

Economic Growth in Kosovo as a Challenge to Environmental Preservation in the Republic of Kosovo

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Abstract

The developing economies pose a significant threat to the environment, which has become a worldwide phenomenon. The need for production, export, and economic growth poses a challenge for every government and company. The Republic of Kosovo has witnessed a considerable economic development during the recent years, but it has fallen short of considering and implementing a strategy for the preservation of the environment. Taking into account the planning and the development strategies in the Republic of Kosovo, from the side of the government and the interest of businesses to run after profit, it leads to a strong debate over the issue that is related to the process and the policies that have their implications in the preservation of the environment. The developing countries argue that they have much to do about employment, exports and an overall development of their countries. Consequently, they breach the rules and norms of environmental preservation. Kosovo is relatively rich with underground and surface resources, where there are large quantities of minerals and coal. Exploiting these resources can have a great impact on economic development. In this paper we look at the largest companies that exploit the raw materials needed for business in Kosovo, which at the same time are also the largest polluters, namely the thermo power plant "Kosova B", the iron ore "Ferronickel", and cement producing plant "Sharrcem", the data for which were collected on site by the authors.

Keywords: Republic of Kosovo, economic growth, development, pollution. **JEL:** D13, M13, O13, Q13.

Introduction

An economic growth can be in conflict with the environment, especially when it is under pressure to make a progress that is aimed at lowering unemployment, alleviating poverty and increase of national incomes. On one side, the growth in industrial sector, relies on exploiting natural resources, while consumers produce a lot of waste that in turn pollute the environment on the other side, thus weakening the prospects of growth in the long run. This relationship is complicated and dependent on several factors. Consuming the environmental resources has come to the use of an approach that would improve efficiency while attempting to preserve or regenerate some of the renewable resources. However, to achieving a desired level of economic growth and activity faces the challenge of, among others, reducing the greenhouse emissions and possibly undertake some measures in the form of a green revolution.

Developed economies have realized that a sustainable economic growth and development must carefully consider the costs of environmental degrading. The concern is becoming more severe in the age of global climate change whose impact is increasing in the 21st century. Stern has estimated that the cost of slowing down or possibly avoiding adverse effects of climate change by 2050, ranges between 1% to 3.5% of GDP. Alternatively or not doing so, the damage may be between 5% and 20% of global GDP.¹ Economic growth is needed in order to ease human conditions of life, raise the standards of living, but this is not guaranteed for a long time as it leads to depletion of natural resources which in turn endanger the ecosystem. The increase in CO₂ emission has accelerated sharply in the 21st century, mostly by vehicles and other fuel operating transport means. The problem of intensive use and consumption of natural resources such as minerals and metals at an increased pace has been identified as early as in the 1970s by Meadows *et al*, who maintained that the Earth is limited in resources to provide steady long-term economic growth if no careful measures of protecting and adjusting the

¹ Nordhaus W.D., (2006), "The 'Stern Review' on the Economics of Climate Change", National Bureau of Economic Research, Working Paper 1274.

environment are not undertaken.¹ While developing economies may justify their pressure in responding to the needs for greater exploitation of the environment in order to provide better living standards and economic welfare for their people, the developed economies with more capital have not yet come to a common agreement to address the threat to environment on a global scale. An example is the non-ratification by the United States, the largest economy in the world, of the Kyoto Protocol on reducing the greenhouse gas emissions.² In 2011, additional larger economies such as Japan, Russia, and Canada went on not to take no further commitment on the Kyoto Protocol, with Canada even withdrawing from it.

The developing economies, primarily those who emerged from the fall of communism and civil wars in Central and Eastern Europe as well as some from the Middle East, have seen a sharp increase in environmental pollution. The destruction in some parts was so great that repairs took considerable resources to be spent without any benefit in return in the short run. They even could not afford the cost of repair on their own, thus the donor assistance was desperate to overcome the consequences. However, the assistance focused heavily on adjusting the environment only to the point when it was sufficiently fit to resume economic activities and growth without any major concern beyond with respect to the environment. One these shortcomings of the donor assistance were that environmental professionals were not consulted on the implications the economic reforms and reconstruction projects can have to the environment. It was not just a matter of institutions directly related to environmental protection like a ministry, but of the rest of ministries and the government of a country as a whole.³

While the environmental cause in developed countries, despite disagreements, has made the way through into politics by establishing *green parties* that would play a significant role in political, economic and social life, many developing economies have yet to repair the consequences of wars and the fear that what is already at disposal in the environment may be lost in potential conflicts. Their concern may be to preserve the existing state, even if it does not meet satisfactory standards. War is a heavy, and often a terrible source of environmental pollution and destruction. The progressive development of various weapons such as chemical, biological, nuclear and their eventual use causes immediate damage to environment, people and vegetation. A nuclear accident like Chernobyl in 1986 has produced long term implications for much of Europe.⁴ Conventional weapons, too, apart from direct damages to infrastructure, release pollutants whose effects can be harmful in longer run. In 2001 the World Health Organization reported several sites in Kosovo in which depleted uranium was used during the bombing campaign against Serbia in 1999 by NATO, mostly in western part of Kosovo, but the results were not conclusive and further investigation was recommended.⁵ While those were the results of an earlier period whose approximate harmful effects were not measured, more adverse effects to the environment have come during the reconstruction period, namely by large plants of thermo power generation, mineral extraction, and massive deforestation. As Kosovo is relatively rich in minerals, primarily in lignite and some metals such as lead, zinc and nickel, much of her economic growth is expected to come from their extraction and use. However, this is the area where the bulk of the environmental pollution is coming from, which is also the focus of this paper.

The tradeoff between economic growth and environmental protection

Economic growth and development may come at a cost of environment to the extent that in the long run many would have done the things differently when they come to face the consequences. There are two main alternatives in the tradeoff between economic growth and environment. First, as already stated, to let the growth at the benefits of income generation, increasing of employment, raising of living standards, in other words, intensify economic activities by neglecting the environment, so to have the needed resources to intervene in repairing the environment. Second, economic growth should go in parallel or in coordination with considerable care to the environment, though in the short to medium run this growth may be smaller than in the first alternative. What does the experience from various countries tell in both cases? The term *cowboy economy*, regardless who might have been the first to coin it, is associated with harsh or intensive use of natural

¹ Meadows D. H., Meadows D. L., Randers J. and W. W. Behrens, (1972), "The Limits to Growth" A Report to the Club of Rome's Project on the Predicament of Mankind, New York: Universe Books.

² Dessai, S. (2001), "The Climate regime change from the Hague to Marrakech: Saying or Sinking the Kyoto Protocol", Norwich: Tyndall Centre.

³ Bell, R. G. and Russell, C. (2002), "Environmental Policy for Developing Countries", Issues in Science and Technology, Vol. 18, No. 3.

⁴ International Atomic Energy Agency - IAEA (2006), "Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience", Report of the Chernobyl Forum Expert Group 'Environment', Vienna: IAEA.

⁵ World Health Organization (2001), "Depleted Uranium Mission to Kosovo", undertaken at the request of the Special Representative of the Secretary-General and Head of the United Nations Interim Administration Mission in Kosovo (UNMIK), Geneva: WHO.

resources with almost no care to harmful effects against the environment and direct hazard to the people's health. It may only take into account the removal of garbage from the working place just around the corner to enable the work. Due to the regulations, this hardly is allowed to apply in modern times. Some limitations are imposed everywhere, but the hunger for economic growth industrialization often overshadows these limitations. The People's Republic of China, when it adopted communism in 1949, was a developing country facing unemployment and poverty. The primary task of the communist party, just as in the rest of communist states and based on mainstream Marxist ideology of development, was rapid industrialization, relying especially in the development of heavy industry. Indeed, this focus and heavy commitment of China on heavy industry produced remarkable results. For 30 years in a row since 1978, China recorded an average economic growth rate of 10% per year. The growth continued to be among the highest in the world to the present day, and this has made China the largest economy as measured by GDP in terms of purchasing power parity.¹ Has this path of economic boom come to the damage of environment? Certainly yes, but what are the magnitudes of this harm? According to the World Bank, in 2003 the cost of environmental pollution and premature deaths by conservative estimates in China was 157.3 billion Yuan or 1.16 of GDP.² The economy may record a high growth and even get overheated, but the cost can also be enormous. But the cost of environmental degradation as measured by its share to GDP, was even higher elsewhere such as Middle East and North African countries than in China. In these two world regions, the damage to the environment in 2000 was estimated at \$9 billion per year with an estimate mean of 5.7% of GDP, with spillover effects to global environment estimated at 0.9% of their own (Middle East and North Africa) GDP.³ In less developed countries people appear to be more hostile to the environment as they tend to exploit natural resources more carelessly to make their own ends meet. Latin America and the Caribbean have depended on extraction of natural resources for their economic development. In Peru and Colombia for example, the annual cost of this extraction for development averaged 3.8% of their GDP.⁴

Realizing the tradeoff between economic growth and environmental preservation through extraction and consumption of resources, the focus is actively shifting towards on innovations that friendly to the environment, and investment on renewable sources of energy, while undertaking measures to reduce the current emission of pollutants. This focus of attention has gained importance after the evidence from the hypothesis that higher incomes is associated with better or improved environment, was inconclusive.⁵ Comparisons between countries suggests that it is not the average level of income that determines the health status, but the size of the gap between the rich and the poor within a country.⁶ Connections between the urbanized environment and health include designs for the prevention of side damages (e.g. roads, buildings and security codes), exposure to toxins (e.g. lead in paint and gasoline, pesticides and fertilizers, fecal discharge), reduction of violence and crime, exercise, and recreation. Given the interdependence of these factors, there is also a strong relationship between the urbanized environment and mental well-being or healthier labor force.⁷

The third or the era of information technology development, is generally friendly to the environment, but in itself cannot reverse the already harm. It can be used efficiently for substantial improvement. How to do that? Maybe through just one man! Interesting, one of the main leaders of the third industrial development that made him the richest person in the world (Bill Gates), has initiated the forth industrial revolution, or the revolution of the environment, for which he has established Bill and Melinda Gates Foundation in 2000. What makes his approach quite different from the first alternative that we referred to earlier, is that his foundations aims at providing economic growth and development, but not so much in developed countries. Another difference is that the fund's donations are primarily directed to developing nations in the projects related against diseases, vaccines, agriculture, education, water supply and irrigation. Only for vaccines the Gates

¹ In 2017, China's GDP at PPP amounted 11,218.3 US\$ billions or 17.76% of the world's total, ahead of USA's 15.49%. For more details, see World Bank (2017), *The Global Competitiveness Report 2017-2018: Insight Report*, Geneva: World Economic Forum.

² World Bank (2007), *Cost of Pollution in China: Economic Estimates of Physical Damages*, Conference Edition, Washington DC: The World Bank.

³ Muawya, A. H. (2008), "Costs of Environmental Degradation: An Analysis in the Middle East and North Africa Region", *Management of Environmental Quality*, Vol. 19, No. 3, pp. 305-317.

⁴ Wingqvist, G. Ö. (2009), "Environmental and Climate Change in Latin America and the Caribbean - Policy Brief", University of Gothenburg: School of Business, Economics and Law.

⁵ Pears, D., Barbier, E., and Markilndya, A. (2000), *Sustainable Development Economics and Environment in the Third World*, Edward Elgar: London.

⁶ Donovan, R. J. (2000), "Understanding the social determinants of health", *Social Marketing Quarterly*, Vol. 6, No. 3, pp. 55-7.

⁷ Burdette, A. M. and Hill, T. D. (2008), "An Examination of Processes Linking Perceived Neighborhood Disorder and Obesity", *Social Science and Medicine*, Vol. 67, No. 1, pp. 38-46.

Foundation has joined a coalition of \$460 million.¹ This is a different approach which takes a different stance to economic growth and development, i.e. the priority should focus on health and environment.

Methodology and data

The primary source of data used in this paper is from three case studies or the companies that are the largest pollutants in Kosovo. As there was no available consolidated database for them, e.g. in the Ministry of Environment and Spatial Planning, especially for some indicators in which were mostly interested in, the data were obtained by our direct visit to the companies concerned and access to the relevant data, which include the period 2010-2012, and that not for all. There are two main reasons for the choice of this period, despite that the scholars undoubtedly would ask for more recent to understand the trend:

As we highlighted in the introductory part, the WHO in 2001 had collected the data on the consequences of NATO bombs of depleted uranium in western Kosovo, but not draw conclusions, thus the difficulty of obtaining reliable data; and

The data for 2010-2012 were more consolidated and comparable for analysis compared to their shortage before and afterwards that period.

The limitation in quantity and quality of the data and their timeframe has constrained us to provide better measurements on potential impact of the pollutants on economic growth, especially at micro level. Instead, the interpretation of the main existing findings is made by knowing the gap in research for the respective country, after which this paper goes on to recommend that more detailed and diversified data on environmental pollution in relation to economic growth, should come before any environmental policy is put into action at national level.

Economic growth and environmental pollution in Kosovo

Developing economies such as Kosovo with high unemployment and widespread poverty press for more activity that would increase their incomes and economic welfare. Economic hardship forces businesses and consumers in search of whatever ways to get more of their material gains. First, let us look at the pace of economic growth in Kosovo and other main macroeconomic indicators.

Table 1: Main macroeconomic indicators of Kosovo (in millions of €, unless otherwise indicated)

	2012	2013	2014	2015*	2016*
Population (in million)	1,807	1,815	1,842	1,838	1,866
Gross Domestic Product (GDP)	5 059	5 327	5 568	5 745	5 994
Annual GDP growth (in %)	2,8	3,4	1,2	3,5	3,8
GPD per capita (in €)	2 799	2 935	3 023	3 126	3 213
Import	-2,360	-2,297	-2,372	-2,494	-2,519
Export	287	305	321	327	350
Remittances (in % of GDP)	10,3	10,4	11,2	11,5	11,4
Government expenditures	888	950	1.059	1.187	1.169
Foreign investment (in % of GDP)	4,2	4,5	2,2	4,2	4,2
Balance of payments	-7,5	-6,4	-7,9	-7,2	-8,9
Foreign assistance	83	-8	-18	56	46
Unemployment (of labor force)	30,9	30,0	35,3	32,0	-

Note:

* estimated

¹ Greyfeld, K. and Bass, D. (2017), "Gates Foundation Joins New \$460 Million Coalition for Vaccines", available at: <https://www.bloomberg.com/news/articles/2017-01-18/gates-foundation-joins-new-460-million-coalition-for-vaccines>, accessed on January 20, 2018.

- no data

Source: International Monetary Fund (2016), "Republic of Kosovo", IMF Country Report No. 16/22, Washington D.C.: IMF, table 1, 2, 3, p. 22-24.

Kosovo has relatively low per capita income in the nominal value of 3 213 €, as of 2016. Unemployment is still high and ranges between 30% and 35% of the labor, which is partly a problem inherited from the past. Kosovo's trade balance is negative, where exports cover only over 12 percent of imports, but with a tendency to growth. Economic growth as measured as a percentage increase of annual GDP has been close to 3% over the period 2012-2016. The economy is making little progress and facing some economic disproportion. GDP continues to grow but with a dynamic that can be considered insufficient to make visible changes in economic development. The fall in foreign financial assistance is also observed. At the same time, it appears that due to this decline in external financing, which is mainly driven by international organizations and agencies of different countries, the remittances of Kosovar emigrants have increased. The balance of payments seems to worsen in the future, while there is a constant increase in Government spending.

Although with moderate economic growth rates, environmental concerns such as pollution of air, water, soil, and deforestation continue to increase. Then, where such a pollution comes from, in what level, and who is the main cause? According to a report by the World Bank, the cost of environmental degradation in 2010 was estimated between €123 and €323 million, with an average of €221 million. In terms of percentage to GDP, this represented between 2.9 to 7.7, or on average 5.3%.¹ Comparing this to GDP growth rates which reach a maximum of around 4%, it suggests that even the current growth rates, apart from some economic gains, cause more harm than good. Although Kosovo is completing the legislation regarding the environment, which are in compliance with European Union standards, the implementation to preserve, repair the damage or otherwise protect the environment is far away in the required standards. We are more interested in the pollutants which in their reasoning are necessary for economic growth and income generation, namely the sector of power generation, mineral extraction and cement manufacturing.

Case studies

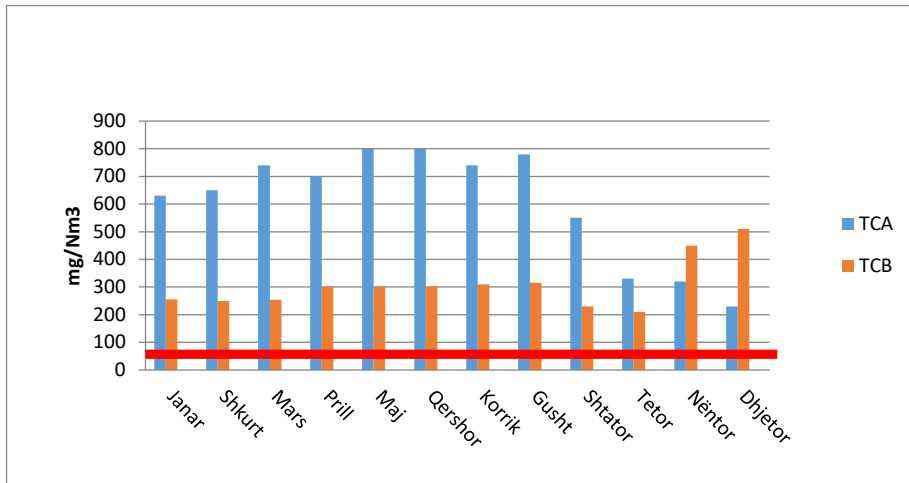
Kosovo's relative small geographical area (less than 11 000 square kilometers) is best known for the resources such as coal and minerals. By various estimates, the coal reserves of Kosovo are amongst the largest in the world. The coal is primarily used for electricity generation and consumption as fuel by the households. At the end of 2017, the Government signed a contract with Contour Global to build a new thermo power plant "Kosova e Re" that would rely on exploitation of the coal nearby. The contract envisages investment worth \$1.3 billion for a power plant with a capacity of 500 MgW. It is expected to be operational by 2023 and have a life time of 40 years. Only few kilometers away, the iron ore "Ferronickel" is a privatized company extracting and exporting nickel, a large polluter. The third largest polluter that is also included in our case studies, is the "Sharrcem" cement plant located close to the border crossing with the Republic of Macedonia.

Kosova B

Is a thermo power plant of KEK (Kosovo Energy Corporation). KEK continues to be one of the strongest sources of air pollution due to high emissions from the Kosovo A and Kosovo B Power Plants. The evaluation of emissions is based on the results of measurements and calculations, for these pollutant parameters: Dust, SO₂, NO_x and CO₂. The dust emission (PM₁₀) for both plants (TC A and TC B) is shown in figure below.

¹ World Bank (2011), "Kosovo Country Environmental Analysis Cost Assessment of Environmental Degradation, Institutional Review, and Public Environmental Expenditure Review", Washington, DC: World Bank.

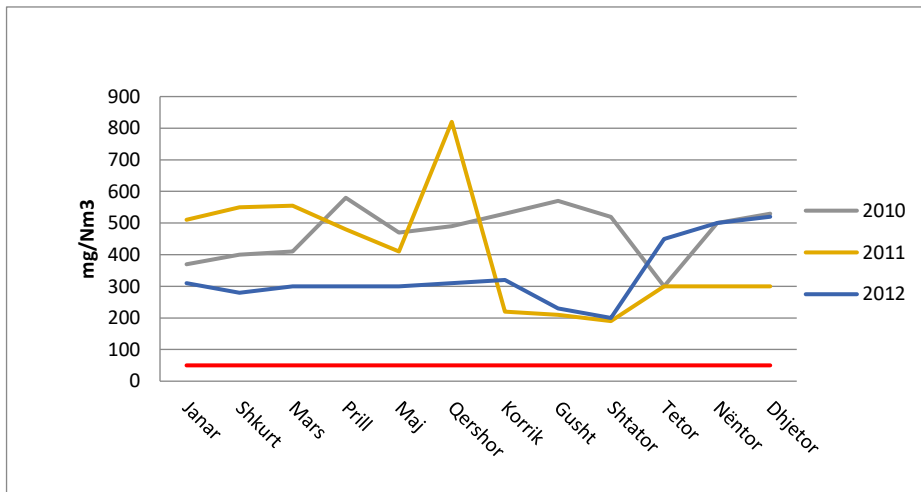
Figure 1: Dust emissions in TC A and TC B as of 2012, by months



Source: KEK database and Authors' calculation.

The red line indicates maximum level of dust allowed to be emitted, which clearly shows both power plants were well above or exceeding it. From 2010 to 2012, in TC A and TC B, the results for dust emissions appear lower compared to the previous years, they still above the red line. TC B in particular, after a short period of lowering the dust emissions, has risen in 2012, as shown in Figure below.

Figure 2: Dust emissions in TC B from 2010 to 2012



Source: KEK database and Authors' calculation.

Over 2010-2012 period, there has been a considerable overtaking of maximum allowed volume of SO₂ emission TC B by nearly twice as much (400 mg/Nm³ allowed versus 750 mg/Nm³ released). Even larger so has been the overtaking beyond limits in emission of Nitrogen Oxides (NO_x), 500 allowed versus 900. To sum up this case without going into further details, TC B remained a heavy polluter, far above the maximum level allowed.

Ferronickel

The main problems of environmental pollution from the mines are that during the mining process large amounts of dust is released, especially during the summer season, which damages the environment and the health of the population and plants nearby. Ferronickel has replaced the filters in early 2007 (before resuming the work), in order to reduce the dust emission and polluting the water. The electric furnaces in which the melting of the iron and nickel is made, releases large amounts of dust and gases (CO, CO₂, SO₂, NO_x) due to high melting temperatures (about 1500 °C). At the beginning of resuming the work after privatization, this unit worked without a dust and gas cleaning system. However, since 2008, the company has contracted the system of cleaning of gases by the Norwegian company "Vatvedt". The gas cleaning system in both electric ovens was put into operation in March 2010. But that is only one part in the chain of activities involving excavation of the minerals, transporting, depositing, processing into alloys, to the storage of scrap and other remains that heavily pollute the environment.

The dust granules created during extraction and processing of minerals are released into diffusive forms into the atmosphere. The dust is categorized by the size of granules (PM₁₀, PM_{2.5} and PM₁ with a certain aerodynamics diameter < 10µm, <2,5µm and <1µm) and total suspension granules (GTS). The emissions of these harmful materials by Ferronickel is presented in the table below.

Table 2: Dust granules emission by Ferronickel, 2011 and 2012

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
mg/m ³	270	180	172	141	112	127	90.1	142	107	80.75	-	102,1
MVA	50 mg/Nm ³											
Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
mg/m ³	-	117.4	55.4	44.6	91.2	50.5	64.4	76.9	70.1	86.9	83.2	103.5
MVA	50 mg/Nm ³											

MVA = Maximum volume allowed

- no data

Source: Ferronickel database and Authors' calculation.

The figures in Table 2 do not need much explanation as they can speak on their own. Every single indicator at all observed times is well above the maximum volume of allowed emission, which is a clear indicator what pollutant in this area Ferronickel is. The situation with other pollutants such as SO₂ and NO_x is found to be more acceptable in terms of environment.

Table 3: SO₂ emissions into the air, 2011-2012

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
mg/m ³	1.58	1.91	1.93	1.75	619	1.00	1.00	1.44	390	977	-	841.4
MVA	800 mg/Nm ³											
Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
mg/m ³	-	1.54	504	4.47	2.03	770	800.8	948.8	848	746	708	807.4
MVA	800 mg/Nm ³											

MVA = Maximum volume allowed

- no data

Source: Ferronickel database and Authors' calculation.

The first half of the years has witnessed lower values of SO₂ emissions than the maximum volume allowed. Only in few months of the second half is the opposite. Here, the situations can be brought under control and bring this slightly higher level of emissions than allowed under control. The same can be said for NO_x emissions, the value of which over the same period has always been under 400 mg/Nm³ or the volume allowed by environmental standards. Despite this, Ferronickel remains a large polluter through dust granules.

Sharrcem

Like the first two cases, the technological process of production of clinker at the Sharrcem factory in Han i Elezit is largely followed by the emission of pollutants with an impact on the environment. The main environmental impacts of the cement plant in the air come from the rotary kiln chimney as a result of the physicochemical breakdown of the raw material and the burning process in the oven at high temperatures up to 1,450 ° C.

Other potential sources of contamination by cement factories are mills for milling cement, clinker warehouse packaging system and transport of finished products. All of these sources that are pollutant dust producers are controlled between the dust filtering system through mechanical dryers whose efficiency is 20mg/m³. The furnace outflow gas filtration system is controlled through an electrostatic filter whose efficiency is below 50mg/m³. The pollutants coming from or related to the Sharrcem, include: dust, flying dust, NOx, SO₂, organic steam components, and greenhouse gases.

Table 4: Emissions of pollutants by Sharrcem in 2012

Type	Dust	SO ₂	NOx
Quantity (mg/Nm ₃)	18	30	390
MVA	50	450	800

MVA = Maximum volume allowed

Source: Sharrcem database and Authors' calculation.

In all pollutant emissions, Sharrcem falls under the limits allowed by regulation and environmental standards. Though still a heavy pollutant, it keeps all the pollutants below the maximum volume allowed, which was not the case with other two previous companies. Once it was privatized and sold to a foreign buyer, the investor (Holcim from Switzerland) began the series of repairs and investing in technology that reduce the environmental pollution before resuming with the production process. As the company is profitable and with prospects to rise, it is a lesson that it should be better to invest in environmental concern first, and not neglect the pollution problem which when it accumulates, becomes so harmful that may go beyond repair and cause the company to be closed down on these grounds.

Conclusion

It is possible to get the economy overheated by intensive exploitation of natural resources such as coal, metals and cement. Not only possible, but actually easy at an enormous cost of environment that is already in trouble. The economic growth rates in many countries outweigh the cost of environmental degradation in the period they both refer to, and this is still considered a great concern. By comparison, in Kosovo, the cost of harm to the environment as measured in percentage of GDP, is higher than the rate of GDP growth. If in China the problem is a concern of alert type, in Kosovo the issue can be considered to have come to the state of alarm.

The three case studies included in this paper are the largest entities of pollutants. At their current state, the objective to pursue their own interest in making profit at the benefits of consumers such as employment, buyers, and spenders of electricity, is coming at a large cost of environment and health of the population. Yet, the Government rushed to sign the contract for construction of a new thermo power plant that is the site of largest pollution of air and soil in Kosovo. As no comprehensive measures were undertaken to the present day, the environment will likely further be degraded, thus the current and future projects in exploiting the mines should come after only the environmental cause is dealt with in advance. Kosovo does not have the needed resources to cope decisively with the harms caused in the environment. The first alternative as we dubbed in this paper, which is focusing on economic growth then switch to radical measures in favor of repairing and preserving the environment, should either be dropped, or the standards of environmental protection are respected, at least to the maximum volume allowed and never exceed it because it is already late. Only the Sharrcem is found to meet the needed criteria regarding the environment.

The second alternative should be put on place instead. Humans would not only like to live longer, but also would wish their heirs to live longer. The question is if they are ready to accept some material gains that brings them faster to premature death and lose everything earlier, or live longer with less economic resources. In the option "either, or", they would like to live longer with material gains. This is not possible in the first alternative, but it can be in the second. How? Economic growth and welfare should switch to other sectors rather than heavy industry like in the second industrial revolution. At this

stage, we recommend a more urgent task to determine the diagnose of environmental pollution by collecting more diversified, detailed and reliable data not only for the present, but also for earlier periods in order to better understand the causes and consequences of environmental degradation before the policies are brought for alleviating or neutralizing the scale of harm to the economy.

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