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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 became 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 BRICS¹⁸ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ emission over the past decades. FDI can also increase CO₂ 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* CO₂ 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* CO₂ 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 green-

house 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).

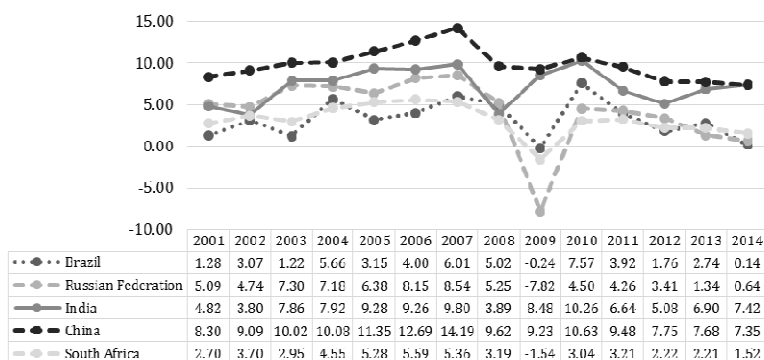


Figure 1 – Annual GDP (%) growth in the BRICS countries

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.

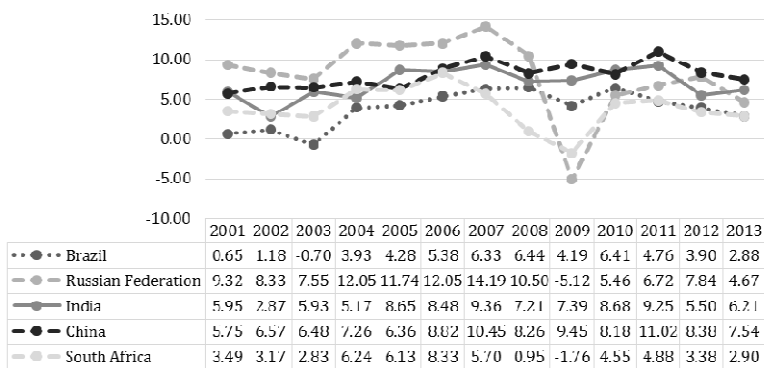


Figure 2 – Annual percentage growth of household final consumption expenditure in the BRICS countries

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.

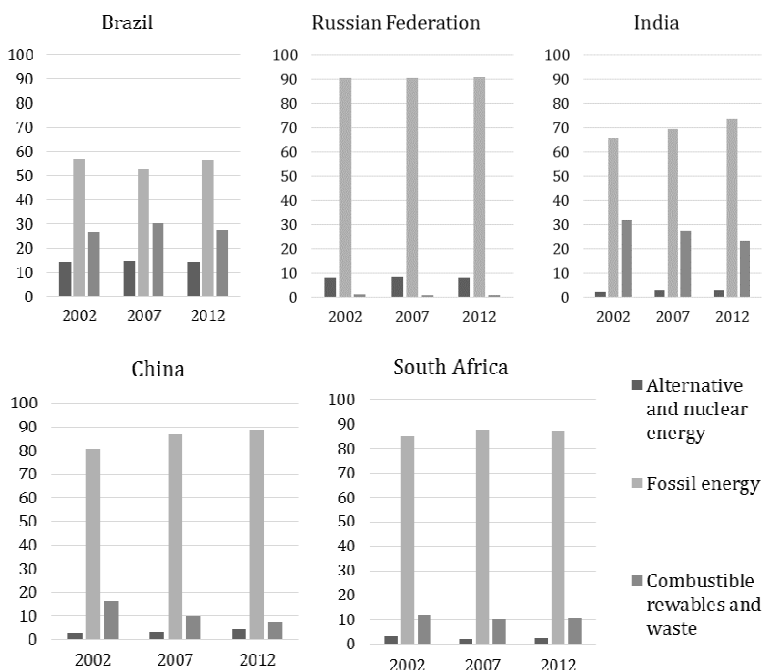


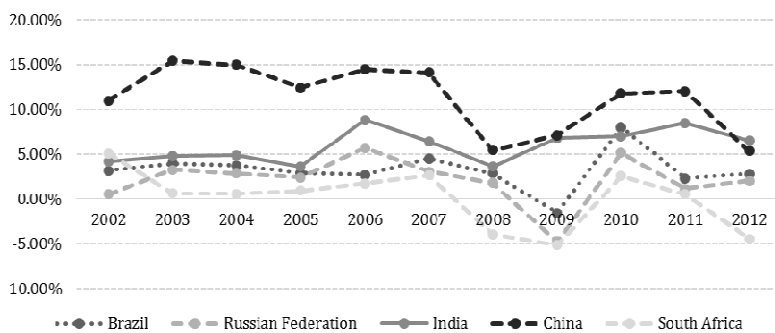
Figure 3 - Energy consumption of the BRICS countries by the source of energy (in percentage)

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 per 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.

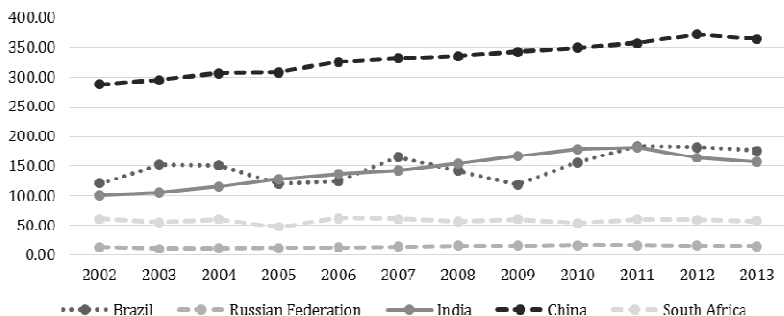


Figure 5 – Fertiliser consumption (kilograms per hectare of arable land) in the BRICS countries
 According to WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

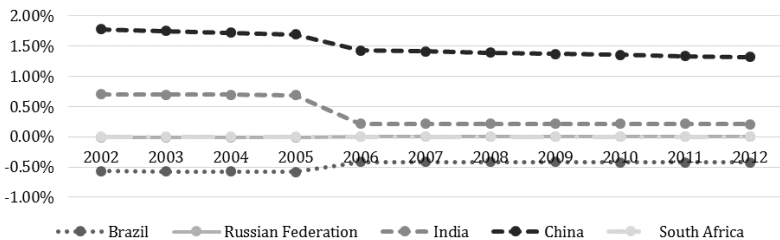
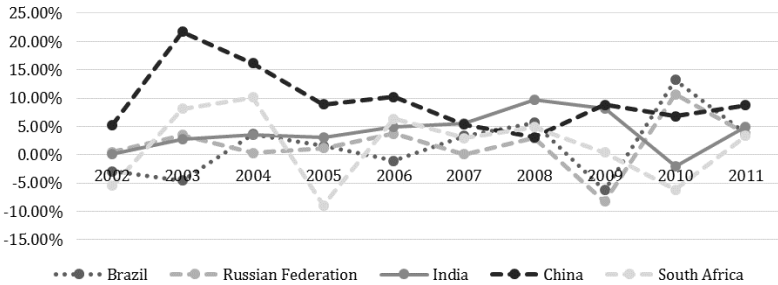


Figure 6 – Annual change of total forest area in the BRICS countries
 According to WORLD BANK STATISTICS (2014); Edited by FEKETE, J. (2015)

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 land-owners 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 CO₂ emissions (chart) and CO₂ 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 CO₂ emissions (see the chart) and CO₂ 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 CO₂ 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 CO₂ 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 CO₂ emissions cannot be compensated by natural processes like photosynthesis, so the further increase of CO₂ 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).

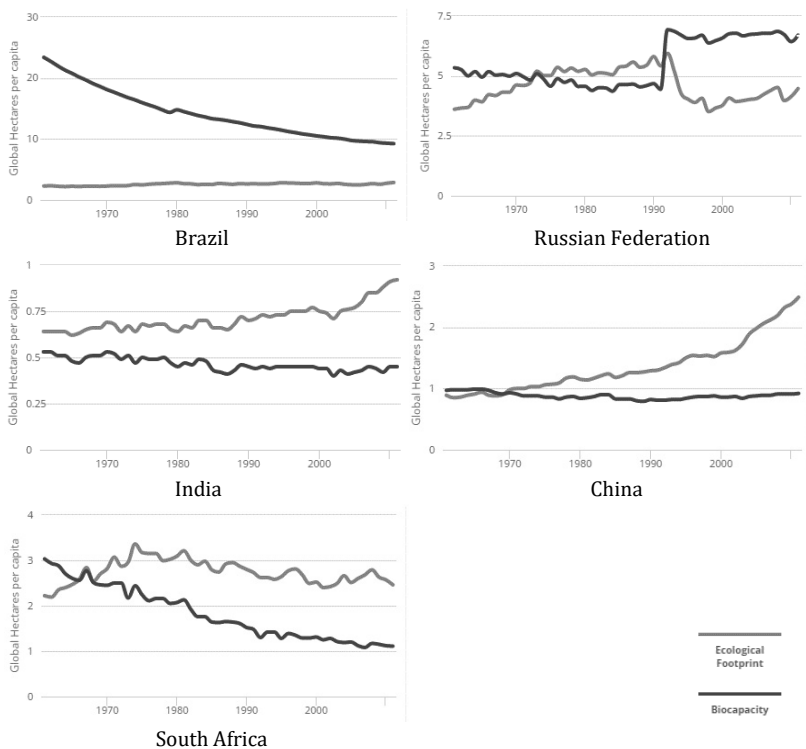


Figure 8 – Ecological footprint and biocapacity of the BRICS countries, 1961–2011

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 phe-

nomenon 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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