

Levani Kikilashvili*, Irma Dikhaminjia**, Rusudan Kvaratskhelia***

PROMOTING HEALTH IN GEORGIA THROUGH ECO-INFRASTRUCTURE AND TECHNOLOGY

Introduction

According to the latest data from the World Health Organization, up to 7 million people die each year due to solid particulate air breathing, one of the main sources of pollutants of which are vehicles.¹ Studies confirm that more people die from air pollution diseases than in road accidents.² Air pollution accumulates sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and carbon monoxide (CO), which increases the risk of developing cardiovascular and respiratory diseases.³

In response to high air pollution, some countries - with the purpose of coordination of all major sources of air pollution - have started producing clean energy, promoting the production of recyclable products, developing various

* Levani Kikilashvili, Ph.D. student, Assistant Professor - Sokhumi State University, Faculty of Business and Social Sciences, Country of Georgia.

** Associate Professor Irma Dikhaminjia - Sokhumi State University, Country of Georgia.

*** Professor Rusudan Kvaratskhelia, Doctor of Economic Sciences - Alte University, Country of Georgia.

¹ World Health Organization Releases New Global Air Pollution Data, World Health Organization, CCAC Secretariat 2018, <http://ccacoalition.org/en/news/world-health-organization-releases-new-global-air-pollution-data> (10.05.2019); A. Petyk, *Epidemiology of Selected Diseases Related to Air Pollution in Krakow*, "Journal of Ecological Engineering", No 19 (6)/2018, p. 124–31.

² K. A. Miller, D. S. Siscovick, L. Sheppard, K. Shepherd, J. H. Sullivan, G. L. Anderson, J. D. Kaufman, *Long-term exposure to air pollution and incidence of cardiovascular events in women*, "The New England journal of medicine", No 356 (5)/2007, p. 447–458.

³ G. H. Goss, A. N. Stacey, J. S. Schildcrout, L. Sheppard, J. D. Kaufman, *Effect of Ambient Air Pollution on Pulmonary Exacerbations and Lung Function in Cystic Fibrosis*, "American Journal of Respiratory and Critical Care Medicine", No 169 (7)/2004, p. 816–821; U. Gehring, A. H. Wijga, M. Brauer, P. Fischer, J. C. de Jongste, M. Kerkhof, B. Brunekreef, *Traffic-related air pollution and the development of asthma and allergies during the first 8 years of life*, "American journal of respiratory and critical care medicine" No 181(6)/2010, p. 596-603.

energy efficient technologies, and changes in infrastructure and construction.⁴ The 21st century faces the greatest challenges. Central databases are being created; a hyper-active system will link infrastructure solutions to each other and cities will become more sensitive, with the information exchange in real time mode.⁵ The smart public services will add more revolutionary power to modern governance. Smart cities are based on the most important asset of the day - data. In the world ecosystem, people face many dangers or risks of negligence. Modern 5G and the latest communications systems push different devices to synchronize and order, ensuring risk-free traffic.⁶

In fact, in the context of the technologies in which modern people live, everything - that the mind can dig into - is accessible and achievable. In this regard, it is important to understand Georgia's role in positioning globally: what kind of investors does the country need in terms of building and implementing eco-projects, and what types of eco-friendly technologies can be developed?

The eco-city is considered a major challenge in the modern world, where it is possible to create a healthy environment and coexist with the flora and fauna. Today's technologies have made it possible to build an eco-city in complete harmony with nature, giving the prospect of creating a flexible housing complex and promoting a healthy, clean and oxygen-rich place for people.⁷

The purpose of the research is to study the factors, affecting health and associated with environmental pollution in Georgia. The objectives of the study are to review the approaches to the environment and health around the world and in Georgia, identify the issues related to the environment pollution and seek the ways to eliminate them, develop a conceptual outline of an urbanized residential city, in which daily human activities will be balanced with nature and supported by harmonious and eco-friendly instruments.

⁴ Z. J. Andersen, M. Hvidberg, S. S. Jensen, M. Ketzel, S. Loft, M. Sorensen, O. Raaschou-Nielsen, *Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study*, "American journal of respiratory and critical care medicine", No 183(4)/2004, p. 455-461; J. Sunyer, *Urban air pollution and Chronic Obstructive Pulmonary disease: a review*, "European Respiratory Journal", No 17(5)/ 2001, p. 1024-1033.

⁵ O. Raaschou-Nielsen, Z. J. Andersen, M. Hvidberg, S. S. Jensen, M. Ketzel, M. Sorensen, A. Tjonneland, *Lung cancer incidence and long-term exposure to air pollution from traffic*, "Environmental health perspectives", No 119(6)/2011, p. 860-865; O. Raaschou-Nielsen, Z. J. Andersen, M. Hvidberg, S. S. Jensen, M. Ketzel, M. Sorensen, A. Tjonneland, *Air pollution from traffic and cancer incidence: a Danish cohort study. a global access science source*, "Environmental Health", No 10/2011

⁶ *Ambient Air Pollution: Health Hazards to Children*, "Pediatrics", Committee on Environmental Health, No 114 (6)/2011, p. 1699-1707.

⁷ J. Shin, J. Y. Park, J. Choi, *Long-term exposure to ambient air pollutants and mental health status: A nationwide population-based cross-sectional study*. PLoS ONE 13(4)/2018, e0195607.

Materials and Methods

Quantitative study was conducted within the framework of the study. A quantitative study was carried out using a non-probability sampling method for survey of the respondents in the public places in Tbilisi city and Kakheti Municipality according to the pre-structured questionnaire. The survey collected 626 respondents' answers.

In-depth survey was conducted with 10 experts within the scopes of the qualitative research with the use of focus group method. The research process was recorded through audio-video format, so that the transcript could be processed without any defect and presented in a timely manner.

Confidentiality, anonymity was maintained at all stages of the study. The study was conducted in March-June 2019.

Results

Most of the questionnaires were filled by 44.4% (n = 278) of 20-29-year old. The mean age is 25 years (± 5). 76.5% (n = 478) of respondents have higher education. 48.4% (n = 303) of the respondents were never married; according to 33.3% (n = 209), five or more members live in their families; 38.3% (n = 240) says two of family members work, and as 22.7% (n = 142) reported, their family average monthly income is 1001-2000 GEL. 42.2% (n = 263) of the respondents think that their living or working environment is less polluted, while 38.4% (n = 241) think that the mentioned areas are polluted due to: dusts of hazardous metals emitted by cars and during construction. 72.8% (n = 455) of the respondents say that cutting trees in recreational areas does not have a positive effect on the society for various commercial purposes, while 93% (n = 582) of the respondent's report that polluting of the air or arable lands with harmful waste affects their health. 71.4% (n = 445) of the respondents say that environmental pollution causes lung diseases, mental illnesses, cardiovascular diseases. 43.9% (n = 274) of the respondents think that living in ecologically clean environment is less available to them, while 28.1% (n = 176) say that ecologically clean environment is not available to them at all. In the opinion of 37.9% (n = 237), hindering living in an environmentally friendly environment is caused by a lack of services in the eco-environment. 48.5% (n = 304) think they would try to minimize the use of natural gas and the emission of harmful waste by means of transport or other means to reduce environmental damage as much as possible.

32.4% (n = 202) of the respondents believe that they would live in an ecological place, in complete harmony with nature and would not attempt on it. 61.9% (n = 388) of the respondents say that the rise of health problems is caused

by lobbying by state officials towards polluting organizations. 86.9% (n = 544) of respondents think that inadequate attention by the public to ecosystem, climate change or other factors increases the health problems. 45.2% (n = 282) of the respondents think that a healthy lifestyle has a great impact on human health, though they are not able to follow it. 43.8% (n = 273) of the respondents believe that maintaining a healthy lifestyle significantly influences their lifestyle and that they are adhering to it, in particular they go in for fitness, maintain a healthy diet. 84.1% (n = 527) of the respondents say that they would live in an eco-infrastructure city where everything is in harmony with nature (a place supported by renewable solar energy and eco-friendly technologies). 45.2% (n = 283) of the respondents believe that they would take care of changing their lifestyle and daily activities from now on in order to protect themselves from the risks of negligence. 46.4% (n = 289) of respondents think that they are positive about the technologies of the future, thinking that modern achievements can change the environment so that one's life becomes more comfortable and productive.⁸

In the framework of the qualitative research we obtained the following results. Most of the respondents mention that their place of residence is polluted, the situation is very difficult and the solution is quite difficult to find, because in the buildings already built, the population in the unit area exceeds the recommended limit, which puts every resident in a unfavorable situation, resulting in limitation of parking, movement, etc.

Green architecture is a very important issue in urban planning. Sustainable development and the role of modern infrastructure in human well-being is extremely actual and interesting, as particularly on these factors depends the environment one lives and develops. The experts point out that countries such as Singapore, South Korea and Malaysia have accumulated a wealth of experience in building modern architectural complexes and it is need to study this experience.

The interesting fact is that living indoors is psychologically harder for people than in an open space. This is what motivates the high campuses to have different indoor gardens. Being under the sun's ultraviolet rays is very important for humans, as well as supplementation of D-vitamin.

In recent years, scientists have come to the conclusion that glass architecture is not very useful because its heating and cooling can be quite expensive. Therefore, it is important to pay attention to modern energy efficient building materials that provide the desired temperature in the apartment.

⁸ Eco-research 2019a, https://drive.google.com/open?id=1AYyimUXo-dfZQxy5N6hKn3ZCZjRm_1YU

The efficient use of solar energy is of great importance. Solar panels have been developing recently, with their efficiency ranging from 100% to almost 78%. Significant loads are given to wind turbines and batteries.

It is important to evaluate the Life in forestland investment proposal, which will help the investor to properly evaluate whether it is worth or not investing in these cities. However, the socio-economic context of the sketch design may have not less contribution. It is imperative that any human activity related to environmental pollution be restricted and replaced by more effective means.

In Georgia, DSP and MDF materials are imported in large quantities, unfortunately the country does not have currently industrial timber and industrial forests, which means that the only choice is foreign materials, which are bound by volatile glue and its leakage creates a risk of various diseases. The most valuable materials are the products of Austrian and Swiss Kronospan and Eger. A great deal of caution is needed when buying varnishes and similar means for a home. Always should be taken into account the adverse effects that may result from neglect and deterioration of health resulting from the use of products saturated with chemicals. Bedrooms for small children should be made of natural wood. The details of the furniture should be mulched on all sides, which will reduce leakage of glue and volatile materials.⁹

Conclusion

As a result of the research an eco-city conceptual project has been developed. According to LIFEINCITYFORESTLAND - the subproject of MIXPROJECT, asphalt is not laid on the ground in the Eco City but drones are used for movement. Modern technologies make it possible to build an eco-city in perfect harmony with nature. In this project, pillars are represented as triangular buildings with a total of 3 pieces, and the residential complexes on the floor – 9 pieces and 18 pieces on two floors.

In the middle there is a transparent solid so-called glass (in grid cells). This space is used to walk; there is a railing at the end of the grid. It is multifunctional and the pads fitted in it allow generating electricity during the movement and illuminating in the night. The grid cell also has the function of turning it into non-transparent instantly when moving on it; its biggest advantage is that it has built-in installations and can run any material and visualize it in 3D format, which will help the tourist to view the region and plan a tour desirable to him/her through a single window principle. However, it will also help designers,

⁹ Eco-research 2019b, <https://drive.google.com/open?id=1rDavn46wuPiv8IBI-J5AODOYToA11ZDk>

IT representatives to lead healthy and productive years of life by working at home as a freelancer. They can live quietly in state-of-the-art eco-friendly homes and have access to everything electronically. Every flat roof is accompanied by a round seating area for a drone. The triangle-shaped building, in addition to having the function of a pillar, is used for various purposes. From a circular area on a pillar it will be possible for people to reach the earth vertically by el-lift. People will be able to relax rest and work in full recreation. This direction can be seen as a trend for people in the movement, eg.: tourists, it is a great place to get to know local landscape even more. Natural gas and water are freely available to the residents here. However, as for sewage and other waste treatment, it is possible to use a modern bio-toilet, which enables to recycle fecal mass and discharge clean technical water to be used for additional watering at particularly high temperatures. Garbage and other technical waste will be sorted. Bunkers will be installed in the ground and waste will be dumped through wide pipes. Drones will be used to carry out the technical works, they will remove waste to recycle it in special plants. According to modern trends, the use of large amounts of natural gas damages the earth. It is also possible to use energy efficient plants. One such plant is the *Mycanthus* plantation, which is processed to produce biofuels. It fits the territory of Georgia very well, its timber is quite solid. It is also noteworthy that the installation of wind, solar power or water turbines ensures that most of the requirements are met.

We have designed the interior of the apartment, which is unique in planning, as people living in it can view nature and avoid living in a polluted area. In the interior, at the top end of the wall and at the beginning of the ceiling there shall be closed racks. The flexible, sliding ceiling mounting mechanism allows the rack to slide out to the location convenient to the individual. Then it can go down with an accordion-like mechanism, cultivate or harvest the crop, and then return to the original position by moving vertically and horizontally. Otherwise, the product will be grown on the rack automatically, given the built-in air filter, with two spectra of dripping light-emitting diodes: for plant growth we need 450 nm, this is blue light; and 650 nm for root system development - this is red light. In general, they help to form a leaf and a plant. We will be able to grow healthy bio-plants (shoots, micro-greens, etc.) on organic soil. The individual would be able to get fresh product every 10 days, with outstanding vitamins and high-quality tasting properties.

According to the interior drawing of the apartment, the total square meter of living space is 78. This is effective for comfortably living for about 2-4 people. The thickness of the outer walls is 40 cm and the inner walls - 15 cm.

The render model of the interior design of the apartment has a variety of necessary elements, and furniture can be accommodated when moving into an apartment. One should have the choice of making massive wood furniture or the same, using DSP and MDF tiles with distinctive quality materials such as Austrian and Swiss Kronospan and Eger products and mulch all areas of the tile to avoid the harmful effects of volatile glue.

We have developed a concept for a healthy lifestyle, according to which we have to create an app that will combine all the products that a person would receive on a daily basis. Individuals will be recommended for opportunities to move to a healthy lifestyle for prevention purposes. We would get high-valid researches on nutrition from the World Health Organization (WHO) and other sources and itemize each fruit and vegetable that would give people a complete knowledge of how much vitamin, mineral, fat, carbohydrate and other similar - useful or usable substances - they accumulate. It would be possible to view and verify daily, weekly, monthly statistics as well as daily monitoring of what the individual would have to have on that particular day to supplement that norm of the specific substances that would be deficient. All foods or drinks, taken by an individual at the appropriate time would be entered manually and recorded by him/her so that relevant data could be counted. This method will help the state to achieve greater efficacy through preventive measures and reduce the burden of disease currently being spent on the treatment / recovery of the patients. See the images of the above application "ABC HEALTH".

Fig. 1. Sketch-render of the complex 1 Fig. 2. Sketch-render of the complex 2



Source: results of the project.

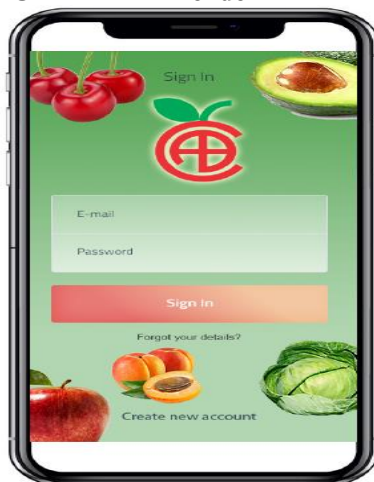
Our project has been developed on the basis of the purposes of the United Nations Global Sustainable Development and is fully compatible with it. These goals and their large scale determine its priority in the world. The opportunity to minimize the risks is real, and one of the clear examples of this is the sketch project above – life city in forestland (Fig. 1-4).

Fig. 3. Interior design of s.c apartment



Source: results of the project.

Fig. 4. Application “ABC HEALTH” render



Source: results of the project.

At the end of the project, a city model and the racks for growing useful plants and micro-greens were developed.¹⁰

It is advisable to encourage eco-projects by the state and to give people long-term loan at a low interest, that will allow people to live in ecological cities. The content project of application developed, which detects pesticides in foodstuffs and determines how harmful or healthy the goods are, will help people to protect themselves from the risks of negligence.

References

- Andersen Z. J., Hvidberg M., Jensen S. S., Ketzel M., Loft S., Sorensen M., Raaschou-Nielsen O., *Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study*, "American journal of respiratory and critical care medicine", No 183(4)/2004, p. 455-461.
- Ambient Air Pollution: Health Hazards to Children*, "Pediatrics", Committee on Environmental Health, No 114 (6)/2011, p. 1699–1707.
- Design patterns 2019
https://drive.google.com/open?id=1L8ehjLCj_v5bwHblaOh7EOmOhnf_1tOp
- Eco-research 2019a
https://drive.google.com/open?id=1AYyimUXo-dfZQxy5N6hKn3ZCZjRm_JYU
- Eco-research 2019b
<https://drive.google.com/open?id=1rDavn46wuPiv8IBl-J5AODOYToA11ZDK>
- Gehring U., Wijga A.H., Brauer M., Fischer P., de Jongste J. C., Kerkhof M., Brunekreef B., *Traffic-related air pollution and the development of asthma and allergies during the first 8 years of life*, "American journal of respiratory and critical care medicine" No 181(6)/2010, p. 596-603.
- Goss G.H., Stacey A.N., Schildcrout J.S., Sheppard L., Kaufman J.D., *Effect of Ambient Air Pollution on Pulmonary Exacerbations and Lung Function in Cystic Fibrosis*, "American Journal of Respiratory and Critical Care Medicine", No 169 (7)/2004, p. 816–821.
- Miller K. A., Siscovick D. S., Sheppard L., Shepherd K., Sullivan J. H., Anderson G. L., Kaufman J. D., *Long-term exposure to air pollution and incidence of cardiovascular events in women*, "The New England journal of medicine", No 356 (5)/2007, p. 447–458.
- Petryk A. *Epidemiology of Selected Diseases Related to Air Pollution in Krakow*, "Journal of Ecological Engineering", No 19 (6)/2018, p. 124–31. doi.org/10.12911/22998993/92892.
- Raaschou-Nielsen O., Andersen Z.J., Hvidberg M., Jensen S.S., Ketzel M., Sorensen M., Tjonneland A., *Lung cancer incidence and long-term exposure to air pollution from traffic*, "Environmental health perspectives", No 119(6)/2011, p. 860-865.
- Raaschou-Nielsen O., Andersen Z. J., Hvidberg M., Jensen S. S., Ketzel M., Sorensen M., Tjonneland, A., *Air pollution from traffic and cancer incidence: a Danish cohort study. a global access science source*, "Environmental Health", No 10/2011
- Sunyer, J., *Urban air pollution and Chronic Obstructive Pulmonary disease: a review*, "European Respiratory Journal", No 17(5)/ 2001, p. 1024–1033.
- Shin J., Park J.Y., Choi J., *Long-term exposure to ambient air pollutants and mental health status: A nationwide population-based cross-sectional study*. PLoS ONE 13(4)/2018, e0195607.
- World Health Organization Releases New Global Air Pollution Data, World Health Organization, CCAC Secretariat, 2018, <http://ccacoalition.org/en/news/world-health-organization-releases-new-global-air-pollution-data> (10.05.2019)

¹⁰ Design patterns 2019, https://drive.google.com/open?id=1L8ehjLCj_v5bwHblaOh7EOmOhnf_1tOp

Summary

Introduction: Georgia faces great challenges at the beginning of the new millennium as a developing country. There are high risk factors for various diseases, often associated with environmental pollution and the significant lack of green eco-cover. The purpose of this research is to study the factors affecting environmental pollution and health deterioration in Georgia. **Materials and Methods:** Within the quantitative study in-depth survey of respondents and experts were conducted using a pre-structured questionnaire and focus group method. **Results:** 93% (n=582) of respondents believe that air or arable lands contamination with hazardous waste affects their health. Nevertheless, 46.4% (n=289) of respondents maintain a positive attitude towards future technologies, thinking that modern advances can change the environment so that people's lives become more comfortable and productive. According to experts, their place of residence is contaminated. The majority of respondents (73.4%, n=367) report that in Georgia they are most concerned about the incidence of diseases caused by unhealthy essentials (food, clothing and living environment) and unhealthy conditions. 63.7% (n=319) of the respondents think that agricultural products grown by chemical methods are a major threat, while 69.3% (n=347) of the respondents think that various foodstuffs (sweets, preserves, dairy products, etc.), containing the hazardous substances are not useful, though the alternative is less found in the country. Within the framework of the study, a model of city arrangement as well as the shelves for growing useful plants and micro-greens waves in the rooms of the apartments have been developed. **Conclusion:** It is advisable to encourage eco-projects by the state and to give people long-term loan at a low interest, that will allow people to live in ecological cities. The content project of application developed, which detects pesticides in foodstuffs and determines how harmful or healthy the goods are, will help people to protect themselves from the risks of negligence.

PROMOWANIE ZDROWIA W GRUZJI POPRAZ EKOFRAKTRUKTURĘ I TECHNOLOGIE

Streszczenie

Wprowadzenie: Gruzja jako kraj rozwijający się na początku nowego tysiąclecia stoi przed wielkimi wyzwaniami. Istnieją wysokie czynniki ryzyka występowania wielu chorób, które często związane są z zanieczyszczeniem środowiska i znacznym brakiem zielonej ekoosłony. Celem badań jest analiza czynników wpływających na zanieczyszczenie środowiska i pogorszenie stanu zdrowia osób mieszkających w Gruzji. **Material i metody:** W ramach badania ilościowego przeprowadzono pogłębione badanie ankietowe respondentów i ekspertów z wykorzystaniem kwestionariusza oraz metody grup fokusowych. Wyniki: 93% (n=582) respondentów uważa, że zanieczyszczenie powietrza lub gruntów ornych odpadami niebezpiecznymi ma wpływ na ich zdrowie. Niemniej jednak 46,4% (n=289) respondentów utrzymuje pozytywne nastawienie do technologii przyszłości uważając, że postęp w dziedzinie nowoczesności może zmienić środowisko, tak aby życie ludzi stało się wygodniejsze i bardziej produktywnie. Według ekspertów miejsce ich zamieszkania jest zanieczyszczone. Większość respondentów (73,4%, n=367) twierdzi, że w Gruzji najbardziej niepokoi ich występowanie chorób spowodowanych niezdrowymi produktami podstawowymi (żywność, odzież i środowisko) oraz niezdrowymi warunkami życia. 63,7% (n=319) respondentów uważa, że duże

zagrożenie stanowią produkty rolne uprawiane z wykorzystaniem chemicznych środków ochrony roślin, natomiast 69,3% (n=347) respondentów uważa, że artykuły spożywcze (słodycze, przetwory, produkty mleczne itp.) zawierające niebezpieczne substancje nie są przydatne, chociaż ich substytuty nie są w kraju dostępne. W ramach badań opracowano model aranżacji miasta oraz regały do uprawy roślin użytkowych i mikrozieleni w mieszkaniach. **Wnioski:** Zaleca się wspieranie przez państwo ekoprojektów i udzielanie osobom fizycznym długoterminowych pożyczek o niskim oprocentowaniu, które pozwolą żyć w ekologicznych miastach. Opracowany projekt merytoryczny aplikacji, która wykrywa pestycydy w produktach spożywczych i określa stopień ich szkodliwości dla zdrowia, pomoże ludziom chronić się przed ryzykiem zanieczyszczenia.

