing communities

Although the visited sites are unique in many ways, they all possess the six general characteristics of cohousing communities (see later) (MELTZER, G. 2005). All of them are average cohousing sites that do not differ much from those researched in other studies (MELTZER, G. 2000; MELTZER, G. 2005; WILLIAMS, J. 2005; POLEY, L. D. 2007; GIRATALLA, W. 2010;

MELTZER, G. 2010; JARVIS, H. 2011; MARCKMANN, B. M. M. *et al.* 2012; VESTBRO, D. U. 2012; STRATMANN, J. 2013). The most important demographic and other general information is presented in *Table 1*.

Table 1 – General information on visited cohousing communities
Edited by SZÁRAZ, L. R. (2015) (~ = Approximately)

Name		Æblevangen	Jernstøberiet	Ibsgården	Lange Eng	Wohnprojekt Wien
Location		Egedal, Copenhagen	Roskilde		Albertslund, Copenhagen	Vienna
		Denmark				Austria
Date of	**first meeting**	1977	1970s	1981	2004	2009
	moving in	1980	1982	1983	2008	2013
Number of	**residents**	120	43	~40	200	~100
	adults	~60	31	~30	~100	~70
	children	~60	12	~10	~100	~30
Average level of	**education**	Higher education				
	salary	Above country average				
Type of ownership[12]		Private ownership		Common ownership	Private ownership	Common ownership
Site plan[13]		Between the pedestrian street and courtyard types	Hybrid of the 'street' and courtyard type	Courtyard site arrangement		Single, multi-store building

[12] See in General characteristics of cohousing communities.
[13] See in General characteristics of cohousing communities.

5. General characteristics of the cohousing communities

"The whole site is our home."

According to their social context, cohousing groups tend to fall into three categories: There are *building together* type of sites where residents have interest only in pooling assets and joining efforts to gain economic and practical benefits. The second type is *sharing everyday life* in which the members do not only develop their site together but also share everyday activities. The last type is *serving a common idea* where residents do not only develop the site and live together, but they also serve an ideology, religious commitment or specific lifestyle. In the last two types, social interactions are dominant and create social capital, which means that these are living small communities (KROKFORS, K. 2012; STRATMANN, J. *et al.* 2013). During this research *sharing everyday life* type of communities were studied purposefully since these seemed to be the most attractive for urban residents, and therefore this is also the most common type (KROKFORS, K. 2012).

Although cohousing communities have a wide diversity regarding their site planning strategy, design, size, and the organisation of their community life (BAMFORD, G. 2001; MELTZER, G. 2005), according to MCCAMANT, K. – DURRETT, C. (2011) they have *six common properties*:

1) participatory process,
2) intentional neighbourhood design,
3) common facilities,
4) self-management,
5) absence of hierarchy and consensual decision-making,
6) separate incomes.

1) *Participatory process* means that residents organise and participate in the design and development of their community, usually with the aid of experts (e.g. architects). For example in *Wohnprojekt Wien* most of the residents wanted to move on the top floor so they decided to create

only common areas there, this way everyone lives on the top floor a little bit.

This development process usually takes a few years (Scotthanson, C. – Scotthanson, K. 2005; Stratmann, J. *et al.* 2013). In this period an initial core group meets regularly to find a proper location, acquire finance, face challenges together, plan and design the site and an architectural form that meets the requirements of members (Garciano, J. L. 2011; Jarvis, H. 2011). During this phase the most common challenges are finding the appropriate land, and making it affordable for themselves and for their future members as well (Giratalla, W. 2010). Although no interviewee mentioned it during this research, enhancing social cohesion among residents, thus creating a real community from people who are mostly strangers to each other might be another significant challenge during the development phase of cohousings.

2) *Intentional neighbourhood design* means that the physical design of the site intentionally encourages and facilitates social interactions between residents. It is also constructed to provide a balance between personal and community life (Stratmann, J. *et al.* 2013; Williams, J. 2005). For example in *Wohnprojekt Wien* the private apartments were opening from a bright and roomy staircase, which was designed to allow residents to speak with each other even when they are on different floors.

Many sites are built according to one of the four generic site plans illustrated in *Figure 2*.

These sites have private houses, semi-private spaces (e.g. balcony, private garden attached to the private unit), indoor and in most of the cases outdoor common spaces (Williams, J. 2005). Private houses contain all the features of conventional houses with kitchens, bathrooms, bedrooms, and living rooms. However, they are usually smaller in size than conventional ones (Garciano, J. L. 2011; Poley, L. D. 2007; Williams, J. 2008). Semi-private spaces are borderlands between private and public spaces, thus, they create possibility for both social interaction and private life (Williams, J. 2005).

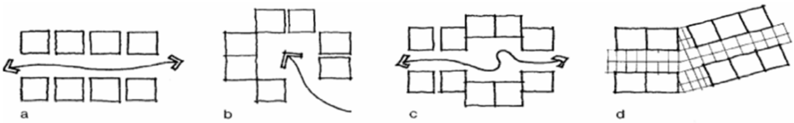

Figure 2 – Generic cohousing site plans: a) the pedestrian 'street'; b) the courtyard; c) a hybrid of the 'street' and courtyard types; d) a single building with an internal atrium that functions as a street but roofed
Source: MELTZER, G. (2005)

3) In these communities there are many *common facilities*, such as the common house or the common outdoor spaces. The common house is usually the most important place of community life. In most of the cases it is a centrally located building that contains many different shared facilities and common recreational areas (MELTZER, G. 2005).

A wide variety of common facilities can be found in cohousing communities: meeting rooms, libraries, rooms for children and teenagers, guest rooms, well-equipped workshops for carpentry and heavy DIY, laundry rooms, freezer or bulk storage, re-use and recycling facilities (e.g. for old clothes, toys) or exercise areas. Furthermore, several different kinds of outdoor common spaces can be found, such as vegetable gardens, hen yards or other productive ventures, playgrounds and outdoor recreational spaces. The possibilities of common facilities are limited mostly by creativity, communities can create any kind of common areas they choose and have resources for (BAMFORD, G. 2001; MELTZER, G. 2005; GARCIANO, J. L. 2011; JARVIS, H. 2011). These common facilities have an important role in creating and maintaining community life, but they have many practical values as well (STRATMANN, J. *et al.* 2013).

4) Cohousing communities are *self-managed*, which means that residents take responsibilities for the management and further development of the community. All the decision-making of everyday community life and the maintenance and management of common spaces are done

by adult members. They also organise regular and occasional social activities, such as daily community meals at the common house or parties and celebrations.

The maintenance and management tasks along with everyday life are somehow regulated and aided by sets of house rules or agreements. These are not legally binding, unique social contracts between the members of the community, and they are not necessarily in a written form (MELTZER, G. 2005).

The maintenance and management tasks are done by different kinds of working groups of the community (LIETAERT, M. 2010). These groups are usually permanent, but there are also temporary ones that only exist whilst there is only one task to deal with. The members or at least the leaders of the most important decision-making groups are elected regularly (MELTZER, G. 2005; POLEY, L. D. 2007; WILLIAMS, J. 2005). However, in three communities the interviewees mentioned that in practice it is more like they ask 'whose turn is it' to become a leader in a group.

To illustrate this kind of working structure *Table 2* presents the main working groups of a cohousing community[14].

Working groups were found in every visited community during this research. Members could freely choose the group they would have liked to work in. In four out of the five cases, adult (in *Jernstøberiet* above 14 years old) members had to join and work in at least one working group. In *Wohnprojekt Wien* members were not obligated to join a group, but they were obligated to do at least 11 hours of community work (e.g. site maintenance, cleaning common areas, organise common events etc.) within a month.

Many different kinds of recreational groups (e.g. sport groups, knitting group, theatre group, singing group, etc.) can be found besides working groups. Thus, community members also spend their free time with each other several ways. The groups develop according to the interests and hobbies of members, therefore they have immense diversity (POLEY, L. D. 2007). Besides these activities there is a lively community

[14] These descriptions were written by one of their members.

life, which is not organised so directly. These activities are derived from a strong support system based on caring and interdependence of residents (MELTZER, G. 2005). For example collective and reciprocal childcare occurs in many if not all of the communities (MELTZER, G. 2005).

Table 2 – The six main working group of Wohnprojekt Wien
Edited by SZÁRAZ, L. R. (2015)

Working group	Tasks of the group
Social Sustainability (Soziale Nachhaltigkeit)	In charge of the 'human' side of the project, takes care of the social glue that holds them together. They keep an eye on the community and organise events in the house (parties, outings, and community weekends).
Ecological Sustainability (Ökologische Nachhaltigkeit)	In charge of keeping an eye on our efforts to live a more sustainable life by organising a Food Group, taking care of the garden, or managing the carpool.
Economic Sustainability (Ökonomische Nachhaltigkeit)	More often referred to as 'FinRecht' (finance and legal), this working group takes care of all financial and legal issues that arise and work with their housekeeping to make sure the bills are paid on time and they have enough money to pay back mortgages.
Communication (Kommunikation)	In charge of keeping an eye on the communication channels inside and outside the house (both digital and analogue). Manages relations to outside (the community in the house) and provides and manages communication infrastructure in the house.
Organisation (Organisation)	Organises the general assembly meetings, takes care of the office.
Sustainable Building (Bauliche Nachhaltigkeit)	One of the most important groups, this group takes care of the house(s): making sure maintenance is performed, performing repairs and improvements, monitoring power and water usage, etc.

5) The working groups for maintenance and management usually hold regular *meetings* where they identify tasks and develop working strategies (LIETAERT, M. 2010). Besides these meetings there are general meetings for the entire community, where they discuss and solve the most important issues. Exceptional meetings are held, if a task or challenge requires it.

In these meetings the *consensus model*, a democratic, non-hierarchic process is used in the decision-making process of the group (MELTZER, G. 2005; SCOTTHANSON, C. – SCOTTHANSON, K. 2005): *"Consensus decision making is a group decision making process that seeks the agreement of all or most of the participants, and the resolution or mitigation of any objections from community residents"* (GARCIANO, J. L. 2011).

The consensus model helps to give everyone a fair opportunity to express their ideas and opinions during meetings (LIETAERT, M. 2010). According to different interviewees, this decision-making process proved to be effective, but relatively slow.

6) Cohousing members have *separate incomes*. They do not have a shared economy, employments are individually organised (MELTZER, G. 2005; SCOTTHANSON, C. – SCOTTHANSON, K. 2005). Members generally own or rent their homes and have a diversity in occupations and incomes. This inequality might create challenges when deciding the amount of common fees (MELTZER, G. 2005; LIETAERT, M. 2010; MELTZER, G. 2010).

In four of the visited communities every member older than 18 years had to pay a fix amount of common fee besides the overhead expenses of their private homes. The common fee covers expenses of the cost of maintenance, common parties, renovations, and the common everyday costs (water, heat and electricity consumption of the common areas). Every visited community had a common bank account where they kept the fund of the community.

Some of the members in *Wohnprojekt Wien* have at least part of their income from the café they created in the building, and the architect from the initial core group has his office in the building, as well. However, these are still individually organised employments with workplaces located in the cohousing site.

Cohousing communities typically consist of 50 to 100 residents or 12 to 40 households (SCOTTHANSON, C. – SCOTTHANSON, K. 2005; POLEY, L. D. 2007; LIETAERT, M. 2010; MELTZER, G. 2010). Significantly smaller or larger groups are rare because they seem to have special challenges derived from their size. Too small communities might become too intimate, the balance between personal and community life shifts towards community life, which often leads to conflicts between members. While too big communities do not allow residents to get to know everybody, thus the social capital that creates community gets weakened (SCOTTHANSON, C. – SCOTTHANSON, K. 2005; WILLIAMS, J. 2005). Although the community *Lange Eng* has 200 members, it has not caused any special challenges yet, because half of them are children and toddlers.

During this research two types of ownership were found: private and common. The type of the ownership also determines the leaving and entering policy of the community. In case of *private ownership*, members can freely sell their house, because they bought it as their own property. *Common ownership* means that besides the common areas, the private homes are common properties, as well. Members can buy and sell their share of the site to the community itself.

In case of privately owned homes, residents can decide to whom they sell them, therefore the community has at best indirect influence on selecting new members. When the site is entirely common, a working group or a delegation of members are chosen to select the new residents from the candidates.

The *social and cultural features* of cohousing communities are very similar to those of the wider society (BAMFORD, G. 2001; MELTZER, G. 2005). As one of the interviewees said, cohousing residents are simple city dwellers who choose to share their lives.

Cohousing residents are *diverse* in terms of their interests, age and religion, but they are relatively *homogeneous* in terms of socio–economic class, race, education, values and attitudes (WILLIAMS, J. 2005; MELTZER, G. 2010; GARCIANO, J. L. 2011).

There are several studies that indicate a greater sense of *well-being* among cohousing residents (WILLIAMS, J. 2008). The feeling of belonging, the mutual care and the involvement in the decision-making process create a feeling in cohousing members that they are valued members of their community (WILLIAMS, J. 2008).

Cohousing communities also provide *security*. In *Lange Eng* I was told that the absence of fence around the site was not a problem because residents notice strangers in an instance.

Cohousing members tend to look after the children of fellow members and it often can be a great deal of help for parents. Furthermore, cohousing communities seem to be especially beneficial for children and seniors. Children are literally living together with their friends. In comparison with children who live in conventional housing forms, they spend more time playing with their fellow kids than in front of the television (MELTZER, G. 2000). According to *Meltzer*, these children also tend to become highly environmentally aware and socially sensitive adults (MELTZER, G. 2000). In the community, children have an extended family with many 'uncles', 'cousins', and 'grandparents'. Therefore, this is a very healthy environment for the elderly, as well. They can provide help with many different tasks during decision-making and everyday life. Cohousing elders can never be bored and they are always valued (BAMFORD, G. 2001). These benefits for children, adults and seniors were mentioned during every interview.

6. Environmental impact and pro-environmental characteristics of cohousing communities

"The most important advantages of living in a cohousing are the practical ones."

Several studies suggest that *ceteris paribus*[15], cohousing lifestyle has less negative environmental impact per capita compared to conventional urban lifestyle (BAMFORD, G. 2001; MELTZER, G. 2005; GIRATALLA, W. 2010; LIETAERT, M. 2010; MARCKMANN, B. M. M. *et al.* 2012; VESTBRO, D. U. 2012). It seems that living together is more energy and resource efficient (GIRATALLA, W. 2010). However, to live with lower environmental impact, everyday household routines are much more important than the

[15] Meaning 'all else being equal' (HANSSON, S. O. 1996).

physical and technical design of the building (KROKFORS, K. 2012; MARCKMANN, B. M. M. *et al.* 2012). Cohousing communities are also suspected to be more sustainable because environmentally conscious people are overrepresented in these (MARCKMANN, B. M. M. *et al.* 2012).

Pro-environmental characteristics of cohousing communities found in the literature and at the visited sites are presented in the following and are structured according to the ecological footprint components. The environmental impact of cohousing lifestyle and that of conventional urban lifestyle have been compared in the studies examined.

6.1. Built-up land

Even with common areas included, cohousing members occupy less than average built land per capita, and thus, they have a higher population density as well (MELTZER, G. 2000; STRATMANN, J. *et al.* 2013; WILLIAMS, J. 2005). Socio-cultural factors such as frequent social interactions, sharing and trust are reducing perceived density. The smaller than average private houses are complemented by common areas, this way residents do not lack the facilities missing from their private units (e.g. laundry room, guest room, storage room) (MELTZER, G. 2005; WILLIAMS, J. 2005; MARCKMANN, B. M. M. *et al.* 2012). Therefore, higher density is not experienced as an inconvenience by residents (MELTZER, G. 2005). Smaller buildings in general also imply that fewer resources are required for the building process (MARCKMANN, B. M. M. *et al.* 2012).

To determine whether the researched communities occupy less than average built land, dwelling areas per capita—community areas included—the four Danish communities were compared to the country average number of square meters per occupant. This value in *Denmark* was 52.0m^2 in 2013 (STATISTICAL YEARBOOK, 2015). The data and results are presented in *Table 3*.

Table 3 – Dwelling sizes (community areas included) in square meters, members of residents and dwelling size per capita in the researched cohousing communities

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Community	Dwelling size of the community (m^2)	Number of residents	Dwelling size per capita (m^2/person)
Æblevangen	4,643	120	38.7
Jernstøberiet	2,070	43	48.1
Ibsgården	2,033	40	50.8
Lange Eng	6,293	200	31.4

As it can be seen in *Table 3*, three out of four communities have smaller than country average dwelling sizes. In the case of the fourth community, this value is close to the national average, but it is still below it. However, the environmental impact of built-up land coverage is only partly indicated by this calculation, because only dwelling sizes are included. For better evaluation, this calculation should be done with values of total property area. Unfortunately, the national average value to compare it with was not available.

Environmental impacts of buildings also depend on whether these are existing retrofitted buildings or newly built ones (MARCKMANN, B. M. M. *et al.* 2012). For example, the common house of *Ibsgården* was formerly a farmhouse and the building of *Jernstøberiet* is a redesigned iron foundry.

6.2. Household energy consumption

Cohousing communities consume less energy because their residents tend to save energy by pro-environmental behaviour and choices, and because of their reduced dwelling sizes and building arrangements (GARCIANO, J. L. 2011; MARCKMANN, B. M. M. *et al.* 2012; STRATMANN, J. *et al.* 2013). None of the visited sites had individual, detached private homes. *Æblevangen* had semi-detached houses with a detached common house. At the other sites the homes were in the same building, and in three cases (*Lange Eng*, *Jernstøberiet*, *Wohnprojekt Wien*) even the common house was in the same building as the private ones. These site arrangements are reducing heat loss, thus, increasing energy efficiency (GARCIANO, J. L. 2011).

During the development phase many communities decided to create a low-impact architecture, and many groups selected their construction materials based on their environmental impact. However, the building regulations in many countries make it difficult or even impossible to choose low-impact options such as recycled building materials (MELTZER, G. 2000). In *Wohnprojekt Wien* when the building was planned, the most important aspect was to make it as low-impact as possible. In older cohousing communities such as *Æblevangen* and *Jernstøberiet*, the energy efficiency of their buildings was mentioned as a major challenge. In *Æblevangen* the buildings were built based on at least a 35-year-old technology and they needed to be upgraded to reduce their energy consumption. It was mentioned as a challenge because this would have been a resource-intensive task and most of its costs would have had to be payed privately. However, not every member could afford this renewal and they have not been able to decide how these should be financed. At *Jernstøberiet* it was mentioned that their building is old and not properly insulated, therefore it was consuming an undesirable amount of energy. Although, the windows were replaced with better insulating ones recently, they had no solution yet to insulate the walls properly due to lack of financing.

This housing model also offers an intermediate scale of social organisation between the levels of the single family and the town or district, thus they can use certain technologies that would not be viable options for individual households (MARCKMANN, B. M. M. *et al.* 2012). At this scale, for example, central heating systems can operate very efficiently (MELTZER, G. 2005). In *Lange Eng* and in *Jernstøberiet* water is heated locally with one central water heater. According to the interviewees, the multi-store building of *Wohnprojekt Wien* uses a reduced amount of energy for heating because it has a heat recovery ventilation. The central equipment heats or cools the air to a given temperature and circulates it throughout the building. Therefore indoor air has a constant temperature all year long.

Many communities use renewable energy sources and devices that imply energy efficiency, such as solar cells and panels, programmable thermostats and heat exchangers (MELTZER, G. 2000; MARCKMANN, B. M. M. *et al.* 2012; STRATMANN, J. *et al.* 2013). In *Jernstøberiet* and *Wohnprojekt Wien* residents decided to install some solar cells on the roof but, according to them, these did not cover their entire electricity consumption. In *Æblevangen* one family installed solar cells to their own roof, though it was their individual decision. In *Lange Eng* members have been trying to find a way to install solar cells, but unfortunately the roofs seemed to be inadequate for this purpose.

6.3. Consumption

Cohousing residents share many spaces, facilities, tools and equipment, and this has environmental benefits. Sharing can be informal which occurs between the residents of their private possessions, or it can be formal like the common indoor and outdoor facilities and amenities (MELTZER, G. 2005). Sharing leads to reduced consumption, thus, less raw material, less energy consumption and less transport is required; and less waste and pollution is being produced (ASSADOURIAN, E. 2008; GIRATALLA, W. 2010; STRATMANN, J. *et al.* 2013).

There are many common facilities that reduce the need for having functionally similar facilities in every single private home. A common laundry room reduces the number of washing and drying machines per household, a workshop reduces the number of many kinds of tools and equipment (BAMFORD, G. 2001). Having recreational facilities such as a gym or a cinema implies that residents do not need to leave their home as frequently, thus, reducing the energy consumption and pollution of travel (GARCIANO, J. L. 2011; WILLIAMS, J. 2008). Every visited community had a fully equipped common kitchen and workshop. In the common kitchens the equipment (e.g. ovens, refrigerators, freezers, dishwashers, etc.) is made to work with greater amounts, thus allowing to cook bigger portions at once which saves resources.

They also had a common laundry room in all cases except for *Lange Eng*. In these there were 2–3 washing machines and 1–2 driers. In some cases (e.g. in *Æblevangen*) industrial types of these machines were bought.

All visited sites had several different kinds of recreational areas, usually different ones for different age-groups in the community. There were outdoor playgrounds, playrooms for children and rooms for adults. Sometimes there were also rooms for teenagers. In *Lange Eng* and *Æblevangen* they also had an indoor gym. *Lange Eng* and *Ibsgården* had a common cinema as well, and all of the visited sites had space and equipment for outdoor barbecue.

Members also share small items such as tools for gardening, cleaning, camping and cooking, and small furniture (VESTBRO, D. U. 2012). They also exchange items like clothes, shoes, games and books, so these are reused several times. Even if they do not have a special storage room or shelves for this purpose, before they throw something away, they at least ask around whether someone else needs it (LIETAERT, M. 2010). In every researched community, members told me that they shared and exchanged many items with each other. All sites had a storage room or at least shelves for items that the former owner did not need anymore, but for others these could still be useful: children clothes, toys, books, DVDs, household equipment, etc. In *Lange Eng*, I was told that they did not really need to buy any clothes for their children until they were about five years old.

Members also share their skills, for example during home repairs, assistance with computers and automobile repair (JARVIS, H. 2011; MELTZER, G. 2005; POLEY, L. D. 2007). The visited sites all had bicycle storage rooms.

Cohousing residents usually tend to choose products that have lower environmental impact such as energy saving equipment or organic food (STRATMANN, J. *et al.* 2013).

6.4. Food

Every interviewed member claimed to have tried to buy ecological or organic food both for private and common consumption as often as possible. They also said that the only factor that influenced their food choices between ecological and non-ecological is the price of the products.

Every visited site had vegetable gardens and in three of them they also had some hens (*Lange Eng, Æblevangen, Jernstøberiet*). In *Jernstøberiet* they had many fruit trees as well. The amount of apples grown was enough to store part of the fruits for winter.

These gardens were semi-private properties, because they did not do gardening or take care of the animals as a community, but it was done by members who enjoy doing it. In some cases, a working group has been formed for these tasks.

The products of the vegetable gardens and the eggs were mostly consumed by the residents who took care of the garden and the hens. Occasionally they brought ingredients for the common meals as well, but they did not produce enough food to cook common meals entirely from these. Gardening and keeping hens were more like a recreational activity than food production. Therefore these activities only exist in a community while they have residents interested in doing them.

Residents also tend to exchange food with each other. One can always ask a little salt from the neighbour, so they do not have to go out shopping right away when they realise during cooking that some ingredients are missing. In *Æblevangen* they used to organise the shopping of basic food and basic household products. They stopped it because the organisation was too difficult. Some of the residents in *Wohnprojekt Wien* joined a community supported agriculture (CSA) programme and order their vegetables from a local farmer. The members of this community also tend to shop at farmers' markets. Unfortunately, this option is not really available for Danish cohousing members, because farmers' markets are very rare and very expensive in *Denmark*.

There were several vegetarian members in every community, but there were no vegans. However, I have not got data on the exact number of vegetarian residents at the visited sites. In *Lange Eng*, *Ibsgården* and *Wohnprojekt Wien* it was mentioned that some of these members had chosen to be vegetarian out of environmental consciousness. Unfortunately, there is a lack of data on eating habits of vegetarian residents, for example, on the extent of their milk product consumption. Therefore, the extent of this pro-environmental characteristic cannot be estimated.

Most of the cohousing communities share meals regularly. This either means that they eat the same food jointly at the common dining room, or they eat it individually at their private homes. These shared meals provide a sense of community, save time for residents, provide more efficient use of space and they are generally assumed to reduce consumption and waste. Unfortunately, the amount of resources saved by sharing meals in cohousing communities has not yet been studied (VESTBRO, D. U. 2012).

There were common meals in every visited community, though they had different strategies for it. In *Lange Eng*, *Æblevangen*, *Ibsgården* and *Jernstøberiet* they ate dinner, in *Wohnprojekt Wien* they had lunch together. In *Æblevangen* there were different dining groups, at least one every day. These were open for all residents, for example my main interviewee had been eating with the Wednesday and Friday dining groups. In *Lange Eng* and *Ibsgården* residents were eating together six times a week, and they organised the meals more jointly. Members had to cook common dinner twice in every five weeks in *Lange Eng*, and three times a month in *Ibsgården*. *Jernstøberiet* had a similar custom, but they only ate together three times a week. In *Wohnprojekt Wien* some members and the employees of the architect office ate lunch together from Monday to Friday. Every community had at least one vegetarian meal a week. In *Ibsgården* it was highlighted that they tried to exclude meat from common meals, and when they had meat, they ate only 75–100 grams per person per occasion. They also bought most of their meat from a local organic farm. They reduced their meat consumption partly due to high price of organic meat.

6.5. Waste management

There seems to be an increased attention towards recycling and composting waste in cohousing communities compared to conventional housing residents (MELTZER, G. 2000; BAMFORD, G. 2001). The residents of the visited communities were recycling waste to the extent of the possibilities provided by the local municipality. For example, in *Æblevangen* they could recycle organic waste as well because the municipality *(Egedal Kommune)* collected it. This municipality was able to operate the central heating system of the district with the organic waste of its dwellers.

Members of the visited sites collected their waste individually then brought it to the closest recycling island or to the common collector bins of their own.

In *Æblevangen*, *Ibsgården* and *Jernstøberiet* they also did composting and they used the compost in their vegetable gardens as fertiliser.

In *Lange Eng* it was mentioned that they had a group to solve the problem of too much food waste at the common meals.

6.6. Water management

Cohousing communities are more likely to have more effective water usage than conventional urban housing options (BAMFORD, G. 2001). According to two of the interviewees in *Lange Eng*, their municipality *(Albertslund Kommune)*, and within that their community used the less amount of water per capita in *Denmark* in 2013 (100 litres/person/month).

In *Denmark*, average precipitation is high, therefore it is seldom needed to collect rainwater individually because they cannot really use it afterwards. There were no visited communities that collected rainwater for usage, though the members of *Wohnprojekt Wien* might start to do so. (They have not started it yet because there was not much rainfall during their first year.) *Æblevangen* collected rainwater in a unique way. They had a system that collects rainwater separately from waste water and transfers it to their pond. This is a natural pond in their garden, which is primarily used for recreation such as swimming or boating, and children also like to catch fish, though, they do not eat them. There used to be lobsters living in it as well. Unfortunately, they had become almost extinct because the pond had become too polluted with agricultural pesticides for them, though not for swimming. The pollution came from agricultural areas delivered by the natural torrent that feeds the pond.

6.7. Transportation

The location of the site determines proximity to commercial and service facilities, schools, and places of employment, thus it influences the vehicle dependency of residents (MELTZER, G. 2005). In the visited communities, members said that they rarely needed their cars for everyday transportation. All the facilities, schools and workplaces could be reached on foot, by bike, or by public transportation.

Thus, residents of cohousing communities own fewer cars than residents living in conventional housing options (GARCIANO, J. L. 2011; STRATMANN, J. *et al.* 2013). Not all families owned cars at the visited communities except at *Æblevangen*. There every family owned at least one car, though, they did not use them every day. In *Lange Eng* approximately half of the families owned cars and they also used it rarely. Some of their residents joined a car-sharing system in the municipality. They also shared their private cars, which is common in all the visited communities. *Wohnprojekt Wien* had a carpooling system of their own. Most members who owned a car gave it to the carpool for common usage. They had six cars in the carpool and there were two more cars that were not included.

It was highlighted in every community that instead of cars, bicycles are mostly used, combined with public transportation if required. Every interviewee said that they generally tried not to use their cars whenever possible. They also claimed that this was a typical attitude of all their members. Most of the children who lived in cohousing travelled to their school, which was in the neighbourhood, by bike.

According to the interviewees their airplane usage did not differ much from the country average. However, in *Ibsgården* it was mentioned that their members travelled a lot by plane. This was not caused by living in a cohousing, but because most of their residents were researchers who generally often travel by plane.

7. Missing pro-environmental characteristics

In most *sharing everyday life* type of cohousing communities the possibilities of eco-friendly technological infrastructure have not been sufficiently recognised (MELTZER, G. 2000). It is especially true in the case of heating and water management. On this scale it would be quite easy to adopt many different kinds of technological solutions such as an ecological sewage system. The possibilities for ecological solutions are mostly limited by the resources and the commitment of communities (ASSADOURIAN, E. 2008).

8. Factors and processes that create pro-environmental characteristics

According to some studies, there is a missing link between recognising the negative environmental effects of our mainstream lifestyle and changing our everyday decisions accordingly. Therefore, it seems that there is little connection between environmental awareness and the lifestyle and consumer behaviour of citizens (KOLLMUSS, A. – AGYEMAN, J. 2002; MELTZER, G. 2005). However, according to *Meltzer*, the quality of our social relationships and our 'sense of community' are major determinants of the pro-environmental behaviour of individuals.

Based on the pro-environmental characteristics of cohousing communities this study presents, it seems that those reducing the impact the most are derived from four of the common characteristics of cohousing. These pro-environmental effects of the common characteristics are strengthened by a higher than average environmental consciousness among cohousing residents. In cohousing communities higher environmental awareness leads to a higher level of pro-environmental behaviour as well (MELTZER, G. 2005; WILLIAMS, J. 2008). Therefore, many of the pro-environmental characteristics are created simply because *"it just makes sense this way in a community like this"*, and not because of environmental consciousness (WILLIAMS, J. 2005). Thus, pro-environmental characteristics derived from the four common characteristics might somewhat fill the gap between environmental awareness and pro-environmental behaviour (STRATMANN, J. *et al.* 2013; MELTZER, G. 2010).

The *participatory development process* enables environmentally conscious members to affect those with lower environmental awareness (MELTZER, G. 2010). Furthermore, since it is a slow process, it allows to think through decisions having effects lasting for decades thoroughly. Cohousing residents act on community scale during this period as well, thus, they theoretically can implement technologies with significant pro-environmental characteristics that would not be feasible on the scale of a single household (MELTZER, G. 2007). For example, in *Wohnprojekt Wien* they carefully selected their heating system with the aid of their expert members during the development period. They also decided to have solar cells at this phase.

Physical design and personal consumption choices affect each other (ASSADOURIAN, E. 2008; GIRATALLA, W. 2010). The goals of *intentional neighbourhood design* are to increase social interactions among cohousing members and to keep a balance between private and community life. Increased social interactions lead to increased trust and connectedness, therefore, it also increases sharing, thus reduces consumption, waste production and energy consumption. The balance between private and community life also ensures sufficient level of interactions while serving privacy as well. These attributes and effects of neighbourhood design were observed in every visited community.

Common facilities enable residents to live in smaller households because they do not need many private facilities and rooms, since these are available for them as common properties. Common facilities also create possibilities to share time, equipment, tools, vehicles and many other things, thus, increase well-being and reduce consumption. These effects are strengthened by pro-environmental behaviours, such as conscious consumers choosing, for example, organic food or energy saving equipment (STRATMANN, J. *et al.* 2013). Basically all of the visited sites had the most common community facilities, such as laundry room, workshop, kitchen, gym, etc. These common areas were well equipped facilities in all cases. Furthermore, several interviewees told me that they paid attention to buy ecological products. Although, when buying something for common usage the price was also an important factor.

Environmental awareness is also spreading among residents during *self-management*. Self-management also gives power to members to decide about their direct environment, thus acting locally is highly enabled (SCOTTHANSON, C. – SCOTTHANSON, K. 2005). Direct involvement of residents in management and maintenance, similarly to the participatory process, also enables environmentally conscious members to affect the less aware residents. This could result more easily in the adoption of renewable energy sources and energy-efficient systems (MELTZER, G. 2005; GARCIANO, J. L. 2011; MARCKMANN, B. M. M. *et al.* 2012). Moreover, several interviewees emphasised that doing the decision making task was easier and more joyful when done together, thus, self-management also increased well-being.

The basis of the pro-environmental characteristics is social interaction, which enables residents to get to know each other better (WILLIAMS, J. 2005; BOUMA, J. – VOORBIJ, L. 2009). This process also has a positive feedback because social interactions promote choices and design that opens up further possibilities for social interactions (WILLIAMS, J. 2005).

Social interactions help to create trust between residents (WILLIAMS, J. 2005), and trust creates co-operation (PRETTY, J. – WARD, H. 2001) and connectedness among them (WILLIAMS, J. 2005). Thus, trust facilitates sharing and collaboration that leads to practical savings and many environmental consequences (MELTZER, G. 2005). Furthermore, sharing also has a positive feedback in cohousing communities. Communities are structured in a way that makes sharing easier, therefore sharing increases and shapes the structure to create even more possibilities (LIETAERT, M. 2010). Thus, sharing based on trust that creates co-operation and more sharing is one of the most important processes that creates pro-environmental characteristics in cohousing communities. During the interviews, it was revealed that most cohousing residents had chosen this lifestyle because they would have liked to share their everyday life with many other people instead of living individually or as an individual family. The possibility of sharing everyday life is the most attractive attribute of cohousing according to the interviewees. Furthermore, according to them, sharing facilities and smaller or bigger items and supporting the fellow residents in many ways are derived from knowing and caring for each other, thus, it ultimately derives from trusting each other.

9. Conclusion

According to the data found in the literature and during the interviews, the members of cohousing communities exert lower negative environmental impact than the residents of conventional housing options. Cohousing residents have a greater sense of well-being.

Cohousing sites usually occupy less than average built land per capita and they have low-impact architecture in many cases. Some sites are created from existing buildings that are retrofitted. Cohousing communities also consume less energy, residents tend to buy less household equipment and other consumer goods. They are also characterised by reduced car usage and increased bicycle usage for transportation. The possibilities of adopting eco-friendly technological infrastructure is wider for these communities than for individual households, however, these have not been realised sufficiently by most cohousing communities.

These pro-environmental characteristics are derived from four out of the six common characteristics of cohousing communities and they are strengthened by a higher level of pro-environmental behaviour among cohousing members. The basis of these pro-environmental characteristics is social interaction, thus it might be a useful process to increase the ratio of pro-environmental characteristics of urban societies.

Today only an extremely small part of urban residents is living in cohousing communities, but it does not necessarily mean that it will only appeal to a small minority in the future[16]. There are about 1000 cohousing communities around the world (LIETAERT, M. 2010), nearly 300 of them are located in *Denmark* (SCOTTHANSON, C. – SCOTTHANSON, K. 2005) and about 100 can be found in the USA (POLEY, L. D. 2007). Although in most countries the political, economic or other contexts have not given any aid for this specific housing concept yet, it has become well-known in many of them. Furthermore, their popularity does not seem to decline: several new communities are currently under development (WILLIAMS, J. 2005). However, the spreading of this lifestyle might be limited. One needs some determination, ability to compromise and a tolerant personality to be able to fit in and live happily in a cohousing community[17].

According to this study cohousing lifestyle might be a good way towards sustainable living for people who would like to live in a small community as well. However, its real potential in creating a sustainable society is undetermined and needs further examination.

Acknowledgements

I am especially grateful to *András Takács-Sánta* who helped me develop the research methodology and carefully supervised the writing process. I also would like to thank *Bence Tóth* for accompanying me during the field research and for his valuable comments and suggestions on this paper. Finally, I shall thank all of my interviewees for their honest welcome and uttermost helpful cooperation.

[16] There were no open spaces left at any of the visited sites and many interviewees said that they have a long waiting list and there are new applicants every month.

[17] According to several interviewees, to be able to cope with the rules and with the somewhat reduced private life one has to want to live in a community. It is not for people who cannot tolerate each other, or who cannot make compromises.

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Appendix: Interview questions

1. About the past

- When was this cohousing community established?
- Please tell me the main events in your community's history.
- What were the main motivations of creating this community?
- What were the greatest challenges during the creation of the community and the cohousing living space?
- Did you have any common goal in the beginning? Did you reach it?
- What were your financial sources for the creation of the cohousing site?
- Did you get any expert help from outside or did you build everything on your own?
- Were there any significant changes inside or outside the community since the establishment?

2. General information

- How many members does this community have? How did this number change since the beginning?
- How many children and adults live here?
- What is the ratio between men and women?
- How many members have lived here from the beginning?
- How many residents have arrived after the cohousing creation?
- Were there any members who left the community?
- What kind of policies do you have for entering and leaving the community?
- What kind of occupations do your members have? What is the average salary category?
- Where do your children go to school?
- Do children remain with the community when they grow up?

3. Physical characteristics

3.1. Housing types and technology

- What types of housing do you have here?
- How are your buildings arranged? I would like to ask a layout plan marked with the private and community spaces.
- What is the exact size of the dwelling and common areas?

- What were the main reasons of arranging the site this way? What was the goal and did you reach it?
- What kind of purposes do your buildings and sites have? E.g. private homes, community buildings, storage buildings, community gardens, playgrounds, etc.
- What is the average size of the private areas?
- What kind of private spaces do the residents have?
- What is the average size of the community areas?
- What kind of community facilities do you have? E.g. laundry-room.
- What kind of technological gadgets are owned by at least every family or every person?
- What kind of technological gadgets do you own together as a community?

3.2. Housing materials and energy usage

- What kind of materials are buildings made of?
- Do you have any kind of renewable energy source?
- What is the energy source for the heating?
- Do you use air conditioners in the summer?
- What is the energy source for the electricity?
- Do you have any special ecological sewage system? E.g. Constructed wetland
- Do you collect and use gray water and rainwater? Do you have a gray water system?
- What do you use the gray water and rainwater for?
- Have you done any renovation since the beginning? If you have, what kind of renovation were these? What were the main reasons to do these renewals?

3.3. Transportation

- How often do you leave the site of the community?
- What kind of transportation do you use?
- How far do you go with the different types of transportation?
- How many cars does this community possess?
- Do you have co-owned vehicles, bicycles?
- What kind of parking spaces do you have? Where are these located?

- Do you do social and recreational activities only inside the community or do you go outside as well?
- How far and with what means of transportation do you go for recreation?
- Are local trips (like to the local store or post office) coordinated?
- Where and by what kinds of transportation do members usually go on vacation?
- How often do your members use airplanes?

3.4. Food

- Do you produce your own food at any level? What kind of food do you produce?
- Do you have any communal gardens for this or do residents produce food in their own private gardens?
- What kind of food products do you buy outside the community?
- Where do you buy your food (directly from farmers, farmer's market, mall, etc.)?
- Does the community shop together (only some members go shopping) or everyone goes individually?
- Do you store food up together for example for winter? Do you have a common building or room for this purpose?
- Do you have any members who do not eat meat (vegetarianism)?
- Do you have any members who do not eat any animal products (veganism)?
- Do you have any other members with other special diet? What kind of diets are these?
- How much meat do you eat in a day/a week/a month/a year (as you have the data)?
- Do your residents exchange food with each other?

3.5. Waste management

- Do you recycle your waste? Do you do composting?
- What protocol do you use for these? (e.g. residents separate their waste and take the material to the centralise depot outside the community individually or do you have another system for this?)
- What do you use the compost for?

- Do you take efforts to reduce the quantity of your waste? Less shopping, to buy less packaged products, repair the broken equipment?
- Do you reuse items you can?
- Do you share your tools and equipment?
- Do you have some kind of ‘garage sale’ events where residents can exchange items or is this happening spontaneously?

4. Socio-cultural characteristics

4.1. Community principles, structure, rules

- Have you got any common principles you live by? Are these principles written?
- Do you have any common principles in parenting your youngsters?
- What is the structure of your community?
- Do you have any tasks that have a committee? Or a designated individual? Or working group? What kind of tasks are these?
- What kind of common rules, regulations, and agreements do you have? Are these written?
- Are these house rules, therefore not legally binding or these are regulations that legally bind the members?
- How do you enforce these rules?
- How do you finance your common expenses?

4.2. Decision making and meetings

- Please describe in detail your community’s decision making process.
- How do you implement (major) changes?
- Do you have regular meetings?
- How often do these meetings occur and who attends these?
- What kind of questions do you discuss on these meetings?
- When do you have meetings besides these regular ones?

4.3. Social activities

- What kind of regular social activities do you have inside the community?
- Do you have common meals? How frequent are these meals? How many residents attend on these usually?
- Do you have different types of activities for different age-groups?

- Do you organise activities as a community for others as well? If you do, for whom?
- Do you go to recreate outside as a community or only by yourself/with some other residents/with people outside the community?
- Do you have any contact with other cohousing or other kinds of communities? What is the nature of this relationship?

4.4. Challenges

- What kind of conflicts usually emerge during your everyday life?
- How do you solve these problems? Do you have any specific method for this within the community?
- What are the biggest challenges in your community life?
- Is there any factors (law, stubborn neighbours, disagreements among members, etc.) that hinders any kind of community activity or the creation of some kind of building that the community or any of your members would like to have?

4.5. Environmental consciousness

- In what way and on what level does your community pay attention to environmental problems during everyday life?
- Have you got any members who are particularly active or have less interest in this topic?
- Do you intentionally teach your youngsters to be environmentally conscious?
- Have you ever organised any activities that were about environment protection?

5. Closing questions

- What is your opinion about Danish/Austrian cohousing communities in general?
- Are you interested in the results of this research?
- Would you like to get them before they are published?

ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 530–556

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The Impact of Economic Development on the Environment: the Case of the BRICS

Abstract

The aim of this paper is to consider whether economic growth has a direct effect on the environment. It is particularly concerned with the BRICS countries and their incomparable results in the 2000s.

The paper consists of three parts. The first one gives an overview on the topic of sustainable development and sustainable consumption. The second part attempts to suggest a literature review on the topic of correlations between the economy and the environment in these countries. Part three addresses the environmental effects of economic development on the basis of different statistics provided by international organisations. Based on the studied literature and the conclusion of the paper, one can agree with the findings of the researchers who make economic growth responsible for environmental degradation and increasing pollution in the BRICS countries.

Key words

Economic development; Environment; Sustainability; Consumption; BRICS countries

1. Introduction and aims of the study

In the past century the world's population quadrupled, the life expectancy at birth increased significantly in all regions, the use of fossil fuels become fourteen times more, while the economy grew more than twentyfold. During the past four decades the number and share of people living in deepest poverty declined. However, the general statistical data and the positive changes in certain regions conceal the fact that both the social and economic inequalities have increased between the regions and the countries. Developments have a number of effects on the environment, one of which is the overuse and depletion of natural resources. These effects are also accompanied by the launch of unfavourable socio-economic processes (increase of income inequalities, indebtedness, strengthening of social extremes) (DURAIAPPAH, A. 1996; BODA, ZS. 2006; AŞICI, A. A. 2013; GYULAI, I. 2013; COWAN, W. N. *et. al.* 2014). The paper is aimed to consider whether the economic developments had environmental effects in the BRICS[18] countries after the turn of the millennium. The *Republic of South Africa* became an official member of the BRIC in April 2011, and since the country group is referred as BRICS. Half of the global population is concentrated on one fourth of the total land area, which belongs to the BRICS in addition to one third of the global GDP. Nowadays, the population of the BRICS reached 3 billion. Furthermore, the middle class is growing constantly in these countries, which means that more and more people can afford the high-priced products (FEKETE, J. *et al.* 2013).

First, the concepts and definitions related to sustainability and sustainable consumption are presented. Second, the various results of international research are introduced. Last but not the least, the environmental impacts of economic growth in the BRICS countries are presented through a variety of charts and graphs, which are based on the statistical data of different international organisations. At the end of the paper, some conclusions are drawn, furthermore the efforts by the BRICS countries to address the problems are also outlined.

[18] BRICS stands for *Brazil*, *Russia*, *India*, *China* and *South Africa*.

2. Sustainable development and sustainable consumption

While many definitions of sustainability were formed during the past decades, most commonly the explanation formulated by the *Brundtland Commission* in 1987 is quoted: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: (1) the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and (2) the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs*" (WCED, 1987). The definition actually means the need for intergenerational solidarity.

According to *Principle 3* of the Report of the *United Nations Conference on Environment and Development*, which was passed on Rio de Janeiro Earth Summit in 1992, "*The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations*" (UNEP, 1992). According to the criteria drafted on the summit, sustainable development is focusing on people and in the light of the new results of scientific research, the process of development should be re-evaluated. Furthermore, since the concept of development is not clear yet, there is a need for holistic development theory, international research programmes and the setting up of demonstration models.

Based on the *Statement on Transition to Sustainability* of the *IAP*, the global network of science academies, *"sustainability implies meeting current human needs while preserving the environment and natural resources needed by future generations"* (KATES, R. W. *et al.* 2000) according to *IAP – The Global Network of Science Academies*'s *Transition to Sustainability in the 21st Century* (Tokyo Summit, May 2000).

The *United Nations Conference on Sustainable Development (UNCSD)*, also known as *Rio+20* or *Earth Summit 2012* was a 20-year follow-up to the conference held in 1992, where the participants drafted a vision of the should be future processes. "*(...) 6. We recognize that people are at the centre of sustainable development and in this regard we strive for a* *world that is just, equitable and inclusive, and we commit to work together to promote sustained and inclusive economic growth, social development and environmental protection and thereby to benefit all. (...) 8. We also reaffirm the importance of freedom, peace and security, respect for all human rights, including the right to development and the right to an adequate standard of living, including the right to food, the rule of law, gender equality, women's empowerment and the overall commitment to just and democratic societies for development"* (UNCSD, 2012).

According to the *Report of the Symposium on Sustainable Consumption*, sustainable consumption is "*the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations"* (NORWEGIAN MINISTRY OF THE ENVIRONMENT, 1994). Signs of unsustainable consumption include the rapidly growing amount of waste, the negative effects of consumption on health (e.g. the advertising of unhealthy products for children), the environmental health hazards (e.g. issue of air pollution) and the degradation of the environment.

3. Economy, Environment and the BRICS – A Literature Review

As stated by neo-liberal economic policies, globalisation can improve the quality of the environment in the long run (BODA, ZS. 2006). Contrarily, the general opinion of environmental activists is that negative ecological effects far outweigh the positive ones.[19] Due to the fierce competition forced by globalisation, many countries were forced to weaken their environmental regulations. Additionally, international specialisation often led to monoculture farming damaging the environment. Economic globalisation and the wasteful production methods of nowadays are mutually reinforcing each other (BODA, ZS. 2006). Although in the past century, it was a common thing that even the population of the most developed countries did not seek to minimise the costs of energy

[19] To value monetarily the natural resources M. SZERÉNYI, ZS. (2001) made a comprehensive study about the methods and techniques.

and to forward energy efficiency (MUSTERS, A. 1995), it appears that now there is a progressive process regarding efficiency. The paper of BINA, O. – VAZ, S. G. (2011) is related to the topic, in which the changing human attitudes and commitments towards sustainability are examined.

DURAIAPPAH, A. (1996) reviewed a great number of empirical studies examining the correlation between economic factors and environmental degradation. The research suggests that the studies cannot be divided into two groups firmly on the basis of whether there is a causality between economic activity and environmental pollution.

PAO, H. – TSAI, C. (2010; 2011) researched the coherency between carbon dioxide emissions, energy consumption and economic growth in the BRICS countries. The results show that there is a significant correlation between the variables listed above. The slowdown of economic growth is associated with the decrease of energy consumption and carbon dioxide emissions, and reverse. The results are confirmed both for a short term period (PAO, H. – TSAI, C. 2010) and for a long term period (PAO, H. – TSAI, C. 2011). Studies also show that FDI-inflow contributes to the increase of environmental pollution. COWAN, W. N. *et al.* (2014) also focused on this subject. Their research is special in a way, since compared to other research, their work do not take a stand on if there is an interrelationship between economic growth, energy consumption and CO_2 emissions. The study draws conclusions by countries and by variables. AŞICI, A. A. (2013), who conducted a multiple regression analysis, found that there is a positive correlation between the GDP per capita growth and the environmental load per capita. The theory is strengthened by the cases of the moderately developed and emerging economies, where CO_2 emissions and the extraction of minerals have significant environmental impacts. Surprisingly, according to the study, the economic growth has no impact on forest stand in the countries examined (AŞICI, A. A. 2013).

The paper written by LEAL-ARCAS, R. (2013) studied the influence of the BRICS countries on climate change. As stated by the results, unfortunately the BRICS managed to catch up to the developed countries from the aspect of greenhouse gas emissions. However, one should not forget that many businesses and research groups have been established in the BRIC(S), which aimed to promote the more efficient use of renewable energy sources. From this perspective, *Brazil*, *India* and *China* have already taken considerable steps by making strategies and increasing the share of renewables. Long-term continuation of the trend is expected (ZHANG, H. *et al.* 2011; TIAN, H. 2015), but *Russia* will continue to rely on fossil fuels since it has globally unique and outstanding reserves.

Other researches reached the conclusion that temperate rise has negative consequences on economy. Considering the climate data of the past 50 years, the following phenomena can be experienced: if the average temperature rises by 1°C than the economy may fall by 1.3% (DELL, M. 2012).

The harmful effects of economic growth are also confirmed by a study made by HOSSAIN, S. (2011). The paper suggests that the increase of consumption and economic development infer carbon dioxide emissions. It is also pointed out by the study that the quality of environment in urban areas started to improve and this process seems to be sustainable. However, the slowdown of urbanisation is not expected to happen in the following in years in the case of the BRICS, therefore eco-conscious strategic planning is a key for sustainable urban environments (MCGRANAHAN, G. – MARTINE, G. 2012).

In 2009, researchers at the *University of Santiago de Compostela* studied whether the outstanding economic performance of the BRIC(S) countries over the preceding years had an impact on environmental degradation. The research demonstrated that economic growth is rather decreasing environmental degradation than increasing it, as with the effect of growth more money could be spend on protecting the environment. In addition to that, as a result of the developing financial sector and technology the CO_2 emission per capita is also reducing. Although, it should be noted that this trend can be achieved and maintained by the continuous development in the quaternary sector (TAMAZIAN, A. *et al.* 2009). In 2010, their research on the impacts of economic, financial and institutional developments brought similar results (TAMAZIAN, A. – RAO, B. R. 2010).

Pao, H. *et al.* (2011) analysed the main determinants of CO_2 emissions by employing annual total data over the period between 1990 and 2007 for *Russia*. The empirical analysis revealed certain characteristics of Russian emissions. Firstly, a long-run equilibrium relationship among emissions, energy use and real output was found. Secondly, in the long-run equilibrium, emissions appeared to be energy use elastic and GDP inelastic. This elasticity suggests high energy use responsiveness to changes in emissions (Pao, H. *et al.* 2011). Fakoya, M. B. (2013) studied the challenges *South Africa* faces with regard to sustainability and sustainable development. The paper found that the fundamental conflict between the use of conventional business approach with sustainability and sustainable development practices can be bridged. This conflict has been exacerbated in *South Africa* by its inclusion among the BRICS economic bloc. While there were economic benefits in terms of growth and business emancipation, unsustainable conventional business practices have given rise to environmental degradation (Fakoya, M. B. 2013).

China has an underlined position in literature, since it is the world's most populous and globally more and more dominant country, which went through dynamic development over the past decade. Zhang, Y. (2011) detected that financial development of *China* contributed considerably to the growth of CO_2 emission over the past decades. FDI can also increase CO_2 emissions, but its impact is not as significant as the impacts of financial development. If the findings of Jalil, A. – Feridun, M. (2011) are accurate, the consequences are opposite to the above mentioned statement: financial development in China has not taken place at the expense of environmental pollution. On the contrary, it is found that financial development has led to a decrease in environmental pollution. However, the empirical findings of Shahbaz, M. *et al.* (2013) indicate that there is a unidirectional relationship running from energy use to real GDP, an increase in energy use would raise real GDP. Their empirical findings support the notion that there has been a decoupling of energy use and economic growth. The growth of energy use does not have a direct one-to-one correlation with GDP growth. Thus, the Chinese economy can grow without corresponding to the increase in environmental pressure. Chinese economy is becoming more energy efficient over the years (SHAHBAZ, M. *et al.* 2013).

The slowing economic growth and future prospects of the BRICS countries, as well as global (environmental) challenges inspired a number of researchers to analyse these issues. A study determines that each BRICS country exercises its influence globally in areas in which they can put forward the national potential: *China* has taken on the role of the global banker, *Russia* that of fuel station, India that of world office, *Brazil* that of resource provider and *South Africa* that of gateway to the *African continent*. (IONICA-IULICA, M. – GEORGIANA, M. 2013). Meanwhile, SHARMA, R. (2012) states that with the world economy heading for its worst year since 2009, Chinese growth is slowing sharply, from double digits down to 7% or even less. And the rest of the BRICS are tumbling, too: since 2008, *Brazil*'s annual growth has dropped from 4.5% to 2%; *Russia*'s, from 7% to 3.5%; and *India*'s, from 9% to 6%. None of this should be surprising, because it is hard to sustain rapid growth for more than a decade. The unusual circumstances of the last decade made it look easy: coming off the crisis-ridden 1990s and fuelled by a global flood of easy money, the emerging markets took off in a mass upward swing that made virtually every economy a winner (SHARMA, R. 2012). ATALE, N. (2012) found that the decade of strong economic growth has exposed problems unique to each economies of BRICS. *India* in particular needs both to significantly raise its basic educational standards, and increase the quality and quantity of its universities. Adult literacy rate among the BRICS are lowest in *India*. *India* also needs to boost agricultural productivity, improve its infrastructure and environmental quality. Except *Russia*, fiscal balance of *Brazil*, *China* and *India* is a worry (ATALE, N. 2012). While the percentage of the population below the poverty level has decreased over the past 30 years in each of the BRICS countries, inequality is still a major issue for these five economies. To achieve sustainable growth, it is necessary for each country to expand economic participation to include broader shares of its population and to ensure the well-being and greater participation of the most deprived segments of their work force (CHENG, H. F. *et al.* 2007).

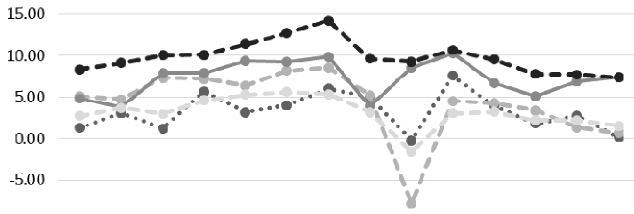
Balancing economic development with environmental protection is already—and will remain—a major challenge to the 'BRICs Dream' (LAWSON, S. *et al.* 2006). Urbanisation, industrialisation and intensive agriculture mean that pressures on the environment are unlikely to abate for decades (LAWSON, S. *et al.* 2006). Air pollution is a burgeoning problem and a predictable consequence of the BRICS's growth, given that they are passing through the most energy-intensive phase of development *China*'s CO_2 emissions are projected to be one-third higher than those of the US in 2030, even before the Chinese economy surpasses the *USA*. *India*'s CO_2 emissions could be nearly twice as high as *Japan*'s in 2030. Agriculture also imposes its share of costs on the environment. Agriculture accounts for the vast majority of fresh water withdrawn from the ground in *India* and *China*. Even so, only one third of the cropland in these countries is irrigated, suggesting that agriculture's draw on water resources could intensify. *Brazil* is perhaps most at risk on this front, since agriculture accounts for 60% of fresh-water consumption, but less than 5% of its cropland is irrigated decades (LAWSON, S. *et al.* 2006). This is the reason why the BRICS countries have recognised the need to transform to green growth strategies. Numerous governments have developed policies and plans, and implemented processes that focus on lower carbon emissions. There are obvious trade-offs in transforming old methods of production using newer, more expensive (in the short term) technologies. What is clear is that intelligent transitioning to a green economy will not only maintain natural resources for future generations, but will also provide jobs in this emerging field (WENTWORTH, L. – OJI, C. 2013). Opposite to the paper prepared by LAWSON, S. *et al.* (2006) and ROODMAN, D. (2007) find that the BRICS countries generally perform well on the greenhouse gas emissions, consumption of ozone-depleting substances, and tropical timber imports. And they have joined important international environmental accord. As a group, their major weakness is low gas taxes. In addition, *Amazon* deforestation and heavy fossil fuel use pull *Brazil* and *Russia*, respectively, below the *Commitment to Development Index (CDI)* 21 average on greenhouse emissions per capita. And *China*'s abstention from the U.N. fisheries agreement puts it a half point below the other BRIC(S) (ROODMAN, D. 2007). GUPTA, N. (2015) studied whether a *Green Economy* is a relevant concept for the BRICS economies. The study found that even if the *Green Economy* is helpful for the development of the BRICS, each country puts great emphasis on its own goals and many of the theoretical concepts have not been challenged in practice yet.

4. Environmental effects of economic growth in the BRICS

O'NEILL, J. (2001) coined the term 'BRIC' in *'The World Needs Better Economic BRICs'* a paper written for *Goldman Sachs*'s 'Global Economic Paper' series. The BRIC acronym consist of four countries: *Brazil*, *Russia*, *India* and *China* (O'NEILL, J. 2001). According to the predictions, these countries have the economic potential to determine the economic, financial and political trends of the coming decades (WILSON, D. – PURUSHOTHAMAN, R. 2003). In the following section the paper is intended to present what kind of environmental impacts the economic growth had in the BRICS from 2001 to present day.

Figure 1 shows the annual GDP growth in the BRICS countries in the period between 2001 and 2014. Although, one can be aware of the fact that the GDP is not enough to measure well-being, because it does not express the global development crisis, which is characterised by increasing social inequalities and irreversible consumption of natural resources (therefore the cost of environmental degradation is not included). However, it is the most widely used indicator for measuring the rate of growth, so it is unavoidable. Until the outbreak of the 2007–2008 global financial crisis, the *China*-led BRIC(S) countries were in the forefront of the emerging economies. It is no coincidence that O'NEILL, J. (2001) and other economists, financial analysts (PURUSHOTHAMAN, R. 2004; CHENG, H. F. *et al.* 2007; ATALE, N. 2012; SHARMA, R. 2012; FAKOYA, M. B. 2013; PETROPOULOS, S. 2013; HOCHSTETLER, K. 2014) also paid a special attention to these countries during the post-millennium years. The crisis set back the economic growth in the BRIC(S), but it was still much higher than in *Europe* or in the *United States of America*. Amongst the

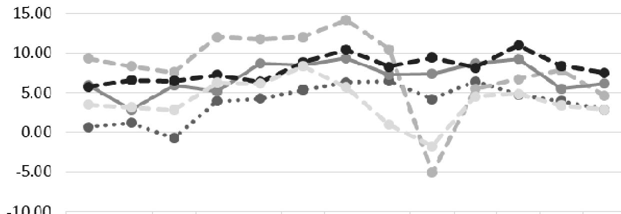
BRIC(S) *Russia* was the most severely affected by the crisis, but every country had to face a 5–6% drop. In 2010, it seemed that the BRIC(S) returned to the previously abandoned growth path, but during the past five years economic growth slowed continuously. With the exception of *India* and *China* one can observe rather stagnation than real prosperity. It is not necessary to ring the alarm bells, but it is obvious that change is needed in the economic policies since the growth formula seems to be outdated (see the data of the figures below, source: WORLD BANK STATISTICS, 2014).



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Brazil	1.28	3.07	1.22	5.66	3.15	4.00	6.01	5.02	-0.24	7.57	3.92	1.76	2.74	0.14
Russian Federation	5.09	4.74	7.30	7.18	6.38	8.15	8.54	5.25	-7.82	4.50	4.26	3.41	1.34	0.64
India	4.82	3.80	7.86	7.92	9.28	9.26	9.80	3.89	8.48	10.26	6.64	5.08	6.90	7.42
China	8.30	9.09	10.02	10.08	11.35	12.69	14.19	9.62	9.23	10.63	9.48	7.75	7.68	7.35
South Africa	2.70	3.70	2.95	4.55	5.28	5.59	5.36	3.19	-1.54	3.04	3.21	2.22	2.21	1.52

Figure 1 – Annual GDP (%) growth in the BRICS countries
According to OECD and WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

Figure 2 presents the trends of household final consumption expenditure in the BRICS countries. Household final consumption expenditure is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses (THE WORLD BANK, 2015). The figure indicates that the GDP growth also increased the consumption in the BRICS countries. The decline can also be linked to the economic crisis, but it was not as serious as the economic recession. However, if one takes a closer look to the data of the past few years, it can be seen that with exception of *India*, the consumption grew faster than the GDP. This process involves a number of risks. On the one hand, increased consumption also means a greater impact on environment. On the other hand, it makes the long-term economic growth unsustainable. Countries should not consume more resources than the expected amount, which is closely related to economic performance.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Brazil	0.65	1.18	-0.70	3.93	4.28	5.38	6.33	6.44	4.19	6.41	4.76	3.90	2.88
Russian Federation	9.32	8.33	7.55	12.05	11.74	12.05	14.19	10.50	-5.12	5.46	6.72	7.84	4.67
India	5.95	2.87	5.93	5.17	8.65	8.48	9.36	7.21	7.39	8.68	9.25	5.50	6.21
China	5.75	6.57	6.48	7.26	6.36	8.82	10.45	8.26	9.45	8.18	11.02	8.38	7.54
South Africa	3.49	3.17	2.83	6.24	6.13	8.33	5.70	0.95	-1.76	4.55	4.88	3.38	2.90

Figure 2 – Annual percentage growth of household final consumption expenditure in the BRICS countries

According to OECD and WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

Figure 3 demonstrates a very interesting topic, the energy consumption of the BRICS by the source of energy in three different times: 2002, 2007 and 2012. The bar charts clearly describe the specific features of each country, which also include the fact that unfortunately the countries are not able to satisfy the needs by environmentally friendly energy sources. The most encouraging trends are related to *Brazil*, where the government was managed to increase the share of renewables more or less thanks to the excellent geographical and natural features. In *Russia*, the share of fossil fuels were over 90% in every studied year. This is not surprising at all, since *Russia* has the world's biggest natural gas reserves. Due to its size and geological features, it has globally unique reserves of mineral raw materials, too. The most alarming data can be connected to *India* and *China*, where the share of fossil fuels continued to increase over the last fifteen years. Although, a lot of grandiose plans were made to use renewable energy. To this end, large sums of money are spent on research and development.

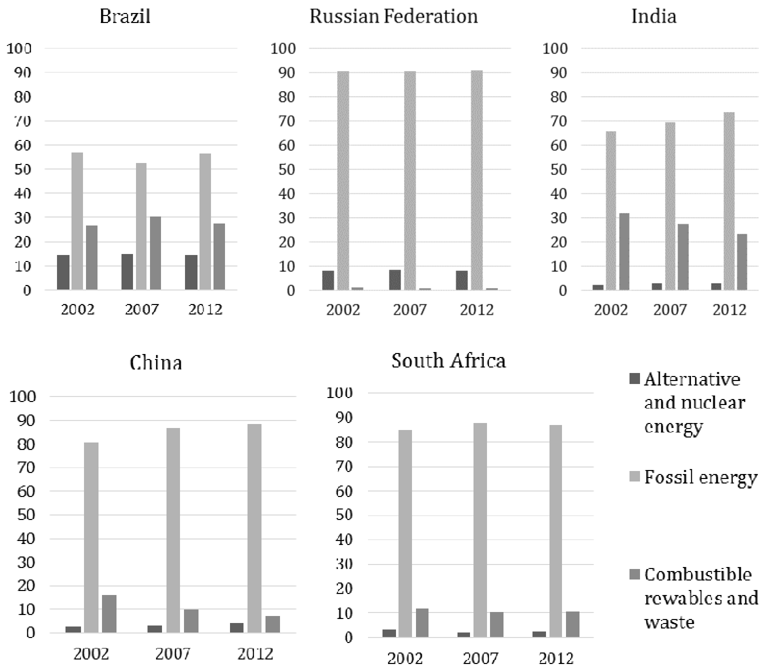
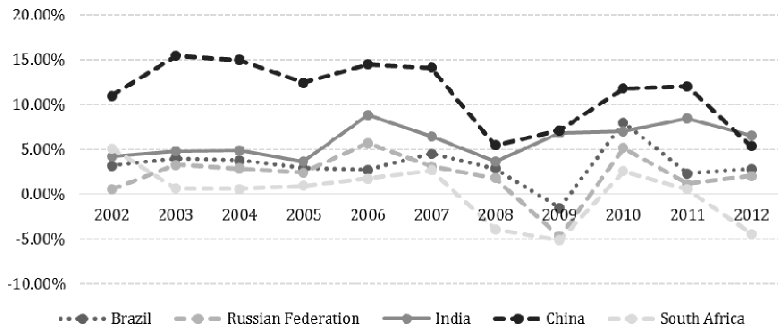


Figure 3 – Energy consumption of the BRICS countries by the source of energy (in percentage)
According to OECD/IEA Statistics (2014); Edited by FEKETE, J. (2015)

South Africa was also consuming fossil fuels predominantly to cover the energy needs.

In the next part of the paper the annual change of electricity consumption and electric power consumption (MWh per capita) in the BRICS countries is discussed *(Figure 4)*. Parallel to economic growth, *China* and *India* had the largest increase in energy consumption before the crisis. Annual increase in *China* was over 10%, while *India* had a growth of 5–6%. The others consumed also more energy, but the annual growth was less than 5%. During the post-crisis years, *China* and India maintained their leading positions, although the growth was less intensive. What is more, *China* was overtaken by *India* concerning annual change. *Brazil* and *Russia* had 2–3% increase. The only exemption is *South Africa*, where the energy consumption fell by 4% in 2012 (THE WORLD BANK, 2014).



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brazil	1.74	1.79	1.86	1.93	1.99	2.04	2.14	2.20	2.17	2.34	2.39	2.46
Russian Fed.	5.27	5.30	5.48	5.63	5.77	6.10	6.29	6.40	6.10	6.41	6.49	6.62
India	0.39	0.41	0.43	0.45	0.47	0.51	0.54	0.56	0.60	0.64	0.70	0.74
China	1.08	1.20	1.38	1.59	1.78	2.04	2.33	2.46	2.63	2.94	3.30	3.48
South Africa	4.37	4.59	4.62	4.65	4.69	4.77	4.90	4.71	4.47	4.58	4.61	4.40

Figure 4 – Annual change of electricity consumption (chart) and electric power consumption (MWh per capita) (table) in the BRICS countries
According to WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

If the comparison is based on the per capita energy consumption, the socio–economic differences of the BRICS are well reflected. At the beginning of the 2000s, the values of *Russia* and *South Africa* were multiples of the other BRIC(S) countries. However, as the countries started to emerge the differences between the BRICS in this regard declined continuously, even though the contrast is still present. Despite the fact that the perc capita consumption in *Brazil* rose by 40%, the value is among the lowest ones. This is originated in the income inequalities. Even if the Russian consumption increased by just 25%, so far the value stands out in the group of the BRICS. *India* managed to double its per capita electric power consumption, but the table reveals it is still very low. In 2001, a Russian resident consumed thirteen times more energy than an Indian. In 2012 there was still a nine-fold difference. If the total population is taken into account the statement is not true, because the population of India is approximately nine times bigger than *Russia*'s. As in other cases, the biggest increase can be observed in *China* since the per capita value increased from 1.08 MW to 3.48 MW: Along with economic growth it also indicates the growth of the Chinese middle class. Until the global financial crisis, slow growth could be seen in *South Africa*, which was followed by stagnation after that the per capita value declined as it was noted above. The value of 2012 was virtually identical to the value of 2001, but it was still the second highest among the BRICS countries.

Concerning the fertiliser consumption of the BRICS *(Figure 5)* (THE WORLD BANK, 2014) it can be seen that more and more fertilisers were used by the agriculture in the last decade. By consumption, the countries can be divided into three groups: small, medium and large consumers. The first group includes two countries. In *South Africa* just 15 kilograms of fertilisers were used per hectare of arable land. The Russian value was almost four times bigger (55–60 kilograms), but it is still relatively small compared to other countries. The second group consist of *Brazil* and *India*, where the use of fertilisers is much more common—150–170 kilograms per hectare. The more intensive use of fertilisers is necessary, because more and more resistive plants and improved yields are required to provide enough food for the growing population. It is also worth to add that fertility of soils is not as good as in the case of *Russia*. The third 'group' includes *China* alone, which stands out from the BRICS in terms of fertiliser consumption as well. The consumption per hectare was over 350 kilos in 2013, which can be also explained by the need for food and the low proportion of soils with good capacities. As far as I am concerned, over a certain amount, it has no use to add more fertilisers to the soil, because of the increasing chance of harmful effects like soil acidification, soil degradation, eutrophication or the deterioration of crop quality and plant disease resistance.

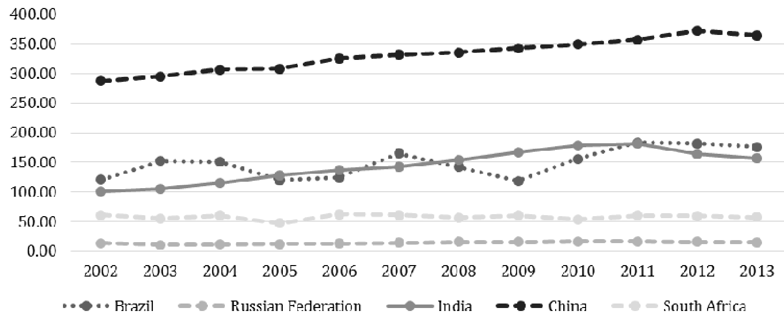


Figure 5 – Fertiliser consumption (kilograms per hectare of arable land) in the BRICS countries

According to W*ORLD* B*ANK* S*TATISTICS (2014); Edited by* F*EKETE, J. (2015)*

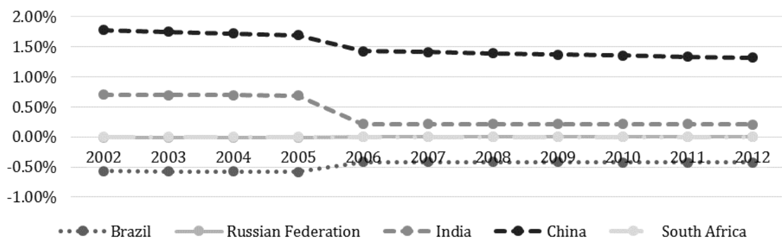
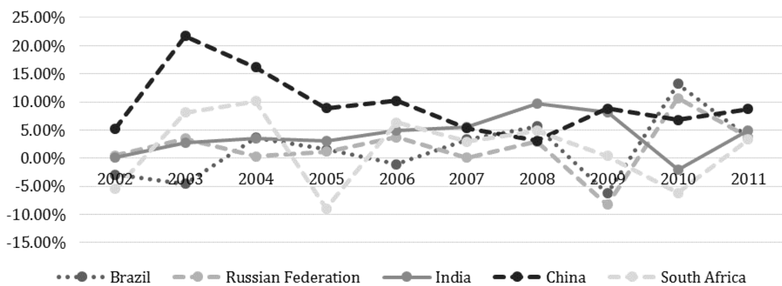


Figure 6 – Annual change of total forest area in the BRICS countries

According to W*ORLD* B*ANK* S*TATISTICS (2014); Edited by* F*EKETE, J. (2015)*

Figure 6 reveals the annual change of total forest area in the BRICS countries. The critical approach is very important towards the topic since according to statistics reported by the *World Bank*, the forest area of *Russia* and *South Africa* changed 0% annually for ten years. Therefore one has to be very cautious before analysing the trends. It can be said the total forest area increased in *India* and *China* due to the lower employment rates in agriculture, because of industrialisation and the improvement of service sector.

Because of the unique natural heritage and the importance of the *Amazon* basin, the following section deals with the forests of *Brazil*. The *Brazilian rainforests*, which sometimes referred as the 'lungs of the world', had a loss of 1% annually (THE WORLD BANK, 2014). 1% does not seem to be a big amount, but it is equal to thousands of square kilometres. Deforestation is partly caused by increase of lands under cultivation. The small famers of *Brazil* try to get new arable areas by cutting down trees. However, to be able to understand this phenomenon, one should notice that even the state encourages them to do such activities by unequally distributing the arable land. Thousands of farmers do not own either a piece of land or some forest area. Meanwhile 1% of landowners has two-thirds of the total arable land. The deforestation caused by poverty might be eliminated by a land reform.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Brazil	1.89	1.84	1.75	1,82	1.84	1.82	1.88	1.99	1.87	2.11	2.19
Russian Fed.	10.67	10.72	11.10	11,13	11.26	11.67	11.68	12.02	11.03	12.20	12.65
India	1.12	1.13	1.16	1,20	1.23	1.29	1.37	1.50	1.62	1.58	1.66
China	2.74	2.89	3.51	4,08	4.44	4.89	5.15	5.31	5.78	6.17	6.71
South Africa	8.08	7.63	8.26	9,09	8.28	8.80	9.06	9.51	9.55	8.96	9.26

Figure 7 – Annual change of the total CO_2 emissions (chart) and CO_2 emission (metric tons per capita) (table) in the BRICS countries
According to WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

Figure 7 shows the annual change of the total CO_2 emissions (see the chart) and CO_2 emission (metric tons per capita) (see the table below) in the BRICS countries. Time series indicate that despite the fact carbon dioxide emissions were still growing, the rate of growth was lower than at the beginning of the millennium, especially in the case of *China*. It is a good reason to be confident that there were some countries, namely *Brazil* and *South Africa*, where carbon emissions started to decrease before the crisis years. Furthermore, it is important to note that *China* is aware of the harmful effects of CO_2 emission, therefore they try to inform the public as efficiently as they can. For 20 years it has been a regular practice that the Chinese national television makes announcements on the air pollution data of *China*'s major cities (YANG, D. 2005). *China* aims to reduce CO_2 emissions by 40–45% until 2020 (ZHANG, Y. 2011), even so *China* overtook the position of the *United States of America* and became the first regarding carbon dioxide emission.

If the per capita data is put under a microscope, the situation is less promising. Comparing the data of 2001 and 2011 growth could be seen in every country. The data of the whole time series, except for a few examples the per capita data had linearly rising characteristics. The data of 2011 were at record level in all countries but *South Africa*. The differences between the countries are comparable to *Figure 4*, but in this case the differences are even larger. There was no significant increase in the case of *Russia* and *South Africa*, but they are the absolute leaders in this respect. They are followed by *China*, where the per capita emission increased by 250% in ten years, which led to the above mentioned results. The laggards are India and *Brazil*. It is also important to emphasize that the carbon footprint of a South African citizen is more than four times bigger as a Brazilian one. For *Russia* this footprint is even higher, almost twice as much as Chinese. The CO_2 emissions cannot be compensated by natural processes like photosynthesis, so the further increase of CO_2 emissions can still remain a major contributor to greenhouse effect and global warming.

Figure 8 shows the *ecological footprint*[20] and the *biocapacity*[21] of the BRICS countries. The difference between the biocapacity and ecological footprint of a region or country can be interpreted as follows: an ecological deficit occurs when the footprint of a population exceeds the biocapacity of the area available to that population. Conversely, an ecological reserve exists when the biocapacity of a region exceeds its population's footprint. If there is a regional or national ecological deficit, it means that the region is importing biocapacity through trade or liquidating regional ecological assets, or emitting wastes into a global commons such as the atmosphere. In contrast to the national scale, the global ecological deficit cannot be compensated for through trade, and is therefore equal to overshoot by definition (GLOBAL FOOTPRINT NETWORK, 2015).

[20] *Ecological footprint* is a measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices. The ecological footprint is usually measured in global hectares. Because trade is global, an individual or country's footprint includes land or sea from all over the world. Without further specification, ecological footprint generally refers to the ecological footprint of consumption. Ecological footprint is often referred to in short form as footprint. 'Ecological footprint' and 'footprint' are proper nouns and thus should always be capitalized (GLOBAL FOOTPRINT NETWORK, 2015).

[21] *Biocapacity* is the capacity of ecosystems to regenerate what people demand from those surfaces. Life, including human life, competes for space. The biocapacity of a particular surface represents its ability to renew what people demand. Biocapacity is therefore the ecosystems' capacity to produce biological materials used by people and to absorb waste material generated by humans, under current management schemes and extraction technologies. Biocapacity can change from year to year due to climate, management, and also what portions are considered useful inputs to the human economy. In *the National Footprint Accounts*, the biocapacity of an area is calculated by multiplying the actual physical area by the yield factor and the appropriate equivalence factor. Biocapacity is usually expressed in global hectares (GLOBAL FOOTPRINT NETWORK, 2015).

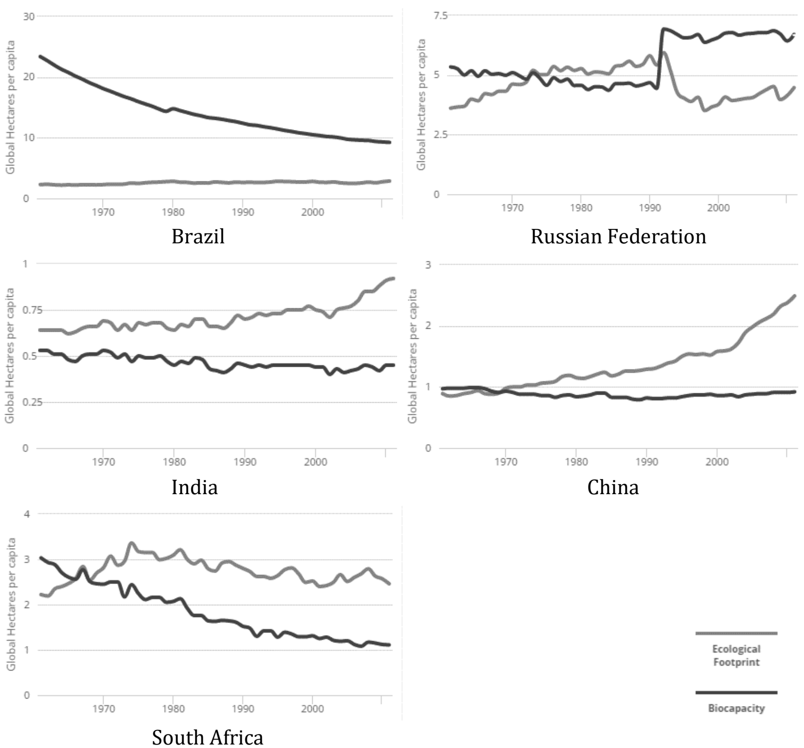


Figure 8 – Ecological footprint and biocapacity of the BRICS countries, 1961–2011

Source: GLOBAL FOOTPRINT NETWORK according to NATIONAL FOOTPRINT ACCOUNTS 2015 (Data Year 2011); International Monetary Fund WORLD ECONOMIC OUTLOOK DATABASE (October 2014); U.N. FOOD AND AGRICULTURE ORGANIZATION

From the aspect of ecology, big differences can be found among the countries. Especially due to the Amazon basin *Brazil* has enormous biocapacity, but this value were declining exponentially over the last fifty years, which can be explained by deforestation. It is hopeful that the process has been slowing down steadily since the 1990s. After the collapse of the *Soviet Union* the *Russian* trend has been reversed, that is, biocapacity has become larger than the ecological footprint. This phenomenon could be described by the decline of heavy industry. But in *India* and *China*, the trends do not increase the confidence about the future. The ecological deficit has been rising progressively, which has been boosted by the economic growth after the turn of the millennium. The case of *South Africa* is neither favourable. Despite the fact that ecological footprint started to reduce, the same is with biocapacity. In collaboration with companies and citizens the government should place greater emphasis on environmental preservation.

5. Conclusion

This paper was an attempt to give a broader view on the correlations between economic and environmental trends in the BRICS. Based on literature review and analysis of the statistical data, findings suggest that the economic growth has contributed to the environmental load. However, it is important to point out that the paper is only a general overview of the topic, the analysis of which has a number of limitations, therefore in order to draw well-founded conclusions in the future, industry-level studies are needed.

Nevertheless, it is certain that based on the current trends there can be no long-term environmental sustainability, to implement changes is a must. The limitations of the existing macroeconomic model became clear during the crisis years. The economic system is viable as long as consumption is increasing constantly. All the same, there is not any model which does not add the increase of consumption in. It means that sustainability has no macroeconomic model, therefore creating a new one is a matter of urgency. The new macroeconomic model needs to establish a more predictable and stable global economy, which has a decreasing impact on the environment. If consumption remains as the engine of growth, more emphasis should be put on the consumption of intangible goods (GYULAI, I. 2013). This model can contribute to economic growth for at least a certain amount of time, while the growth is separated from the environmental load.

A government can play a key role in supporting sustainable developments: guidelines can be established, national programs can be made and a government can also provide a framework for sustainable development. In 1992, the *Agenda 21*, a non-binding, voluntarily implemented action plan for the *United Nations* with regard to sustainable development, was accepted during the *Rio Earth Summit* (BÁGER, G. *et al.* 2005) and since then many other plans were accepted which draw attention to the need for sustainability. It is very important that the leaders of BRICS countries show also commitment in this regard, as in world politics the BRICS countries have an increasingly significant role (PETROPOULOS, S. 2013). *Kyoto* mechanisms affect the energy strategies of the BRICS at a different scale. The consumption of fossils fuels is not reducing in several countries (for example in *Russia*), the focus is rather on improving efficiency (FREITAS, I. M. B. *et al.* 2012). PARK, J. *et al.* (2010) stressed that investments in environment also can provide economic growth equally for state-owned and private businesses. A good example to promote environmental protection could be the establishment of *New Development Bank (NDP)* in 2015 by the BRICS. NDP aims to develop infrastructure and promote sustainable consumption. Nonetheless, one should keep in mind that difficulties can arise when the economic actors try to reconcile the two objectives, since a number of infrastructure developments go hand in hand with substantial interferences in the environment (HOCHSTETLER, K. 2014).

Another critical area of environmental risks, which is not concerned in this paper, the problem of natural and environmental disasters. Huge crowds of people are threatened by insecurity due to the above mentioned phenomena, which may be mitigated by the different risk prevention systems, but in some regions, irrespectively of the level of economic development, natural disasters can be significant factors due to increasing population density.

However, it is also important to note that the efforts of the BRICS countries (preservation of forests, utilisation of renewable energy sources, research and development) are often not recognised by the various international organisations and by the media. In addition to economic partnership, BRICS also cooperate in the field of environmental protection, investments aiming environmental protection are also implemented in each other's countries.

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ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 558–585

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The Geography of Textile Production and its Damaging Processes to the Environment

Abstract

The authors in this article combine their different research backgrounds in geography and fine art to discuss and analyse the damage caused by the textile industry to the living environment.

To begin with textile production is described geographically including where and which Asian countries are considered as the main contributors to pollution through textile production. Secondly, the authors go into specifics on how a textile production, such as cotton, can have multiple processes, all in which include their own damaging effects to the environment. With the majority of our textiles coming from Asia, it is of no surprise that India, for example, has 35 million employees in textile factories and production alone. With the economic growth of Asia's textile world being increasingly successful, what downsides are there to this 24/7 business and what is being done to protect the environment surrounding textile factories and sites?

Key words

Textile production; Harmful chemicals; Fibre; Asian textile manufactory; Cotton

1. Introduction

According to a wide range of resources we used to develop our knowledge on this topic (see *Research Methods* at *Section 3*), we can state that in developed countries, every process and processing method in the textile and clothing manufacture industries are regulated by strict environmental rules. These types of factorial activities go with the most notable environmental pollutions that are closely affecting the human living sphere. The countries involved in production have long been exporting their products to those areas of the world where profit and economic growth come before the protection of the natural environment. The loose or non-existent environmental regulations and technological rules—both on a short and long run—lead to severe contamination that can both harm the human and physical spheres respectively.

2. Aims of the study

Whilst preparing this paper, we approached the topic mainly from two aspects: geographical and environmental, but wrote it as a co-operation between a geographer and a fine artist, which led us to other areas to discover and study, such as chemistry, technological processes, machinery, product material development and usage, and trade. With this article we aimed to reflect on the textile industry and how its current technologies and processes affect the environment. We concentrate on *Asia*'s traditional textile producing countries and focus on their impact of and contribution to global environmental issues.

3. Research methods

Throughout the research of this study, we relied on recent statistical data that was mainly provided by the *European Commission (EC)*, the *International Labour Organization (ILO)* and the *World Trade Organization*. We collected information from specialist websites on the internet, but we also used a significant number of scientific papers written by mainly Asian authors in last 15 years, for example CHAVAN, R. B. (2001); MIA, C. M. (2001); MALIK, A. S. (2002); SHAH, B. (2002); HAYDAR, S. – BARI, A.

(2009); DANG, T. D. *et al.* (2010); RUPP, J. (2010); KANT, R. (2012); MERK, J. (2012) and YADAV, I. C. *et al.* (2014). We also used some hard copy books written by, for example, SLATER, K. (2003); BERNERS-LEE, M. 2010; RIELLO, G. (2015). For preparing the visual material for this paper we used *CorelDraw X6*, *MS Word* and *Excel*, and an online map image maker called *P&P World Map*.

4. The geography of textile production

The development of organic chemistry in the beginning of the 20th century revolutionised the methods and processes that had previously been used in the textile industry. Initially a variety of materials were used to produce synthetic basic materials. However, most of the compounds of applied chemistry are harmful to the living spaces and environment that can still be traced in the soil and water reserves. In the newly industrialising countries (NICs), the following environmental hazards are still uphold:

- air and heat contamination,
- the change of pH level (acidification),
- bleaches, colourings (dyes) and optical whiteners,
- non-biodegradable chemical compounds.

KALBERLAH, F. – SCHWARZ, M. (2011) demonstrate that the imported clothing and textile products from *East Asian* countries are not complied with European norms and there may be invisible threats to humans and to the environment. The propagation of modern and innovative production technologies and procedures are hindered by economic and political processes. This retroaction may affect the physical environment and, in most cases, it can lead to irreversible changes. On the long run, it may demolish local, natural values, and on the short run—by the presence of carcinogen and mutagen compounds—it can cause sever health problems and lead to illnesses. The average consumer is bombarded by false facts regarding environmental hazards; therefore, it is important to draw up a comprehensive picture of the textile industry's physical, economic and regional situation and current positions.

Based on the *World Trade Organization*'s statistics of 2012, the countries that form the backbone of the global textile and clothing production can be specified. Moreover, by using this statistical data, tendencies can also be drawn up for those countries where previously they had almost no textile industry, but which has become a significant economical factor in the last 10 years with a notable market share.

According to the export of the *World*'s three largest continents, half of the trade of textile products happen within the regions of Asia and *North America*. In *Europe*, three quarters of the trade deals are made within the continent's boundaries. In *Asia*, *China* plays a key role which in 2012 exported 33.4 million USD worth textile products; the other significant countries in *Asia* are *India*, *Pakistan*, *Vietnam* and *Thailand*. However, the textile industry's share of export within a country's overall industrial production gives a much different view: *Pakistan* (34%), *Nepal* (32.1%), *Bangladesh* (6.5%), *India* (5.2%), *China* (4.7%) (WTO, 2013a).

In the market of garment products, *Asia*'s dominance is significant and equally trades globally. *Europe* operates a more closed, 'indoor' market—80% of products are traded within its boundaries; only a small number is exported to, among others, *Asia* (5.6%), to the *former Soviet Republics (Commonwealth of Independent States)* (5.3%), and to *North America* (3.6%) (WTO, 2013b). In the American continent, *Central America* (especially *Guatemala*) plays a key role which is leading the regional cloth production and 66% of their items are exported to the *North American* markets. The global garment products in the export of the overall industrial sector represent a significant share in *Haiti* (88.3%), in *Bangladesh* (79.4%), in *Cambodia* (52.4%), in *Sri Lanka* (42.7%), and in *Vietnam* (12.3%). Compared to the year 2000, the production in *Vietnam* had increased by seven times, in *Cambodia*, *China* and *Bangladesh* four times, and in *India* two times by the year 2012 *(Table 1)*.

Table 1 – Clothing exports of selected economies, 1990–2012
Source: World Trade Organization (2013a; b)

	Value (Million dollar)					Share in economy's total merchandise exports (percentage)	
	1990	**2000**	**2010**	**2011**	**2012**	**2005**	**2012**
Cambodia	...	970	3,041	3,995	4,294	71.5	52.4
China	9,669	36,071	129,820	153,774	159,614	9.7	7.8
Bangladesh	643	5,067	14,855	19,213	19,948	74.1	79.4
India	2,530	5,965	11,229	14,672	13,833	8.8	4.7

Figure 1 – Countries included (shaded areas) in this paper in order of discussion: Vietnam, Cambodia, Bangladesh, India, Pakistan, Nepal and China
Edited by Bokor, L. with P&P World Map (2015)

Based on these statistics, the textile industry's impact on the environment defines two main categories for the countries analysed: first of all, the countries with high export value—*China*, *India*, *Pakistan* and

Bangladesh (Figure 1). Secondly, the industrialising countries with no significant previous textile and garments industry—*Vietnam*, *Cambodia* and *Nepal (Figure 1).* In the next chapters, these counties will be analysed as *Asia*'s weight in the global market as the most significant.

4.1. Vietnam

The most interesting example is *Vietnam*'s. In this *Asian* country, despite the changing economic factors, a significant growth rate can be identified. The leading products are knitted items, for example jerseys, jumpers and shirts. According to the production's regional division, the *Northern Region* (*Hanoi*, *Hung Yen*, *Hai Duong*, and *Nam Dinh*) shares 30%, the *Central Region* (*Thua Thien Hue*, *Da Nang* and *Khanh Hoa*) 7%, and the *Southern Region* 63% (DANG, T. D. *et al.* 2010). In the northern areas, due to the lack of infrastructure, the industry has been developed around or near the large settlements which also minimises the time between orders and productions. Vietnamese companies favour small or medium size business orders, and the extended production deadlines guarantee the better quality final products and also the continuity of workload. The main trading partners are the *United States of America (USA)* (60%), the *Europe Union (EU)* (12%), *Japan* (11%) and *Canada* (3%) (VIETRADE, 2014). A steady growth may be observed in the *USA* and the *EU*. From an environmental point of view, the textile factories settled in the *Northern Region*'s industrial parks combine modern, complex fibre producing, knitting, dyeing and sewing processes: for example in the *Dinh Vu industrial park* in *Hai Phong* (KONSTADAKOPULOS, D. 2008).

In the case of *Vietnam*, the most threatening problem is water pollution caused by their decentralised production structure; the small factories' principal reason for this is that the wastewater is without purification let straight into the environment, mainly to wetlands. This causes severe problems in fishing, and on the rivers' lower sections, agriculture—especially rice production and fish farming—which is heavily impacted by it.

4.2. Cambodia

Cambodia's geographical situation, physical conditions and environmental issues are very similar to *South Vietnam*'s. However, their social and economic development are significantly different as the very cheap Cambodian labour provided a quick grow rate and space for the textile industry. In the medieval times, Cambodian 'golden' silk was world-renowned, but the centuries-old tradition was almost fully exterminated by the *Khmer Rouge*; therefore, the necessary basic materials have to be imported from *China* and *Thailand*. It makes the advance more advantageous that the country has a quota-free access to the *North American* and *European* markets. Among the foreign investors, primarily the large manufactures moved their factory plants to *Cambodia*, for example *China* (121 million USD), *Taiwan* (112 million USD) and *South Korea* (70 million USD) have invested in the local production (CLAUDIO, L. 2007). This is the only country where the labour norms are supervised autonomously by the *International Labour Organization (ILO)*. Thanks to the *Better Factories Cambodia (BFC)* programme, the *USA* gradually opens a wider market space for the country (MERK, J. 2012).

4.3. Bangladesh

Based on the ILO (2012) statistics, the share of textile production in *Bangladesh*'s export represented 79.4%—which is the highest rate in the world. According to the rapid industrialisation, the worst environmental problems occur in this country, majorly because the environmental rules are entirely ignored.

Bangladesh is one of *Earth*'s most significant wetland regions, and the *Ganges Delta* together with the coastline of the *Bengal Bay* are heavily populated. The low-lying land areas are constantly threatened by frequent transgressions caused by climate changes which dramatically affects the productivity of agriculture. This problem is aggravated by the toxic unpurified water let straight into the rivers by textile factories. The situation is extremely serious in the vicinity of *Dhaka* where the heavily concentrated factorial wastewater is accumulating in canals and lakes. The government authorities only deal with environmental protection and sustainability at administrative level which does not manifest in practice (AHMED, T. – TAREQ, S. M. 2008). The degree of contamination caused by the textile industry is well indicated by the coconut trees, thus their productivity is heavily decreasing due to their exposure to a constant bombardment of pollutants. *Dhaka* and the *North Central Region* contribute to half of textile production which includes predominantly ready-made garments and leather products. Accordingly, the environment around *Dhaka*, especially the *River Turag*, is the most contaminated areas in *Bangladesh*; the by-products of the textile dyeing, tanning and dressing of leather processes (copper, cadmium, lead, and chrome) have the most significant environmental impacts (MIA, C. M. 2001).

At present, the most challenging is to keep the textile industry producing competitively whilst moving towards the usage of environmentally friendly dyes and chemicals which would reduce the burden of pollution on the environment and provide better energy efficiency as well. Also, the modernisation of production technologies, the introduction of biological and photochemical treatment of wastewater, and advanced ion-exchanger and membrane filter equipment would be a key task. The textile industry is a 'double-edged sword' in the country's existence, because this is what pulls the overall industrial production which therefore improves the standard of life. By the co-operation of research and development institutions (R&Ds) founded and funded by governmental support, along with the involvement of local communities and also by the expansion of trainings, *Bangladesh* will only be able to reduce significantly or stop further environmental contamination.

4.4. India

India's biggest 'employer' is the textile industry where there is about 35 million people working (5.2% in 2012 within the total industrial export) and being involved in the industrial production. In the agriculture closely connected with the textile industry gives job to another 93 million employees. In the production, 70% represents cotton, 20% goes to the synthetic materials, and about 10% is silk, wool, jute and coir. The ready-made products are then principally exported to the *USA*, the *EU*, *Japan* and *Hong Kong*. It plays a leading role in the production and trade of quality basic materials which influences the contamination of air, water and soil, but it has effects on the society, too. The production processes are mainly concentrated in factories around the large cities; overall there are 1400 textile factories and 280 synthetic fibre producers in operation in *India* (CHAVAN, R. B. 2001). These plants as spot-like pollution sources technically cover every area of the country. Their concentration can be observed along their industry-essential water resources. *Kolkata* on the coastline of *Bengal Bay*, and *Kanpur* along the *River Ganges* are the biggest centres of textile industry. On the *Western* side of the *Indian subcontinent*, *Mumbai* and *Ahmadabad* represent the classic, large textile centres (BOKOR, L. – SZELESI T. 2011).

The cotton industry's odorous discharged materials (for example sulphur for dyeing, sodium hypochlorite for whitening) make it unbearable for plant/crop growth in heavily urbanised living spaces. The sector's biggest problem is represented by the non-biodegradable materials which are not used in production, but during maintenance (for example machinery). The treatment of wastewater left after the dyeing process is the easiest, but by the modernisation of the technological processes and the reorganisation of them, a significant result could be achieved (HAYDAR, S. – BARI, A. 2009). The *Indian Government* has stated that it is in favour of tightening the environmental regulations and the compliance with international norms by which in the last few decades they have been able to displace almost entirely the carcinogenic substances from the production processes. This process started off in 1996 by an external pressure when *Germany* and *the Netherlands* prohibited the trade of garment products in a wide spectrum. In present days, international organisations (among others for example *MST–German Textile Association*; *OTN–Ökotex Institute of Austria*) define, evaluate and grade the manufacturing processes which is also supported by the *Indian Government* (CHAVAN, R. B. 2001). Materials produced in an environmentally friendly way are denoted by a new symbol (earthen pot, also known as 'matka'); the ecomark makes it clear for the consumers from where the product comes.

4.5. Pakistan

The *River Indus* and its tributaries, in a clearly demarcated region, concentrate the textile industry of *Pakistan*. The largest centres are *Islamabad*, *Faisalābād*, *Lahore*, *Multān* and *Karachi*. The wide spectrum-forced manufactory shares a significant piece in the environmental contamination, but the transport and the agriculture that consume chemicals without measure cause similar damage. *Karachi* registers nearly 6000 industrial producers who give 60% of the country's total production (TECHNOLOGY TRANSFER FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT, 1995). This makes the environment specialists face extreme challenges, thus the producers at the coastline of the *Arab Sea* together with the pollutants from the source of the *Indus* are collectively threatening the habitats and wildlife reserves (AMJAD, N. 2011). The crisis situation is well indicated by the extinction of shrimps from the coastal waters. The textile industry within the entire industrial production represents 35.4% which is a significant downfall since the year 2000 when it was at 60%. The biggest basic material production is yarn manufactory which is used by the spinning industry where there are about 200,000 people in work. The woven fabric industry uses the domestically produced cotton and synthetic filaments and employs about 300,000 workers, whilst the biggest sectors and employer is the garments manufactory that counts over 700,000 employees. Among the production processes such as whitening, dying and printing are the main causes for water pollution which are dramatically reducing the water's *Biological Oxygen Demand* (BOD), increasing its pH level, and releasing oils and fats (MALIK, A. F. 2002). Similarly to *India*'s case, the majority of the *European* countries have banned the azo dyes which forced the modernisation of textile industry, the *ISO 9000* and *14000* quality management standards systems have been applied and are used by 290 companies which represents 80% of the total industrial producers (MALIK, A. S. 2002).

4.6. Nepal

Nepal is a specific case in the geographical neighbourhood of textile producing giants. A traditional branch of industries is textile spinning which basis is formed by the small and backyard entrepreneurships. The old manufacturing methods and procedures can basically be considered environmentally friendly; however, regarding their basic materials, they rely on products imported mainly from *India* and *China*. The neighbouring countries can produce their items 25–30% cheaper than the traditionally based Nepalese spinning industry. Due to this reason, the imported clothing items have been gradually increasing in the market (SHAH, B. 2002). According to the effects on the market, 60% of the medium size industrial plants have recently been closed down, the productivity of the rest in operation is about 30%—which has had a positive benefit on the battle against environmental pollution (YADAV, I. C. *et al.* 2014). On the world market, pashmina—which is the finest type, light and warm knit wear made from the wool of cashmere goats—has achieved great popularity, and the cotton terry towels represent 88.9% of the export products. With *China*'s help, two synthetic fibre plants were established in 2002 which, from an environmental point of view, are modern and provide additional locally produced basic materials. Because the country is situated in high mountain regions and it does not have large volumetric flow rated rivers, the bases of textile industry are provided by groundwater reserves—which are seriously threatened by the discharge of heavy minerals, bleaches and whiteners (BRITISH GEOLOGICAL SOCIETY, 2001).

4.7. China

In *China* around 50,000 textile factories are contributing to 34% of the world's textile, and 38% of garment products. The export is shared by 62% of knitted goods, 31.5% of woven products and 6.5% of synthetic fibre. The textile industry's geographical situation is significantly affected by the access to water resources; thus along the *Huang He*, *Chang Jiang (Jangce)* and their tributaries, and along the shoreline of *South China Sea* are concentrating most of the factory units. Inside the country, business districts have been developed for the production and trade of a variety of goods; thus concentration of the fabrics are in the southeast, the garment items and their complements are in the northeast, the company oriented international trade are in the central east, and the basic material market is in the west.

The centralised environmental protection does not encourage sufficiently the producers to implement new technologies (LUONG, V. H. – UNGER, J. 1998). By investments with a 5-year recovery period, the ecological footprint of the textile industry could be decreased, but the competition among companies and the voracious greed for profit entirely push the green thinking in to the background. In the government's 9th and 10th five-year plans there are serious aspirations to supply the textile and garment industry with modern machinery. There have been four categories implemented to support new investments: supported, permitted, restricted and banned. A supported method or project is which

- applies the newest R&D technologies from the production of raw materials via processing to the ready-made goods production,
- saves a significant amount of energy,
- increases the quality of the produced goods,
- in a comprehensive way utilises raw materials and by-products.

A restricted method or project is which

- uses obsolete technologies,
- does not benefit to the environment and support sustainable raw material economy,
- has come in existence for manipulative purposes.

A banned method or project is which

- means a risk to the national security and it is a potential hazard to the public interest,
- pollutes the environment and weakens the general health of people,
- threatens the market of traditionally crafted goods.

In the permitted category goes everything that does not fit in any of the other three (RUPP, J. 2010).

5% of the *Chinese* electricity consumption is billed to the textile industry which means a significant amount of CO_2 emission and air pollution. For the majority of water utilisation and wetland contamination the textile and garment industries are responsible; the unpurified waste water may cause sever and irreversible damage in the environment. The conventional and obsolete technologies *China* has also exported to countries with poor environmental regulation and lack of sustainable actions (for example *Cambodia*, *Laos*, *Bangladesh*)—profit and economic growth has enjoyed privilege (EUROPEAN COMMISSION, 2005).

Asia plays a significant role in the world's textile industry where each country specialises in a different product category and, therefore, each has certain environmental issues. Profit centred large companies do not take into account the norms of sustainability, any development of technologies, more or less, happens only by external constrains.

Positive change is that several countries have applied to emerging, environmentally friendly and holistic technologies including the use of natural ingredients, raw materials and colours (dyes). The R&D sector plays a key role in the management of industrial wastewaters which helps preventing an extensive environment degradation.

In the next section, the processes textiles go through in factories from crop to finished product and how many different production processes effect the environment will be explained. The majority of people may not even realise such productions are involved when it comes to creating a simple cotton T-shirt for example. When referencing textiles in this section of the essay, the authors are specifically looking at clothing, focusing on cotton which is one of the most popular materials for making fabrics from. Of course there are many raw materials that clothes can be made from, but here cotton is discussed because of its huge production process from crop to clothes and how this process stresses and strains our living environment from multiple directions.

5. The methods of cotton textile production that effect the environment

To begin with, cotton is usually grown in tropical/subtropical regions of the world such as *Africa* and *South Asia* (for example *India*). To grow the crop it takes plenty of sunshine and just a little rainfall to supply a sufficient cotton crop. The first environmental impact for both the crop and other living elements are the pesticides used in the cotton fields (RIELLO, G. 2015). Herbicides, fertilisers and insecticides are heavily relied on by cotton farming industries, causing considerable damage to other natural wildlife surrounding the fields. The chemical pollution absorbed into the land itself can then pass into streams and rivers. Nitrogen fertiliser, for example, can be 300 times more potent than CO_2 depending on the factory it has been produced in and the efficiency of the farmer spreading it across the fields (BERNERS-LEE, M. 2010).

Next is the harvesting of the cotton. Today the cotton crop is harvested by machines that pick the crop without damaging the cotton boll itself. Of course cotton is still picked by hand today which brings many ethical issues into this process; however, we have chosen to concentrate on the machine harvesters as they contribute to the overall environmental impact of this textile production. The harvesters need fuel that subsequently burns into the atmosphere contributing to the high CO_2 levels produced by petrol and diesel vehicles every day. Further fuel is then needed for transport vehicles to take the harvested cotton bolls to factories that prepare the crop to be transported again to a mill. There are many elements within the factories themselves that contribute to environmental damage. For example, these factories heavily rely on fossil fuels for their energy needs, the burning of which not only contributes to more CO_2 levels, but other environmental concerns such as noise, heat, smell (from fumes and smoke) and light pollution. All these play a role within textile production and the depletion to the environment. (MURTHY, M. S. S. 2001; UTIACOMM, 2011).

The next step is the production of cotton in the mill. There are several processes inside the mill itself. To begin with you have the machine that separates the cotton from any debris such as grass, stones, mud and stalks. It is then funnelled into a compressor to extract cotton oil which is commonly used in all types of food from potato crisps to salad dressings. The cotton is compressed into bails and packaged to be delivered to factories all over the world via multiple forms of transport (UTIACOMM, 2011). Some modes of transport like flying on a plane for example is worse than driving a transporter truck when it comes to CO_2 levels. And of course we have to think of the fuel usage by these modes of transport, how well the vehicles perform and other factors for road vehicles such as traffic. For example, driving a truck in a traffic jam can cause three times the emissions than a clear drive on the same road. (BERNERS-LEE, M. 2010). As we can see, the cotton has gone through a huge environmentally damaging process already and it is still only in its raw form.

Once at the mill, the cotton is put into a cleaning machine which processes half a tonne of cotton per hour—we will go into more detail on the environmental effects of the 'washing' process in textiles later. The raw cotton is in fact cleaned twice before being taken to the carding machine which acts as a giant comb to untangle the cotton fibres. A coiler than gathers up the untangled fibre and creates thick strands to then be threaded through a roving frame which thins out the cotton to create the typical cotton thread we recognise today. A typical Bangladeshi warehouse running on coal or gas power producing textiles from cotton will process 1 tonne of cotton which needs 65,000 kWh of electricity and 250,000 litres of water. Three-quarters of that water is used in the 'wet' treatment which includes the washing, dyeing and rinsing processes (PUMPKIN INTERACTIVE, 2011).

Further equipment and machinery is used to wind the yarn on to spools. There are a variety of methods and automated machinery that create these spools all of which require a huge amount of energy to run. On average it takes around forty-eight hours for the cotton to be spun—from the moment it is put into the cleaning machine in its raw state to it being processed and spun tightly onto the spool (COLLIER, I. 2009). This means the factory would be running constantly, as soon as one process ends, another one begins. In 2008, yearly worldwide textile production was estimated at 60 billion kilograms of fabric. The estimated energy and water needed to produce this was estimated at 1,074 billion kWh of electricity or 132 million metric tons of coal and between 6–9 trillion litres of water (RUPP, J. 2008).

The spools are then packaged and transported again to the factories where giant looms process the threads into recognisable textiles. Sometimes the cotton threads are put through a starching process which strengthens the fibres, but also involves a considerable amount of heating for the cotton to absorb the starch efficiently. The looms then take over, weaving the cotton into huge sheets of fabric. The looms alone are incredibly noisy and factories will sometimes have over 200 looms in a single space all working simultaneously to produce the fabric. A considerable amount of dust from the cotton fibres litters the factory floor and machinery resulting in machinery break down, hazard to human health and environmental damage if not disposed of properly. The finalised fabric is then transported to factories where they complete the singeing process. This process involves the fabric being scoured, peroxide bleached and dyed different colours (LAP QUILTING WITH GEORGIA BONESTEEL, 2014)—the bleaching/dying process we will look at in more detail later. It is then further washed at 80°C on a continuous roll and then rinsed in more water at 30°C. The fabric rolls are then dried in a fabric 'oven' at 200°C and then packaged to be sent to clothing factories (COLLIER, I. 2009). So far, everything we have discussed is, of course, based on an average textile factory and its processing needs, but all manufactories differ in machinery use, the degree of energy utilisation and, therefore, production.

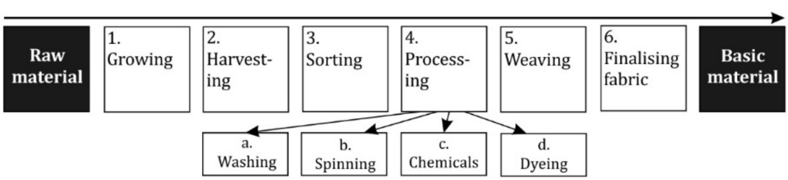

Figure 2 – The route of cotton from raw material to basic recognisable fabric

Designed by BOKOR, L. – ECCLESTON, K. (2015)

6. The most environmentally damaging processes in the production of cotton

This section will look at three processes that cotton goes through in a factory which have been described in the previous chapter, and looks at the extended environmental impacts of discussed process. These processes are (*a*, *c* and *d* in *Figure 2*):

- dyeing,
- washing/rinsing,
- chemical use.

First is the dyeing process which begins inside the factory, but causes catastrophic harm outside of the factory environment to humans, animals/insects, the land and to water resources. The second is the washing and rinsing process which uses unbelievable quantities of water often getting thrown away and pumped out into the outside world. The third process is chemical use. Chemicals begin in the fields when the cotton crop is growing, but in the factory further chemicals are used to strengthen and coat cotton fibre resulting in small amounts of toxins being released when wearing or using the material form and the inability for the fabric to degrade. After, how each process can be improved through alternative environmentally friendly methods, such as natural dyeing and eco farming, will be shortly overviewed.

6.1. Dyeing

Dyeing is the process of colour being absorbed into a materials fibre for a permanent aesthetic change. Natural dyes can be made from food stuffs such as berries, a variety of vegetables, plants and nuts. It can be made with flowers, roots, wood, mineral sources and small animals such as insects. Synthetic dyes are based on particular types of chemical compositions. Some of these include acid dyes such as anionic dye and neutral dyes like sulphur dye, vat dye, pigment dye and reactive dye.

There are many ways to dye fabric depending on what the material is made from. The most common way of dyeing cotton is with synthetic dyes by a process called 'direct dyeing.' This is when the dye is added directly to the fabric without any other agents such as affixing chemicals or stabilisers. Synthetic dyes are most commonly used on cotton because they are highly soluble and react best to the cotton fibre (TE-ONLINE, N.A.).

There are many different dyeing machines used in factories which all require a continuous power supply to run efficiently, however, the type of machine in this case is not our focus. All these machines need to have heating facilities to heat the dyes up to temperatures that are near boiling point, meaning extra power is needed to keep these temperatures up at a continuous rate. One of the most common machines is a batch process where the fabric is fed through a concentrated chemical pool on a roller with the extra appliance of heat and steam. Each time a fabric is passed through a solution, an amount of water equivalent to the weight of the fabric must be used (CHEQUER, F. M. D. *et al.* 2013).

The biggest problem with the dyeing process of textiles is the disposal of the left over dyeing water/effluent after it has been through the machines and fabric. It has been calculated that approximately 200 litres of water are needed for each kilogram of cotton produced and that 10%–50% of the dyes used in the dyeing process are lost ending up in the disposed water or in toxic sludge waste (CARNIERO, P. A. *et al.* 2007; CHEQUER, F. M. D. *et al.* 2013).

There can be as many as 2000 chemicals used in a textile dyeing process, many of them highly toxic to human and animal life. The textile industry is the number 1 biggest industrial polluter to our fresh water sources (O TEXTILES, 2011a). *Bangladesh's* textile industries produce around 56 billion litres of contaminated water a year, enough to fill twenty two and a half thousand Olympic sized swimming pools. Three-quarters of this water is used during the 'wet process', which is the dyeing, washing and rinsing. (PUMPKIN INTERACTIVE, 2011). *China* however has the most polluted waters due to their industry wastage. Half of *China*'s water is classed as unsafe for humans with 70% of rivers, lakes and reservoirs being polluted (GREENPEACEVIDEO, 2011). Wastage from a textile factory for example will discharge their waste water (often different colours from the dye stuff) straight into local rivers and seas.

"Today the water is red and tomorrow it could be green…that's how it is!"
(Textile factory worker. Hangzhou, China.) (GREENPEACEVIDEO, 2013)

People who live and work near the factories accept 'that's how it is'. They are living with dangerously high levels of pollution in both drinking and washing water, with local farmers and fisherman losing their businesses as the polluted waters will kill all crops and water life such as fish and crab. The dyes from these factories not only colour the waters but also human skin. It is not uncommon for a typical factory worker to finish work and be covered from head to toe in dye powders. The dye stains your skin that no amount of washing can remove, eventually (after several months) it only begins to fade. Workers have even reported their saliva changing colours because of these dyes. If this with the amount of dye powder is combined with fibre particles and other chemicals present in the factory environment, it is not surprising that long term diseases and cancers are becoming more and more common amongst factory workers and those living locally to the factories also (GREENPEACEVIDEO, 2013).

6.1.1. Environmentally friendly dyeing

Air dyeing technology is an alternative to typical dyeing methods that mainly use water. On average air dyeing process can use (depending on the type of fabric) 95% less water, and 87% less energy in its process and emits 84% less *Green House Gases (GHG)* (KANT, R. 2012). Air dyeing works by heating up fabric, then injecting dyes straight into the fibres in the form of a gas. Unfortunately air dyeing can only be used on synthetic fibres, so the need to reduce water and chemical dyeing consumption in cotton and other natural fibres remains an ongoing problem to solve (UPHAM, B. C. 2009).

6.2. Washing/rinsing

The washing/rinsing process is the biggest cause of water consumption in textile production during the wet treatment. As mentioned earlier in *section 5*, in 2008 the yearly worldwide textile production for water was between 6–9 trillion litres with some 17–20% of industrial water pollution coming straight from textile wet treatments (KANT, R. 2012).

In *section 5.1* the dyeing process was discussed and understood as dye stuffs including many hazardous chemicals such as mercury, nickel, arsenic and lead, resulting in water being polluted with toxic effluent. These chemicals including many others, give the waste water a foul smell and unpleasant appearance. According to KANT, R. (2012), *"This in turn interferes with the oxygen transfer mechanism at air water interface" which then effects "marine life and self-purification".*

Water is not only required for dyeing but for further washing and rinsing of finished fabrics. Dyeing however can contribute to 15–20% of the total water used in wet treatments (KANT, R. 2012). Further chemicals are used in the washing process such as caustic soda soaps and enzymes. More water is then needed to clean the machines themselves as the build-up of dye powder and soap scum can affect the machinery's overall performance resulting in break downs and inefficient running.

One of the worst effects on water caused by textile wet treatments is the depletion of oxygen in the water itself. This results in no marine life in nearby waters surrounding the local textile factories. Factories will often discharge of their waste water at night (as not to get caught by environmental officers) straight into rivers, the sea and into human water resources. Such polluted waters may not be able to host marine life but they can be a breeding ground for bacteria and viruses. *"Some 72 toxic chemicals have been identified in water solely from textile dyeing, 30 of which cannot be removed"* (KANT, R. 2012).

Another serious issue with polluted water from textile factories is the waters resistance to disinfectant. Carcinogens such as chlorine react with disinfectant making it impossible to treat the waste water. Chlorine is also known to have serious side effects to human health when inhaled or absorbed by the skin (KANT, R. 2012).

6.2.1. Improving the textile industries' water consumption

To help the wastage of water, using less in the manufacturing and reducing the steps in the wet treatment process could be beneficial in reducing large water quantities (SLATER, K. 2003). Also, by reducing waste, this could not only help the environment but also prove cost effective to the manufacturers due to using less water and recycling left overs.

Reducing and recycling water are the only ways factories will be able to effectively control their water consumption. Water is of course necessary in textile production but by reducing all forms of waste, industries could save between 20–50% expenditure on water with further appropriate water recycling methods saving even more money. For example, waste water could be recycled and used for cleaning machinery and other areas of the factory (KANT, R. 2012).

FREY, F. – MEYER, M. (1996) describe an oxidation reactor that could treat polluted waters and reduce consumption water and chemicals in the process. The benefits of this is that it could convert up to 90% of waste water into carbon dioxide and water, as well as saving 80% of water and 20–30% of chemical use.

Textile industries use many waste water treatments, but unfortunately water can only be re-used effectively if it is free of chemicals. Next, chemical use and their damaging effects on the environment will be discussed in more detail.

6.3. Chemical use

Chemical use initially begins in the fields of the cotton crop through the use of herbicides and insecticides, but in this section we are just focusing on chemicals used in factory processes on textiles themselves. As discussed in *sections 6.1.* and *6.2.* many, many chemicals are used throughout the wet treatment process and here we will look at the main effects these chemicals have on the environment.

Chemical use is of course crucial to fabrics being hard wearing and longer lasting. It is far better for a consumer to keep and re use a T-shirt for 5 years, than to throw away and buy a new one every year. However, the chemicals stored in the fibres of fabric today are making it harder for these textiles to degrade. For example, non-bio degradable and formaldehyde based dyes result in textiles being so preserved that they fail to degrade when placed in land fill (KANT, R. 2012). Formaldehyde is often used as a finishing element to a textile, helping to resist staining and improve waterproofing. The formaldehyde can contain releasing preservatives when the textile is under such pressures as heat from ironing or outside temperature, resulting in the person wearing them to inhale and/or absorb the preservatives through the skin (O TEXTILES, 2011b). Not only does this chemical have damaging effects to human health but to the environment as well. Many companies will disguise the name 'formaldehyde' with names such as methyl aldehyde, methylene oxide, oxymethylene and oxomethane. When these chemicals are disposed of as wastewater into surrounding areas, they are absorbed into the land, resulting in contamination of soils and vegetation. They eventually make their way into water resources destroying aquatic life and polluting human drinking water. These chemicals are pumped out as wastewater often at high temperatures from the wet treatment process, which can cause change in the chemicals themselves, realising fumes into the air and permanently contamination the water (KANT, R. 2012).

6.3.1. Reducing chemical use in textiles

It is unlikely that chemical use is going to be prohibited completely when it comes to the production of textiles. However, standards and controls are currently in place to help limit the use of common chemicals. For example, *GOTS (Global Organic Textile Standard) "is a tool for an international common understanding of environmentally friendly production systems and social accountability in the textile sector"* (O TEXTILES, 2011b). GOTS covers a wide area of textile production, particularly in the use of certified fibres, the banning of genetically modified organisms (GMO) and also the prohibition of many chemicals, including formaldehyde. GOTS claim that, *"only textile products that contain a minimum of 70% organic fibres can become GOTS certified (a textile product carrying the GOTS label grade 'organic' must contain a minimum of 95% certified organic fibres whereas a product with the label grade 'made with* *organic' must contain a minimum of 70% certified organic fibres) and all chemical inputs such as dyestuffs and auxiliaries used must meet certain environmental and toxicological criteria"* (GOTS, 2014).

7. Conclusion

Through the putting together and researching of this article, many issues between textile production and its effects on the environment have been highlighted, the majority of which have the capability for further research to be carried out and other articles to be written. Our focus has been on *Asia* and its significant role in the textile industry. The countries mentioned all work towards a large amount of textile production which therefore has individual environmental issues that need to be addressed. Profit centred large companies do not take into account the importance of sustainability, with any development of technologies happening by external constrains. Several countries have adopted environmentally friendly and holistic technologies including the use of natural ingredients, raw materials and dyes with the R&D sector playing a key role in the management of industrial wastewaters, helping to prevent an extensive environment degradation.

A description of cotton, from crop to finished fabric, highlighted the multiple processes a material is put through, including the damaging effects these processes have and still are causing to the environment. Irreversible damage has been done through the use of poisonous chemicals and dyes, and the factories still burn away at our fossil fuels as a source of their power. However, through new technologies such as air dyeing and steps introduced to ensure water is recycled and reused efficiently, further damage to the environment around the textile factories can be minimised and monitored.

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ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 586–623

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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).

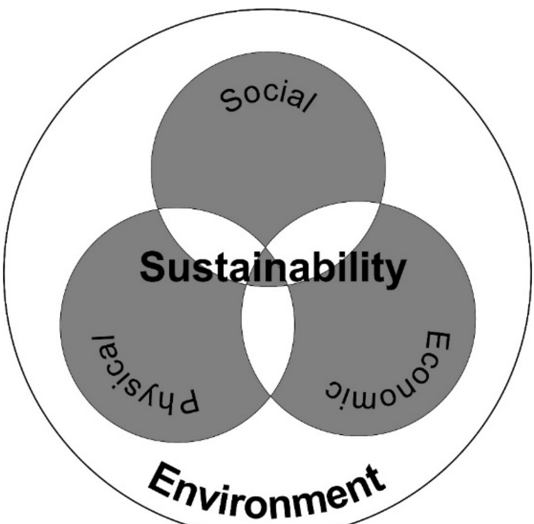

Figure 1 – Cake of sustainability and environment
Designed by BOKOR, L. (2015)

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)*.

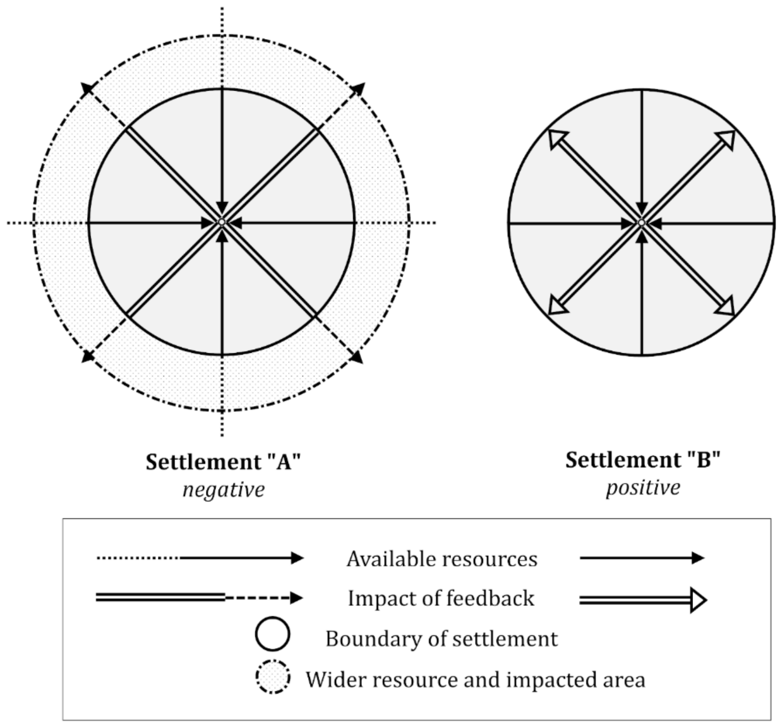

Figure 2 – The 'Need Model' based on a settlement
Source: Bokor, L. – Nemes, V. (2014)

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)*

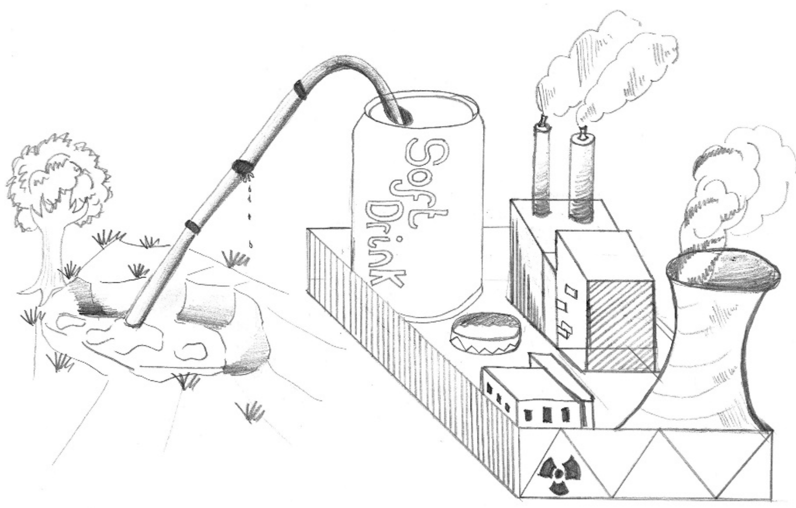

Figure 4 – Companies use up the Earth's resources, make products and sell them for profit.
Drawn after ISLAND BREATH *(2011) by* ECCLESTON*, K. (2015)*

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.

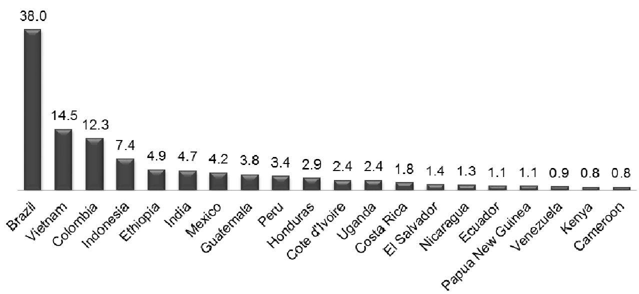

Figure 5 – Coffee producers
(The chart represents coffee production in millions of 60-kg bags.)
Designed by BOKOR, L. 2015; Source: SCHOLER, M. (2006a), ICO (2015)

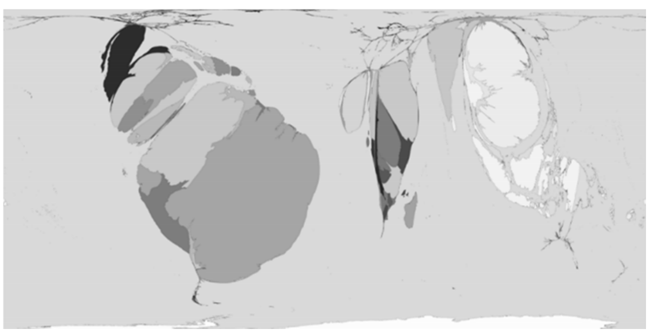

Figure 6 – The weight of coffee producer countries on the global market
Source: SCHOLER, M. (2006a)

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]).

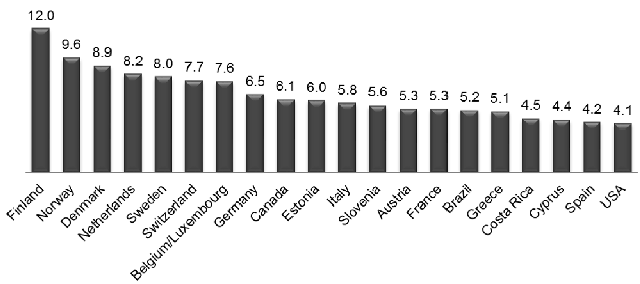

Figure 7 – Coffee consumption
(The chart represents data in kg per capita.)
Designed by BOKOR, L. 2015; Source: SCHOLER, M. (2006b), ICO (2015)

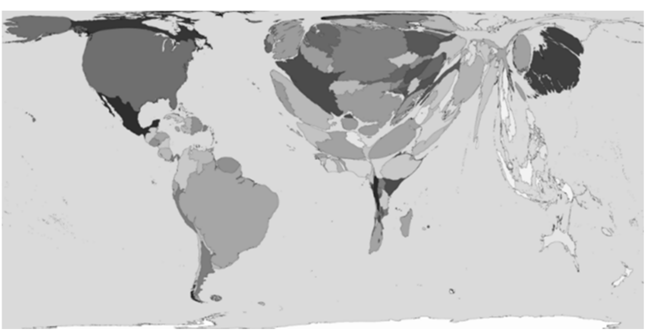

Figure 8 – The weight of coffee consuming countries on the global market
Source: SCHOLER, M. (2006b)

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.)

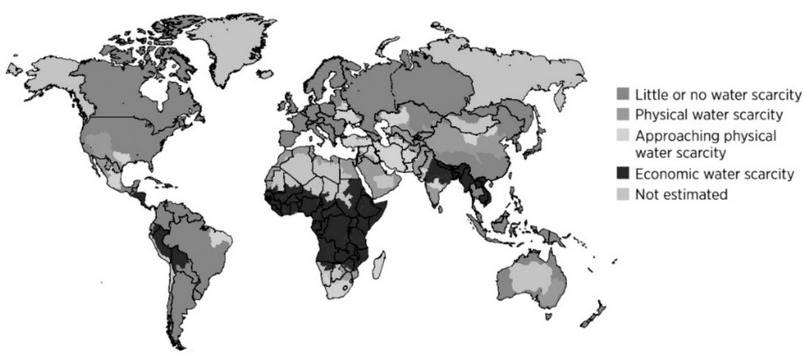

Figure 9 – Water scarcity
Source: UN WATER REPORTS (2012)

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*.

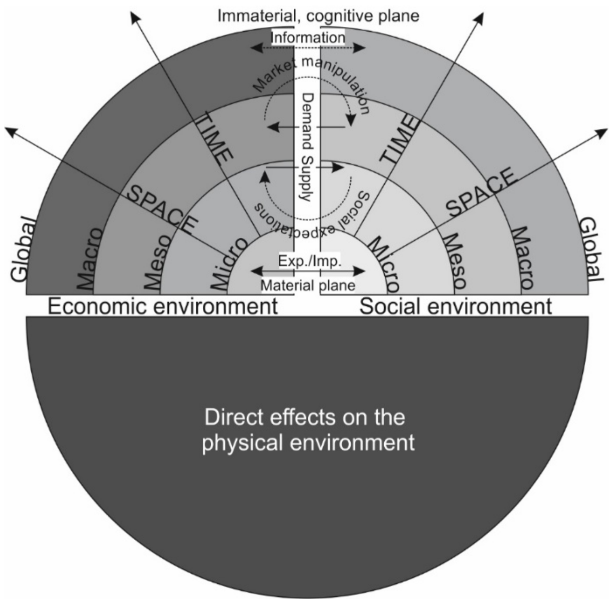

Figure 10 – Mechanism of actions of the coffee consumption in the social–economic space
Designed by Alpek, B. L. (2015)

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 expectations 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.

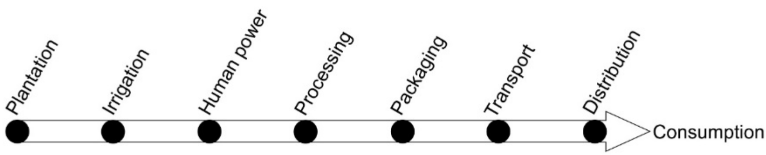

Figure 11 – The route of the coffee

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.

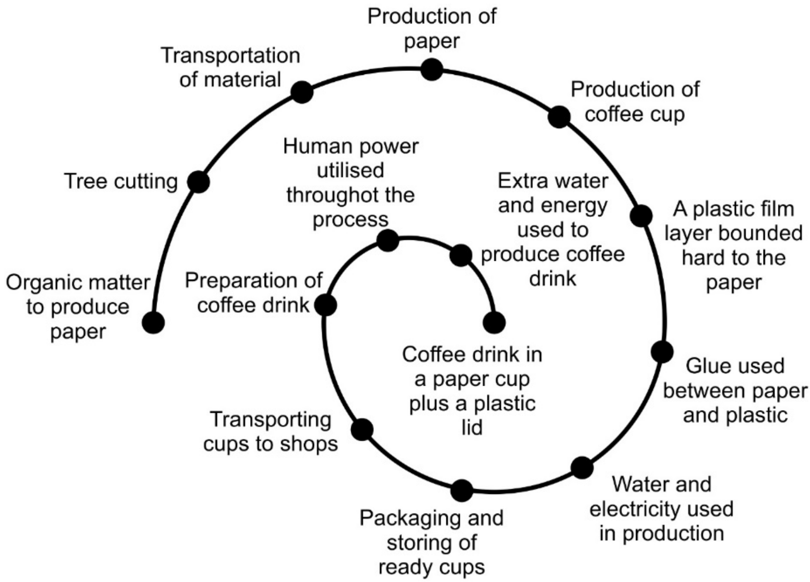

Figure 12 – Spiral of effects – a simplified and schematic idea of how one thing generates another – an example on the coffee cup.
Designed by Bokor, L. (2015)

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).

Acknowledgment

The lead author of this paper would like to thank to *Birmingham City University* and its *Students' Union's Eco Project* for their continous support between 2013 and 2015.

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ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 624–644

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Responsible Tourism Destinations: A Win-Win Situation for Sustainable Tourism Development?

Abstract

Since the middle of the 1950s, tourism has become a constantly increasing and one of the most important parts of the economy; it has produced an ever growing impact on physical and cultural environments. In order to react to the evolved—both negative and positive—impacts of tourism, since the 1990s, a new approach of sustainable tourism development has been initiated, more or less globally. One of the most recently evolved areas of this process focused on responsible tourism destinations. Along with the newly formed international organisations of responsible tourism development in destinations the tourists became more and more aware of sustainable tourism issues, and as a result of this process tourists became more and more responsible as well seeking for those destinations which lay a special emphasis on sustainability.

The article intends to present the most important steps and forms of the creation of responsible tourism destinations and its importance in modern tourism development. Such issues will be dealt with as raising awareness of responsible tourism and sustainable tourism destination development, responsible destination branding or the behaviour of the new tourists with a strong focus on the impacts on the physical environment.

Key words

Responsible tourism; Destination; Responsible tourist; Impacts, Tourism development

1. Introduction

Having a look at the topic of the article from a historical perspective, the *Global Code of Ethics for Tourism* published by the 13th *WTO General Assembly* in *Chile* in 1999, provided one of the first and also most important answers and a fundamental frame of reference for the new challenges of tourism. It has been dealing and managing 10 complex issues (Articles) from the contribution to mutual understanding and respect between people and societies (Article 1) to the implementation of the principles of the *Global Code of Ethics for Tourism* (Article 10). With these guidelines, the *Global Code of Ethics* laid the foundations for sustainable and responsible tourism as well (UNWTO, 1999).

After the formation and introduction (to public awareness, as well) of this holistic approach, the next important step in the formation of responsible tourism destinations can be connected to the *Cape Town Conference on Responsible Tourism in Destinations* which was organised by the *Responsible Tourism Partnership* and *Western Cape Tourism* as a side event preceding the *World Summit on Sustainable Development* in *Johannesburg* in 2002 (CAPE TOWN DECLARATION, 2002).

This conference, and the 280 responsible delegates from 20 countries, published its results in the *Cape Town Declaration* laying down the foundations for responsible tourism and responsible tourism destinations by proposing guiding principles for economic, social and environmental responsibility.

Having realised that *"responsible tourism seeks to maximise positive impacts and to minimise negative ones*" (CAPE TOWN DECLARATION, 2002) this declaration also highlighted that the proposed principles cannot be totally adapted to a certain destination, the local differences and peculiarities have to be reflected in the process of becoming a responsible destination.

2. Aims of the study

The aim of the present article is, on the one hand, to introduce and summarise the basic results in the field of responsible tourism destination building and, on the other hand, to serve the most modern examples and emerging issues in a critical perspective of this important aspect of tourism development.

In this respect, the study presents the most important steps and forms of the creation of responsible tourism destinations and its importance in modern tourism development. Such issues will be dealt with as raising awareness of responsible tourism and sustainable tourism destination development, responsible destination branding or the behaviour of the new tourists with a strong focus on the impacts on the physical environment.

3. Research methods

This study is largely based on the thorough examination and evaluation of the related scientific literature so the most important research method was desk research. Parallel with the literature covering responsible tourism outstanding and important policies were elaborated and analysed after which representative case studies and best practices were collected in order to demonstrate their role in responsible tourism development issues.

4. The tourism destination

Before we deal with and thoroughly investigate the issues of responsibility in relation to destinations, we have to make clear what a tourism destination is. According to the United Nations World Tourism Organisation (UNWTO, 2002), *"A local tourism destination is a physical space in which a visitor spends at least one overnight. It includes tourism products such as support services and attractions, and tourism resources within one day´s return travel time. It has physical and administrative boundaries defining its management, images and perceptions defining its market competitiveness. Local tourism destinations incorporate various stakeholders often including a host community, and can nest and network to form larger destinations"*.

In other words, destination is a physical geographical unit, area or region which is chosen by the tourists to be visited, having unique characteristics both due to its physical and cultural-historical background.

The destination provides space to the appearance of the concrete tourist attractions, of course in different scales, quality and quantity. It is also important to highlight that the destination as a complex phenomenon connects the attractions with the tourism infrastructure and services, providing a package for the visitor (AUBERT, A. *et al*. 2012; AUBERT, A. 2014).

For further analysis, we should also mention that the tourism destination is the fundamental unit for the academic, practical-business research and analysis of tourism studies, and is the basic unit for tourism policy strategies and actions. The spatial investigation on the tourism destination indicates the possibility for cluster studies as well where the tourism attractions and activities, so the complex supply, can spatially be connected in a network or a form of co-operation. According to the UNWTO (2002), a destination is a spatial unit where the tourist spends at least 24 hours at a commercial or private accommodation.

Figure 1 – The major components of the tourism destination

Based on UNWTO (2002), Edited by CSAPÓ, J. (2015)

The destination is not only having physical characteristics, but there is an intangible side of the concept as well. In this respect, the most important terms are image and façade which fundamentally influence, of course, the supply and demand sides of the tourism industry. The local image, the peculiar characteristics of a certain region will make the area different from the others (RAFFAY, Z. *et al*. 2013).

Based on the above mentioned, it is clear that the destinations are in the focus of not just the (spatially oriented) tourism researches, but with their complexity on both the demand and supply side, they become a central element in the system of tourism. The most important elements of the system of the tourism destination are the visitors, the local community, the regional authorities, the destination management organisations and the tourism industries services. These create an interdependent system having impacts vice-versa on the tourism destination and on each other as well *(Figure 1)*.

5. Where do we start from?

In order to research what a responsible tourism destination is, one has to be aware of the concept of responsible tourism. The already mentioned *Cape Town declaration* states that responsible tourism:

- 'minimises negative economic, environmental, and social impacts;
- generates greater economic benefits for local people and enhances the well-being of host communities, improves working conditions and access to the industry;
- involves local people in decisions that affect their lives and life chances;
- makes positive contributions to the conservation of natural and cultural heritage, to the maintenance of the world's diversity;
- provides more enjoyable experiences for tourists through more meaningful connections with local people, and a greater understanding of local cultural, social and environmental issues;
- provides access for physically challenged people; and

- is culturally sensitive, engenders respect between tourists and hosts, and builds local pride and confidence' (CAPE TOWN DECLARATION, 2002).

Although having similar approaches and issues, experts state that this concept should not be confused with the term sustainable tourism, since responsible tourism is a term more often used by the tourism industry which is due to the fact the sustainability is overused and seems to be fashionable often without proper meaning.

However, if we want to understand what responsible tourism destination (RTD) means, we also have to take into consideration the 2004 declaration of the *World Tourism Organisation* what sustainable tourism and sustainable tourism development are about:

'Thus, sustainable tourism should:

1. *Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity.*
2. *Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.*
3. *Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.*

Sustainable tourism development requires the informed participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is a continuous process and it requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary.

Sustainable tourism should also maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their *awareness about sustainability issues and promoting sustainable tourism practices amongst them."* (UNWTO, 2004; UNEP-UNWTO 2005)

6. The basic requirements for responsible tourism destinations (RTDs)

Based on the above mentioned basic concepts and fundamental approaches on the new aspects of tourism and tourism development—both on the demand and supply sides—the author of this article focused on two major or decisive sources which initiated the basic requirements, indicators, etc. to the creation of RTDs. The earlier one, the 2004 *UNWTO Guidebook on Indicators of Sustainable Development for Tourism Destinations* (UNWTO, 2004) has established the most important aspects of sustainable tourism development both from theoretical and practical points of view. The other, the 2013 *European Tourism Indicator System*, based on the recommendations of the previous one as well, concentrated more on the management issues so this more practical approach is demonstrated here.

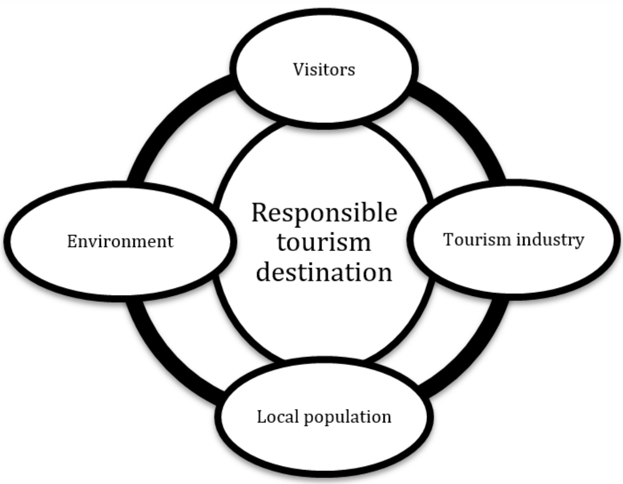

Figure 2 – The most important actors of a responsible tourism destination
Edited by CSAPÓ, J. (2015)

However, before the representation of the EU approach, the author would like to stress that a responsible tourism destination relies and, at the same time, affects 4 major players, namely the visitors (demand), the tourism industry, the local population and, of course, the physical environment *(Figure 2)*.

7. The European Tourism Indicator System

The European Commission has published this comprehensive material as a deliverable of the Study on the *Feasibility of a European Tourism Indicator System for Sustainable Management* at Destination Level in 2013. The most important result of the study from the point of view of this article is the creation of a comprehensive and complex system of indicators which allows a destination to become sustainable and responsible, at the same time when adapting them to its operation *(Table 1).*

Table 1 – The main criteria of destination indicators of the European Tourism Indicator System

Source: European Commission (2013)

Section	**Criteria**
A. Destination Management	• A.1 Sustainable Tourism Public Policy • A.2 Sustainable Tourism Management in Tourism Enterprises • A.3 Customer Satisfaction • A.4 Information and Communication
B. Economic Value	• B.1 Tourism Flow (volume & value) at Destination • B.2 Tourism Enterprise(s) Performance • B.3 Quantity and Quality of Employee • B.4 Safety and Healthy B.5 Tourism Supply Chain
C. Social and Cultural Impact	• C.1 Community/Social Impact • C.2 Gender Equality • C.3 Equality/Accessibility • C.4 Protecting and Enhancing Cultural Heritage, Local Identity and Assets

D. Environmental Impact	• D.1 Reducing Transport Impact • D.2 Climate Change • D.3 Solid Waste Management • D.4 Sewage Treatment • D.5 Water Management • D.6 Energy Usage • D.7 Landscape and Biodiversity Management • D.8 Light and Noise Management • D.9 Bathing Water Quality

8. Pushing factors for the creation of a responsible destination

So, that was a theory but what is the reality? The above demonstrated approach is modern, up-to-date and, in a way, fashionable, as well. However, in order to realise these requirements, we need to have exact pushing factors that would promote both the supply and the demand side to act responsibly or take part in responsible tourism destination development.

One of the most decisive aspects of the realisation or the rejection of this approach is from the financial perspective. In order to introduce and adapt such new techniques, both the supply and the demand side has to understand that creating sustainable and/or responsible tourism might (not necessarily) increase prices (GOODWIN, H. 2012; GOODWIN, H. *et al.* 2014). Nevertheless, the pushing factors are far more valuable in the holistic approach.

9. Behavioural changes of the new tourists with a special attention to responsibility

So on the demand side, the appearance of the 'new tourist' was very much needed in order to establish the social involvement for the creation of responsible tourism (GOODWIN, H. 2014). Who is this new tourist then? According to earlier researches (YEOMAN, I. 2008; LEE, T. *et al.* 2013;) the most important characteristics of the 'new tourist' and at the same time of the 'new tourist demand' can be derived from the phenomenon of changing from mass tourism to different forms of alternative tourism (HAJNAL, K. 2007; WINKLER, K. 2007; CSAPÓ, J. 2012; VARGA, D.–DÁVID, L. 2013).

Instead of one great vacation, tourists and visitors travelled for shorter times in the high season (summer holidays), but started to be involved more in active or cultural tourism in different parts of the year (ski holidays, hiking, or weekend brakes, etc.) (AUBERT, A. 2010). This was also supported by the changes in the transport industry for instance with the liberalisation of air travel in Europe and the appearance of the low cost airlines (CSAPÓ, J. – MATESZ, K. 2007).

Based on AKPINAR, S. (2003) and YEOMAN, I. (2008), PIRNAR, I. *et al.* (2010) summarised the characteristics of the new tourist in the following:

1. More learning, adventure and experience oriented tourists, seeking out authenticity looking for real experiences.
2. More flexible and independent in nature (new tourists are generating demand for better quality, more value for money and greater flexibility in the travel experience).
3. Very much interested in sustainability, even willing to pay more.
4. Very much interested in the living and participating the experience of local cultures.
5. Have changing preferences of destinations and length of stay for travels.
6. Demanding various tourism types, like cultural heritage tourism, agritourism, medical tourism, health tourism, soft tourism, sustainable tourism, sports tourism, hiking, rafting, volunteer tourism, bird-watching, photography, kayaking, wild life watching, visiting national parks, mountain climbing, cruise tourism, yachting, golf tourism, fishing, educational, city tourism, etc.
7. Have changing demographic profiles like aging population, changing family size, etc. in the future tourism establishments have to serve for everyone, from grandparents to grandchildren.
8. More stressed out and therefore are looking for relief and convenience.
9. More technology friendly, often using internet for booking and

purchasing tourism products.
10. Have growing anxiety about health and safety (PIRNAR, I. *et al.* 2010.)

10. Creating a sustainable tourism destination

According to the recommendations, the *European Tourism Indicator System Toolkit* offers a complete step by step guide to the stakeholders who would like to be involved in changing their destination to responsible requirements. Adapting to this system a destination should follow a 7 step guide *(Figure 3)*.

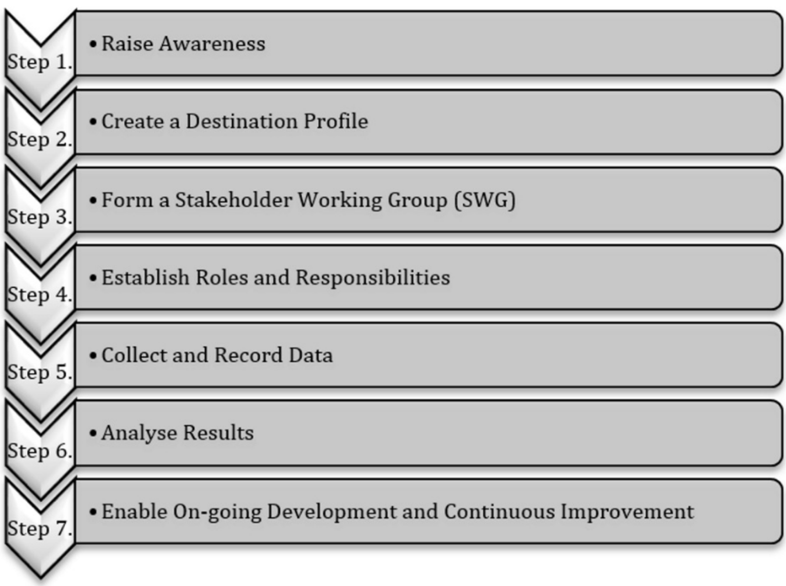

Figure 3 – A Step-by-Step Guide to Using the Indicator System
Source: Based on EUROPEAN COMMISSION (2013); Edited by CSAPÓ, J. (2015)

Besides the mentioned major steps, the *Toolkit* determines core and optional indicators as well, which further on provides guidelines and feedback information on the fields of destination management, economic value, social and cultural impact and environmental impact as well.

11. Best practices

Of course, it is much easier to find best practices of responsible tourism on the level of enterprises, tourism product development practices, or taking into consideration the tourism practice of a settlement, but not a complete destination. Nevertheless, we can find some examples which can serve as a basis, best practice, or as a standard for future RTDs.

Since the highlighted topic is relatively a new initiative, the author of this article is unable (yet) to choose from a very wide set of examples, so as a starting point here, the *Best Destination for Responsible Tourism* carried out by *Responsible Travel* (WRTA, 2015b) will be introduced. This organisation is supported by experts throughout the world chaired by *Prof. Harold Goodwin* (professor of responsible tourism at *Manchester Metropolitan University* and founder of the *International Centre for Responsible Tourism*) accompanied with competent authorities from responsibletravel.com, *ABTA*, *World Travel Market*, *bgb*, *UNEP*, and *CESHI*. This category is *"awarded to a holiday destination setting an inspirational and influential example for responsible tourism. … The best destination category is for those destinations who put their unique community and environment at the heart of exciting and memorable tourism experiences; places which use tourism to make better places for people to live in and better places for people to visit, whether it be a village, a town, a city, a region, or a country, the best destination category is looking for places that inspire and promote responsible holiday experiences that celebrate and protect the best of their destination"* (WRTA, 2015a). The winners of this award, being pioneers in RTD development, are represented in *Table 2*.

12. Summary, final thoughts

So what are the most important advantages of the RTDs? Is really the creation of the new kind of destinations a win-win situation?

Table 2 – The winners of the Best Destination for Responsible Tourism award
Source: WRTA (2015a)

Year	Destination
2014	• V&A Waterfront, Cape Town, Republic of South Africa
2013	• Bonito, Brazil
2012	• St. Kilda, Scotland
2011	• Røros, Norway
2009	• City of Cape Town, South Africa
2008	• New Zealand
2007	• New Forest (an organisation awarded for their achievement in responsible tourism)
2006	• Aspen, Colorado

Certainly, responsibility is based on the principles of sustainability providing a new step towards a green economy and society. From the point of view of the tourist and the local population as well a greener environment provides more liveable circumstances for holidays or everyday living.

On the other hand the appearance and spread of the 'new tourist' indicates that during their travel decision they will be greatly concerned and so influenced by the presence or absence of responsible destinations. It means that the solvent demand will also further support the local economy and sustainable development of the destination.

So every aspect of tourism or tourism development proves the existence for the RTDs to be one of the most important challenges of modern tourism development.

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Appendix 1 – The main criteria of destination indicators of the European Tourism Indicator System

Source: European Commission (2013)

Section	Criteria	Indicator Reference #	Indicator (Core indicator = grey; optional indicator = white)
A. Destination Management	A.1. Sustainable Tourism Public Policy	**A.1.1**	Percentage of the destination with a sustainable tourism strategy/action plan, with agreed monitoring, development control and evaluation arrangement
		A.1.1.1	Percentage of residents satisfied with their involvement and their influence in the planning and development of tourism
		A.1.1.2	Percentage of the destination represented by a destination management organisation
	A.2. Sustainable Tourism Management in Tourism Enterprises	**A.2.1**	Percentage of tourism enterprises/establishments in the destination using a voluntary verified certification/labelling for environmental/quality/sustainability and/or CSR measures
		A.2.1.1	Number of tourism enterprises/establishments with sustainability reports in accordance with the Global Reporting Initiative (GRI)
	A.3. Customer Satisfaction	**A.3.1**	Percentage of visitors that are satisfied with their overall experience in the destination
		A.3.1.1	Percentage of repeat/return visitors (within 5 years)
	A.4. Information and Communication	**A.4.1**	The percentage of visitors who note that they are aware of destination sustainability efforts
		A.4.1.1	The percentage of businesses that communicate their sustainability efforts to visitors in their products, marketing, or branding

B. Economic Value	B.1. Tourism Flow (volume & value) at Destination	**B.1.1**	Number of tourist nights per month
		B.1.1.1	Relative contribution of tourism to the destination's economy (% GDP)
		B.1.1.2	Number of 'same day' visitors in high season and low season
		B.1.1.3	Daily spending per same day visitor
		B.1.2	Daily spending per tourist (accommodation, food and drinks, other services)
	B.2. Tourism Enterprise(s) Performance	**B.2.1**	Average length of stay of tourists (nights)
		B.2.1.1	Average length of stay of same day visitors (hours)
		B.2.1.2	Percentage of ten largest tourism enterprises involved in destination mana-gement/cooperative marketing
		B.2.2	Occupancy rate in commercial accommodation per month and average for the year
		B.2.2.1	Average price per room in the destination
	B.3. Quantity and Quality of Employee	**B.3.1**	Direct tourism employment as percentage of total employment
		B.3.1.1	Percentage of jobs in tourism that are seasonal
		B.3.1.2	Percentage of tourism enterprises providing student internships
	B.4. Safety and Healthy	**B.4.1**	Percentage of tourism enterprises inspected for fire safety in the last year
		B.4.1.1	Percentage of tourists who register a complaint with the police
	B.5. Tourism Supply Chain	**B.5.1**	Percentage of tourism enterprises actively taking steps to source local, sustainable, and fair trade goods and services
		B.5.1.1	Percentage of the destination covered by a policy promoting local, sustainable and/or fair trade products and services
		B.5.1.2	Percentage of tourism enterprises sourcing a minimum of 25% of food and drink from local/regional producers

C. Social and Cultural Impact	C.1. Community/ Social impact	**C.1.1**	Number of tourists/visitors per 100 residents
		C.1.1.1	Percentage of residents who are satisfied with tourism in the destination (per month/season)
		C.1.1.2	Number of beds available in commercial visitor accommodation per 100 residents
		C.1.1.3	Number of second/rental homes per 100 homes
	C.2. Gender Equality	**C.2.1**	Percentage of men and women employed in the tourism sector
		C.2.1.1	Percentage of tourism enterprises where the general manager position is held by a woman
		C.2.1.2	Average wage in tourism for women compared to average wage for men (sorted by tourism job type)
	C.3. Equality/ Accessibility	**C.3.1**	Percentage of commercial accommodation with rooms accessible to people with disabilities and/or participating in recognised accessibility schemes
		C.3.1.1	Percentage of destination served by public transport that is accessible to people with disabilities and people with specific access requirements
		C.3.2	Percentage of visitor attractions that are accessible to people with disabilities and/or participating in recognised accessibility schemes
		C.3.2.1	Percentage of visitors satisfied with the accessibility of the destination for those with disabilities or specific access requirements
	C.4 Protecting and Enhancing Cultural Heritage, Local Identity and Assets	**C.4.1**	Percentage of the destination covered by a policy or plan that protects cultural heritage
		C.4.1.1	Percentage of residents who have positive or negative views on the impact of tourism on destination identity
		C.4.1.2	Percentage of the destination's biggest events that are focused on traditional/local culture and assets

D. Environmental Impact	D.1. Reducing Transport Impact	**D.1.1**	Percentage of tourists and same day visitors using different modes of transport to arrive at the destination (public/private and type)
		D.1.1.1	Percentage of visitors using local/soft mobility/public transport services to get around the destination
		D.1.2	Average travel (km) by tourists to and from home or average travel (km) from the previous destination to the current destination
		D.1.2.1	Average travel (km) by same day visitors from and to destination
	D.2. Climate Change	**D.2.1**	Percentage of tourism enterprises involved in climate change mitigation schemes—such as: CO_2 offset, low energy systems, etc.—and 'adaptation' responses and actions
		D.2.1.1	Percentage of the destination included in climate change adaptation strategy or planning
		D.2.1.2	Percentage of tourism accommodation and attraction infrastructure located in 'vulnerable zones'
	D.3. Solid Waste Management	**D.3.1**	Waste volume produced by destination (tonnes per resident per year or per month)
		D.3.1.1	Percentage of tourism enterprises separating different types of waste
		D.3.2	Volume of waste recycled (percent or per resident per year)
	D.4. Sewage Treatment	**D.4.1**	Percentage of sewage from the destination treated at least at secondary level prior to discharge
		D.4.1.1	Percentage of commercial accommodation connected to central sewage system and/or employing tertiary sewage treatment
	D.5. Water Mana-gement	**D.5.1**	Fresh water consumption per tourist night compared to general population water consumption per person night
		D.5.1.1	Percentage of tourism enterprises with low-flow shower heads and taps and/or dual flush toilets/waterless urinals

		D.5.1.2	Percentage of tourism enterprises using recycled water
		D.5.1.3	Percentage of water use derived from recycled water in the destination
	D.6. Energy Usage	**D.6.1**	Energy consumption per tourist night compared to general population energy consumption per person night
		D.6.1.1	Percentage of tourism enterprises that have switched to low-energy lighting
		D.6.1.2	Annual amount of energy consumed from renewable sources (MWh) as a percentage of overall energy consumption
	D.7. Landscape and Biodiversity Management	**D.7.1**	Percentage of destination (area in km^2) that is designated for protection
		D.7.1.1	Percentage of local enterprises in the tourism sector actively supporting protection, conservation, and management of local biodiversity and landscapes.
		D.7.1.2	Percentage of destination covered by a biodiversity management and monitoring plan
	D.8. Light and Noise Mana-gement	**D.8.1**	The destination has policies in place that require tourism enterprises to minimise light and noise pollution
		D.8.1.1	Percentage of the destination and percentage of population covered by local strategy and/or plans to reduce noise and light pollution
	D.9. Bathing Water Quality	**D.9.1**	Level of contamination per 100 ml (faecal coliforms, campylobacter)
		D.9.1.1	Number of days beach/shore closed due to contamination

ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 646–666

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The Importance and Environmental Effects of Quality Health Tourism in Hungary, the Case-study of Hévíz

Abstract

Tourism and the environment are inseparable, in other words they are interdependent, and thus the relation of tourism and its environment should not be treated as a unilateral one. The authors of this study try to give an overview on the relation of health tourism and the sensible natural environment of a famous Hungarian spa resort, Hévíz. The health and wellness tourism are exceptional areas of the Hungarian tourism—mainly due to its unique geothermal characteristics. The study aims to show the risks which are threatening Hungary's famous spa towns and the actions and measures that should be carried out to preserve and maintain these valuable natural resources. Besides these, the study also presents the possible ways to release the increasing environmental pressure of tourism, for example the reorganisation of farming system to a sustainable one is also presented.

Key words

Health tourism; Human impact; Environmental effects; Spa towns; Lake Hévíz

1. Introduction

Hévíz (Figure 1) received its fame due to the well-known medicinal lake, the *Lake Hévíz*.

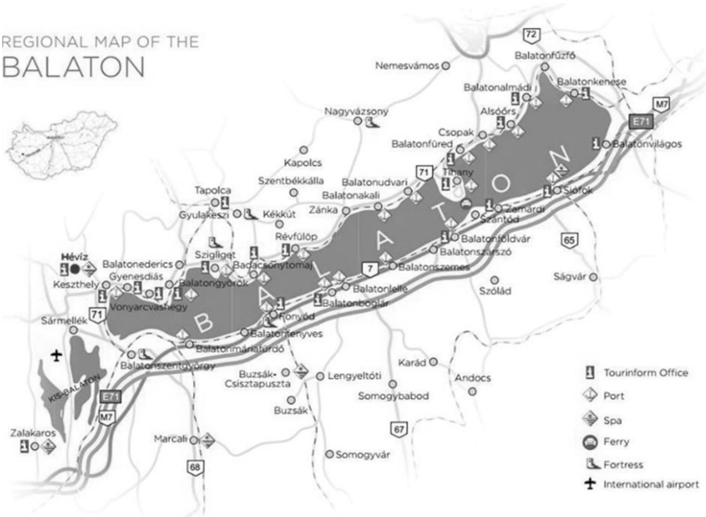


Figure 1 – The spatial allocation of Hévíz
Source: HUNGARIAN TOURISM PLC. (2014)

This tourism resource is based on a thermal-karst spring-lake with the diameter of 250 m of which crater cave can be found in a depth of 38 m *(Figure 2)*. The lake has a flow rate of 30–40 l/m. The water flows through the *Upper-Triassic* main dolomite and reaches the surface at the border of the karstic rocks and the covering *Pannonian loamy sandstones* (KORDOS, L. 1984).

The lake is a *„unique natural value to be protected and a popular tourism destination as well. Its water is used for medicinal purposes for a long while thanks to its temperature and composition. Though Romans were beware of the medicinal effects of the lake, it only started to develop after 1795"* (*Lake Protection Program of Lake Hévíz, Preparatory Study—*

translated by the authors)[26]. Besides its uniqueness and popularity in tourism, the physical environment surrounding the lake and providing the base of its tourism is a fragile system. We can say that *„Both tourism and our physical environment are open and complex systems"* (PUCZKÓ, L. 1999).

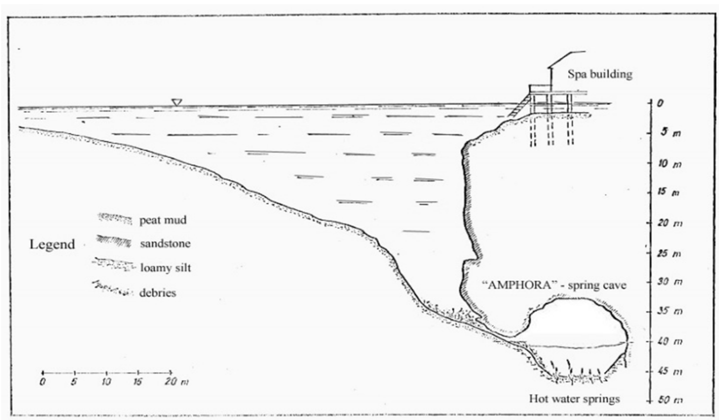


Figure 2 – The cross-section of Lake Hévíz and its spring cave
Source: AMPHORA (1976)

Tourism is embedded in and depends on its physical environment, which includes the natural—waters and their flora and fauna, the soil, geological formations, climate, microclimate, the habitats—and the human/cultural –historical sites, traditions, settlements, buildings, handicrafts etc.—resources. Thus this openness, complexity and interdependence lead to the fact that they are an integral part of each other and cannot be separated. Tourism—as all human activities—uses resources and raw materials from its environment; from the nature; has got a kind of infrastructure and emissive sources. Tourism as an economic activity

[26] BALATONI INTEGRÁCIÓS ÉS FEJLESZTÉSI ÜGYNÖKSÉG KHT. – VITUKI KÖRNYEZETVÉDELMI ÉS VÍZGAZDÁLKODÁSI KUTATÓ INTÉZET KHT. – A MAGYAR ÁLLAMI FÖLDTANI INTÉZET KÖZREMŰKÖDÉSÉVEL (2007)

generates profit and extra-profit with the use of natural and human resources (HAJNAL, K. *et al.* 2009). Of course this economic sphere, just like agriculture or industry, can be overused and exploited and necessarily has to compete with other activities. And we must not forget that basically tourists are consumers (although in a growing extent responsible consumers) —and not environmentalists who are aware of their consumption rate and the effects they may cause to the environment and nature (PUCZKÓ, L. 1999). Therefore, it is not surprising that in the recent years the environmental protection received an outstanding role in the relation of tourism and its physical environment. In the context of tourism environmental protection includes: *"All those human activities which intend to protect and sustain the physical environment (natural and anthropogenic), which is the base of tourism. Tourism has to minimize its disadvantageous, adverse effects and has to optimize the positive ones in accordance with the economic and socio-cultural effects as well"*—PUCZKÓ, L. 1999.

Considering all these, tourism has to be sustainable as well. Hence, tourism has to consider the bearing capacity of its natural environment and allow the resources to renew; has to realise that local communities, traditions and lifestyle are important parts of the tourism product; to accept the communities to share proportionally in the positive economic effects of tourism and to respect the interests and requests of the inhabitants of destinations regarding the development of tourism (PUCZKÓ, L. 1999).

As, the whole economy of the *Hévíz* region is based on tourism, therefore any change in the condition (water level, temperature and composition) of the lake has a great impact on it. The national, regional and local authorities should handle those tourism development strategies in the first place which aim to protect the rare and precious sources like water and energy and to minimise waste production (Global Code of Ethics for Tourism—GCET).

2. Aim of the study

The aim of our study is to give an overview on the relation of health tourism and the sensible natural environment of a famous Hungarian spa resort, *Hévíz*. Through our example, we would like to show the risks threatening *Hungary*'s famous spa towns and what kind of actions, measures should be carried out to preserve and maintain our valuable natural resources. We also present some possible ways to release the increasing environmental pressure of tourism, like the reorganisation of farming system to a sustainable one. The environmental effects and the possible solutions, ways of development are occurring questions in the case of all the Hungarian spa towns; thus with the case study of *Hévíz*, we can give an overview on the present situation, problems and development possibilities of the Hungarian spa resorts.

3. Research methods

During our research we analysed the settlement development strategies, studied and evaluated the implementation of town concepts, made interviews with local tourism and local government experts. Besides these, we also analysed the media reports because many of the investments, developments are very new and we also used our own observations—as one of the authors is a local resident.

4. The role of health tourism in Hungary

In the last decades health tourism become one of the most dynamically developing tourism products in world tourism market (TURNER, L. 2011; CONNELL, J. 2013). Hungary has got unique geothermal characteristics with quality tourism supply, thus, it is not surprising that health and wellness are exceptional areas of the Hungarian tourism as well.

„Health tourism is an overall definition which includes both the health and wellness tourism. It means that field of tourism where the motivation of a tourist is to improve or retain his/her health (for example recovery or prophylaxis). Therefore, the tourist utilises health tourism service(s)" (AQUAPROFIT, 2007). In *Hungary* health tourism is typically based on natural

therapeutic factors (MICHALKÓ, G. – RÁTZ, T. 2011). According to the 2013 data of the KSH (2015), there were 137 settlements involved in health tourism from which 18 had been given the qualification of a health resort by the ÁNTSZ (National Public Health and Medical Officer Service). As we mentioned above *„Hungary, besides possessing medicinal water stocks of universal significance, has leading positions in health tourism in certain fields of medical services as well. In the tourism development of Hungary over the last decade medical tourism and health tourism have been given a central role and have also been acknowledged by international sectoral analyses."* (JÓNÁS-BERKI, M. *et al.* 2014).

Hévíz is one of *Hungary*'s internationally important and most visited spa towns beside *Hajdúszoboszló*, *Bük*, *Balatonfüred*, *Sárvár* and *Zalakaros (Table 1)* which have similar characteristics, thus general development proposals can be framed for them.

Table 1 – The most visited Hungarian cities/towns (spa towns with bold letters), 2014

Source: KSH (2015) – preliminary data

	Most visited Hungarian cities/towns, 2014. All guest-nights (KSH)	
	City/town	**Number of guest-nights**
1	Budapest	8,059,154
2	Hévíz	982,760
3	Hajdúszoboszló	806,076
4	Siófok	700,611
5	Bük	680,451
6	Balatonfüred	543,801
7	Sárvár	453,159
8	Zalakaros	433,829
9	Sopron	381,537
10	Eger	374,709

The main attraction is the therapeutic water and the quality services of health tourism based upon it which is available throughout the year; therefore, seasonality is low and the environmental impact is continuous. All other attractions (baths, hotels, programmes) are based on this natural resource; thus, any change in its state has a great effect on the economy and tourism of the towns and the inhabitants as well. *"In monofunctional spa towns health tourism is undoubtedly the catalyst of development"* (SMITH, M. – PUCZKÓ, L. 2009).

As a reason, the environmental protection should be a key task in spa towns. The visitors usually stay for a longer period of time which is important in many ways. *"On the one hand, the length of their stay influences what sort of relation a visitor can establish with local people (the shorter the residence time, the greater the chance of shallow relations). On the other hand, the cost of a visitor is lower in the case of a shorter residence time in one destination"* (PUCZKÓ, L. – RÁTZ, T. 2001). In the case of spa towns visitors usually make themselves at home and as a result care more for the local environment and this environmentally conscious lifestyle is very important from the aspect of sustainable development.

Spa towns have disposal over the higher tax income, which they can appropriate to the renewal, care of their environment. A healthy, elegant townscape can be formed thanks to the organised, clean settlement, large green areas and parks which play an important role in the image of the town as well.

5. The case study: Hévíz and its unique natural value, the Lake Hévíz

In *Hévíz* tourism is based on a natural element, the world famous and unique *Hévíz Thermal Lake*. The special supply of this lake is replenished with traditional health tourism services and treatments, the spa town milieu and a peaceful environment. The hazards presented in our case study are typical of the other spa towns of *Hungary*; thus the development proposals can be applied on them as well, in accordance with the local conditions.

"Hévíz owes its fame to its medicinal lake, which is the largest biologically active natural thermal lake in the world with its 44,400 square metre water surface. The medicinal water gushes out from the 38 metre deep spring crater, its average temperature in summer is 33–35 °C which does not go below 23°C neither in winter, and thus outdoor bathing is possible throughout the year. The water contains sulphurous, alkaline hydrogen

carbonated, slightly radioactive active ingredients, having a curative effect primarily on various rheumatic, locomotor, muscular and nervous system disorders, as well as some gynaecological problems." (HÉVÍZI KISTÉRSÉG TERÜLETFEJLESZTÉSI KONCEPCIÓJA, 2008)[27]. In 2013, the number of guests entering the lake spa was more than one million.

Hévíz primarily relies on medical services, although the number of guests arriving for beauty, wellness and medical tourism (especially dental and anti-rheumatic treatments) is ever increasing. Because of the demand of tourists, quality accommodations are required, which have been built mainly in the form of hotels. In 2013, there were 23 hotels, 5 guest houses and 1 campsite ready for guests in the spa town (KSH, 2014; 2015). During the last decades, 3, 4, and 5-star quality hotels have been constantly built upon the medical tourism, and in the bigger hotels most of the known forms of medical treatments are available for guests. The therapeutic supply is completed with qualitative gastronomy, local goods, wine tourism and different activities associated with health maintenance, such as bike tours, in the recent years (HAJNAL, K. – KÖBLI, Á. 2015).

6. The Lake Hévíz and its environment

The springs feeding the lake originate from a cave developed in *Pannonian sandstone*. The cave itself was discovered in 1975, when the divers also observed the inflow of cold (17.2°C) water from the eastern side, and hot (39.6°C) water from the western side, which together resulted in an average temperature of 38.8°C at the mouth of the cave. The watershed of the cold water is located in the *Keszthely Mountains* whilst the hot water is located in the *Bakony Mountains*. The two most important parameters of the lake are its temperature and the discharge of the spring.

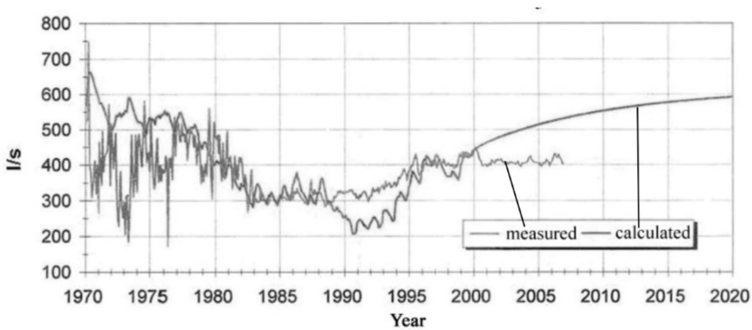
The VITUKI non-profit organisation calculated the changes in the discharge of the lake from 1970 until 2000 with the help a mathematical

[27] Hévíz Micro-region Regional Development Concept 2008–2018

model and with the consideration of those factors affecting water discharge. These results were then compared with the real values measured as shown on *Figure 3.* A prognosis was made with the help of this model; of which reliability greatly depends on anthropogenic and environmental conditions.

Figure 3 – The measured and calculated discharge of Lake Hévíz

Source: Balatoni Integrációs és Fejlesztési Ügynökség kht. – Vituki Környezetvédelmi és Vízgazdálkodási Kutató Intézet kht. – A Magyar Állami Földtani Intézet közreműködésével (2007)



The town of *Hévíz* itself is located in the territory of *Zalavár*, *Zala county* in the western part of *Hungary*. Larger part of the territory is sensitive or less sensitive to surface contamination where environmentally friendly economic activities could be carried out. The lake, the surrounding safety zone and the peat-bog is extremely sensitive while the offset of the valley is less sensitive. The settlements located within the territory with the greatest impact on the lake's discharge are the following: *Hévíz*, *Alsópáhok*, *Cserszegtomaj*, *Felsőpáhok*, *Keszthely*, *Nemesbük*, *Sármellék* and *Szentgyörgyvár*, but only *Hévíz*, *Kehidakustány*, *Alsópáhok* and *Keszthely* are characterised by permanent tourism.

7. Natural hazards of Hévíz and the environmental effects of tourism

7.1. How sensible is the lake? – A case from the past

The water discharge of the lake was unfavourably affected by the excessive use of karstic water from the *Transdanubian Hills* and especially by the bauxite mining in the *Nyirád region* from the 1960s. At the beginning of the mining works, the experts were not aware of the impact on the area's hydro–geological system caused by water extraction. With the continuous mine water extraction, the springs, riverbeds and karstic wetlands were dried out and—as a result of the decreased pressure caused by the depressive area of *Nyirád*—the groundwater balance was affected, as well. The most intensive water extraction works were carried out in the southwestern part of the *Nyirád region* where more than 40 wells were established. Their discharge together reached 250–300 m^3/min in the 1970s and 1980s. In this period, the amount of water extracted reached the amount of recharge in the reservoir area (ALFÖLDI, L. – KAPOLYI, L. 2007).

These interventions had an effect on the habitats, the flora and fauna, on the agriculture and on the *Lake Hévíz* as well. From the beginning of the 1990s, different measures were made to release the harmful effects. The mines were closed down and the extraction of karstic water was limited to satisfy the need of settlements for drinking water. As a result, the level of karstic water was restored (MÓGA, J. *et al.* 2014). Now the most important aims of the Lake Protection Programme are to secure the regeneration process of the lake, to reach the discharge of 550 l/s, the temperature of the medicinal lake to be not lower than 28°C, the sulphide content should reach 2,500 mg/l and to inhibit the spread of invasive species (plants, animals) *(Lake Protection Program of Lake Hévíz, Preparatory Study)*[28].

[28] BALATONI INTEGRÁCIÓS ÉS FEJLESZTÉSI ÜGYNÖKSÉG KHT. – VITUKI KÖRNYEZETVÉDELMI ÉS VÍZGAZDÁLKODÁSI KUTATÓ INTÉZET KHT. – A MAGYAR ÁLLAMI FÖLDTANI INTÉZET KÖZREMŰKÖDÉSÉVEL (2007)

7.2. Other risks of the lake and its environment

Besides the past effects of mining, there are several other conditions which threaten or can influence the lake and its environment. These include:

- Drying wetland area as a result of the lack of precipitation and the improper interventions into the groundwater system;
- Harmful anthropogenic interventions, illegal water extractions (illegal karstic wells, water extraction of the spas and wellness centres, mineral water extraction);
- Constructions resulting in the covering of the surface around the lake;
- The increased extraction of karstic and thermal waters as a result of the developments of *Transdanubian thermal spas*;
- The land use and the growing urban areas are threatening the ecological system of the lake and its surrounding;
- The settling and spreading of non-native species is another risk factor;
- Tourism threatens the species;
- The growing health-tourism in the area means a threat on the lake and the surrounding wetland. *(Lake Protection Program of Lake Hévíz, Preparatory Study)*[29]

7.3. Natural hazards caused by increased traffic

The quality therapies and the additional tourism services attract a huge foreign and domestic clientele resulting in the increase in traffic exposing the spa towns to a great environmental burden and in several cases endangering the natural resources. The bus station at the entrance of *Lake Hévíz* causes significant environmental and aesthetic problems, so it is one of *Hévíz*'s biggest environmental problems. The bus station contributes to a decrease in air quality, it is noisy and not an attractive scene

[29] Balatoni Integrációs és Fejlesztési Ügynökség kht. – Vituki Környezetvédelmi és Vízgazdálkodási Kutató Intézet kht. – A Magyar Állami Földtani Intézet Közreműködésével (2007)

Figure 4–5 – Environmentally dangerous street along the Lake Hévíz

Pictures photographed by KÖBLI, Á. (2014)

in the middle of a health resort. The only positive aspect of its location is that the elder visitors arriving by bus can easily reach the lake. In the recent years, several plans have been made on the relocation of the bus station and in 2013 a traffic concept was made which establishes the territories to be developed considering the needs of the whole region.

According to the plans the new bus station would be placed on the confines of the town, along the new bypass; thus decreasing the crowdedness of the town centre. The town plans new electric buses which would serve as a local bus and would connect the town centre with the *Hévíz–Balaton Airport*. The present location of the station could function as a public place; thus could be the home for diverse programs and the centre of social life for the local people and the visitors as well. Moreover, new green areas could be established, ameliorating the climate in the spa town.

From an environmental aspect, the *Ady Endre street* means a great problem as it goes straight along the lake, not more than 8–10 meters away from it *(Figure 4–5)*. This is very dangerous as the great traffic—both cars and buses—can easily pollute the water and also endangers the natural environment surrounding the lake. It would be very important to redeem this road or to decrease the rate of traffic.

8. Some ways toward a sustainable tourism in the region

8.1. Lake Protection Program

The protection of the local health/therapeutic factors and the long-term preservation of the environment is an outstanding task for all spa towns and should be placed before economic aims. To secure environmental sustainability in *Hévíz "The Lake Protection Program of Lake Hévíz"* (the aim was to protect the lake's ecosystem and the natural values and framing the aims ensuring both the qualitative and quantitative protection) and the relating law system was formed (HÉVÍZ VÁROS TERÜLETFEJLESZTÉSI KONCEPCIÓJA, 2015)[30].

[30] Hévíz Regional Development Concept 2015

The actions against activities decreasing the water level and against the pollution of surface and groundwater are of high priorities considering the preservation of the lake's condition.

Among the measures of the 'Lake Protection Program', the renovation of the monitoring system could be highlighted: the regular measurement of the lake's water output, temperature and the water level of the surrounding karst- and groundwater wells.

The quality of the spring water, originating from the spring craters of *Lake Hévíz*, greatly depends on the quality of water from the infiltration area. Therefore, the tasks of lake protection reach out from the administrative boundaries of the town, thus the settlements concerned should co-operate in order to execute the proper tasks. The long term protection of the lake's surroundings is also a high priority task. The *Lake Hévíz Nature Reserve* includes the lake itself and the surrounding swamp forest areas functioning as a protective buffer area. In the last decade, we have experienced a gradual decrease in the state of the forests. *"The most important element of nature protection rehabilitation is to be able to regulate the water balance of a territory in order to stop deterioration"* (HÉVÍZ VÁROS TERÜLETFEJLESZTÉSI KONCEPCIÓJA, 2015). In the territory of the *Nature Reserve*, a park may be established which would be suitable for leisure and recreation. This would supply a long-lasting need both for local people and for the tourists arriving into the town. All the same *Hévíz* and its territory have got favourable climatic conditions and the town is characterised by large green areas, parks and flowery streets. It is also favourable that 21% of the town is forest which plays an important role in the regulation of the local climatic conditions. That is why the expansion of these green areas, the rehabilitation of the extant ones and to fill them with different functions is so important.

8.2. Utilisation of renewable energy resources

In the recent years, there are more and more local, alternative solutions—based upon the unique characteristics of the Hungarian spa towns—to release the energy dependence. *"In the case of Hévíz a main aim is to lower the energy costs, to use renewable energy sources and to* *urge a gradual switch to the use of such resources"* (HÉVÍZ VÁROS TERÜLETFEJLESZTÉSI KONCEPCIÓJA, 2015). There is a great opportunity in the use of geothermal, wind and solar energy, as well as in the utilisation of flowing thermal waters in *Hévíz*. The co-operation with the *Pannon University of Keszthely*, a neighbouring town, could be an excellent help to execute the innovations regarding the use of renewable energy sources by which the region energetically could be increasingly independent.

Plans have been made for the utilisation of areas endangered by floods and inland waters, thus inadequate for agricultural purposes, as well. The special characteristics of these territories would be suitable for the cultivation of energy willow which favours the wet environment. But, this would have more negative results than profit. Wetland areas are ecologically very fragile territories, they are under general protection as biodiversity is thriving in these areas. The flora has a great role in the cleaning of water percolating into lower layers. If this diverse biome would be destroyed and cultivated with a monoculture of energy willow, then it would cause a severe damage to the natural environment of the region. One of the most spectacular innovations in *Hévíz* is the staircase *(Figure 6–7)* heated by the thermal water, flowing from the hotels, during wintertime.

This was the own investment of the town's government. *"The 30°C thermal water from the pools of hotels is conducted through two thick tubes, under the almost 70 m long staircase (bridging a height difference of 11 m). New handrails, ramps and LED lamps were placed along the staircase as well, thus decreasing light pollution"* (PAPP, G. 2013). The town is planning to renovate more staircases as there are many rheumatic and other patients with locomotor diseases, thus accessibility is of great importance.

Thanks to these projects, an elegant, healthy, intimate townscape and environment can be formed which would be able to attract tourists itself.

Figure 6–7 – Staircase heated with hot water in Hévíz
Pictures photographed by KÖBLI, Á. (2014)

8.3. Organising a sustainable agricultural system

When it comes to catering connected with health tourism, quality gastronomy should play a great role. The visitors can eat healthy foods contributing to their recovery. The hotels and restaurants offer foods from fresh, raw materials from bio farms provided by local farmers. Eco-farms are more resilient and can easily adapt to seasonal and other demands, they are able to offer unique services, produce quality goods with law ecological burden and secure fresh, healthy foods for the guests.

There are several hotels and restaurants which import their foodstuff in large quantities. In the respect of sustainability, these materials should originate from local entrepreneurs. Certainly, there are some of which cannot be produced locally, but producers should aim to purchase goods from nearby merchants in the region or county. The most ideal situation would be whether the special goods would originate from *Fair Trade* commerce. Although, the prices of these products are higher, it would contain the costs of a fair wage, trade and environmental burden, but at the same time they would be unique products such as coffee, tea, chocolate, spices and hand crafts of faraway places and in addition more and more guests search for *Fair Trade* products. The marketing of such products together with local ones is the best solution as they are complementary supplies. Tourism is only able to change the economy and society of a given region positively, if it is able to integrate more and more local stakeholder into the economic processes. It is important to invest a part of the incomes of hotels into the local economy, thus the region could be developed efficiently. Hotels shop in bulk, saving the costs of transportation, packing and custom fees, can have a more direct relationship with the farmers which makes purchasing more efficient.

There is a growing need for healthy and quality foodstuffs for the hotels and restaurants to rely completely on local economy. Therefore, it is important to establish a sustainable, local agricultural system. *"The sustainable agricultural systems are such complex systems which besides plant cultivation, animal husbandry, forestry, wildlife management and fishery include the half-processing of these, the tasks of some settlement types and the employment of rural population, the subsistence of local communities and their traditions, the environmental protection and tourism of the regions"* (HAJNAL, K. 2010). *Hévíz* has got very favourable physical–ecological conditions; there are large natural or nearly-natural areas/habitats and traditionally cultivated landscapes. The lands of this area are suitable for the establishment of sustainable agriculture as they have a great agricultural potential. Such lands include the not utilised outskirts and the uneconomically used lands as well. Although, *Hévíz* has got only a few outskirts, the borders of the nearby settlements *(Alsópáhok, Felsőpáhok)* reach almost to the inner areas. But the microregion has got adequate areas; therefore, it is very urgent to reshape the local agricultural system to a sustainable one within the frames of micro-regional co-operation.

They were profitable as there would be a great demand and market thanks to the proximity of *Lake Balaton* and *Hévíz*, they would have enough income and so could further develop other sectors as well. The hotels could support the development of local economy; they would be able to deal with them so their offer would be better with organic products. As the tourism supply of *Hévíz* is based on natural resources, the environmental protection is a key issue and the protection against the contamination of surface and groundwater as well.

Since organic farming do not use chemicals and/or only fair ones in a minimal amount, they aim to increase biological diversity where environmental and nature protection are the part of it. *"Their basic aim is to keep the natural environment, to protect natural values with the integration of a reasonable profitability. These farms, agricultural areas were developed within the territory of nature protection areas, near endangered water tables or other substantial natural values and the preservation or regeneration of the quality of a given region within the frames of their production structure is of significant importance"* (KOVÁCS, G. 2008).

The best solution would be—both in short and long-term—to reshape the agricultural system of the *Hévíz micro-region* into qualified (IFOAM, Biokontroll Hungary) organic farms. The local governments have got the responsibilities to organise the tasks and to ensure subsidies.

9. Conclusion

In *Hévíz*, the lake, the therapeutic treatments and the programs of the wellness hotels attract tourists and patients all over the year, thus the environmental impact is continuous which results an increase in traffic, exposing the spa town to a great environmental burden and in several cases endangering the natural resources. The bus station at the entrance of the *Lake Spa* causes significant environmental and aesthetic problems, so several plans have been made regarding the relocation of the bus station and the town also plans new electric buses which would serve as local buses and would connect the town centre with the *Hévíz-Balaton Airport*.

As the whole economy of the *Hévíz region* is based on tourism therefore, any change in the condition (water level, temperature and chemical composition) of the lake has a great impact on it. Thus, to handle tourism development strategies and to protect the environment—

which aim to protect the rare and precious sources like water and energy and to minimise waste production—are the main tasks of the national, regional and local authorities.

The effects of bauxite mining in the *Nyirád* region from the 1960s exemplify the sensibility of the *Lake Hévíz*. The continuous mine water extraction caused the springs, riverbeds and karstic wetlands to dry out and the decreased pressure caused by the depressive area of *Nyirád* the groundwater balance was changed as well. Finally in the 1990s the mines were closed down and the extraction of karstic water was limited to satisfy the need of settlements for drinking water. As a result the level of karstic water was restored. To secure environmental sustainability in *Hévíz* and the regeneration of the lake the so called 'Lake Protection Program of Lake Hévíz' was worked out in 2007.

Hévíz and its surroundings have also got very favourable natural–ecological conditions; there are large natural or nearly-natural areas/habitats and traditionally cultivated lands which are suitable for the establishment of sustainable agriculture. Besides these, the micro-region has got adequate areas as well; therefore, it is very urgent to reshape the local agricultural system to a sustainable one within the frames of micro-regional co-operation.

There is a great opportunity in the use of geothermal, wind and solar energy, as well as in the utilisation of flowing thermal waters. The co-operation with the *Pannon University* could be an excellent help to execute the innovations regarding the use of renewable energy sources by which the region energetically could be more independent.

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ISSN 2052-0018 (print), ISSN 2053-3667 (online)
Geographical Locality Studies 2015 Volume 3, Number 1. pp. 668–689

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Affordability and Energy Consumption: A Study on Zero Carbon New Built Homes in the United Kingdom

Abstract

The need for sustainable development, the near zero tolerance to carbon emissions and rise in global house prices, have necessitated the provision of affordable and energy efficient housing projects by governments in most developed countries. In the United Kingdom, the same is true as almost half the total amount of carbon dioxide emissions is building-related, with housing contributing about 27% of the overall emissions. This paper demonstrates the role early building performance and cost evaluation could play in delivering affordable and energy efficient homes through evaluation of housing typologies against the UK policy set benchmark for assessing new built and zero carbon housing. Extensive reviews of various methods and techniques have been followed for pre-design evaluation, building performance simulation and cost estimation. The paper concludes by recommending guidelines for future studies on delivering affordable and reducing energy consumption in the new built homes.

Key words

Zero Carbon Home, Sustainable Housing, Energy Efficiency, Affordable Housing, Cost Analysis

1. Introduction

Over the past two decades, issues of climate change—as it relates to impacts of natural resource developments—has formed the overarching themes of academic and international discourse. As a result, international agencies and national governments have led the advocacy for sustainable development, as a key component to transforming the built environment. So far, many solutions to the challenges of global energy crises have been proposed and applied in recent years, including the provision of energy efficient housing projects by governments in most developed countries. In the *United Kingdom* (UK) the same is true as over 65% of *Global Greenhouse Gas* (GHG) emissions are energy generated (WILLIAMS, J. 2012), with about 64% of annual energy consumption by the building sector generated in houses (NICHOLLS, R. 2002). This assertion was buttressed by the INNOVATION UK (2009), who maintained that almost half the total amount of carbon-dioxide (CO_2) emissions, is building-related with housing contributing approximately 27% of CO_2 emissions.

COMMUNITIES AND LOCAL GOVERNMENT (CLG, 2006) report shows an average UK household emission of about 1.54 tonnes of carbon per annum. This has prompted government-led campaign on decarbonising the housing sector through the ambitious set target of affordable, zero carbon new-built housing delivery by 2016. In this regard, the housing industry is tasked with the erection of 120,000 private homes and 26,000 social homes per year to meet the housing supply of 200,000 units per year in England by 2016, which will account for about 30% of the housing stock by 2050 (BANFILL, P. – PEACOCK, A. 2007; RYDIN, Y. 2007; OSMANI, M. – O'REILLY, A. 2009; MCMANUS, A. 2010). This shows the proposed and expected contribution of the housing industry to the overall carbon emissions reduction by 2050 from the 1990 levels.

Surprisingly, the housing sector that seems to emit considerable amount of CO_2 among other sectors in the UK has been identified by the government as a solution to tackle energy crises and climate change at large. Back in 2004, UK government’s affordable new built homes programme set at sixty thousand pounds (£60,000) target, challenged the home builders to device measures aimed at building high standard energy efficient homes irrespective of the 'still-developing' renewable energy technologies which are supposed to be integrated in the building design (for example OSMANI, M. – O'REILLY, A. 2009). Following this, the housing developers are enjoined to deliver homes with set of standards that will consequently lead to a significant increase in cost of housing delivery (MCMANUS, A. 2010). Therefore, urgent need arises for the house building industry to align themselves with government plans by welcoming, implementing and proffering solutions to building energy efficient homes with low carbon emissions.

According to ENERGY EFFICIENCY NEWS (2010), the UK government proposed that 15% of its energy demand would be sourced from renewables by 2020, with interim targets of 4% from 2008 to 2012, and 7.5% from 2015 to 2016. However, based on the third quarter of the 2011 statistical report of the Department of Energy and Climate Change (DECC, 2011), renewable energy currently accounts for 9% of total electricity production. Although the utilisation of energy efficient heating and renewable system can lead to low energy homes (WANG, L. – GWILLIAM, J. – JONES, P. 2009), lack of financial data analysis, together with excessive energy efficiency policies linked with the construction of zero carbon homes may hinder the accomplishment of the carbon reduction target through the housing sector (OSMANI, M. – O'REILLY, A. 2009).

2. Aims of the study

The study aims to investigate the possibility of achieving an affordable and zero carbon home, through early design evaluations using demonstration houses that are currently being built at *Barnsley College*, *Honeywell* site in *South Yorkshire*, UK. The researcher questions whether zero carbon truly means zero energy? There are two major objectives in carrying out this study: one is to discover the impact integration of renewable energy sources and energy efficient design measures could make in overall building cost and energy consumption in housing; and the other is to investigate the annual energy consumption and the exact CO_2 emission savings the newly built homes are expected to deliver. In so doing, it is intended that these could help understand the benefits of pre-design evaluation for the *Barnsley College*, and the society at large. The study adopted both analytical case study approach using the *Dynamic Simulation Modelling* (DSM) for energy performance analysis and the *Building Cost Information Services* (BCIS) for cost analysis. Despite evidence of limited studies on pre-design evaluation with regard to energy performance and base build cost of the proposed new dwelling, the new built homes were assessed using code for sustainable homes and building regulations standards. The code for sustainable homes is the national standard for the sustainable design and construction of new homes, which aims to reduce carbon emissions and promote higher standards of sustainable design above the current minimum standards set out by the building regulations (CLG, 2006). Also, this will further produce cost effective and more energy efficient designs.

3. Case study

The case study project, *Barnsley College Demonstration Houses*, proposed to be on site at *Barnsley College* in *Barnsley Metropolitan Borough* at the north of the city of *Sheffield* in *South Yorkshire* (UK). According to *Jefferson Sheard Architects* (JSA, 2011), it comprises of 10 demonstration houses to be sited close to the *Barnsley College Sustainable Construction and Renewable Energy Centre* north of the Honeywell site which is well connected by public transport as shown in *Figure 1*. It is also of walking distance from the main campus at *Old Mill Lane*, the town centre and shopping areas.

The proposed *Barnsley College Demonstration Houses* have been selected as a case study for this paper for the following reasons:

- The proposal is in line with the UK government's proposed zero carbon homes by 2016.
- The design proposal is at stage D approval and appears to be the best time for early design evaluation for energy consumption check and base build cost.
- The proposed building units are intended to be sold as private houses, which make it paramount for affordability check.

- This study outcome may lead to cost and carbon savings of the proposed project.

Figure 1 – Artist Perspective view of The Barnsley College Demonstration Houses
Source: JSA (2011)

These sustainable homes are intended to serve as a tool for practical knowledge, in addition to the theoretical background of environmental technologies the *Sustainable Construction and Renewable Energy Centre* is expected to deliver. In the same way, they are expected to benefit the housing sector at large that is currently challenged with the delivery of affordable and energy efficient homes. The demonstration houses were constructed with various techniques of housing development eras ranging from the Pre 1900 Victoria end terrace *(Plot 1)* to 2016 Code level 6 house *(Plot 10)*. For the researcher to remain focused on the goal of achieving zero carbon homes through early design evaluations, the following plots were selected for evaluation and comparative study:

- *Plot 6* of 1970s Modern timber frame house
- *Plot 7* of 1990s Building regulations standard baseline house

- *Plot 8* of Code level 4 house
- *Plot 9* of Code level 5 house
- *Plot 10* of Code level 6 house.

This is to draw a comparative study of the cost and energy performance of the proposed 1970s and 1990s houses, representing the typical UK homes and the recent code level houses designed to meet criteria set out by the code for sustainable homes (CLG, 2010). On the next pages, *Table 1a–1b* detail the design requirements and specifications for both the typical UK houses and the code level houses.

Table 1a – Design specifications for the typical UK houses and the code level houses

*Source: Jefferson Sheard Architects (JSA, 2011) *see units below Table 1b*

	Typical UK houses	
Code level Target/ BREEAM Aspiration	**Plot 6 1970s Timber frame**	**Plot 7 1990s Building regs.**
Improvement in CO_2 emissions	60% Improvement	40% Improvement
GIA (m^2)	85	75
Floor to Floor Height	2,600	2,660
External Walls	0.18 W/m^2K	0.1 W/m^2K
Wall Thickness	265 mm	315 mm
Internal Walls	Timber stud	Timber stud
Windows	Double glazed	Double glazed
Doors	Double glazed	Double glazed
Ground Floor	0.18 W/m^2K	0.18 W/m^2K
Upper Floors	Suspended timber joists system	Suspended timber joists system
Roof	0.18 W/m^2K	0.1 W/m^2K
Renewable energy sources	2 kW PV (photovoltaic) Panels	4 m^2 Solar Thermal

Units: kW: Kilowatt; kWh: Kilowatt-hour and W/m^2K: Watts per square metre per degree Kelvin (U Value).

Abbreviations: GIA: Gross internal area; DER: Dwelling Emission Rate and TER: Target Emission Rate.

Table 1b – Design specifications for the typical UK houses and the code level houses.

Source: Jefferson Sheard Architects (JSA, 2011).

	Code level houses		
Code level Target/ BREEAM Aspiration	**Plot 8 Code level 4**	**Plot 9 Code level 5**	**Plot 10 Code level 6**
Improvement in CO_2 emissions	≥ 25% Improvement 2010 DER/TER	≥ 100% Improvement 2010 DER/TER	Zero Net CO_2 Emissions
GIA (m^2)	76	138	138
Floor to Floor Height	2,600	2,550	2,550
External Walls	0.18 W/m^2K	0.1 W/m^2K	0.1 W/m^2K
Wall Thickness	335 mm	330 mm	225 mm
Internal Walls	Timber frame Partitions	Timber frame Partitions	Timber frame Partitions
Windows	1.0 W/m^2K	0.7 W/m^2K	0.7 W/m^2K
Doors	1.0 W/m^2K	0.7 W/m^2K	0.7 W/m^2K
Ground Floor	0.18 W/m^2K	0.18 W/m^2K	0.18 W/m^2K
Upper Floors	Suspended timber Joists system	Suspended timber Joists system	Suspended timber Joists system
Roof	0.18 W/m^2K	0.1 W/m^2K	0.1 W/m^2K
Renewable energy sources	Mechanical Ventilation and Heat Recovery (MVHR), 3 kW PV Panels	Biomass Boiler, MVHR, 4 kW PV Panels, Rainwater Harvesting	Biomass Boiler, MVHR, 7.5 kW PV Panels, Rainwater Harvesting

Units: kW: Kilowatt; kWh: Kilowatt-hour and W/m^2K: Watts per square metre per degree Kelvin (U Value).

Abbreviations: GIA: Gross internal area; DER: Dwelling Emission Rate and TER: Target Emission Rate.

3.1. Typical UK houses (Plot 6 and 7)

This is a semi-detached building consisting of two bedrooms each. *Plot 6*, a typical 1970s house designed, utilising timber frame construction with a combination of brickwork and timber boarding. However, this was upgraded with insulation added to cavity, plasterboard and skim paint finish. While *Plot 7* was proposed following the 1990s building regulation standards for fabric heat loss, insulation levels and U-values for building elements. Designed as a late 20th century building using cavity wall construction with brick or stone outer leaf, cavity insulation and a lightweight concrete block inner leaf.

3.2. Code level houses (Plot 8, 9 and 10)

The brief for *Plot 8*, *9* and *10* is to provide new-built houses that meet future targets for reduced carbon emissions and the demand for higher environmental standards as detailed in the code for sustainable homes. The proposed building designs appear to be influenced by the *Building Research Establishment (BRE)* consultants that recommended lightweight construction designs using *Structural Insulated Panels (SIP)* construction for Code levels 5 and 6 in order to achieve the desired airtightness. Furthermore, the college desired a 'volumetric' design (prefabricated modular construction) for Code level 6. The Code levels 4 and 5 is a semi-detached two and three bedrooms house respectively, while the Code level 6 is a three bedroom detached house.

4. Methodology

The study adopted both fieldwork approach of primary data collection using analytical case study methodology to capture complexity of a single case and desktop study approach of secondary data in form of stage D report obtained from *Jefferson Sheard Architects*. For early design evaluation and analysis of the case study buildings, the *DesignBuilder* software has been used for building energy modelling and per formance analysis (DESIGNBUILDER, 2012).

The *DesignBuilder* software with its built-in *EnergyPlus* thermal engine and simplified *Building Energy Modelling (SBEM)* of result output as well as its recognition of Part L 2006, building regulations on fuel and energy consumption, was selected as a DSM option. Furthermore, to check affordability of the case study design, BCIS (2012) online, early design cost estimator has been used instead of manual calculations. This is believed to be more reliable and a preferred standard for building cost assessment in the UK.

4.1. Building modelling and simulation

The *EnergyPlus* simulation engine was chosen in the modelling options within the *DesignBuilder* software. The *Sheffield* weather file was used as the closest to the *Barnsley* location. The buildings were modelled observing the orientation and precisely following the architectural drawings and specifications provided by *Jefferson Sheard Architects*. The plots were modelled and zoned as separate plots although they are semi-detached buildings, as shown in *Figure 2*.

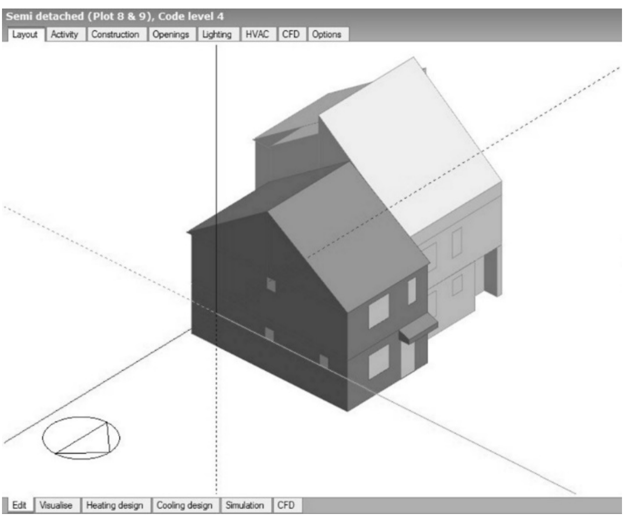

Figure 2 – Building simulation modelling using DesignBuilder software.
Designed by D*ARA*, *C. (2015)*

This is to enable easy simulation of individual plots and simplified data analysis of the annual energy consumption, and CO_2 emissions produced. The various activities, construction, openings, lighting and HVAC system were carefully entered. The model was then simulated. This process was followed for all different plots.

4.2. Building cost analysis

Similarly, the BCIS online building base cost was used to calculate the cost of the houses (Plots). Firstly, the study type which is cost per square metre (£/m^2) was chosen. Newly built, residential and semi-detached estate housing was selected. This was then rebased to the *Barnsley* location, index 94 from *Yorkshire* and *Humberside* counties. It was further calculated and the result of various semi-detached houses, designed in different years with *Barnsley* rebased cost displayed. The building type and storey height were considered during the selection to enable a relatively close amount for the study buildings. The affordable homes at *Station road* appear to be most suitable when checked against other currently matching analysis. Therefore, this was chosen for all semi-detached houses both typical *(Plots 6 and 7)* and the Code levels 4 and 5 homes to promote quality research outcome. Moreover, the typical homes were designed to be energy efficient. The exact base cost of the housing type was used as a benchmark for calculating the cost per square metre of semi-detached houses and the cost of renewable technologies provided by approved suppliers. Again, this was carried out for the *Plot 10*—Code level 6 detached house, following the aforementioned procedure for the semi-detached house. In the same way, a close match project was chosen and the cost per square metre used to estimate the base build cost for Code level 6.

5. Analysis and results

The author believes that an early design evaluation will help building design professionals in the UK understand the cost implications and actual energy performance of the newly built dwellings which were rated using the 'code for sustainable homes' and 'building regulations' standards. The base build cost and annual energy consumptions of *Barnsley College* demonstration houses have been analysed to prove affordability and energy efficiency of newly built houses through a comparative study of the 1970s modern timber frame house to Code Level 6 (zero carbon) house. The findings were evaluated as a case study, which utilised different software for precise modelling and critical analysis. For the building energy performance simulation results, the computer models were simulated from 1st January to 31st December to generate annual energy consumption and CO_2 emissions rate. Finally, a comparative study of research outcomes were discussed. The inferential method of analysis that engages the comparison of results were used to further orchestrate some points.

5.1. Analysis of typical UK houses (Plots 6 and 7)

In the simulation modelling of the 1970s (Plot 6) typical house, the overall building energy demand from heating, lighting and hot water system were evaluated. However, the heating were calculated using gas, as the integrated PV panels output cannot cover for the heating system required in winter season. Following the analysis, the annual fuel breakdown gives an electricity of 2,108.67 kW, 5,283.30 kWh of gas and a total energy consumption of 7,391.97 kWh. In addition, the energy demand of heating, lighting and other activities were calculated with heat generation contributing about 71.47% of the total energy consumption. Recall, that the building is expected to meet 60% improvement in CO_2 emissions, in this regards the CO_2 emission produced was calculated and this amounts to 2,474.68 kg. The 1990s (Plot 7) typical house, energy performance simulation considered a 4 m^2 solar thermal system integrated for hot water generation. The system output in kilowatt hour will be deducted from the annual energy consumption. In addition, the plot was designed to meet 40% improvement in CO_2 emissions. The result of the analysis gives the annual fuel breakdown with electricity consumption of 2,095.58 kWh and a gas contribution of 6,993.12 kWh. Thus, the total energy consumed amounts to 9,088.70 kWh. Again, heat generation contributed about 76.94% of the total energy consumption. Furthermore, CO_2 emissions produced amount to 2,756.99 kg.

The 1970s and 1990s base cost calculation for a 2 storey semi-detached affordable home rebased to Barnsley location is about £605.31/m^2 (BCIS, 2012). However, 2% was added to the building cost to accommodate inflation as the sample building was designed in 2010. Further, the cost of installing the renewable energy features are considered (ENVIKO, 2012; EST, 2012). The building base cost for *Plot 6* (1970s) amounts to £57,613.71, and *Plot 7* (1990s) calculated to be £49,768.22.

5.2. Code Level Houses Analysis (Plots 8, 9 and 10)

For Code level 4 house *(Plot 8)*, energy performance simulation considered a design with thin bed masonry construction fitted with MVHR and 3 kW PV panels. In addition, to meet the environmental factor improvement set in 2010 Part L1A building regulations, it is estimated to perform ≥25% improvement of the *Dwelling Emissions Rate* (DER) over *Target Emissions Rate* (TER). For the Code level 4 house, the result of the building simulation displays electricity consumption of 2,917.25 kWh and 7,779.17 kWh of gas respectively per annum; therefore, the total energy consumed amounts to 10,696.42 kWh. For Code level 5 house *(Plot 9)*, energy performance simulation considered a design using SIP panel construction, fitted with MVHR, 4 kW PV panels and biomass boiler for heating. Rainwater harvester was used to recycle grey water. In addition, it is estimated to perform 100% improvement of DER over TER. The result of the analysis gives the annual fuel breakdown of 9,568.65 kWh for electricity consumption and the remaining 5,331.44 kWh from renewable source. Thus, total energy consumption stood at 9,568.65 kWh.

For Code level 6 house *(Plot 10)*, energy performance simulation considered a design using volumetric construction, fitted with MVHR, 7.5 kW PV panels and biomass boiler for heating. Rainwater harvester was also used to recycle grey water. Recall that plot 10 is estimated to have zero net CO_2 emissions. Following the analysis for the annual fuel breakdown, electricity consumption accounts for 9,652.28 kWh and the remaining 6,544.32 kWh from renewable source. Given this, the total energy consumption is 9,652.28 kWh. Heating contributes about 72.73% of the total energy consumption for code level 4 house. For code level 5 system misc. contributes 45.01% followed by 35.78% from heating. In addition, system misc. contributes 41.41% followed by 40.41% from heating for code level 6. Similarly, the CO_2 emissions output was calculated to be 3,515.26 kg, 10,220.26 kg, 11,094.60 kg for code level 4, 5 and 6 respectively. It is believed that heating with biomass boiler for code level 5 and 6 increased the CO_2 emissions output.

For Code level houses building base cost analysis (*Plots 8*, *9* and *10*), the same building cost estimation for the typical UK houses have been applied for the code level 4 and 5 as semi-detached houses. However, a sample project, detached 2 storey newly built house together with external works were used to calculate the cost per square metre for *Plot 10* (code level 6 house). This sample project was designed in 2010 at *St. Peter*, *Jersey*, and also rebased to *Barnsley* location (index 94). The cost of installing a compact loft mounted MVHR unit with super-efficient DC motors for extremely quiet running, maximum product life with minimal running costs (SOLARCREST, 2011), cost of installing biomass boiler inclusive of 5% VAT (EST, 2012), and the cost of rainwater harvesting system including installation cost (ENVIKO, 2012) were added to the respective plots to calculate the building base cost (see *Table 1a–1b* for details). Subsequent to that, the following were deduced:

1) The building base cost for *Plot 8*—Code Level 4 estimated to be £55,481.63
2) The building base cost for *Plot 9*—Code level 5 calculated to be £111,988.11
3) The building base cost for *Plot 10*—Code level 6 costs £137,685.67.

6. Discussion and comparison

Through the findings above, achieving affordable and energy efficient new builds in the UK might depend on the integration of renewable technologies. It clearly shows that zero carbon homes might not be zero energy homes with the *Plot 10* (Code level 6 house). To report the actual annual energy consumption, the electricity output produced by the renewable sources will be deducted from the modelled energy consumed as this was not calculated in the computer simulation.

The *European Commission* (JRC, 2010) website on estimating the performance of PV panels based on their geographical locations was used to calculate the solar electricity generated by the PV panels. A 2 kW crystalline silicon photovoltaic panel adjusted to the *Barnsley* location will produce about 1580 kWh electricity per annum. This excludes estimated percentage losses due to temperature, cables, angle of reflectance effects and others. Again, the 3 kWh, 4 kWh and 7.5 kWh PV panels used for code levels 4, 5 and 6 respectively were calculated using the same estimation method. The solar electricity outputs include: 2,380 kWh, 3,170 kWh and 5,940 kWh respectively. In addition, the usable free energy yield per annum, generated by using 4 m^2 evacuated tube solar thermal collector system, (ENVIKO, 2012) was also calculated. Similarly, the energy consumption generated due to the use of biomass boiler in code levels 5 and 6 were further deducted as it is considered as non-fossil fuel. Thus, the actual annual energy consumption for various plots calculated and tabulated in *Table 2*. In addition, the dwellings fabric energy efficiency were calculated.

The results on energy consumption figures are positive as all plots performed above the benchmarked annual energy demands of the typical UK household of 3,300 kWh of electricity and 16,500 kWh of gas (OFGEM, 2011). Furthermore, the code level 5 almost met the estimated dwelling *Fabric Energy Efficiency Standards (FEES)* with a difference in 0.37 kWh/m^2/yr.

Table 2 – Comparative assessment of the plots' energy consumption.
Source: Author's synthesis

	Plot 6 1970s Timber Frame	**Plot 7 1990s Building Regs.**	**Plot 8 Code Level 4**	**Plot 9 Code Level 5**	**Plot 10 Code Level 6**
GIA (m^2)	85	75	76	138	138
Modelled Electricity (kWh)	2,108.67	2,095.58	2,917.25	9,568.65	9,652.28
PV Panel (kWh/yr)	*1,580*	-	*2,380*	*3,170*	*5,940*
Solar Thermal (kWh/yr)	-	*1,800*	-	-	-
Electricity Consumption(kWh)	528.67	295.58	537.25	6,398.65	3,712.28
Gas consumption (kWh)	5,283.30	6,993.12	7,779.17	-	-
Annual Energy Consumption (kWh)	**5,811.97**	**7,288.70**	**8,316.42**	**6,398.65**	**3,712.28**
Dwelling FEE= kWh/m²/yr	**68.38**	**97.18**	**109.43**	**46.37**	**26.90**

*FEE: Fabric Energy Efficiency

The code level 6 house dwelling Fabric Energy Efficiency (FEE)was below the estimated performance standard of 46 kWh/m²/yr for zero carbon homes, as stipulated by the *National House-Building Council (NHBC, 2009)* and the *Zero Carbon Hub* (ZCH, 2010). This can be attributed to the lightweight construction using the SIP suggested by BRE consultants to ensure fabric airtightness. Moreover, the use of biomass boiler for space heating reduced the annual energy demands as space heating accounts for about 53% of a typical UK home (CLG, 2006). The contrast is seen with the code level 4 house that used gas for heating which contributed about 72.73% of total annual energy consumption. Thus, giving the highest dwelling FEE of about 109.43 kWh/m²/yr.

To achieve the aim of the study, which is whether zero carbon homes can be actualised in the UK, the modelled CO_2 emissions rates as well as the *Dwelling Emission Rate* (DER) and the *Target Emission Rate* (TER) of all plots were calculated. The kWh generated using PV panels, was converted to $kgCO_2$ to determine the actual CO_2 savings. To convert kWh to kg of carbon saved based on the current guidelines provided by the *Department of Energy and Climate Change* (DECC, 2011). The conversion factor adopted was 0.542 kg CO_2 saved for each kWh produced from a carbon free source. The factor is based on the carbon emissions generated by the current UK power stations per kWh generated. A 4 m^2 evacuated tube solar thermal collector will save about 350 kg of CO_2 emissions per annum (ENVIKO, 2012). In addition, wood pellet biomass boiler is expected to save about 7,500 kg of CO_2 emissions per annum (EST, 2012). Following the same method, used to calculate for annual energy consumption, the carbon savings made from the use of renewable sources was deducted from the modelled CO_2 emissions output as illustrated in *Table 3*. Thus, determining the actual CO_2 emissions in kg CO_2/yr.

Result of *Table 3* shows that code level 6 house emits only 0.38 tonnes of CO_2, while code level 5 emits approximately 1.00 tonnes. These are below the 1.54 tonnes average UK household emissions rate per annum (CLG, 2006). From all indications, although the modelled CO_2 generated shows more emission for code levels 5 and 6, when the biomass carbon savings were deducted, it dropped leaving the code level 4 with the highest emissions rate of all plots. This could be attributed to the Mechanical Ventilation and Heat Recovery (MVHR) system used. In addition, when this was compared to the 1970s timber frame house which emits about 1.62 tonnes, slightly higher than average UK household emissions, it shows that the typical UK house *(Plot 6)* emits less than the code level 4 house *(Plot 8)*.

The results of the *Building Cost Information Service* (BCIS) online analysis on build base cost to prove the project affordability, the 1970s timber frame, the 1990s building regulations standard and the Code level 4 houses cost were below the UK set target of £60,000 for newly built homes.

Table 3 – Comparative assessment of the plots' CO_2 emissions rate
Source: Author's synthesis

	Plot 6 1970s Timber Frame	**Plot 7 1990s Building Regs.**	**Plot 8 Code Level 4**	**Plot 9 Code Level 5**	**Plot 10 Code Level 6**
GIA (m^2)	85	75	76	138	138
Modelled CO_2 Emissions ($kgCO_2/yr$)	2,474.68	2,756.99	3,515.26	10,220.26	11,094.60
PV kWh to kg = kWh x 0.542	856.36	-	1,289.96	1,718.14	3,219.48
Solar Thermal (kg)	-	350	-	-	-
Biomass (kg)	-	-	-	7,500	7,500
Actual kg CO_2/yr	**1,618.32**	**2,406.99**	**2,225.30**	**1,002.12**	**375.12**
CO_2 Emissions in Tonnes ~	1.62	2.41	2.23	1.00	0.38
DER (kgCO2/m2/yr)	**19.04**	**32.09**	**29.28**	**7.26**	**2.72**
TER= DER x 0.75	**14.28**	**24.07**	**21.96**	**5.45**	**2.04**

To calculate the DER, which is measured in $kgCO_2/m^2/yr$. we have

$$\text{DER} = \frac{\text{Modelled } CO_2 \text{ emissions}}{\text{given Gross Internal Area}}$$

The annual fuel running cost *(Table 4)* for the households was calculated with the typical British, 1970s timber frame building *(Plot 6)* showing lowest running cost, and the code level 5 home as the highest in cost. This was done following the typical prices for bulk purchase of fuels at domestic or small commercial scale; 14.5 p/kWh for electricity and 4.8 p/kWh for natural gas (BIOMASS ENERGY CENTRE, 2012).

Table 4 – Comparative assessment of the plots' cost analysis
Source: Author's synthesis

Type of cost (in GBP)	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10
	1970s Timber Frame	**1990s Building Regs.**	**Code Level 4**	**Code Level 5**	**Code Level 6**
Build Base	**57,613.71**	**49,768.23**	**55,48.63**	**111,988.11**	**137, 685.67**
Electricity	76.66	42.86	77.90	927.80	538.28
Cost of gas	253.60	335.67	373.40	-	-
Annual Fuel Running	**330.26**	**378.53**	**451.30**	**927.80**	**538.28**

7. Conclusions

The paper describes the standards and procedures for evaluation that should be adopted for most reliable results to architects, building professionals, impact assessors, clients and established government bodies in the UK. The study followed an extensive review of various methods and techniques for pre-design evaluation, building performance simulation and cost estimation with the intention to draw a comparative study of the cost and energy performance of the proposed 1970s and 1990s houses and the recent code level houses designed to meet criteria set out by the 'Code for Sustainable Homes'. However, this was achieved by evaluating a case study of housing typologies project against the UK policy set benchmark for assessing new built and zero carbon housing. The findings do not only show the annual energy performance and base build cost of the plots, but also present a clearer picture of the exact cost of energy efficient measures and their impact on achieving the zero carbon homes, which would enable government and housing sector at large to get more focused on achieving the set target. Moreover, this would be of immense help to the *Barnsley College* that intends to use the project as a case study project to be monitored all through its life cycle.

Following the findings, achieving fabric energy efficiency of newly built homes depends significantly on walling, insulation and other construction materials used which further improve airtightness. The set energy efficiency standard of 46 kWh/m^2/yr for both semi-detached and detached homes was used to evaluate the result findings. The performance of the 1970s timber frame house of 68.58 kWh/m^2/yr could be attributed to the upgrading made on the cavity insulation. It is important to note that from the study, although the 'Code for Sustainable Homes' appears to be the most efficient tool in assessing the environmental performance of newly built homes, it cannot in all ascertain the actual energy performance and emissions rate of the investigated projects. This is seen with the code level 4 house with dwelling fabric energy efficiency of about 109.43 kWh/m^2/yr. On the other hand, the code level 5 met the set standard while code level 6 was over 40% better in fabric energy efficiency. It is suggested to the lightweight construction method adopted in design. Also, the utilisation of biomass boiler for space heating played an important role as heating contributes over 58% of average UK household energy demand Communities and Local Government (CLG, 2006).

The results of the study turned positive for code level 5 *(Plot 9)*, code level 6 *(Plot 10)* and the 1970s *(Plot 6)* timber frame houses based on energy efficiency. While the code level 4 *(Plot 8)* and the 1990s *(Plot 7)* building regulation baseline house seems to have performed below standard. The results of analysis of plots when compared with a typical UK household emissions rate of 1.54 tonnes per annum, the code levels 5 and 6 also met their set target of CO_2 emissions rate. Moreover, the 1970s house was slightly higher than the typical British household leaving the 1990s with the highest emissions rate of 2.41 tonnes per annum. On the other hand, this study has proved that zero carbon homes do not in all mean zero energy. Furthermore, the analysis of the plots cost to prove their affordability, showed that three out of five studied beat the UK set target of £60,000, with fuel running cost of below £500 per annum. It can be concluded that the study was positive as most project proved affordable and energy efficient with controllable emissions rate;

although, there were some differences in meeting set standards. The study results further show that achieving zero carbon homes does not totally depend either on meeting the criteria of energy and CO_2 emissions in the *Code for Sustainable Homes* or the SAP building assessments using the Part L Building Regulations as the case may be. However, the actual performance can vary in real times and this has proved that pre-design evaluation is pertinent in delivering the zero carbon houses by 2016. This will further benefit to *Barnsley College*, housing sector professionals, academics, government and public agencies involved in achieving affordable and energy efficient homes in the UK and globally.

Acknowledgment

The author would like to thank to *Jefferson Sheard Architects* for releasing the Stage D report and drawings of the proposed *Barnsley College Demonstrations Houses* through the help of *Dr. Hasim Altan*.

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Information for New Authors

Geographical Locality Studies (GLS) is the official journal of *Frugeo Geography Research Initiative* registered in the *United Kingdom* as print serial (ISSN 2052-0018) and online (ISSN 2053-3667) materials. It is a scientific journal that sets its specialist area in locality, sustainability and environmental topics. It is (at the moment) issued and published annually, and each number is planned and developed by a specially selected, international editorial board that consists of expert researchers, lecturers and peer-reviewers.

GLS aims to erect a bridge between academic research and general educational knowledge development; that is why its target audience involves a wide range of students from secondary to doctoral schools, young researchers and anybody from any background who wants to know more about locality and sustainability-related environmental and geographical topics.

Supporting this aim, *Frugeo GRI* invites ambitious researchers to join the success of our projects and be an original and significant contribution to the human knowledge of *Earth Sciences* (geography and geology) and also *Environmental Sciences*. We provide publication possibilities to academics who have already earned a PhD degree; and we would like to highlight the importance of education and give the chance and opportunity to PhD Students, and also MSc/BSc Students, to help them gain recognition, points and credits, and assist in their scientific life getting an easier start on the sometimes difficult path of publishing and academic writing.

We provide opportunity for publications to researchers, although we do accept only outstanding papers; therefore, a published work in one of our upcoming issues has to be of a high standard, must be well-researched, well-illustrated and well-written in an engaging style that can call the attention of anyone who reads it. It must be something interesting, topical and must contribute to the development of any scientific disciplines. It also has to be educative and build a good balance between academic and public understanding.

Our journal covers many different types of—mainly geographical—subjects; therefore, we encourage and approach anyone who acts on the fields of Earth or Environmental Sciences, too. For the upcoming titles and publishing possibilities, please keep an eye on our regularly updated websites (www.frugeo.co.uk and www.frugeo.eu) or contact us (info@frugeo.co.uk).

In order for an article to be published, the author(s) has/have to follow our instructions and must achieve the expected standards of *Geographical Locality Studies*. In special cases, the requirement is defined according to the project expectations, but mostly we want an article to be:

a.) prepared by

- one individual author, or by
- co-operating authors;

b.) written in

- British English, and
- the majority of the paper in Passive mode;

c.) be one of the following types:

- Original articles in basic and applied research,
- Critical reviews, surveys, opinions, commentaries and essays;

d.) and follow this structure:

- Abstract (1000–1200 characters with spaces) + 5 key words;
- Introduction;
- Aims of the study;
- Research methods;
- Results;
- Discussion;
- Conclusions;
- Acknowledgements;
- Reference list or/and bibliography (This has to be prepared by using Harvard referencing. See examples on Frugeo's website.).

Anybody wishing to contribute in one of the upcoming GLS projects, please send an e-mail with the following information provided to: info@frugeo.co.uk

- Title;
- Full name;
- Highest academic degree;
- Workplace / Institution;
- Position;

- E-mail address;
- Contact telephone number;
- Paper's working title;
- Along with your registration, please prepare an abstract no longer than 1000 characters with spaces and include at least 5 key words.

In 2015, we decided to make the journal participation available for student free of charge; although there is a small contribution fee for anybody else with no student status. Under a student we mean anyone with a valid student card and status from secondary school level up to PhD. Although, we accept donations.

As of 2015, participation fees for anybody else is £100[31].

We expect the fee paid in Pound Sterling (Great British Pounds). Payment can be made securely through PayPal. Payment requests are always sent out by Frugeo GRI.

We guarantee that every paper will be

- read by professional and fully independent reviewers (peer reviewers);
- they will be proof-read;
- the authors will be given as much extra help as possible;
- the book will be published;
- the book will be available in a print copy as well as online;
- the online edition will remain free of charge;
- it will be distributed and
- every participant will receive a copy at no extra fee.

The authors who have to pay must bear in mind that the fee is

- non-refundable and

[31] This means, if the article is prepared by, for example, three authors, the total cost of the article processing and publishing shall be £300. However, papers written by three or more co-operating authors may qualify for a discount. Before making a final decision, please contact us and see what we can offer you.

- it can only be paid by one author individually (for example, if an article is prepare by three co-operating authors, each will have to pay £100).

Participants only need to pay when the *Editors* have read and approved the first version of the submitted document and have confirmed and reserved a place for the authors in our book. However, papers will not be published, if we do not receive the fully completed articles by our set deadline. If the authors miss the last day of submission, the opportunity to publish in our book and the participation fee will both be lost.

Frugeo GRI membership

Everyone who joins the GLS project as a fee payer will automatically become the member of the *Frugeo Community* for a 1-year-period (the membership is worth up to £50.00) which will give the opportunity to all the participants to request services (e.g. translation, proof-reading) from *Frugeo GRI* for a discounted rate (30% off all services except for subsequent participation fees).

If you would like to be considered for our offer or if you have questions regarding the publication possibilities or the GLS project, please contact us instantly.

We look forward to hearing from you!

Frugeo Geography Research Initiative
Shrewsbury, United Kingdom
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Notes

Notes

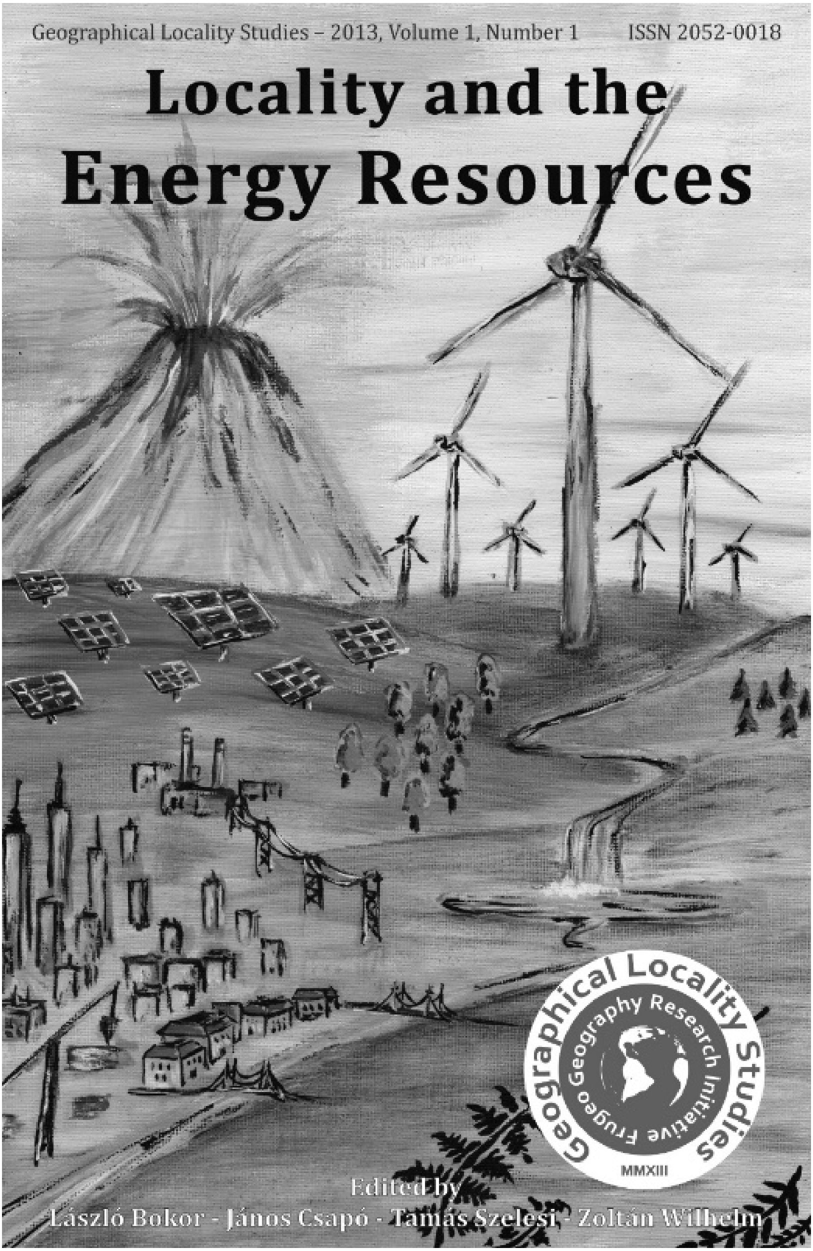
“Locality and the Energy Resources”
June 2013, Volume 1, Number 1

Edited by László Bokor, János Csapó, Tamás Szelesi, Zoltán Wilhelm

Paperback: 216 pages
ISBN 978-0-9576442-0-5 (Paperback)
ISBN 978-0-9576442-1-2 (eBook-PDF)

The first number of Geographical Locality Studies anatomises the possibilities of local utilisation with regard to natural energy resources. In this present issue, we have given publicity to 12 studies which have all been written by 13 expert Hungarian researchers and higher education lecturers. Their task was to shed light on global examples and introduce specific, locally achievable methods, solutions or ideas which could be used anywhere else on the planet. By doing so, the ideas could be transplanted, adapted and could give birth to foundations for newer, more efficient and revolutionary techniques, technologies and developments. The written masterpieces can be classified into three categories: a) articles that support general knowledge on the topic; b) selected Asian examples that foster such understanding; and c) a selection of Hungarian cases.

This present co-operation, however, is not only a gathering of academics who try to bring recognition to themselves, but it is also meant as a surprise to one of our special friends and colleagues. *Klára Bank*, who is a professor at the *University of Pécs*, *Institute of Geography*, has reached her 60th birthday this February. She has been a pioneer and a significant contributor to the development of *Geography of Energy* and also *World Regional Geography*. When it comes to the chosen authors' specifics, the aim of *Frugeo Geography Research Initiative* has been to find and work together with experts who have exclusively known the respected and honoured person and, therefore, been familiar with her achievements on these specific scientific fields. By this book, we would like to erect a simple but long-lasting memory and acknowledgment for her invaluable effort, support and motivation which are felt by generations.


Geographical Locality Studies – 2013, Volume 1, Number 1 ISSN 2052-0018
Locality and the
Energy Resources
Geographical Locality Studies
Frugeo Geography Research Initiative
MMXIII
Edited by
László Bokor - János Csapó - Tamás Szelesi - Zoltán Wilhelm

Papers published in GLS 1: Locality and the Energy Resources

László Bokor

The Importance of Energy Resources in the Local Environment

This paper deals with the naturally occurring energy sources; introduces their physics and basics, accurately defines their terms and types, and assorts them into groups. It explains their importance in human history, reflects on their communal impacts of, for example settlement establishment and development, industrialisation and the formation of modern societies along with their consequences.

Béla Munkácsy

The Importance of Holistic Approach in Energy Planning

The challenges of energy management and planning are considered as technical and economic problems by the society with decision makers and engineers included. This approach has proven to be globally insufficient. In this paper, some explanations and examples about the new approach is shown and demonstrated.

János Csapó

Energy Efficiency in Tourism – Towards a More Sustainable Travel Industry

A tourist accommodation, catering place or whichever form of tourism enterprises seems to be more attractive to the conscious travellers when they can produce a new form of sustainable energy consumption and utilisation. The paper intends to demonstrate these best practices concerning sustainable development and energy efficiency from international and Hungarian perspectives.

Nándor Zagyi

Traditional Energy – Free Solutions for Ventilation and Air-Cooling in Arid Tropical Areas of Asia

Nowadays, more and more air-conditioning devices are installed to cool the inner spaces of dwelling and public buildings in the populous developing countries. Therefore, it is worth drawing attention to those traditional methods and architectural forms by which comfortable air conditions could be generated in the hot arid and semi-arid areas of the Planet.

Zoltán Wilhelm

Water as a Natural Resource, Cultural Heritage and Tourism Attraction in India

The present study aims to discuss social heritage that is based upon a commonly utilised natural resource. In this case, the natural resource is the groundwater; the infrastructure is the groundwater's exploiting facility (stepwells); this type of infrastructure is much more than a simple well or water extracting facility: it is part of the social heritage.

László Bokor & Tamás Szelesi

'Geodrawphy' of Bhutan: A Nature-based Holistic Society in the Himalayas

This work is meant to shed light on Bhutan—its geography that particularly deals with its energy resources, energy production and supply—but it also introduces this country as the first on Earth that has formally adopted Gunter Pauli's 'Blue Economy' for a sustainable and competitive holistic economic and social progress.

Lajos Gööz

The Feasibility of Micro-regional Autonomous Energy Systems

The present situation, as well as the future, of renewable energy sources is contradictory. As a consequence of the present economic crisis, investments in this field are in decline all over the world. In this study, an attempt is made to draft the optimal ways of development.

Károly Tar

Energetic Parameters of the Wind Directions

The objective of this study is to assess whether changes in the surface pressure field over Europe are reflected in the statistical structure and the inner definiteness of the wind energy (relative frequency, relative energy content, mean velocity, etc.) field over Hungary, despite the country's specific pressure field.

Károly Tar & Mihály Tömöri

Realistic Potentials of Wind Energy Utilisation in Hungary

After the demonstration of the present situation of wind energy utilisation in Hungary, the policies are analysed that determine the economical harnessing of the wind energy potential. The following aspects are examined: climatic possibilities and climate change in Hungary, facilities in Hungary's geography and land use.

Gabriella Ancsin

Local Geothermal Energy Sources in Csongrád County, Hungary: A New Way for a More Sustainable Energy Supply

Szeged and Csongrád County are among the few lucky territories which are well supplied with natural energy resources. This present study discusses the potential areas where thermal waters in Szeged could be more widely used by touching upon the modern geothermal cascade systems. The latter are already installed and running in some of the neighbouring settlements.

Lajos Keczeli & Mária Mohos

The Functioning of the Cement Factory in Királyegyháza in a Rural Area

The study intends to give a thorough overview on the impacts—from social, economic and environmental aspects—of a new cement factory in Baranya County, Hungary. It is situated in a typical rural area where agriculture is the strongest tradition, but without large employers and industrial plants.

Viktor Glied

Social Conflicts in the Shadow of the Paks Nuclear Power Plant

Since the use of nuclear energy has become a possible global solution for the replacement of traditionally used fossil energy resources, it affects the public realm in Hungary, as well. The aim of this paper is to provide an insight into social aspects of constructing and operating a nuclear power station in Paks, Hungary.

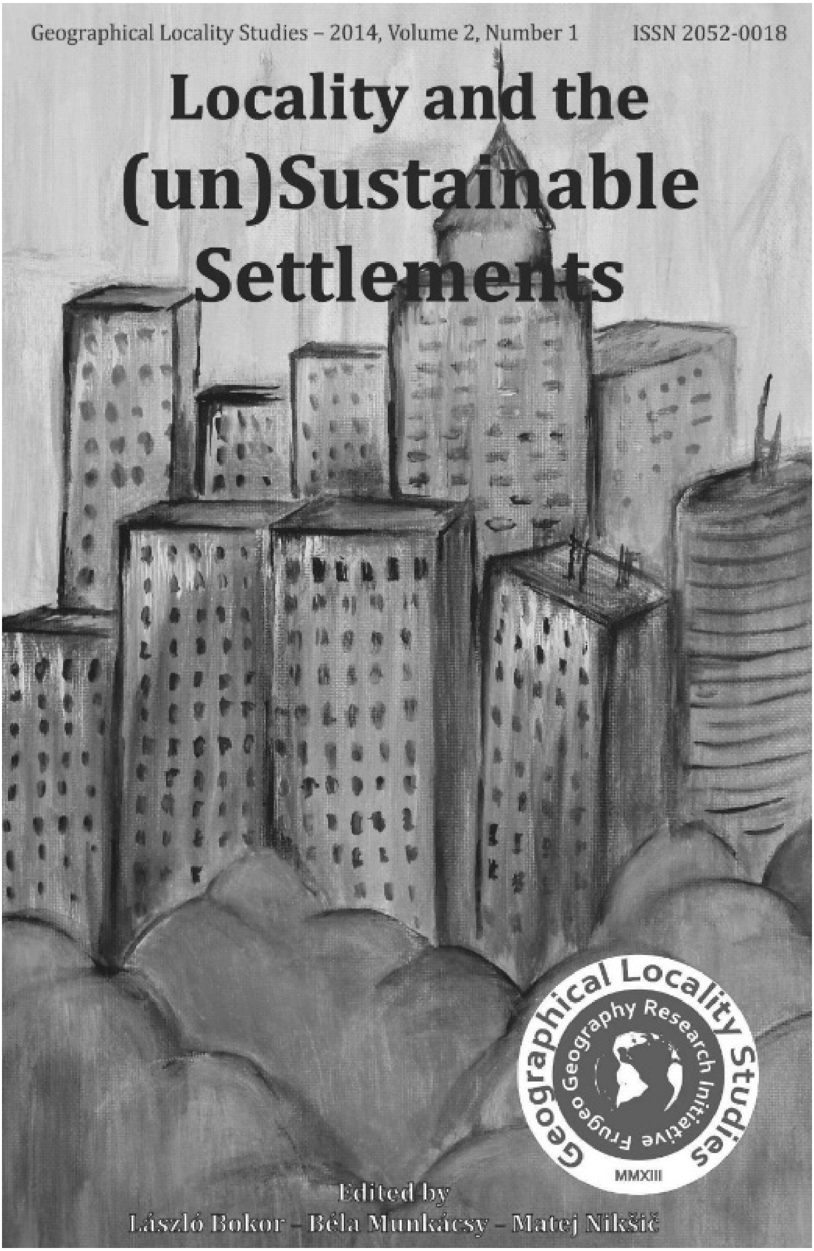
"Locality and the (un)Sustainable Settlements"
June 2014, Volume 2, Number 1

Edited by László Bokor, Béla Munkácsy, Matej Nikšič

Paperback: 256 pages
ISBN 978-0-9576442-3-6 (Paperback)
ISBN 978-0-9576442-4-3 (eBook-PDF)

This second number of *Geographical Locality Studies* dips into locality by analysing the *World*'s settlements (villages, towns, cities) and their composite structures and complexity. The aim of the multidisciplinary editors and authors is to highlight the urban areas to give understanding about their suitability in the context of 21st century thinking of environmentalism and sustainability. The various articles analyse some parts of the *Earth*'s urban environment and bring examples from different locations of the planet to show how a settlement (or anything that strongly relates to the human sphere) is sustainable or unsustainable.

This present issue gives publicity to 9 scientific papers which were written by an international team of expert researchers, higher education lecturers and specialist masters students. The diversity of their subject specialism (which involves geography, environmental science, urban planning, environmental management) provides a wider analytical view on the main topic of the journal; therefore, their tasks were to show specific examples brought over from their specialist and research areas to introduce the reader to locality, settlement planning and their sustainability, efficient management of urban transport and energy related topics. In accordance to the tradition of *Frugeo Geography Research Initiative*'s *GLS series*, *Locality and the (un)Sustainable Settlements* is commemorating the life of *József Tóth*, an exceptional scholar and academic who greatly influenced and shaped the modern human geography at an international level. He suddenly died on the 7th February 2013, but his work and achievements will always be found and traced in settlement geography.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Geography Research Initiative
Frugeo
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Edited by
László Bokor – Béla Munkácsy – Matej Nikšič

Papers published in GLS 2: Locality and the (un)Sustainable Settlements

László Bokor & Viktória Nemes

Locality, Sustainability and the Ways They May be Measured

The authors' aim is to identify and understand the key factors of a local entity that may help to work out a simplified measuring method to analyse a certain locus. Their approach goes through defining classic terms like space and time, locality, sustainability and the combination of the two latter ones. Also, the initial step of creating the Need Model and Geographical Locality Index is now made.

Dániel Leidinger & Ádám Harmat

City Modelling from a Sustainable Point of View

If it is assumed that the biosphere is a single living entity, cities can be compared to the tumours in a cancerous body. They take material and energy from their surrounding areas and they charge them with the waste of their metabolism. The aim of this paper is to compare the evolution, the development and the operation of the urban area to a cancerous body.

Matej Nikšič

Access to a Quality Open Public Space as an Urban Sustainability Measure

The paper is a critical review of an open public space regeneration programme in the city of Ljubljana, Slovenia. The point of departure is a belief that an important measure of the sustainability of any settlement is the accessibility of quality open public spaces for its inhabitants. The paper analyses the open space improvements through the distribution of the investments.

Béla Borsos & Béla Munkácsy

Locality, Mobility and Energy Sustainability in Settlement Planning

This paper looks at cause and effects of mobility needs and key fields of energy use with a view to the Jevons paradox and the rebound effect. A line *of thought is applied to the relation of energy use with climate, culture, habits and comfort, various heating solutions and the respective role of production, trade and services. In a case study, the eco-village of Gyűrűfű is also analysed.*

Luca Rozália Száraz

The Impact of Urban Green Spaces on Climate and Air Quality in Cities

The main objective with the present study is to investigate how urban green spaces impact on the air quality and the microclimate in cities. Each section examines an urban climatic process and how it differs in an urban environment which includes vegetation. It also discusses how urban green spaces can help ease the local consequences of climate change.

Tamás Szelesi

The Development of Fixed-Rail Public Transport in Frankfurt

One can find both green zone and brown zone investments amongst recently developed residential areas in Frankfurt. The traffic infrastructure is designed to catch up with the development of those new residential areas. Several districts of the city provide good examples to show the way in which the mentioned two closely related fields can be jointly investigated.

Fanni Sáfián

The Synergies of Community Ownership, Renewable Energy Production and Locality – The Cases of Güssing and Samsø

This paper presents the concept and the main forms of community ownership. Analysing the literature and the cases of Güssing, Austria and Samsø, Denmark helps to recognise how to promote a successful local renewable energy project and what kind of additional benefits may be earned by applying the appropriate ownership model and project outline.

Wojciech Goryl & Ádám Harmat

The Characteristics of the Biomass Sector in Poland and Hungary

Presently, a hot debate is taking place in Hungary and Poland about the use of biomass for electricity generation in existing coal power stations. The arguments are of technological, logistic and foremost of economic nature. The aim of this paper is to set two ways of biomass power generation against each other by analysing the biomass sectors of the two countries mentioned above.

Katalin Kiss & Nándor Zagyi

Principal Characteristics of the Indian Micro, Small and Medium Enterprises (MSME) Sector and its Importance in Rural Development

The spread of the small business sphere in the rural areas of India could have a significant role in order to decrease the spatial and social differences derived from sociocultural and demographic reasons. The authors provide a thorough overview of the production and labour force positions of the enterprises taking part in the Khadi & Village Industries Program.

CALL FOR STUDENTS! CALL FOR PAPERS!

"Selected Articles 2016"
2016, Volume 4, Number 1

Frugeo Geography Research Initiative and *EUROGEO-European Association of Geographers* have joined together to launch a student academic paper competition. We are giving a publication opportunity to students to participate in our project free of charge and the potential chance to win an award. The competition is open to any topics with the following keywords: locality, sustainability, environmental/global issues, recycling, upcycling, and reuse. Deadline 15 January 2016.

GLS–EUROGEO Award / Student Paper Competition

Frugeo Geography Research Initiative and *EUROGEO-European Association of Geographers* are keen supporters of the development of *Earth Sciences* as we believe that a comprehensive and up-to-date geographical knowledge is an essential part of the lives of everyone. We specialise in many geographical and non-geographical subjects and carry out scientific research, educating people for them to understand and achieve more competitive knowledge in any associating science and human subjects.

Frugeo Geography Research Initiative is a friendly and down-to-earth educational, research, editorial, design and publishing enterprise that specialises in Earth Sciences (Geography, Geology), Environmental Sciences, Mathematics and Fine Arts. It was established in 2011 in *Wolverhampton* (England/UK), but shortly after resettled to *Shrewsbury*. Frugeo's principal purpose is to deliver valuable and high quality services for everyone with specially tailored needs. It currently offers a wide range of expedient services focusing mainly on home tuition, personal education, research and surveys, technical editing and design, and also publishing.

Geographical Locality Studies (GLS) is the official journal of *Frugeo GRI* registered in the *United Kingdom* as a print serial (ISSN 2052-0018) and online (ISSN 2053-3667). It is a scientific journal that sets its specialist area in locality, sustainability, and environmental topics. It is issued and published annually, and each number planned and developed by a specially selected editorial board that consists of expert researchers, lecturers, and peer-reviewers.

EUROGEO is a non-profit scientific and educational society founded in 1979. Since its establishment, it has contributed to the promotion and advancement of geography in Europe. It has members from more than 60 countries who share interests in the theory, methods, and practice of geography. This is represented through the activities at meetings and conferences, scholarly publications like the European Journal of Geography and the EUROGEO Newsletter. EUROGEO lobbies for Geography, encourages discussion among geographers and with those in related fields.

Now as *Frugeo* is initialising the work associated with our upcoming 4th GLS journal, we invite ambitious people to join our project and make an original and significant contribution to the human knowledge of *Earth* and *Environmental Sciences*. We are giving a publication opportunity to students to participate in our project free of charge and the potential chance to win an award with the conditions stated below:

- Single authorship of article submission.
- Students must be enrolled on a BSc/BA, MSc/MA, PhD/DLA course.
- Open to any topics with the following keywords: locality, sustainability, environmental/global issues, recycling, upcycling, and reuse.
- There is no age restriction.
- Open to any citizen of any country of the world.

The various articles that we expect from our multidisciplinary participants may cover many different scientific (and non-scientific) subjects, fields and areas, e.g. biology, architecture, manufactory, arts, mathematics, catering, fair trade, tourism, etc.; so we would like to encourage any subject and we really do mean any – as long as it interlinks with the keywords in a geographic sense.

The papers accepted in this GLS–EUROGEO project will go through our specially assigned editors and carefully selected peer reviewers who will independently and individually score each article. The three best articles selected for the project will be granted one of the following prizes below:

- The Winner will receive the GLS–EUROGEO AWARD: an award plaque; certification; a Frugeo GLS t-shirt, and £150.
- And the two runners-up will get:
    - Certification, a Frugeo GLS t-shirt, and £100.
    - 2. Certification, a Frugeo GLS t-shirt, and £50.

The first three awarded winners will also be invited[32] to the annual EUROGEO conference[33] which will be held in Malaga, Spain between 29–30 September 2016.

Beside the three winning papers, our editors will pick 12 more articles out of all submissions for this GLS project and these papers will all be published in the GLS 4 journal entitled Selected Articles 2016.

Technical parameters:

- Expected written amount: 20,000–25,000 characters with spaces.
- The list of references and bibliography do not count into the expected amount and may have the length of any size that is required by the author.

[32] Although this invitation may include free admission to the conference, it does not include any travel and accommodation expenses whilst traveling to and staying in Spain.
[33] More information on the conference available here: http://www.eurogeography.eu/conference-2016-malaga/

- Papers may contain a reasonable number of photos, figures, charts, diagrams, tables, etc. – Any of these illustrating materials have to be embedded in text and also sent as single files to the editors.

How to prepare your scientific paper?

- Your manuscript has to be prepared by you, so one individual author only.
- The article has to be written in Standard English, and the majority of the paper in passive mode.
- The following types of papers are considered for publication: original articles in basic and applied research, critical reviews, surveys, opinions, commentaries, essays.

Your paper has to have

- Abstract (1000–1200 characters with spaces) + 5 key words
- Introduction
- Aims of the study
- Research methods
- Results
- Discussion
- Conclusions
- Acknowledgements
- Reference list or/and bibliography (This has to be prepared by using Harvard referencing. See examples on Frugeo's website.)

How to register?

- If you wish to participate in the GLS 4 project, please send the following to info@frugeo.co.uk:
- Your title, full name and date of birth.
- Highest achieved degree and the degree you are studying for (e.g. BSc, MSc or PhD).
- A scanned or photographed student ID (or anything that can prove student status).
- Name and address of institution.

- Country of residence.
- E-mail address.
- Contact telephone number.
- The fully prepared article.

Deadline:
Please send us your article prepared in regards to the technical requirements stated above, along with all the other information required by no later than Friday midnight on the 15th January 2016.

If you need to get in touch, please send us an e-mail to info@frugeo.co.uk

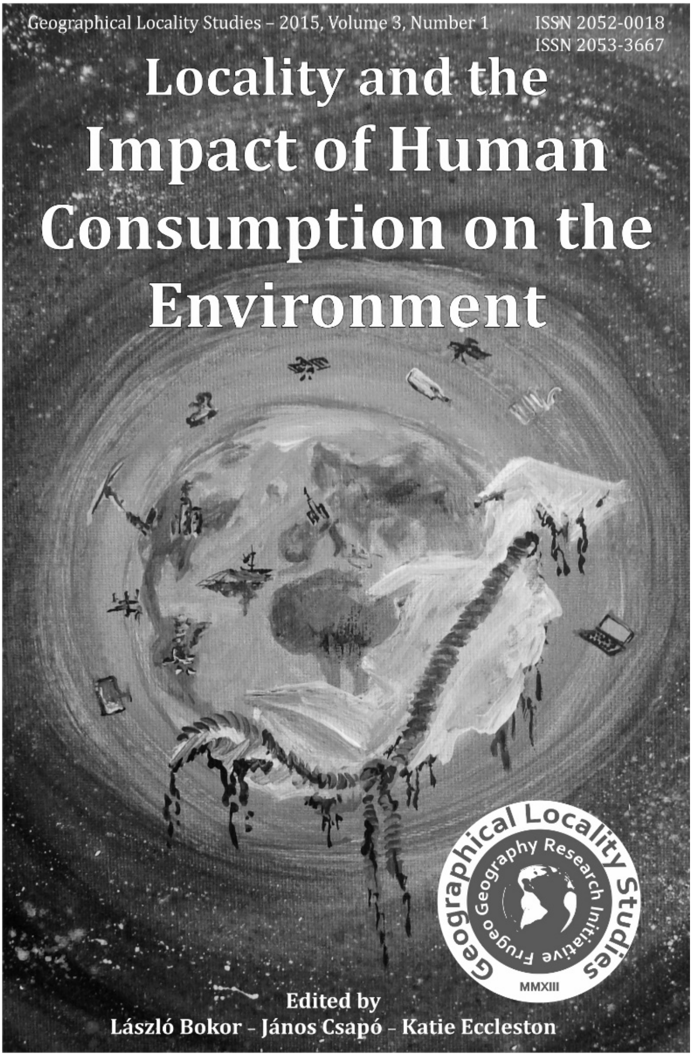
Frugeo's website is available at www.frugeo.co.uk
Frugeo's information pages and shop are at www.frugeo.eu

More information on the GLS 4 and award:
http://www.frugeo.co.uk/gls4.html

We are also on Facebook: https://www.facebook.com/FrugeoGRI
and Twitter: https://twitter.com/FrugeoGRI

More about EUROGEO – European Association of Geographers:
http://www.eurogeography.eu/

We are looking forward to hearing from you!



The online version of *GLS 3: Locality and the Impact of Human Consumption on the Environment* is available to download free of charge from the official website of *Frugeo GRI*.

Please visit: http://www.frugeo.co.uk/gls3.html