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Eco-aesthetics and Ecological Aesthetics of Nature¹

Ekoestetyka i ekologiczna estetyka przyrody

Włodzimierz Tyburski

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Abstract

Eco-aesthetics and ecological aesthetics of nature are closely related, twin disciplines having a similar, but not identical object of interest. **Eco-aesthetics** is a discipline which – in our opinion – focuses on the existing world of nature, nature intact by man or modified by him only to a limited extent (wilderness areas, natural ecosystems, nature and landscape parks). Eco-aesthetics would advocate simple acceptance of nature without arranging it, nature protected against anthropogenic impact distorting or modifying its original, existing beauty. And for these reasons eco-aesthetics is part of – or at least is close to – the biocentric vision of the world, in contrast to **ecological aesthetics of nature**, which fits more into the anthropocentric vision of reality. While eco-aesthetics is interested in nature understood autonomously in its original and existing form, ecological aesthetics of nature focuses more on the environment modified by man.

Key words: nature, beauty, art, eco-aesthetics, ecological aesthetics of nature

Streszczenie

Ekoestetyka i ekologiczna estetyka przyrody to bliskie, siostrzane dyscypliny o podobnym lecz nie tożsamym przedmiocie zainteresowań. **Ekoestetyka** to dyscyplina, która – naszym zdaniem – uwagę koncentruje na zastanym świecie natury, nietkniętej przyrodzie, bądź w ograniczonym tylko stopniu zmienionej przez człowieka (obszary dzikie, naturalne ekosystemy, parki przyrodnicze i krajobrazowe). Ekoestetyka opowiadałaby się za prostą akceptacją przyrody, bez jej aranżowania, chronionej przez wpływy antropogennymi, zniekształcającymi czy modyfikującymi pierwotne, zastane piękno. I z tych powodów ekoestetyka wpisuje się, albo przynajmniej bliska jest, biocentrycznej wizji świata, w przeciwieństwie do **ekologicznej estetyki przyrody**, która wpisuje się bardziej w antropocentryczny obraz rzeczywistości. O ile dla ekoestetyki przedmiotem zainteresowań jest przyroda pojęta autonomicznie w swej pierwotnej i zastanej postaci, to ekologiczna estetyka przyrody, bardziej kieruje uwagę ku przyrodniczemu, przetworzonemu otoczeniu człowieka.

Słowa kluczowe: przyroda, piękno, sztuka, ekoestetyka, ekologiczna estetyka przyrody

In the second half of the 20th century attempts were made at understanding and interpreting the rich spectrum of man's aesthetic relations to the natural environment. As a result, a new discipline of knowledge emerged (or rather has been emerging, as it has not yet been fully constituted), located on the border between ecology and aesthetics, most often referred to as *e c o – a e s t h e t i c s*. The very name of the emerging discipline suggests that it is interested

in the subject matter in the field of the possible relations between aesthetics and ecology. **Eco-aesthetics** is the term most frequently used to refer to the emerging area of interest, but there are also other concepts and terms, behind which there is content which seems different to some and similar or even identical to others, such as: *aesthetics of reality, environmental aesthetics, empirical aesthetics, ecological aesthetics of nature, or aesthetics of ecology*. In this situation, cer-

¹ The article refers to some author's statements comprised in the book *Nauki humanistyczne i ekologia/ Humanities and Ecology*.

tainly there is a need to first introduce some conceptual, terminological and – as a consequence – problem order. According to M. Gołaszewska, *eco-aesthetics is an empirically-oriented branch of aesthetics and its subject matter are the phenomena of synergy (mutual support) and feedback between beauty (aesthetic values of art and nature) and broadly understood ecology* (Gołaszewska, 2000). Aesthetics of reality, in turn, seems to be a broader concept and it represents a certain theoretical proposition of *understanding the phenomenon of beauty in the real world: in the anthroposphere as a system connecting man with nature in individual experiences, sensations* (Gołaszewska, 2000).

Eco-aesthetics is undoubtedly a contemporary discipline, but its roots reach far into the past. The issue of the beauty of nature, but also the conviction still valid today, that *beauty is a direct link between the natural world and the world of man* are part of the aesthetic reflection of different cultures and epochs (Iron, 2008) and let us add that it is a particularly important reason why these two worlds have moved noticeably closer. What deserves special emphasis, however, is that eco-aesthetics is a discipline which is emerging and developing in the context of an environmental crisis and largely due to this crisis. Among others, German ecologist E. Meinberg draws attention to this fact when, analyzing the contemporary processes alienating man from his environment, he shows that the experience of the ecological crisis has, somewhat paradoxically, *forced the rehabilitation of the aesthetics of nature* (Meinberg, 1995, 2003). We should agree with Zbigniew Łepko when he observes, that *the encroachment of the products of human civilization upon the world of nature most often isolates man from the experience determining the full development of his aesthetic sensitivity* (Łepko, 2003). At the same time, these processes ruthlessly make us aware of the fact that the world of nature in its pure, natural form uncontaminated by human activity is fading into the past, along with the form of beauty which can be discovered and contemplated in the natural environment not modified by man. Unfortunately, for the modern man this beauty has to a large extent been lost. Nature films, literary descriptions of nature, and small enclaves of primeval nature remaining in their wild form, shrinking by the day, are the only substitute for it. With the degradation and devastation of nature, its original beauty fades away.

In this context, the question is rightly posed of how *the aesthetic perception of nature is linked with the phenomena jointly referred to as the contemporary ecological crisis? (...) Perhaps not strongly enough – is one answer to this question – it is emphasized that the ecological crisis is primarily the crisis of the perception of nature, and therefore it is of a purely aesthetic nature. While heated debates are held on whether we are indeed dealing with a global ecological crisis or rather with some pessimistic visions of environmentalists, there is no doubt about the fact*

that beauty, or, more broadly speaking, the aesthetic values of nature consisting, inter alia, of the diversity of plant and animal species, forms of landscape, unique combinations of colors and shapes, are disappearing at an alarming rate. Hardly anyone draws attention to the importance of this issue, especially in Poland (Liszewska, Liszewski, 2011). Others, on the other hand, believe that the argument of aesthetic character is one of the strongest arguments in favor of the conservation of nature. This approach is advocated by Jean Dorst, who in his book entitled *Before nature dies* argues that *above all, nature can be saved by our feelings, since nature is beautiful, and we need beauty in all its forms* (Dorst, 1970).

The form of nature the modern man is exposed to is – to a lesser or greater extent (with a clear majority of the latter) nature processed by the work and activities of man, tailored to his aesthetic taste, preferences, and ideas about what beauty is. Therefore, a different kind of beauty, the beauty of *civilized*, processed nature, is taking place of the beauty of primeval nature, unspoiled by the activities of man. The patterns of beauty typical of nature in its original form are being replaced with the patterns of beauty of nature transformed by human activity. It is probably worth realizing more clearly that when we are referring to the beauty of nature today, what we actually mean is not the natural, primeval beauty, but the beauty which has been extensively processed or, speaking more bluntly, constituted by man. This difference is clearly illustrated in the comparison of the natural beauty of the primeval forest unspoiled by human intervention with the beauty of the city park, shaped in line with the ideas, taste and aesthetic beliefs of its designers. *What is nature to modern man?, What determines the validity of the category of beauty?* and, in particular, *What is the role of beauty as an ally of ecology?* We should expect answers to these questions, hoping that they will be provided by the science of the beauty of nature – as eco-aesthetics is referred to in the subtitle of the book *Święto wiosny/The Rite of Spring* by M. Gołaszewska (2000). This should be expected of eco-aesthetics, which cannot be satisfied with the overly narrow, traditional formula of philosophy of art. Therefore, it focuses attention on the object of study brought out by modern ecology, this object is understood not only as the natural environment, but any human environment. Some aestheticians perceive the concept of the environment offered by modern ecology as an extremely attractive research area in which, in some ways, it is easier to formulate clear theses of the new aesthetics, departing from the formula of the philosophy of art. Aesthetics combined with ecology becomes an attempt to respond to both the desire of beauty and the need for being in close contact with nature, not remaining indifferent to aesthetic values. Gołaszewska sees the origin of eco-aesthetics at the time when two attitudes: *pro nature* and *pro arte* came into contact. In her opinion, art purposefully got closer to nature, preserving reverence for its strength

and beauty. Eco-aesthetics focuses on the links between the human axiological world and various natural phenomena. Writing about the general theoretical premises of eco-aesthetics and raising the subject of the peculiarities of its research, the author formulates the thesis that the said discipline is *committed to the task of getting to understand the phenomena associated with the beauty of nature – it assumes a priori the axiomatic premises regarding the manner of existence of these phenomena and creations of nature (the real and the potential one), the formal character of the system of values, especially aesthetic values, and the ways of structuring reality (symmetry, rhythm, enrichment, etc.): eco-aesthetics strives to create a closed, coherent system of propositions describing and interpreting the axiological side of natural phenomena* (Gołaszewska, 2000). According to Gołaszewska, eco-aesthetics is theoretical knowledge, *it is not meant to formulate directives governing behavior, it is not trying to improve the world, but its goal is to understand the extent to which the beauty of reality, nature, and wildlife contributes to the creation of the specific aesthetic attitude rising out of the sensitivity of man to the beauty of nature* (2000). I share the author's opinion that eco-aesthetics has no intention of improving the world, let me add, however, that I believe that – the way I understand it – it postulates that what exists, i.e. the natural world, should be protected and preserved, referring to aesthetic arguments and motivation.

In the eponymous rite of spring, Gołaszewska offers the reader a vision of a happy man inspired by the beauty of Nature, while devoting a lot of attention to the issues of eco-aesthetics as a science. The author wonders about the phenomenon of the widespread conviction that aesthetic sensitivity supports environmental attitudes and actions. If, indeed, beauty serves as an important ally of ecology, this role should be examined, we can also talk about the formation of a peculiar *ecological ideology* in which the pro-ecological function of beauty takes its rightful place (next to pragmatism, humanistic view of the world, and purely emotional involvement).

In my opinion, eco-aesthetics as a discipline has two functions: cognitive and theoretical, and practical and educational. The former is theoretical knowledge, and more precisely – philosophical knowledge, aimed at understanding the phenomena associated with the beauty of nature, formulating propositions regarding the phenomena and creations of nature expressed from the aesthetic perspective, identifying the character of aesthetic values associated with nature, or the ways of structuring reality, etc. The latter is interested more in the phenomenon of directly experiencing the beauty of nature, reflecting on how human sensitivity to the beauty of nature and aesthetic and emotional relationships between man and nature emerge and are shaped, and the emergence of a specific aesthetic attitude resulting from such dispositions. All this is connected with the belief that aesthetic sensitivity en-

coded in a specific aesthetic attitude can greatly support environmental attitudes and actions.

The belief that nature has value not only in the instrumental, utilitarian and biological dimensions – as a living organism, but also in the aesthetic dimension – which, for many, is much more valuable – is, in my opinion, a vital and strong motive for taking environmental actions. Doubtlessly, many examples could be provided to illustrate how much the aesthetic qualities of a landscape, a particular place, sometimes a single object, motivate environmental actions. In order to save and preserve the aesthetic values of nature in its more or less concretized dimensions and when convinced of its real, not imaginary values, we are sometimes capable of making heroic efforts. I know one example from my own city, where the residents of a housing estate did not agree to the construction of a road in a beautiful forest located nearby, even though it would allow them to get to their homes a lot faster. They simply recognized the aesthetic, recreational values as being more valuable than the – generally speaking – utilitarian values (waste of time, costs associated with longer rides, convenience).

Perhaps the concepts of combining the aesthetic and ethical dimensions in the reflection on the environment emerged in connection with such examples. They include the attempt to found environmental ethics on aesthetics – and thus anthropocentric environmental values formulated by Eugene C. Hargrove. *Its starting point – says Marek M. Bonenberg – is the claim that modern environmentalism is genetically based more on aesthetic than ethical considerations, since it is the aesthetic experience resulting from the contact with nature that has shaped the modern environmental sensitivity and intuition. For this reason, debates on the moral relationships with the environment will be more fruitful and conclusive if they remain connected with their aesthetic roots. Hence, Hargrove constructs a theory of aesthetic values as 'anthropocentric internal values', according to which the aesthetic value of an object is, indeed, the result of an act of evaluation by the subject, and this is due to the positive experience of this subject, but at the same time this valuation is selfless in nature and therefore non-instrumental, from which Hargrove concludes that it is internal in nature* (2000). The author of the foregoing statements is convinced that the aesthetic values of nature can serve as the basis for the moral concern for the environment, and provides grounds for them by presenting an *ontological* argument, *trying to prove that what determines the unique status of aesthetic values of natural objects is the real existence of these objects, which is a property enhancing their aesthetic value* (2000). Thus, it can be said that *the awareness of the real existence of an object makes us assign a greater aesthetic value to it, which means that we have a moral obligation to preserve the existence of aesthetically valuable natural objects* (Hargrove favors the beauty of nature over the beauty of art) – *nature is not only the subject of*

aesthetic contemplation, but also the 'creator' of the forms existing in it, while works of art are passively shaped by man (2000).

We do not wish to get into a discussion here about the extent to which aesthetic sensitivity resulting in a specific aesthetic attitude is a natural response to our close and more remote natural environment, and to what it is a conscious and shaped ability. The fact is, that the phenomenon, which can be referred to as the absence or scarcity of the aesthetic dimension in connecting with the natural world, is something which occurs very often. This, in turn, clearly raises the question about the problem of aesthetically oriented environmental education.

Moreover, in our opinion, eco-aesthetics is a discipline which should focus its attention on the existing world of nature, intact wilderness, or wilderness only slightly modified by man; what I mean here are wilderness areas, natural ecosystems, nature and landscape parks. Eco-aesthetics would advocate a simple acceptance of nature, the beauty of which, intact by conscious human activity, was experienced by it in its *natural*, primeval and existing form, nature unarranged, protected against the anthropogenic impact distorting or modifying the original, existing beauty. And for these reasons eco-aesthetics is part of, or at least is close to, the biocentric vision of the world, in contrast to **ecological aesthetics of nature**, which fits more into the anthropocentric view of reality. While the subject of interest of eco-aesthetics is nature understood autonomously in its original and existing form, ecological aesthetics of nature focuses more on the natural environment of man.

The idea referred to as ecological aesthetics of nature – a discipline being designed rather than fully formed – was conceived by Gernot Böhme. In his view, the constitution and development of such a discipline is urgently needed in times when *we have rediscovered that we have to live in nature and with nature, more than that, we need nature* (Böhme, 2002). The new discipline is needed as an ally of ecology and human ecology, which emphasize the need to experience nature in physiological terms only *as a need for clean media conducive to health*. They do not say anything, however – and it is much needed – *about the sensual and emotional or (...) sensual and moral qualities of the environment* (2002). According to Böhme, ecological aesthetics of nature has an important task of spreading the belief *that for a healthy, not to say, a good life, one has to experience the environment which has certain aesthetic qualities* (2002). Setting such a goal for itself, aesthetics should provide arguments supporting the view that the frame of mind of a man is co-determined by the sensory and emotional qualities of his environment.

Yet another, equally important task of the new discipline is to continuously remind us of the belief that the basic needs of human life include not only the general need of beautiful surroundings, but also the need which the author of the project of the discipline

calls the need of nature, i.e. something which *exists on its own* and which *moves man through its independent existence*. The truth is that each one of us has a deep need to experience something other than himself or herself.

Böhme believes that the future ecological aesthetics of nature should make direct references to and learn a lot from the theory and practice of landscape gardening. It turns out that a number of very similar premises can be seen in the ways of relating to nature as a garden and treating nature in accordance with the proposals and guidelines of the new ecological aesthetics. Landscape gardening bears traces of human activity. Recalling this fact and giving it a more generalized dimension, one should note that *we have irrevocably entered an era in which every state of nature contains anthropogenic elements, i.e. it is marked in some way by the existence of man* (2002). The difference between the previous aesthetics of nature and the new ecological aesthetics lies in the fact, that the former treats nature as something already existing, given, while the new discipline emphasizes the fact that nature is saturated – to a greater or lesser extent – with anthropogenic elements, and, therefore, it is socially constituted nature. Böhme adds that ecological aesthetics of nature is also about nature as such, *that is about what exists and operates on its own*, and that means that ecological aesthetics of nature cannot be *exclusively a preparation of the environment, nor – as eco-aesthetics – a simple acceptance of nature* (2002). And it is *the theory and practice of landscaped gardening that provides here an example of a possible solution to this paradox. As a specific poetics of nature, landscape gardening was an art, which was about making as much room for nature as such as possible. If nature is arranged here, it is to move man to a greater extent* (2002).

Böhme thoroughly analyzes various types of gardens, mainly comparing the French and the English gardens. French gardens are almost always presented in the form of their vertical projections, geometric layouts equipped with sophisticated ornamentation, they are an absolute subordination of nature to the formal principles of man, and, in particular, to geometry. The plants merely provided the construction material which was used to build walls and ornaments, or the mass in which statues were carved out. The autonomy of nature appears in this context as an obstacle or a deviation, and the whole production work of man is targeted at a drastic reduction or destruction of the effects of the independent activity of nature. It is clearly emphasized that the form of the French garden can be maintained only in a constant battle with the autonomy of nature.

A typical feature of English gardens is that they are presented through *views* and changing sceneries. One should look for their artistic sources in landscape painting. The English art of shaping gardens begins with the actual nature, accepts its diversity and adapts to it in its implementation of order. Land-

scape gardens – although they are still gardens – are guided by the idea of freedom, free nature. In these gardens the gardener allows the plant objects to grow. It should be noted and clearly stressed that the English garden does not fit into the traditional dichotomies: nature and art, nature and technology, nature and civilization, nature and culture. On the one hand, in these dichotomies nature is always something which exists on its own and develops according to its own laws. On the other hand, there are things which are deliberately created by man through laws, work and shaping. This form of gardening breaks the existing models and, as a result – as maintained by Böhme – becomes art allied with nature. What is typical of the English garden is that human activity here focuses on the intentions of nature, on respecting its freedom and liberty. Even if the English garden should be treated as a product of art, and even – to a certain extent – of technology, it is a special kind of art or technology that assumes the possibility of a future reference to nature. What is important, is that landscape gardening – although it is a form of art and a technique of gardening – does not appropriate nature and does not intend to control it. Böhme believes that the English garden has a paradigmatic significance for the development of the new way of relating to nature.

Landscape gardening does not fit into the dichotomy of art and nature. The future ecological aesthetics of nature can learn a lot from the theory and practice of landscape gardening, because the latter provides rich material on the relationship between the aesthetic qualities of the environment and the well-being of man. It implies a relationship with nature which is about preserving, favoring and experiencing its spontaneity. It is not so much about watching, becoming aware of, contemplating or perceiving nature in any other way – which has been the case in aesthetics so far, *but about life in nature and in alliance with nature*. While the very beauty is not merely an addition, ornament or reflected light of an idea, but rather sensory and emotional nourishment. The English garden was created with a view to its being used on a daily basis, it was meant to create certain conditions and opportunities for the life of its user, for his or her mental economics, quality and value of life. *From this perspective, English landscape gardening was not only a branch of aesthetics but also of ecology – human ecology, while the theory of landscape gardening is becoming a paradigm for the future ecological aesthetics*. Böhme believes that *landscape gardening as an alliance technique, through recognizing the spontaneity of nature and minimizing the indispensable reproductive work, may serve as a point of reference for the new practical way of relating to nature as such* (2002).

Eco-aesthetics and ecological aesthetics of nature are two twin disciplines interested in protecting the beauty of the natural world, both existing in its natural form and processed by the work of man.

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Impact of the Environmental Factor on the Dynamics of Development of Neighbor Law in the Context of Issues of Sustainable Development

Wpływ czynnika środowiskowego na dynamikę rozwoju prawa sąsiedzkiego w kontekście problematyki rozwoju zrównoważonego

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Abstract

The article deals with evolution of neighbor law beginning from the age of the ancient world and up to our times. The authors prove that already by the middle of the 19th century environmental and technological threats become greatly important in the neighborhood relations, and from the early 21st century these threats start acquiring a new systematic attribute associated with the beginning of the age of globalization. Sustainable development at the local level is greatly influenced by the dynamics of population settlement leading to emergence of giant megalopolises, where millions of people reside at the same time.

This causes new types of neighborhood disputes not existing before. The post-Soviet legal science, courts and legislation are not completely ready for their resolution. Nevertheless, even now we can observe the outlines of new environmental threats to sustainable development at all its levels, caused by development of green energy, nanotechnology and the climate change. There are no simple ways to resolve neighborhood conflicts either – it is necessary to create an integrated system of containment and counterbalance, including both private and public methods.

Key words: neighbors, disputes, environment, technologies, private law, development

Streszczenie

Artykuł przedstawia rozwój prawa sąsiedzkiego począwszy od starożytności po czasy obecne. Autorzy udowadniają, że już w połowie XIX w. zagrożenia środowiskowe i technologiczne odgrywały istotną rolę w relacjach sąsiedzkich, a od początku XXI w. wzbogaciły się o nowy atrybut systemowy związany początkami ery globalizacji. Rozwój zrównoważony na poziomie lokalnym pozostaje pod znaczącym wpływem dynamiki osadniczej, związanej z powstawaniem gigantycznych mega-metropolii, zamieszkiwanych w tym samym czasie przez miliony ludzi.

Warunkuje to powstawanie nowych typów konfliktów sąsiedzkich, dotąd nieznanych. Postsowieckie nauki prawne, sądy i prawodawstwo, nie są do takiej sytuacji przygotowane. Ponadto już teraz możemy dostrzec zarysy nowych środowiskowych zagrożeń dla zrównoważonego rozwoju i to na wszystkich jego poziomach, a związane z rozwojem zielonej energii, nanotechnologii i postępujących zmian klimatycznych. Nie ma także prostych

sposobów rozwiązywania konfliktów sąsiedzkich – należy stworzyć zintegrowany system kontroli i przeciwdziałania, który uwzględniałby zarówno środki publiczne, jak i prywatne.

Słowa kluczowe: sąsiedzi, konflikty, środowisko, technologie, prywatne prawo, rozwój

Introduction

The emergence of neighborhood relations was initially caused by transition of tribal communities from hunting and gathering to settled agriculture. The first conflicts between neighbors were resolved in accordance with customs and traditions of the peoples, and only much later, with the emergence of positive law, resolution of neighborhood disputes and conflicts moves to a more formal basis. Already in the *Law Code of the Babylonian of king Hammurabi* we find the first formulae to resolve conflicts between neighbors. However, the most successful and detailed were the neighborhood rules of Rome. Further development of legal regulation of neighborhood relations acquires a strong national basis, and from the middle of the 19th century *classical* threats and conflicts are supplemented with those associated with scientific, technical and environmental factors. This is particularly evident in the 21st century. Despite this trend, analysis of legislation, legal doctrine and judicial practice of most post-Soviet countries shows unreadiness of developing legal systems to resolve even *classical* neighborhood disputes existing without any major change since the time of Roman law. The latest environmental challenges and threats to neighborhood relations are simply ignored.

Meanwhile, the strengthening impact of the environmental factor on the dynamics of the development of social relations at the local level is a part of a more global issue associated with sustainable development.

First issues of sustainable development became the center of world attention in 1972, during the United Nations Conference on the Human Environment held in Stockholm, which established the connection between economic and social development as well as environmental issues.

In 1983, according to the Decision of the United Nations General Assembly, the World Commission on Environment and Development was created. In 1987, this Commission prepared its report *Our Common Future* for the UN. Its authors suggested understanding *sustainable development* as *development which meets the needs of the present without compromising the ability of future generations to meet their own needs*. According to the Commission, it contains within it two key concepts: the concept of *needs*, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. Later this report was further developed in the proceedings

of the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992.

The following stage of discussion of the concept of sustainable development started in 2002, when an essential political document, the *Johannesburg Declaration on Sustainable Development*, was adopted at the World Summit in Johannesburg, and as a result of the United Nations Conference on Sustainable Development, RIO+20, held in Rio de Janeiro in 2012. The outcome document of the conference *Future We Want* shows, that the idea of sustainable development gained widespread acceptance all over the world. In it.1 of this document the Heads of State and Government confirm that, having met at this conference, they renew their commitment to sustainable development and want to ensure the promotion of an economically, socially and environmentally sustainable future for our planet and for present and future generations.

This focus on the transition to sustainable development means, that all its constituent components (economic, social, environmental), should become a part of a new civilization survival strategy. The essence of the sustainable development model is to identify the causes of the negative trends of the current economy-centric development, when profit and benefit are the main value. In addition, the change of goals in modern civilization may lead to preservation of the biosphere due to reduction of the anthropogenic pressure. This new planetary purpose will not only stop degradation of man and nature but also create conditions for environmentally safe development. However, at the moment, in terms of global challenges and threats, declarations on commitment to ideas of sustainable development are obviously not enough. A comprehensive approach to sustainable development of society affecting all the aspects of social life and ensuring an equal concern for sustainable development at local, regional and national levels is necessary, along with identification of numerous sectors requiring a special concern, including development of transportation, housing, interaction of public and private sectors (Eisen, 1999).

Hence it follows, that study of issues of sustainable development at the local level, associated with emergence of new threats to neighborhood relations, appears particularly important today, as it enables to find a new dimension in the issues of sustainable development – *degree of comfort of living environment of citizens*, which is little studied today. However, in our opinion, this is the point where environmental, economic and social aspects of sustainable development are closely intertwined, which requires reasonable regulation of this issue by means of development of national legislation.

Central, regional and local legislation of any country, including countries of the post-Soviet space, may suggest various measures aimed at sustainable development, full analysis of which goes beyond the scope of our article. Nevertheless, we should note that the most part of legal regulation of sustainable development at the local level should be governed by legal acts of local government bodies. Exactly they are capable of both ensuring comfortable living for local residents and creating a lot of problems for them by means of urban development zoning, determination of the procedure for collection and disposal of waste as well as by means of many other measures. This raises the question of search for the balance of private and public interests at the local level, the attempts to find which have been repeatedly made before in the history of different countries and peoples.

1. Main trends of historical development of neighbor law

1.1. Neighbor law in the age of the Ancient World

Neighborhood relations in the early centuries of human civilization were governed by traditions and only the transition to settled agriculture and formation of compact settlements with a lot of farmlands led to emergence of law and formal (written) rules for resolving neighborhood conflicts. We find the first mentions of neighbor law in the *Law Code of the Babylonian of King Hammurabi* (1792-1750 BC), which states that if a person is too lazy to strengthen a dam in his field, and the neighboring fields are flooded due to water breakthrough, the guilty person must reimburse the cost of the damaged bread (§53, 55) (The Law Code of the King Hammurabi, 1996). The Laws of Manu (India, 2nd century BC – 2nd century AD) establish rules for determining the borders between two villages, as well as the procedure for settlement of boundary disputes between neighbors (The Laws of Manu, 2016). However, the structure of neighbor law acquires its most complete and modern form in the time of ancient Rome.

Analysis of Roman law (including the *Laws of the Twelve Tables*) shows, that in Rome the main principle regulating neighborhood relations consists in the fact, that the area of rule of one owner was limited to his land plot, and any violation of its boundaries allowed another owner to make a claim for elimination of obstacles. The exceptions were two groups of cases. First, it was necessary to accept and tolerate the adverse effects if they were caused by normal methods of disposal of the property. They included the owner's obligation to endure nuisances associated with the neighbor's tree branches extending over his plot, if the branches grow at a height of not less than 15 feet and do not rise above his building; to allow the neighbor to collect the fruits that fall from this tree; not to change the natural flow of rain

water. Later these limitations were supplemented with other ones, for example, nobody is obliged to endure the smell of smoke or manure from a neighboring plot, except the cases when these phenomena are within the custom (Pokrovsky, 1999), as well as with the rules stipulating the height and location of the neighbor's structures on the plot border, enduring moderate noise sound of neighbors, etc.

1.2. Dynamics of development of neighbor law in European history (in terms of the Russian state of the XI-XX centuries)

Russkaya Pravda is traditionally named as one of the first monuments of law of Kievan Rus (9th-13th centuries). Its authors focused their attention on regulation of boundary disputes (responsibility for destruction and damage of landmarks), which is reproduced in all other subsequent Russian regulations. Later monuments of law (*Sudebnik* 1497 and *Sobornoye Ulozhenie* 1649), in addition to settlement of boundary disputes, include the rule of establishment of hedges, in order to prevent damage of crops by cattle (and, accordingly, compensation of harm, if such damage takes place), as well as prohibitions on destruction of alvearies (Vinichenko, 2013). Particular attention in *Sobornoye Ulozhenie* 1649 was focused on prohibitions on setting stoves and kitchens close to walls of neighbors, sweeping up rubbish from buildings or *playing mean tricks* on neighbors' buildings, if they are lower in height. These rights were negative, forbidding neighbors to make a certain kind of actions. Positive rights were those stipulated by articles 239-241 of *Sobornoye Ulozhenie* – a right to walk and ride through other people's forests, arable lands, water bodies (Kalinichev, 2007). However, in general the level of development of neighbor law was low, as spaces of the Russian state, its small population size, insignificant (compared to Europe) growth of cities, did not give rise to European *tension of conflicts*, and clashes between neighbors were rare.

In general, development of neighbor law in the end of the 19th – the beginning of the 20th centuries was of contradictory nature.

On the one hand, laws of the Russian Empire did not include many *classical* wordings of Roman law, for which this legislation was criticized by Russian civil law scholars. On the other hand, it was then that the conventional civil concept of neighbor law started including rules of public law becoming more modern. Exactly during this period cities grew rapidly, and neighborhood relations emerged not only among separate citizens (and their families), but also among hundreds of residents of neighboring blocks of flats. At the same time, there was a growth in emissions of harmful substances from the rapidly growing (and still far from the modern understanding of environmental standards) industry, which started causing damage to health and property of a large number of urban residents.

Therefore, by the end of the 19th – the beginning of the 20th centuries, a lot of environmental, sanitary, fire protection and other regulations were approved with the purpose to maintain the safe living environment of people residing close to the industrial facilities, in order to prevent diseases, accidents, damage and destruction of the property. For example, there is a ban on location of some industrial facilities in cities, and a classification of other facilities according to their degree of hazard to the environment. They were divided into completely harmless and harmful, which later made it possible to improve their classification and helped to develop new rules for the various production facilities. Fire protection regulations affected the area of industrial facilities: they stipulated their separate location, including at a certain distance from residential buildings, with earthen mounds surrounding them around the perimeter. The regulations provided for details of location of production buildings, their isolation in relation to other plant buildings, as well as their distance from railways, navigable rivers and canals. Flammable goods could be stored only in closed rooms far from factories and plants as well as places where people lived. Development of these rules served as a guarantor of environmental safety in Russia in the 19th – the beginning of the 20th centuries (Kovaleva, 2015). Development of these trends was not affected by the seizure of power by the Bolsheviks and the creation of the USSR. It is more likely that the rules existing before became more detailed and full-scale. Within the entire period of existence of the Soviet Union, its laws recognized the possibility of neighborhood of land plots of citizens and government agencies, in connection with which, certain limitations were imposed on citizens using the land. For example, if their plots bordered upon an airfield, it could be prohibited for the land user to erect buildings and structures on them above a certain size established by Article 34 *Air Code of the USSR*. Obligations arising out of the neighborhood could be also imposed on land users whose plots were adjacent to the state borders of the USSR, navigable rivers and canals, transmission lines and other special facilities.

These obligations were different from obligations of common land users to their neighbors. The difference consisted in the fact that the neighborhood obligations served subjective interests of neighboring land users and the above mentioned ones were aimed at protection of interests not of certain persons but of the entire state as a whole. On this basis, they were under protection according to the criminal and administrative procedures. Enforcement of these obligations was never implemented by bringing an action (Nefedov, 2015).

Public limitations of neighborhood relations were greatly affected by sanitary rules, environmental standards, construction norms and regulations, as well as other special technical standards developed in large quantities by the executive authorities and

issued in the form of orders, instructions and other regulations. They established the acceptable exposure limits for noise, electromagnetic radiation, vibration, maximum permissible concentration of harmful substances which may be present in water, soil or air. All these limitations of neighborhood rights with minor changes are still in force.

1.3. Trends and approaches to regulation of neighborhood relations according to legislation of some modern European countries

In the past hundred years, neighbor law have been governed by civil codes of most European countries (§ 906-924 *Deutsches Bürgerliches Gezetzbuch* (BGB), Articles 669-701 *Schweizerisches Zivilgesetzbuch* 1907 (ZGB), it.2 §364-§364b *Österreich Allgemeines Bürgerliches Gezetzbuch* (ABGB), as well as laws of former socialist countries of Europe (Czech Republic, Hungary, Bulgaria).

Thousands of scientific papers are dedicated to analysis of rules of these codes, however, we are interested in them only with regard to search for the balance of private and public interests by means of civil law aimed at sustainable development at the local level. One of these rules determining the content of neighbor law is it.1 § 906 BGB, according to which the land owner may not prohibit impact of gases, vapors, odors, smoke, soot, heat, noise, vibration and other such impact from another plot, if it does not affect or insignificantly affect use of the land plot. As a rule, impact is insignificant if the extent and rules established by law are not violated as a result of impact, which is provided for and qualified in accordance with regulatory prescriptions. The same principle applies to the indices set by general guidelines which are published in accordance with § 48 of the *German Federal Act on the Prevention of Harmful Effects on the Environment*.

§ 364a ABGB enshrines the rule that states, that if violation results from operation of a structure officially permitted in a neighboring land, the land owner may apply to court in order to claim compensation for the inflicted damage, even if the damage is caused by circumstances which are not taken into account in the framework of administrative proceedings.

As for the Swiss ZGB, we can also observe a similar rule, but it is enshrined in relation to exercise of the property right on the plot on which activities of a company are performed. According to it. 1, Art. 684 ZGB, everyone exercising property rights is obliged, in particular in case of operation of a company on their plot, to refrain from excessive impact on the rights of neighbors. Any impact by means of smoke and soot, odors, noise, or concussion, harmful and unjustified by position and nature of plots or local customs, is forbidden. According to Art. 1087 *Civil Code of Latvia*, no one has the right to build on their land such industrial or craft facilities that can create obstacles or endanger public safety and health of

people due to danger of fire, noise, odor, excessive amount of smoke, etc. The question of whether there is actually an obstacle or a threat at the moment is to be decided by the court.

Therefore, the listed rules of legislation of various countries are based on a general doctrine permitting two types of impact on a neighboring land plot: **material** impact (solid substances and liquids) and **non-material** impact (smoke, odor, soot, etc.).

Austrian law distinguishes *direct* and *indirect* impact, *admissible* and *inadmissible* impact. An example of deep impact in modern Austrian judicial practice may be flow of drained rainwater from downpipes to a neighbor's plot or the output of a lightning rod cable in it. In search of balance of interests Austrian judicial practice allows some indirect effects in relation to a land plot. In particular, judicial decisions recognized entry of wood chips, red sand to a neighboring plot, possibility of playing tennis on a neighboring plot admissible. In addition, analysis of judicial practice makes it possible to conclude that reduced light in residential premises or air pollution resulting from activities on a neighboring plot may be recognized as inadmissible impact. These are forms of so-called negative interferences, their legal meaning in Austrian practice is rather significant, and, at the same time, disputable. The issue of admissible impact is settled in different ways: if negative impact is caused by technical means, as a rule, it is recognized as inadmissible impact (Iro, 2008).

Interrelation of rules of European public and private law in terms of protection of neighborhood rights requires special consideration. In special legislative acts, public law includes a range of standards, urban planning norms and rules, sanitary and epidemiological rules, which, in their turn, serve as a criterion for determination of significant impact from the neighbor on a land plot. Proof of excess of limits and rules established by law leads to proof of inadmissible impact. In addition, in this case rules of neighbor law grant the owner a right, first, to allow this impact with establishment of adequate compensation, second, to prohibit the impact by means of various lawsuits (prohibitions of activity, requirements to demolish structures etc.). As it is shown by German and Austrian judicial practice, prohibition of activity is most often claimed by land owners in case of violation of environmental protection standards.

However, in European practice, instead of court injunctions in relation to activity on neighboring land, courts often make decisions on compensation for caused damage the amount of which depends on the extent to which the emissions exceed the admissible limits (for example, in accordance with it. 2 § 364a ABGB). Moreover, courts usually make decisions on obligatory cleaning of oilfield waste facilities and fulfillment of other duties to eliminate excessive emissions to the environment (Iro, 2008).

Therefore, the above overview of modern European law indicates a very high level of development of

European measures aimed at regulation and protection of neighborhood rights by means of tools of private law. Meanwhile, recently the legislator and the courts increasingly frequently begin to apply public law criteria and estimates allowing establishing a measure of admissible impact of one neighbor's activity on the rights of another one. This trend is particularly evident in the field of environmental protection. Further we will show the universality of this process, which is widespread among countries of the post-Soviet space as well.

2. Trends and contradictions of the modern stage of development of neighbor law in the post-Soviet space in the context of issues of sustainable development

The task set at international summits regarding sustainable development at global, national and local levels has its own peculiarities in each country. With regard to the republics of the former USSR (and, in many respects, to the countries of Eastern Europe), modern local threats to sustainable development are as follows.

1) In the age of mass housing construction the most typical neighborhood conflict in megalopolises is not between two owners of cottages but a few hundreds of apartment owners (whose land plots are in joint property), who cannot determine the order of distribution of lots in the underground parking or outdoor parking located between their apartment buildings. Other typical disputes are those about recognition of the joint shared property right of owners of premises in an apartment building relating certain nonresidential premises of the building (for example, underground garages) belonging to other owners (*Decision of the Supreme Commercial Court of the Russian Federation* of January 13, 2014 No. BAC-16030/13) or disputes about property rights to plots intended for parking and not included in the joint shared property of tenants of a building (*Decision of the Supreme Court of the Russian Federation* of May 25, 2015 No. 309-ЭС15-5293).

We should point out disputes of collective owners of buildings about siting of a cell phone tower in the neighboring yard. For example, on 03.06.2014 Limited Liability Company *Construction Company 'Atlanty'* appealed to the Commercial Court of Omsk Region against Open Joint-Stock Company *Vympel-Communications* for recognition of the cellular base station of the joint-stock company as an unauthorized structure and its demolition. The claim was denied because the court found that the base station is not immovable property, erected in accordance with construction norms and regulations, the state of the main engineering structures of the facility complies with the current construction norms, regulations and national standards. Establishment and operation of the base station poses no threat to the life and health of the citizens, which is confirmed by the sanitary

and epidemiological inspection report of the *Directorate of the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing for Omsk Region* and the report of physical factor measurement (electromagnetic emission of radio-frequency range and industrial frequency of 50 Hz) (*Resolution of the Commercial Court of the West Siberian District* of March 19, 2015 in case No. A46-7540/2014).

These conflicts are also well known in other countries of the world (Iro, 2008). In the course of their resolution a neighbor appealing against siting of a cell phone tower on another plot must prove that this change restricts the use of his property and decreases its value. The plaintiff may file a claim to the court for compensation also if a local government by its decision modifies land use conditions infringing his rights (Sommers, 2005). There are also ongoing discussions about the possibility of placement of advertising signs on neighboring plots, the degree of public regulation and forms of overcoming *neighborhood nuisances* (aesthetic, informational and other kinds) (Loshin, 2006);

2) Today, there are quite a lot neighborhood conflicts between owners of industrial enterprises once built on the outskirts of cities but later situated in the centers of residential areas and residents of private houses and apartment buildings owing the corresponding land plots as private property (or joint shared property). Evaluation of the health hazard from *odors* of this plant involves application of environmental standards stipulating exposure limits for harmful substances. It is impossible to regulate the parameters and the size of such emissions in another way. Moreover, if the proposed amendments to the *Civil Code of the Russian Federation* are approved, this will more likely to impede rather than to facilitate consideration of even common neighborhood conflicts by judges. For example, a *classical* neighborhood dispute is associated with maintenance of an excessive number of cattle on the plot, which leads to unpleasant odors for a neighbor. At the moment, this issue is settled by means of tools of public law (sanitary norms and regulations). It will be quite difficult to resolve it through implementation of Roman ideas of neighbor's *borders of patience*, as there is no objective criterion of evaluation of these nuisances;

3) Even more negative consequences will follow if the rules of the draft law referring construction of buildings and structures which a neighbor may not *like* to *neighborhood* issues will come into force. The reasons for this *discontent* may consist in the fact that residents bought apartments or houses because this neighborhood provided suitable conditions (lack of noise, roads and railways, a small number of residents, etc.). However, in this case these citizens, prohibiting new construction in their or a neighboring area, will violate public interests. It is necessary to deny this right because land owners already have the

right to veto through urban planning procedures, including zoning and elections of local governments (Lewyn, 2015).

The urban development zoning procedures existing in most developed countries of the world are one of the most efficient ways to ensure sustainable development at the local level, creating criteria of *comfort of living environment* for citizens. This zoning implies that the whole area of an urban district is divided into territorial zones. Urban planning regulations are established for each of them. They stipulate the height and the number of storeys, the percentage of site development, the distances from the plot boundaries, the intended use of the facility being built (industrial, residential, commercial, etc.). These norms and regulations make it possible to resolve not only neighborhood disputes regarding construction of buildings but also many other ones. For example, in the USA a plaintiff considered restriction of his rights to extract sand and gravel caused by zoning illegal. He made an equal protection claim based on the fact that a competitor was allowed to extract sand and gravel from a 125 acre parcel contiguous to his. However, the Supreme Court of the USA concluded that in this case there were substantial differences in terrain and degree of development between these two contiguous parcels. Zoning draws lines that may benefit one owner over another. Nevertheless, merely alleging that a competitor might prosper as a result of zoning is not sufficient under the equal protection clause (Kramer, 1996).

In case of use of Roman principles of resolution of neighborhood conflicts supposed by Russian lawmakers instead of all these contemporary rules, civil (neighbor) law and urban planning law come into artificially created conflict, which is hardly appropriate. What is different about it is that neighbors can be notified of the expected construction, as it is done in some European countries. However, this neighbor may not prohibit construction of immovable property meeting the requirements of law;

4) A typical example of modern neighborhood conflicts is impact on neighboring plots of polluted air and water from land plots occupied by large livestock farms. In addition, their neighbors suffer, first, considerable economic losses, as this neighborhood reduces the cost of their immovable property. Second, environmental effects of industrial livestock farming (pollution of air, water) involve various health effects for rural residents, who cannot avoid consumption of polluted well water and toxic air emissions. Harmful odors impair the quality of life of the neighbors, which also implies a significantly higher level of tension, depression, anger and fatigue among the residents owning neighboring houses and land plots (Murphy, 2008). Currently, these issues are settled (though not always successfully) by public law methods – by means of development of a system of sanitary regulations and environmental stand-

ards governing the level of pollution of water bodies and air by livestock farms and establishing sanitary protection zones around them – a territorial barrier to the neighboring residential area. Attempts to solve these issues in rural areas only by means of private law methods will have no effect;

5) The issue of guarantees of rights of national minorities or the poor (socially disadvantaged) groups of population is still unsettled in case of location of hazardous waste sites in neighboring areas, construction of industrial or other facilities polluting the environment (for example, waste incineration plants) (Mank, 1995).

The issue of eradication of poverty in the context of sustainable development was first raised at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. The declaration of principles (*Rio Declaration*) issued at this conference states, that the quality of life of people as a priority for sustainable development is implemented through Principle 5 (eradicating poverty, decreasing the disparities in standards of living and better meeting the needs of the majority of the people of the world). With regard to neighborhood relations this issue manifests itself in the fact that environmentally harmful facilities are located on the outskirts of cities, and owners of cheap property suffer from their hazardous emissions. In Russian science this issue has not been discussed yet, while only in 2011 in the Russian Federation 14 684 authorized waste sites of total area of 4 070,158 thousand ha were organized, and 41 854 unauthorized landfills were detected (State report, 2012). Emergence of the latter is just caused by the problem of poverty, as rural residents do not have enough money to pay legal waste disposal;

6) Underground storage tanks. At the moment, such an aspect of neighborhood relations as placement of underground urban facilities is not regulated in Russia. These underground facilities can be various, ranging from car parking or placement of underground tanks of filling stations to laying utilities systems. Today, there is no real way to calculate the total number of underground storage tanks which remain in the ground, consequences of spilled gasoline or other liquids. It is believed that such an inventory and liquidation of the underground pollution consequences only in the USA will exceed \$ 41 billion and take more than 30 years (Johnson, 1996/97). Moreover, the annual increase of information about failures of concrete and citizens (their property) affected by it allows us to suggest a discussion of this aspect of neighborhood relations. Settlement of this issue may consist in extending application of urban development regulations not only to surface but also underground facilities, thus defining the parameters and types of their permitted use in different urban areas establishing a number of prohibitions. In addition, it is reasonable to extend the scope of public hearings;

7) A separate issue is distribution of responsibility between sellers and buyers of plots contaminated with hazardous substances which caused damage to the neighbors. This issue is actively discussed in juridical science of the USA. It is noted that settlement of issues of responsibility will depend on whether an innocent purchaser knows that the property purchased by him is contaminated and may adversely impact the property of the plaintiff-neighbor. Consideration of such cases often involves a problem of proving the causal relationships between the presence of hazardous substances and the extent of the caused damage. It is necessary for a balanced allocation of responsibility between guilty neighbors (or previous owners of the plot). The fact is that numerous types of hazardous substances may be present in different places and originate from different sources of emissions, consequently, the lack of potential information of the period between the release and damage creates difficulties in proving causation (Sarlo, 1999).

Moreover, we can point out specificity of neighborhood conflicts if an adjacent land plot is used for mining operations (as mining industry is little compatible with other types of land use), which is particularly obvious in case of production of shale gas or oil on a neighboring plot through the use of hydraulic fracturing technology. In this case residents of neighboring settlements often complain about polluted water, ruined farmland, and headaches from airborne toxins. They are often displeased with the noise, trucks, dust, and itinerant workers living on drill sites that overrun their peaceful agricultural town (Apple, 2014). Neighborhood with areas occupied by ports, stations and airports (restrictions on certain types of activity, noise, etc.), areas occupied with energy facilities (transmission lines), construction of canals, ponds, dams or other similar facilities in a neighboring area, which implies a threat to the security of neighboring plots due to a possible breakthrough of hydraulic structures (Pensley, 2008) (by the way, this problem has not been completely solved since the time of King Hammurabi), creation of specially protected natural areas (for example, in case of creation of a reserve close to a citizen's plot, a number of prohibitions and restrictions are imposed on citizens in its protection zones) also have their own specific features. We should point out the specificity of neighborhood relations with military facilities (for example, in 2012 in Chelyabinsk Region undermining of old ammunition by servicemen in the military grounds caused damage to residents of five settlements, houses were reported damaged due to ground vibration during explosions – chimneys, furnace equipment of houses located in the neighborhood were damaged). This list can be continued.

Hence it follows that environmental legislation existing in Russia provides no guarantees for sustainable development, is based on obsolete legal views

and unable to prevent modern environmental threats to local population.

3. New challenges and prospects for development of neighbor law in the 21st century: some discussion questions and suggestions in the context of strategies for sustainable development

Along with remaining classical neighborhood conflicts existing since the time of Roman law and emerging contemporary issues of neighbor law, which are not solved completely, we can observe the gradually appearing outlines of new threats to neighborhood rights resulting from the challenges of the age of globalization. The post-Soviet scientific doctrine, legislation and courts are not ready at all to resolve this new generation of neighborhood conflicts.

1) Already since the end of the 20th century *green energy* has been growing rapidly, which is associated with its production, mainly from solar panels and wind turbines. The very *green energy* is a technological step forward and helps to reduce harmful emissions. Development of renewable energy sources is an important step towards sustainable development, and has been repeatedly supported at international environmental summits of the UN (for example, items 127-129 of *Future We Want*, the outcome document of the United Nations Conference on Sustainable Development, RIO+20, are devoted to this issue). However, along with all obvious advantages, development of *green energy* also led to significant changes in neighborhood relations resulting from a completely different set of factors.

These changes may mean allocation of separate areas during zoning of municipalities where it is forbidden to perform any construction or plant trees which would infringe *sun rights* of neighbors, as it already happens in the USA (Klass, 2011). In addition, there is information that massive accumulation of wind turbines can affect the climate worsening ventilation of areas. Solar panels shade lands, which leads to changes in the soil conditions and death of plants. Adverse environmental effects of their operation are considered to include heating of air due to solar radiation passing through it, which causes changes in the heat balance, humidity, wind direction. An important factor of impact of wind turbines on the environment is their acoustic influence. Sound effects from wind power plants are of different nature and divided into mechanical (noise of gears, bearings and generators) and aerodynamic effects. Interference caused by reflection of electromagnetic waves by blades of wind turbines can affect the quality of television and microwave radio transmissions, as well as a variety of navigation systems in the area of wind parks (Sylkina, 2016). Finally, many citizens consider the appearance of windmills unaesthetic, violating their right to the *view from the window*. They complain about direct physiological effects of

operation of wind turbines, including rapid heart-beat, nausea and blurred vision caused by ultralow-frequency sound and vibrations of machines. Integrated neighborhood complaints may emerge with statements that the wind engine is loud, affects the health, and the dirt and dust reaches the neighboring plot reducing its cost (Walker, 2011).

2) The priority remaining in the policy of most countries of the world to ensure the economic interests at the expense of social and environmental ones, in violation of recommendations of the United Nations Conferences on Sustainable Development, involves a variety of adverse environmental effects, including global climate change. According to research conducted in Russia and state reports issued on its basis, climate changes are characterized by changes in air temperature and precipitation levels. Trends of growth of air temperature have been recorded in Russia for several years (State report, 2014). The effects of such climate changes may be most unexpected. For example, in 2015, in Volgograd Region, the Volga-Akhtuba floodplain experienced a drought that is the strongest in the history of the region and has involved a range of unexpected consequences.

First, in May-June 2015, in villages located within the boundaries of the Volga-Akhtuba floodplain there were cases of conflicts between neighbors, local residents of different settlements over access to the dry lakes necessary for irrigation of crops.

Second, new species of plants and insects not peculiar to this area have been recorded in the Volga-Akhtuba floodplain and in the city of Volgograd. For example, for the first time in many years of observations in Volgograd, numerous bites of Mediterranean black widows, inhabiting the south in the deserts of Central Asia, were recorded. Mediterranean black widows build their shelters on the slopes of ravines, ditches, abandoned structures, piles of garbage. From this it follows that the failure of owners of land plots to perform their responsibilities of rational use, stockpiling of branches, other garbage near their plots can cause nesting of dangerous insects that threaten the life and health of all the surrounding neighbors. We should also note that in case of reproduction of these dangerous to humans insects it is not possible to resolve the conflict with a neighbor by means of private law, as consideration of the civil claim will take a long time, but intervention of the sanitary epidemiological services will give a quick effect.

3) One of *classical* examples of neighborhood conflicts are conflicts over maintenance of livestock. However, apart from unpleasant odors or destruction of crops by animals, the *livestock* aspect of neighborhood relations in the 21st century is increasingly burdened by mass diseases of livestock, bird flu or swine flu. The probability of spread of these diseases is especially high in large farms, which are often characterized by tightness and filthy conditions of

maintenance of birds or animals, which creates perfect conditions for the spread of viral diseases among animals and their transmission to humans (Stathopoulos, 2010). This situation gives rise to questions about compensation for damage by the neighbor who fails to take measures for veterinary examination of sick animals. It is necessary to develop new methods of evaluation of the size of this damage and proving of causal relationships, as such epidemics spread from one infected animal to the entire livestock (poultry) in the village, and often cause diseases of people, often fatal. It is also necessary to develop new methods of prevention of these epidemics with the participation of all the neighbors.

4) One of the most discussed technological breakthroughs of the 21st century is the invention and mass use of nanotechnology. In the context of our interest, it should be noted that nanomaterials can enter the environment through their use in agriculture, industry, etc. Studies of biologists, medical professionals and representatives of other sciences show that nanoparticles are not always harmless to human health and the environment. Nanoparticles released into the environment are hardly biodegradable and absorbed. This is a new class of pollutants, the harm of which is due to their unusual properties, including mobility, stability in soil, water, air, bioaccumulation, unpredictable interaction with chemical and biological materials (Antsiferova, 2012). If the environmental effects of use, for example, of conventional pesticides are well known both by lawyers and biologists (Morris and Meiners, 2003), the further development of nanotechnology will lead to new emissions of modern plants or use of nano-pesticides and nano-agrochemicals in agriculture with damage to the health or property of neighbors.

This will be a completely new type of neighborhood disputes and threats to national sustainable development in all countries of the world.

Conclusion

Dating back to Ancient Rome as an institution of private law, neighbor law underwent significant transformation over the following centuries. By the middle of the 19th century environmental and technological threats become more significant in neighborhood relationships, and since the beginning of the 21st century such threats have been acquiring a new systemic feature due to emergence of new problems caused by the age of globalization (for example, climatic ones). Hence it follows, that the issues of modern neighbor law gradually obtain all signs of complexity, and their proper regulation is possible only through the synthesis of achievements and methods of various social, humanitarian and other sciences. Strengthening of this specificity is greatly influenced by the dynamics of population settlement that involves emergence of giant megalopolises where millions of people reside at the same time. This causes

new types and forms of neighborhood relations that had not existed before.

This issue should be considered in the context of the concept of sustainable development, emergence of which resulted from development of national environmental legislation due to the increased anthropogenic impact on nature as well as awareness at the international level of the sharp deterioration of the environment on a global scale and the adverse social and economic consequences arising in connection with it. In addition, the issue of sustainable development should be addressed daily not only at the global or national levels but also at the local level, where people involved in neighborhood conflicts directly live. At this local level, *comfort of living environment of citizens* can be considered as one of the criteria of sustainable development, which is achieved through adoption of laws by the central government bodies as well as legal acts of local government bodies which combine rules of private and public law, the reasonable balance of which allows achieving the set goals.

Despite the constant increase in the *specific weight* of rules of public law in the mechanism ensuring sustainable development at the local level, this does not mean a complete rejection of the Roman idea of tolerance in neighborhood relations, the need to *endure the neighbor's impact*. It is rather about the further development of criteria of inadmissible impact with consideration of the new needs of life, with the subsidiary application of norms and regulations existing in public law as the main criteria of excess of admissible impact in neighborhood relations.

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Environmental Ethics as Ethics of the Political State

Etyka środowiskowa jako etyka sfery politycznej

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Abstract

The main aim of this article is to prove the existence of the need to develop the theory of environmental ethics for the purposes of political activity. Its arguments refer to the following five observations. The first concerns the changes that have occurred in the area of human activity in connection with separation of the autonomous areas: private and public (including political). The second is related to the effects of globalization process, such as the birth of the global environmental problem and the evolution of international relations towards global policy in which national states are involved with different history, tradition, culture and religion, as well as international and supranational organizations. The third results from the retreat from the *Realpolitik* pattern towards a policy based on moral values (human rights). The fourth concerns the role of politics as the most effective tool of environmental protection. The fifth points to the need for a global environmental policy in a pluralistic political reality.

Key words: environmental ethics, political philosophy, a model of ethics, environmental problem

Streszczenie

Głównym celem pracy jest dowiedzenie istnienia potrzeby opracowania teorii etyki środowiskowej na użytek działalności politycznej. U podstaw podejmowanej problematyki leży pięć konstatacji. Pierwsza dotyczy zmian, jakie zaszły na obszarze ludzkiej aktywności w związku z wyodrębnieniem się w niej autonomicznych sfer: prywatnej i publicznej (w tym politycznej). Druga jest związana ze skutkami procesu globalizacji, takimi jak narodziny globalnego problemu środowiskowego i ewolucja stosunków międzynarodowych w stronę polityki globalnej, w której biorą udział państwa narodowe o odmiennej historii, tradycji, kulturze i religii oraz organizacje między- i ponadnarodowe. Trzecia wynika z odwrotu od wzorca *Realpolitik* w stronę polityki opartej na wartościach moralnych (prawa człowieka). Czwarta dotyczy roli polityki jako najbardziej efektywnego narzędzia ochrony środowiska. Piąta zakłada konieczność prowadzenia globalnej polityki środowiskowej w pluralistycznej rzeczywistości politycznej.

Słowa kluczowe: etyka środowiskowa, filozofia polityczna, model etyki, problem ekologiczny

Introduction

The relationship between eco-philosophy and political philosophy seems a doubtful matter. The first deals with the relationship between man and nature, while the second concerns the relationship between people. In fact, the thing is quite different. Any eco-philosophical theory promotes some program of changes in the relationship between nature and man, which entails specific economic costs that need to be put on someone's shoulders. Distribution of goods between the states and inside the state organism is

one of the most important and most sensitive political issues. Societies and social groups demand equitable distribution of all burdens, which inevitably introduces eco-philosophy into the area of consideration occupied by justice. This is the main problem of modern political philosophy. For eco-philosophy and political philosophy to be close to each other, the inertia of conclusions drawn from eco-philosophical inquiry shall suffice. And yet one could give a number of other reasons. This convergence has been appreciated so much that in some philosophical compendia eco-philosophy and environmental ethics

(ecological ethics, eco-ethics) are mentioned next to typical theories of political philosophy (Passmore, 1998). In other cases, environmental ethics is treated as axiological and normative background of environmental policy (Elliot, 2000). Furthermore, ecological values began to be separated – for example, by Zbigniew Hull – from the socio-political domain (Hull, 2015). Therefore, posing the issue of environmental ethics as more than others adapted to the requirements of the political dimension of social life does not contradict the idea of eco-philosophy. Rather, it fills the white spot on the map of issues of this philosophical sub-discipline.

1. The spheres of human activity

Individualism, liberalism and romanticism and the division of spheres of human activity.

Sigismund Augustus is known as a Polish monarch who conducted the internal policy in accordance with the principles of religious tolerance. He expressed his position in memorable words: *I am not master of your conscience*. They show the changes taking place in the consciousness of the 16th century intellectual elites on the issue of human activity. They included the separation of the sphere of activity that could operate independently from political power. In the 17th century, the distinction between public and private sphere found justification in the liberal philosophy. According to the theses of classical liberalism the private sphere extends to where there is a lack of legal regulations and there is no oversight on the part of government officials. Proclaiming minimal state, liberals sought to progressively enlarge the sphere. For a long time, they attached particular importance to liberating the economy from the tutelage of politics, in order to finally consider the private sphere as a whole range of organizations, associations and institutions created by the will of entities, for which the model was similar economic creations (Calhoun, 1997). As rightly observed by Rafał Proszak: *Private sphere, in this sense, meets the definition of civil society: while the public sphere is nothing other than state institutions* (Proszak, 2004). Liberal thought from the turn of the 17th and 18th centuries set the original boundary between the private and public spheres, but could not keep them at the thus determined positions. The boundary between the private and the public sphere of human life later moved several times due to issues raised in subsequent periods. Important changes occurred in the Romanticism. Specific to this era, the understanding of what is private, has survived to this

day, tying a strong knot between privacy and intimacy. Under the influence of the Romantics understanding of the private sphere grows and moves to a new level of social relations. It grows, because the private sphere now means freedom from state control, and the expectations and interference of other people, freedom – paraphrasing the term by Ernest Gellner – from kings and cousins (Gellner, 1997). In contrast, it moves to another plane of social relations – as the privacy moves out of the area occupied by civil society. The opposition of what is private to what is state-dependent and associated with the civil society has not remained unnoticed. In fact, it led to a change in the meaning of the public sphere. The new definition of the sphere included both the state and civil society. There have also been attempts to incorporate the economy¹. This opposition is also important from the point of view of religion. Freedom of conscience, which originally meant – constitutive for the private sphere – freedom to choose religious organization, has undergone a significant evolution. Religious unions and organizations were on the outside of the private sphere while remaining part of civil society.

Modern degradation of the social function of ethics.

Changes associated with the separation and transformations within subsequent autonomous spheres of human activity have been accompanied by changes in the understanding of the role of ethics. By subjecting the ethics to the process of *privatization*, they led to the degradation of its social role. First and foremost, after the final separation between public and private, it ceased to be relevant to politics. The main current of new ethical theories became increasingly distanced from the Aristotelian definition of politics as the art of governing the country in the name of the common good. The Machiavellian separation of ethics and politics was supported by modern critique of Aristotle's physical theories. On the other hand, the collapse of the authority of Aristotelian theories meant benefits for new cultural and civilization trends. In foreign policy came the era of *Realpolitik*. Morality, and in its wake modern ethics, did not have access to it. And were it not for the fact that in the mainstream of modern ethics the ethics has become a shadow of political philosophy, one could say that it has been completely relegated to the private sphere. When it reached to the fore, as in the philosophy of Immanuel Kant, it did not so much explain how politics should be conducted, but rather focused on inventing reasons why politics cannot exceed the threshold of individual's privacy – it provided the

¹ The finding that modern public sphere involves civil society, political society, and perhaps also the economy may seem questionable in light of the work of modern theorists of civil society, who endeavoured to clearly delimit the civil society and political society. However, from the perspective of the present, influenced by romanticism, under-

standing of the private sphere of human activity, the first and the second type of society are now seen as the antonym of private. In turn, the capitalist economy has now become a field of activity of such entities of market game, which in many ways resemble the hierarchical state apparatus and leave as little room for independent individual initiative.

substantiation for the introduced division of spheres of human activity. Ethics was also evicted from the economy. The lively inquiries of medieval philosophy on the social destination of the goods and the resulting consequences, such as a fair price (Hołówka, 2001) in modern thought died gradually until silence overtook these matters (Bell, 1994). The belief reigned that there is nothing to deliberate upon, since the market just like nature has its own rules, guarding order with its invisible hand. Even Karl Marx in some way yielded to the pressure of the notion of market rationality because he translated his anti-liberal ideals in their entirety into critique of political economy of capitalism, abandoning the construction of ethical theory of justice. The process of reducing the role of ethics to the private sphere reached its peak in utilitarianism, which consistently passed every moral problem through the press of personal suffering or individual benefit. In the end, in the mainstream ethics normative reflection on human activity has been pushed even from the private sphere, giving way to the science of ethics, i.e. the history of ethics and metaethics, and science of morality, i.e. descriptive ethics. In the mid-twentieth century ethics has become as dead and useless as Latin.

The modern renaissance of ethical thought.

Bad luck turned at last from the ethics after next two decades. Beginning with the 1970s, philosophers gathered courage needed to challenge the described understanding of ethics dominant in the academic world. Also in this case the impact of a mass social change became known. This time, consequences of democratization of social life came to the fore, especially the introduction of universal suffrage. Without prejudice to the existing division of human activity into the private and the public sphere, they significantly transformed the public realm from the inside. By extending the principle *Nothing about us without us* on the whole of society, they provided every citizen with the right to speak out and express their opinions in matters of the general public. The simultaneous extension of the space of public discourse has opened it to the topics related to the development of scientific and technological civilization. The subject of public discussion became issues of politics, society and culture. Acceleration of civilizational changes and globalization processes provided new problems. Euthanasia, abortion, cloning, *in vitro* fertilization, corporate social responsibility, global justice, intergenerational justice, nature protection, treatment of animals, mass illegal migration, feminism, homosexual unions, human rights are just examples of some of them. These and similar topics constitute the content of radio and television transmissions and the subject of political fights, making a lot of people discuss them in the comfort of their homes, with family and friends. The media uproar, proposals of mutually exclusive solutions make it

difficult not to lose their sense. The traditional beliefs of good and evil are no longer sufficient guidelines. Public debaters need arguments, private listeners – orientation. It's hard to say whether participants in the public debate expected the support of ethics. In contrast, philosophers saw it as an opportunity to return ethics to its former role. Public debate provided incentives to retreat from ethics focused on itself and to jump into the vortex of moral dilemmas of the public sphere and politics. For its part, politics itself increasingly opened the door for ethics. This was due to the experience of World War II. The period of the *Realpolitik* was closed during an international trial of Nazi war criminals, charged, among others, with crimes against humanity. In the absence of adequate legal provisions, the judgment of politics conducted by them was subordinated to the ethical values underlying universal human rights and justice. It is no wonder that the next step of ethics towards politics was a question of justice of social institutions asked by John Rawls. Caused by globalization, the weakening of the position of the nation-state in international relations and bringing closer together the societies have shifted interests of philosophy from international to global justice (Hahn, 2009). Global problems started to become increasingly important in philosophical reflection.

In the last half-century, ethics returned to the borders from before the individualist revolution in culture and the liberal revolution in politics. But this is not a return to the former positions – the wheel of history cannot be turned back. Erstwhile moral universe is still fragmented into parts. The division of human activity into the private and public sphere remains in force. Thus, we have private ethics, though no one uses that name, i.e. ethics of the private sphere of human activity, everyday ethics for everyone. But we also have social ethics, and political ethics is talked about increasingly often.

2. The need to develop environmental ethics for the political sphere

Global nature of environmental problems and the origins of environmental ethics as an ethics of responsibility.

The need to develop environmental ethics for the political sphere appeared at the birth of international environmental policy. Since the environmental crisis, which is at the heart of environmental policy, is a global problem that requires a common solution for all mankind, it has to be a policy of global scope and nature. Its mission is to revise the existing methods and extent of the economic use of natural resources and to counter the negative consequences of human interference in nature. Environmental ethics legitimizes such a policy, referring to assumptions that indicate civilizational and cultural roots of ecological threats, and – due to anthropogenic causes of environmental crisis – the obligation of the people to bear

responsibility for the conduct, the effects of which affect the wildlife. The topic of human responsibility for nature is a new ethical and political issue, to the same extent as global problems. Both issues were in the crosshairs of philosophical reflection and political practice in the same period and under the same circumstances: in the 1960s and under the pressure of adverse changes in the conditions of human life. The existence of global problems became known in 1968, in connection with the activities of the Club of Rome and the United Nations, especially through the speech of Secretary General Sithu U Thant at the 23rd Session of the UN General Assembly. Both issues have become part of the public discourse under the influence of the threats posed by the effects of civilization development. First, the danger of the outbreak of a world nuclear war was strongly emphasised – here, one must remember the shock of the Cuban crisis of 1962; then the information about the risks carried by the global ecological crisis encountered a wide range of responses. The same can be said about the issue of responsibility. In his article from the mid-1970s, Georg Picht regretfully stated that he found only one monograph on the concept of responsibility (Picht, 1981), thus indicating the marginal importance of this issue in contemporary ethical considerations.

The name *ethics of responsibility* is used to describe the group of theories comprising the broader environmental ethics. The topic of responsibility combines a number of theories of environmental ethics with theories of ethics of responsibility so closely that it is difficult to clearly resolve belonging of a specific position to one or the other ethical theory. And not just because they take the same issues, such as the issue of environmental crisis, and look at them through the prism of global problems. This is mainly due to the fact that these are the positions belonging to a new type of ethics, which makes responsibility the very foundation of existence of morality and the law (Picht, 1981). Environmental ethics is therefore also the ethics of responsibility and reflects the shape given to reflection on morality as a result of the revision of an earlier understanding of the term *responsibility*.

The new type of ethics was initiated by the pursuit of environmental ethics to broaden the subject of ethical reflection with an assessment of human behaviour towards nature. Enriching the subject of ethical reflection with issues related to conservation and the defence of spontaneous good and the interests of non-human living beings has made ethicists face a new problem. It was a question of estimating the effects of humans refraining from acting in the field of phenomena and processes independent in their genesis of human activity, but susceptible to its effects. Precursors of philosophical reflection on global issues were the first to undertake the task of addressing this issue. They tried to deal with it by expanding the area of individual human responsibility for affairs

not connected by causal relationship with human actions. This led to a shift in emphasis within the main themes of the concept of responsibility. The responsibility towards someone or something went by the wayside against responsibility for someone or something. While the result may seem trivial today, because apparently the issue may be boiled down to refraining from relevant action, a new formulation of the problem of responsibility overcame the modern scheme of moral reasoning adopted by the ethics of the mainstream under the influence of Cartesian philosophy. The proper effect of exposing the limitations of the prevailing scheme of moral reasoning is the new definition of the subject of morality, according to which the subject of morality is constituted by claims of someone or something. Another outcome is a releasing responsibility from the tight corset of causal relationships, initiated by the acts of will of specific *I*, someone recognizable by name. Another consequence is to return to a still questionable concept of collective responsibility, e.g. responsibility of institutionalized target groups or generation, which differs in meaning from the concept of shared responsibility as responsibility borne by an entity arising from the degree of its participation in the activities of the assessed group.

Responsibility in the private and public spheres from the perspective of the subject of responsibility.

Of great importance in the argument for the development of environmental ethics for the political sphere are considerations leading to the identification of the subject of morality with the subject of responsibility. In the article *The notion of responsibility* Picht argued that man is responsible for everything that is not a natural process, that is, *not only for human-induced processes, but also those which a man can influence, although they occur without human participation* (Picht, 1981). The desire to go beyond the existing ethical individualism also marked the actions of Hans Jonas. Published at the end of the 1970s, *Principle of responsibility* tried to do that by *expansion of the issues covered by individualism into new areas of complexity and strengthening its identity in a collective action, in which the place is found for a new dimension of power that requires harnessing and control* (Ciążela, 2007), thus duplicating Picht's intentions concerning the extension of the notion of individual responsibility. Both philosophers have chosen this path in the belief that following it is the right answer to the universalization of human responsibility, in which *public and private awareness moves indeed, regardless of whether we want to admit it or not* (Picht, 1981).

Although the position of both philosophers seriously contributed to the understanding of the importance and the problem of responsibility and marked the path for many followers, in the next decade it was subject to substantial revision. Picht's and Jonas' followers realized that the difficulties encountered by

those philosophers, result from the omission of difference between the spheres of human activity. Picht's and Jonas' attempt to extend to the public sphere, including political, the concept of responsibility grown on the ground of the experience acquired in the private sphere of human activity was doomed to failure because of disregard of the differences occurring between them. The forerunners of the modern concepts of responsibility did not take into account the fact that *»universalized global activity«, as »responsibility of humankind« would be possible only if the changes taking place in the historical process led to unification, as noted by, among others, Sztompka, of collective memory and culture, which at present seems unlikely* (Leźnicki, 2010).

New approach in the theory of responsibility to the spheres of human activity is characterized by the work of Dieter Birnbacher. In the final parts of the book *Responsibility for future generations*, he concludes that private preferences, expressed in the market choices, and public preferences, reflecting the political choices are divergent to an extent that makes it impossible to support universal ethics on the private sphere. In contrast to the private sphere only the public sphere, or, in principle, politics, has the potential required to implement the principles of universal responsibility. Birnbacher says: *awareness of participation in community preventive activity and contributing to a common goal can be an additional incentive to ensure responsible behaviour towards future also when community does not rely on anything other than on »factum brutum« of state coercion* (Birnbacher, 1999). He explains this fact in three ways. From the point of view of morality, it is important that, in comparison with the market decisions political choices as a whole are subject to stronger influence of norms and moral ideals. In turn, the psychological perspective allows to accept that the political decision acts as a mechanism of external motivation. It is particularly important in the case of elimination or minimizing the phenomenon known in economics a *free rider problem*.²

Responsibility and shared responsibility from the perspective of scientific and technological civilization. In arguing for the development of environmental ethics for the political sphere, one cannot also ignore another, apart from a redefinition of the subject of ethics, of the aforementioned consequences of the revision of the concept of responsibility. This time, we are talking about a new approach to the relationship between the conscious action of the individual and its social consequences. This topic has been specifically developed in the philosophy of technology, delineating the boundary between the old and the

new version of the philosophical discipline. Andrzej Kiepas, during polemic with the views of Henryk Skolimowski on pro-ecological science and environment-friendly technology, points to the need to move away from the traditional approach to responsibility, where the subject of the action and subject of responsibility are the same, and the field of agency and area of responsibility overlap. The understanding of responsibility as self-responsibility, i.e. responsibility before oneself, own conscience, no longer fully agrees with the present. It came about to include such complexity of many social relationships that the will and the individual agency in many cases are an illegible element of network relations. *In the case of network structures, there may appear consequences that might be a result of accidental disturbances and side dependencies, including also those which will not have direct and clearly identifiable perpetrators*, (Kiepas, 2001) says Kiepas. Therefore, qualitative difference between the private and the public sphere of human activity arises from the differences between their respective structures and objects of responsibility. While in the private sphere structure of responsibility retains the shape of simple, mechanistic causal relationships, the responsibility in the public sphere consists of anonymous network connections, which make it impossible to assign an individual responsibility for all the consequences of their actions. While in the private sphere object of responsibility is the welfare of the subject of action and the entities united with them by the bonds of direct contact, in the public sphere it is about well-being of an anonymous community, which consists of both current and future generations. Therefore, in the private sphere if one can still speak of personal responsibility, in the public sphere one should also bear in mind the shared responsibility of the individual for what as the result of their complicity stems from the decisions and actions of the community with which they operate.

As follows from what has been written above, environmental ethic for the political sphere is not the correct answer to the call of Leszek Kołakowski, in which he outlined the need for *metanoia*, to change the mentality of humanity (Kołakowski, 1996). In contrast, it is an attempt to create the position matching the situation in which the responsibility for the ecological crisis is embroiled in a depersonalized, network structure of dependence in which the subject of responsibility is constituted by claims on the part of individuals, groups, entire communities and institutions affected by the effects of the crisis or capable to assess them, and perhaps even by claims put forward on behalf of the interests and rights of non-human beings. Such structure of responsibility has

² Free rider is an entity which benefits from a given good or service to a higher degree than its participation in the costs of providing that good or service. Free rider problem stems from a situation where one cannot provide a particular good or service to some, without providing it to everyone.

This is a problem characteristic to, among others, environmental policy. A classic example of such free rider is still the United States, the largest producer of air pollution per capita, which have not acceded to the *Kyoto Protocol* and do not bear the associated economic costs.

the characteristics of responsibility in the public sphere. The subject of responsibility in this area includes institutions of a political nature, distinguished by the ability to organize life of large and diverse populations and the ability to use mechanisms of strong external motivation. The need to develop environmental ethics for the political sphere thus results from the assumption, according to which foreign policy is an effective tool to overcome the limitations imposed on the global responsibility by the specificity of the private sphere of human life. The ethics, on which such a policy could be based, should therefore be able to meet the challenges arising from cultural diversity of pluralistic global society, this social mixture of fractions with different histories, distinct traditions of other cultures and cultural resources of experience, diversified in terms of ideology and religion, morality and customs.

Conclusion

Emphasizing the need for developing environmental ethics for the political sphere should not be perceived as an attempt to challenge the values of these eco-ethical concepts that are focused on the private sphere of human activity. Any attempt to create ecological culture must refer to the positions reflecting the historical tradition of the community, its past cultural experience, religion, customs, basic ideas and beliefs, including metaphysical claims about the nature and human beings. Ecological culture of the community cannot develop in isolation from the dialogue, which is maintained with beliefs from the past about good and evil, right or wrong lifestyles, goals worthy and unworthy of implementation. A lot can be done by starting from the moral intuitions typical for the community, reviewing its valued assets, assessing the consequences of conduct in accordance with its system of values before and after making the *ecological* adjustments. The revision of social practices destructive from the perspective of the quality of nature will lead nowhere, if it remains blind and deaf to these issues. The need to develop specific environmental ethics for the use of politics simply comes from the fact that in international politics, in the environmental policy pursued on a global scale, there is no such thing as a common tradition, which can be referred to, and from the conviction that any attempt to impose one style of living in such conditions surely will not be well received. In other words, this need follows from the fact that the conceptual models and systems developed in relation to the private sphere of human activity cannot be accurately transferred to the specific problems of a globalized public sphere. This need is thus conditioned by the fact that the usefulness of these conceptual models and systems for theoretical description and explanation of phenomena and processes from the private sphere is not confirmed within the phenomena and processes belonging to the public sphere.

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Categorical Imperative in Defense of Strong Sustainability

Imperatyw kategoryczny w obronie silnej zrównoważoności

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Abstract

Strong sustainability defends that certain forms of natural capital (environment) are critical and therefore, non-substitutable. There is an increasing concern for conserving the natural environment due to its unique contribution for sustenance and wellbeing of all living beings. The development process which does not preserve its natural capital is bound to lead towards an unsustainable growth path. In the wake of strong sustainability, it is an imperative to preserve the natural environment as it is degrading beyond its threshold limit. The ethical aspect of strong sustainability raises the ethical question *what is right thing to do* and emphasizes on ethical relations of humans with natural environment. The paper defends strong sustainability from Kant's Categorical Imperative. Categorical Imperative motivates every human to act out of duty. Actions done for the sake of duty alone are morally worthy. A *duty* is the relationship between one's moral action and his autonomy of the *will*. Concerning the sustenance and wellbeing of the present and the future generation, it is the moral duty of the humans to preserve the natural environment.

Key words: strong sustainability, weak sustainability, natural capital, categorical imperatives, direct and indirect duty

Streszczenie

Silna zrównoważoność oznacza, że niektóre formy kapitału naturalnego (środowiska) są krytyczne i dlatego nie podlegają substytucji. Troska o ochronę naturalnego środowiska z uwagi na jego wyjątkowy udział w podtrzymywaniu i pomyślności wszystkich żywych stworzeń rośnie. Proces rozwojowy, który nie ochrania naturalnego kapitału oznacza wkroczenie na ścieżkę pozbawioną zrównoważenia. Podążając za silną zrównoważonością za imperatyw należy uznać ochronę środowiska naturalnego, które obecnie podlega degradacji przekraczającej próg akceptacji. Etyczny aspekt silnej zrównoważoności odnosi się do pytania *co należy czynić* i podkreśla znaczenie etycznych relacji pomiędzy ludźmi a ich środowiskiem naturalnym. Artykuł stanowi próbę obrony silnej zrównoważoności w oparciu o imperatyw kategoryczny Kanta. Motywuje on ludzi do podejmowania działań płynących z obowiązku. Takie działania określane są jako moralnie wartościowe. *Obowiązek* to relacja pomiędzy działaniami podejmowanymi przez jednostkę a autonomią *woli*. Biorąc pod uwagę postulat podtrzymania pomyślności obecnych i przyszłych pokoleń, moralnym obowiązkiem ludzi jest ochrona środowiska naturalnego.

Słowa kluczowe: silna zrównoważoność, słaba zrównoważoność, kapitał naturalny, imperatyw kategoryczny, obowiązek bezpośredni i pośredni

1. Introduction

One of the key challenges of 21st century is sustainable development, as economic development has become one of the widely acknowledged goals for human society as well as one of the major barriers to sustainable development. As a result, the entire

world is facing the dreadful consequences of the techno-centric and over consumptive attitude of humans in different forms of environmental catastrophes like, pollution, destruction of croplands and grazing lands, urban expansion, the destruction of wilderness, the destruction of non-human habitat etc.

Development is an elusive concept; it is closely related to growth and quantitative attributes. Though we are prospering and resources are abundantly available, we are surrounded by poverty, unemployment, and other related issues. This mournful situation has not come suddenly but is an outcome of the materialistic civilization, where development is materialized in the form of economic progress. The present economic development pattern has its roots in the industrial revolution in western countries. Soon after the Second World War, the concept of economic growth came into focus by the then American president Truman; he said that a large area of the world is an *underdeveloped area* – and in order to develop them – *greater production is the key to prosperity and peace* (Trueman, 1951). Industrial revolution grounds its foundation with two basic notions; one, commodifying the nature and second, society consists of only human beings. These two concepts have brought over-dominion attitude of humans on natural environment which has brought a drastic change in the development process.

Development, whether economic or human, should not add a deteriorating environment and for environment to be protected, economic growth must insulate environmental devastation. Economic development is the only catastrophe to environmental sustainability (Stockholm Conference, 1972).

The basic objective of development is to create an enabling environment for people to enjoy long, healthy, and creative lives (Jain, 2013). Thus, in order to limit the adverse effects of economic development on natural resources, there comes the need of sustainable development.

Sustainable development implies great potential for human well-being as it holds two terms *sustainability* and *development* and; while the latter deals with different forms of human evolution and their dominion activities on social and economic levels, the former is concerned with a limit to such economic growth which adds to the degradation of environmental resources. The notion of sustainable development was introduced in Stockholm Conference (1972) to address the rational management of resources. It emphasized the adoption of an integrated and coordinated approach towards development planning to ensure its compatibility with the need to protect and improve environment for the benefit of the population.

The notion of sustainable development was propagated by the World Commission on Environment and Development (WCED, 1987). The report *Our Common Future* (The Brundtland Report) was based on the vision of humankind towards a better life on one hand and the limitations imposed by nature on the other hand. The commonly quoted phrase goes, that *sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED, 1987). It is also believed, with the

Brundtland commission, that meeting the need of the poor is also an essential aspect of sustainability.

At Rio Summit in 1992, majority of nations and states formally signed *Agenda 21* – the strategy for sustainable development (UNCED, 1992). Again, during World Summit 2002 and Earth Summit 2012, various nations participated for sustainable development platform which is known as Rio+20 (Neumayer, 2012).

Therefore, the present situation demands a shift from economical paradigm to ethical paradigm that can lead us to a strongly sustainable world. The concept of strong sustainability has an ethical aspect and this aspect is defended in this paper from Kant's Categorical Imperative perspective. By analyzing Categorical Imperative, the paper focuses on individual duty, both direct and indirect. The paper discusses direct duty of humans to their contemporaries as well as to their future generation and indirect duty to the natural environment.

2. Strong Sustainability: An Overview

The initiative in the direction of sustainability requires attention on its three pillars i.e. economic, social, and environmental. Thus, for managing and providing suitable directions to an economy and its human resources, economic indicators and social indicators like GDP, life expectancy at birth, adult literacy rate, mean and expected years of schooling have been developed; but the environmental aspect of sustainability has been ignored. UNESCOSCOPE (2006) very rightly mentioned that making decisions without reliable indicators is like driving without road signs. The drive towards sustainability requires more specific and adequate indicators across all economic, social, and environmental dimensions. The term sustainability is the subject of intense debate among environmental and resource economists. The debate currently focuses on the substitutability between the economy and the environment or between *manufactured capital* and *natural capital*, a debate captured in terms of *weak* and *strong* sustainability. The weak sustainability approach assumes that natural capital and manufactured capital are essentially substitutable and there are no essential differences between the kinds of well-being they produce (Neumayer, 2012). Weak sustainability is based on the work of two notable neoclassical economists: Solow (1974) and Hartwick (1977). It is based on the belief that man-made capital is more important than natural capital. For example, water is more purposeful when it is converted into electricity, rather being simply water; natural resources like coal and its beneficial are used as raw materials to run different companies. In broader terms, *weak sustainability* requires welfare potential of the overall capital base to remain intact (Hediger, 1999).

In contrast, the conception of *strong* sustainability relies on the principle of resource management or

conservation of natural resources. The strong sustainability approach holds that, certain forms of natural capital are critical and non-substitutable. In the wake of the strong sustainability approach, it becomes imperative to preserve the natural capital. The development process which does not preserve its natural capital is bound to lead towards an unsustainable growth path. According to strong sustainability (Ekins et al., 2003; Dietz and Neumayer, 2007; Brand, 2009; Pelenc and Ballet, 2015), the ecosystem has to be sustained on the following grounds:

- It provides the essence to human sustenance and wellbeing.
- It is non-substitutable for its unique contribution for both biotic and abiotic beings.
- The risk of these services is increasing because natural capital is degrading beyond its threshold limit.

The idea behind the paradigm of *weak* sustainability implies an economic value principle which is found within the body of neoclassical capital theory, whereas conception of strong sustainability is based on biophysical principles. This is a result of different visions about how a sustainable world could and should look like, and how to manage environment and development.

2.1. Models on Weak Sustainability

Several researchers (Elkington, 1997; Medhurst & Ekins, 2006; Jickling et al., 2009; Ekins, 2011) have developed different models on weak and strong sustainability to illustrate relationships between ecology, economy and society. Some of them are as follows:

2.1.1. Triple-bottom line Model

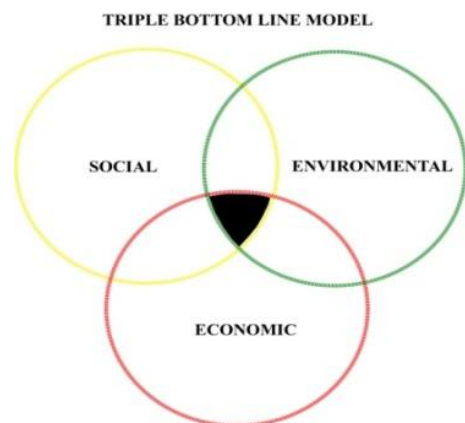


Figure 1. Triple-bottom line model (Elkington, 1997)

Triple Bottom Line Model (fig. 1) was proposed by Elkington (1997) as a means towards sustainable development that underpins most of the discourse and policy-making in fields such as *economic development*, *environmental protection* and *sustainable society*. The model asserts that there exists an appropriate balance between economic, environmental

and social outcomes. However, we find that only the (small) intersection (see fig. 1) of the three circles represents the possibility of sustainability. The ultimate limits imposed by the environment (biosphere) on economic and social activity are ignored. Hence this model ultimately leads to weak sustainability model. During the actualization of this model, economic sustainability is considered as a widely accepted goal and consequently it takes the form of Mickey Mouse model.

2.1.2. Mickey Mouse Model

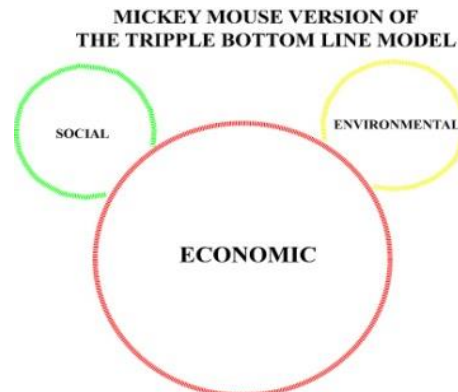


Fig. 2. Mickey Mouse Model (Peet, 2009)

Mickey Mouse model focuses on economic bottom line over the environmental and social bottom lines. The Mickey Mouse model leads to those anthropocentric behavior where, economic activities largely influence the environmental and social security, and growth. It is currently the model that underpins most global economic and political decision making (see fig. 2). The absence of intersection between the three dimensions of sustainability viz., economy, society and environment in this model leads to un-sustainability.

Both the above models are called weak sustainable models because of their shortsightedness as their main focus is economic achievement with social development at the expense of environment. Weak sustainability models extend their concern for economic achievement by considering humans apart from the biosphere. However, in reality, economy and society cannot exist outside the environment. Hence, economic and social activities should be carried out within the horizon of environment. Strong sustainability model shows the interrelatedness and dependency of humans with the biosphere as part of it.

2.2. Strong Sustainability Model

The diagram labeled *Strong Sustainability Model* (fig. 3) shows that all forms of life – including humans exist within the biosphere. Thus, human life and actions flourishing within the biosphere are a part of it. This approach recognizes that the economy exists as a subsystem of the ecosystem and hence imposes limitation on the expansion of economy and society. Strong sustainability refers to a situation,

where the natural environment is sustained and human impact remain manageable.

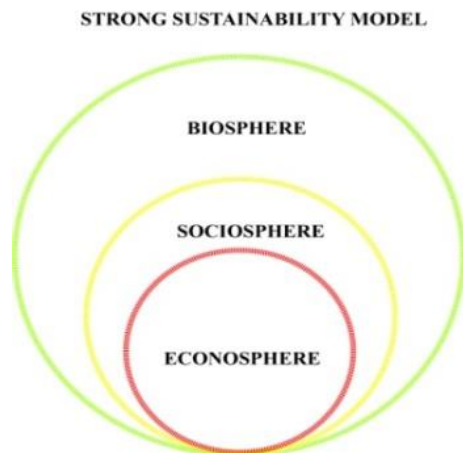


Fig: 3 (Adams, 2006)

3. A Context to the Research

Competitiveness and over consumerist attitude multiplied with greed have led to a massive situation where a great deal of attention is given to economic growth only and environmental aspects are highly neglected. A huge rise in economic development in recent years have resulted in better infrastructure, high life expectancy rate, high birth rate, low death rate and expansion of industries which have consequently contributed in high population growth, depletion of natural resources, pollution, global warming, climate change, species extinction etc. If these attitudes will not change, then the day is near to the failure of strong sustainability model. This failure is presented in the following figure (fig-4), where the environmental, social and economic dimensions are overlapping each other. The expansion of econosphere along with sociosphere and contraction of biosphere will ultimately create a war like situation among human-human (social, political, communal, global etc.), human-animals for the basic needs (food and shelter).

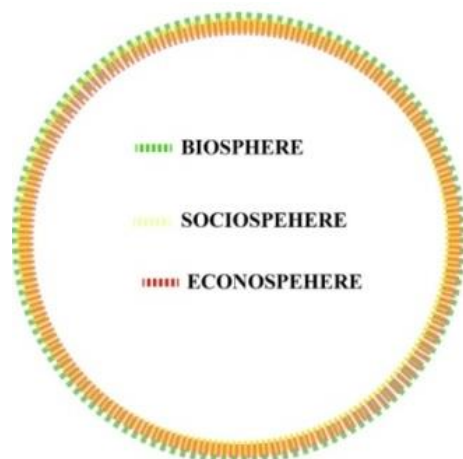


Fig. 4. Failure of Strong Sustainability

Various researchers (Beckerman, 1995; Jamieson, 1998, Daly, 2005; Vucetich & Nelson, 2010 etc.) have also doubted the effectiveness of strong sustainability as there is no end to human greed. The reason behind the failure of strong sustainability is the lack of ethical training, where human civilization is unable to understand their needs and a limit to the needs. Though, economic development is necessary for the development of countries, growth should not be achieved at the cost of polluting air and water, destroying forests, depleting natural resources and human life. Moral degradation is the cause of environmental degradation. We argue that a shift from economic development to ethical/ moral development can be the key to human willingness to adopt the path of strong sustainability. It is certain that scientific knowledge is indispensable, as much as to identify the present problems as to continue with the search for their technical and economical solutions. However, scientific knowledge is not enough; it must be connected with certain moral principles, as moral principles govern human code of conduct in a daily basis.

To support the strong sustainability model, the paper analyzes the concept of strong sustainability based on Immanuel Kant's Categorical Imperative. A presentation of strong sustainability (fig. 3) from Kant's Categorical Imperative, can serve the present need.

4. A Conceptual Framework: From Kant's Categorical Imperative

In the *Groundwork of the Metaphysics of Morals* (GW), Immanuel Kant established the role of reason in ethics: *A Metaphysics of Morals is therefore necessary, not merely because of a motive to speculation but for investigating the source of practical basic principles that lie a priori in our reason* (GW, 4:390). Kant said reason is *the faculty of principles* (Sullivan, 1989, p. 48). Rationality to Kant guides all humans with freedom of choice and duty to fulfill the moral law.

For Kant, human reason has adequate power to overcome illogical, inconsistent and relativistic approaches of life and can practice a moral law which can be logical, consistent, and absolute. His conviction was that non-empirical reasoning would lead to the discovery of our duty and give us an absolute moral theory based on the Categorical Imperative. Kant subscribes the multiplicity of commands and imperatives to one which is unique, unconditional, absolute and inherently moral: the Categorical Imperative. In *Groundwork*, Kant foresees the nuances of this absolute formula: *Finally there is one imperative that, without being based upon and having as its condition any other purpose to be attained by certain conduct, commands this conduct immediately. This imperative is Categorical Imperative. This imperative may be called the imperative of morality*

(GW 4:416). The objective behind Kant's Categorical Imperative is to motivate everyone (human) to act out of duty.

Kant gave three formulae of Categorical Imperative and in this section we shall investigate their implications in promoting strong sustainability.

4.1. Formula I, Principle of Universal Law

The principle of universal law is a principle of rational reciprocity; this commands each individual to act which can be rationally accepted by all. The first formulation of the Categorical Imperative states, *act only in accordance with that maxim through which you can at the same time will that it become a universal law* (GW 4:421). That is, act on a maxim only if it can be universalized. If the maxim cannot be universalized then we should not act on it. The Categorical Imperative is objective and independent of personal desires and their subjective ends. This is a law of nature; it has to be followed unconditionally without any expectation under any circumstances.

The primacy of duty is affirmed in Kantian ethics. In true sense, the moral worth of a person is revealed only when he acts from duty. The person concerned has to bracket his emotions (greed) while performing his duty if that action is done for the sake of morality as a universal law. There is no place for any kind of inclinations. A person, who is righteous, will always positively respond to the call of duty as a moral standard. A duty is the relationship between one's moral action and his autonomy of the will. All actions do not qualify to be moral but actions done for the sake of duty alone are morally worthy. The moral worth of an action depends on whether one acts from duty or from inclinations. If inclination dominates, the moral worth of these actions will deteriorate and on the other hand if the role of inclination is low its moral worth be on the higher side. Kant's admiration for duty is expressed in the *Critique of Practical Reason*:

Duty! Thou sublime and mighty name that embraces nothing charming or insinuating, but requires submission, and yet does not seek to move the will by threatening anything that would arouse natural aversion or terror in the mind but only holds forth a law which of itself finds entry into the mind and yet gains reluctant reverence (though not always obedience), a law before which all inclinations are dumb, even though they secretly work against it; what origin is there worthy of you, and where is to be found the root of your noble decent which popularly rejects all kinship with the inclinations, decent from which is the indispensable condition of that worth which human beings alone can give themselves? (CPrR 5:86)

There is no prerogative to duty. Duty has to be done for the sake of duty. It is the duty of a human to leave pure air, pure water and fertile land to other fellow humans as well as to its future generations. It is opined that the duty of one individual is to promote the rights of other in order to exist in society by extending a fellow feelingness and responsiveness. It is argued, from categorical point of view, whether weak sustainability can be regarded as a principle of universal law or strong sustainability? According to the principle of weak sustainability, man-made capital can be used as a substitute to natural capital (Neumayer, 2012). But in practical situation this concept is vague, for example: can the ozone layer be substituted by any manufactured object? If it is practically possible then there would be no global warming, depletion of ozone layer, etc. It is against the principle of universal law that we can let people suffer, as it is about their autonomy or dignity of being a human. Hence, humans have to leave their consumerist attitude and think about their sustenance as well as future generations by adopting ethical means of life.

4.2. Formula II, Principle of End-in-itself

The second formula goes as: *Act so that you use humanity, as much in your own person as in the person of every other, always at the same time as end and never merely as means* (GW 4:429). According to Kant, since humans have autonomy and reason to execute the autonomy, they have dignity and a value beyond any price. Therefore one individual should not use another individual as a means for the accomplishment of his/her own interests.

In *Groundwork*, Kant says *Morality is the condition under which alone a rational being can be an end in itself. Hence morality and humanity in so far as it is capable of morality, is that which alone has dignity* (GW 4:436). Kant in his later work, the *Metaphysics of Morals*, wants everyone to remember that our respect for a person is because of his moral character. He writes, *this is why showing respect for a human being as a moral being is also a duty that others have towards him and a right to which he cannot renounce his claim* (MM 6:464).

Second formula of the Categorical Imperative upholding the humanity in every person, invites everyone to responsibly involve towards the enhancement of everyone respecting each other's rights. According to Kant, the only species that can be moral, can assign value to anything is human (Gillroy, 1998, 148).

Wood (1998) calls the principle of *end-in-itself* as *personification principle*. Kant's division of duty to ourselves (direct duty) and duties to other (indirect duty), may be regarded as an upshot to the personification principle. According to Kant, humans are counted for only to their own species. Hence promoting strong sustainability would be a duty to others or

promoting wellbeing of humans, its contemporaries as well as future generations (Wood, 1998). Hence by, protecting natural environment we are promoting our own perfection. Strong sustainability demands a rational duty (though indirect), because certain things in natural environment cannot be substitutive. Our attitude has to reflect in our action, and our actions should be done in such a manner, where it can be followed universally. It is argued that, only humans can produce such actions which can be universally accepted. In order to protect the rights of human beings, it is argued that strong sustainability has to be treated as an end in itself, as there is no other substitute. Hence to save the humanity it is an imperative to preserve the natural environment. Humans should do an indirect duty to the natural environment as an extension of the direct duty towards their contemporaries as well as future generation. It is therefore emphasized that the Categorical Imperative should be an underlying principle of strong sustainability for the betterment of human beings.

4.3. Formula III, Principle of Autonomy

The formula of autonomy states, *Act so that, the will could be regard itself as at the same time giving universal law through its maxim* (GW 4:434). Here, Kant shows the depth of Categorical Imperative by asserting that every *human will* is potentially also a law giver. The individual human will is capable of not only just to follow the law but, also can define and modify it. By doing this, the individual-self acts as a legislator, obeys it as well as communicate it to the society. While, giving the law, humans exercise their moral autonomy; it is the principle of goodwill. According to Kant, morality rests on goodwill and the will is good not for its effect produced but for its innate quality. There is nothing called absolutely good except the goodwill. Kant writes in his *Ground work of Metaphysics of Morals*:

A good will is not good because of what it effects or accomplishes, because of its fitness to attain some proposed end, but only because of its volution, that is good in itself and regarded for itself, is to be valued incomparably higher than all that could merely be brought about by it in favor of some inclination and indeed, if you will, of the sum of all inclinations (GW 4:394).

According to Kant, it is only good will which can be conceived without a limitation (GW 4:393). For Kant, good will has no constraints, no boundaries. Good will is good with all time through all space. Good will is absolutely and always good and does not shuttle between the dichotomy of ends and means. An autonomous person always listens to the inner will while giving any law to himself/herself or to the other.

While applying this principle of autonomy to strong sustainability, we find that every human being is a subject to moral autonomy. According to Kant, morality is meaningful only if we assume that autonomy is the property of the will of all rational beings. Autonomy is the property of the will and hence is a law in itself. Hartman observes:

If I am an autonomous man, then I can be able to decide what kind of person I shall be, then I can decide what will be the most important to me and what shall I most want, hence what will be in my interests. And while having interests that are at odds with those of others is disadvantageous, being self-interested is not bad insofar as one's interests include others' well-being (Hartman, 2007).

According to Kant, every rational being possesses autonomy. It is not an adventitious quality rather it is intrinsic to every rational being. Autonomy is the character of human will, which helps him in decision making. Dean argues that *Kant's strategy is that every rational agent who has choice and deliberation capacity is free being. It is in this concept of autonomy alone we can ably trace the prerequisites of human freedom. Only a free rational being can enjoy the state of self-legislative being. Deliberation implies choosing between options which is possible only for an autonomous being. It is freedom that rules one's action* (Dean, 2006). Thus autonomy is indispensable for the human beings to be called so. According to Gillroy (1998, 146), human autonomy requires the environment to sustain and perfect our agency. Yovel, said:

Man is no longer a member among other members of the natural environment. Rather, by virtue of his rational consciousness, he now becomes the focal point of nature itself (...) reason (...) makes nature itself possible by imparting a logical structure to it. Human reason thus becomes a world-shaping power (Yovel, 1980, 136).

It has been widely reported that humans are facing problems in forms of natural resources depletion, global warming, pollution, hunger, etc. In order to uphold the individual autonomy, we have to protect the natural world. Kant's concept of indirect duty towards natural environment in order to promote the direct duty for our own human beings is relevant in the present context. Human beings should think rationally to consider their need be treated as a universal law by considering each and every individual (of present and past) not their greed for economic development only. Actions have to be done in the moral sphere by considering its viability through the principle of Categorical Imperative. Hence it is the duty of every person to protect the rights of their fellow beings by doing their own duty.

5. General Discussion and Conclusion

J. M. Gillroy, (1998), proposed a term *Kant's Conservationism* in his paper *Kantian Ethics and Environmental Policy Argument: Autonomy, Ecosystem Integrity, and our Duties to Nature*. He said, it is a duty to us, to our contemporaries, to our future generation as well as to the natural environment to conserve the natural environment. The maxims of Categorical Imperative, helps the humans to recognize their duty to seek excellence in-itself and justice to their society and future generation (Gillroy, 1998). Andriy Matviychuk (2014) proposed *ecological deontology* as a new scientific discipline to address global problems of humanity in his article *Ecological Deontology in the Context of Solving the Task of Ecologization of Modern Man Thinking*. He said, a real solution to environmental issues require a deontological approach. By deontological approach, he meant greening of society. His deontological approach based on the concept of ideal world, where human will be able to fix the gap from both the environmental and humanitarian perspective. According to Matviychuk, ecodeontology provides a platform for greening the society with the help of greening human consciousness (Matviychuk, 2014).

It is argued that the solution to environmental problems requires an ethical approach that can lead a path towards strong sustainability, as Categorical Imperative distinctly defines the system of requirements for human's behavior in a particular sphere of life, as well as identifies their specific implementation. The objective behind Categorical Imperative is to deal with human nature and its relation to other humans. The econocentric person knows how nature is valued in terms of its utility in terms of economic gain i.e., nature has only instrumental value but an ethical person knows how to value the nature as an end not as a mere means. The sustainability principle is rooted in the adage that each generation holds a duty to ensure the future aspects of its offspring's that they must access the same comfort they had accessed. This axiom got wide recognition in the literature of philosophy (Howrath, 1995) and the same statement materialized in the Brundtland Commission as a central theme in the form of *sustainable development* that a development is sustainable only when it meets the need of both the present and future generation. Strong sustainability is needed for both present and future generations for their sustenance. Here, Kantian approach shows a moral duty towards each and every individual and also towards the nature (indirect value). And this can be plausible through the practice in the domain of moral awareness and then individual (group) actions can be reflected through their ethical and responsible behavior to themselves as well as to their future generations. In Kantian ethics, an action can be truly moral if and only if, it is made by an autonomous, rational being.

Placing Kant's Categorical Imperative in the context, the paper suggests that it is only humans who can save themselves from the environmental catastrophes, and protect the natural environment. Hence, it is opined that the present situation demands a shift in the thinking process and an ethical practice for a sustainable development in a strong sense. Though, we have information we are lacking in practice. Hence, it is suggested that deontological approach can be a solution to real life situation. By supporting the principle of Categorical Imperative we can possibly bring the change in human outlook in a broader perspective where humans can differentiate between their needs and greed, between what is to do and what ought to do, though humans are created by the nature but their destructive attitude can be reason of their own destruction. For a strong sustainable world, humans have to perform his duty (direct and indirect) within the periphery needs. By performing a direct duty to him/her and to its contemporaries, human is performing an indirect duty towards the natural world. Thus far, it is argued that the principles of Categorical Imperative are helpful, to fight against the weak approach of sustainability. The principles of Categorical Imperative can help us to promote strong sustainability from individual level to global concern.

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Orchards on Eroded Uplands of Southeast China: Sustainability or Abandonment?

Sady na zerodowanych wyżynach pld.-wsch. Chin: zrównoważoność czy problem?

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Abstract

Orchard development on eroded uplands is considered as a successful method in integrating soil erosion treatment with economic development in many developing countries. However, much attention focused on its present achievements without thinking over the economic viability over long plantation duration. Orchards that have not been intensified seem to be threatened by complete abandonment. To illustrate the economic viability and sustainability of orchard management, we have deliberately focused on a case study in Southeast China. The results of economic viability based on a cost-benefit analysis showed that orchard management was barely economically sustainable. Their viability is assured if reduced labor costs and increased fruit price are accepted. Based on these results, recommendations are made to prevent the abandonment of orchards on degraded uplands and to preserve its environmental benefits.

Key words: soil erosion, rural livelihoods, sustainability, cost-benefit analysis, China

Streszczenie

Tworzenie sadów na zerodowanych wyżynach w wielu krajach rozwijających się jest traktowane jako metoda udanie łączącą zintegrowane przeciwdziałanie erozji gleb z rozwojem ekonomicznym. Niestety, zbyt mocno podkreśla się znacznie szybkich osiągnięć, bez rozważania kontekstu wieloletniej opłacalności takich działań. Sady, których nie poddano modyfikacjom, opuszczono. By zilustrować ekonomiczną sensowność i zrównoważoność zarządzania sadami, wybrano jako case study obszar pld.-wsch. Chin. Rezultaty oceny opartej na analizie kosztów i korzyści wykazały, że zarządzanie sadami okazuje się być słabo ekonomicznie zrównoważone. Opłacalność zostałaby zapewniona w przypadku obniżenia kosztów pracy i podniesienia cen owoców. Na podstawie przeprowadzonych badań przedstawiono rekomendacje, których uwzględnienie umożliwiłoby zaprzestanie procedury rezygnacji z prowadzenia sadów na terenach zdegradowanych wyżyn i utrzymanie korzyści środowiskowych.

Słowa kluczowe: erozja gleb, poziom życia rolników, zrównoważoność, analiza kosztów i korzyści, Chiny

1. Introduction

Soil erosion is one of serious threats to rural sustainability in many tropical developing countries (Das and Bauer, 2012). The fragile hilly ecosystems in these areas provide many important ecosystem ser-

vices and sustain the livelihoods of poor rural households (Persha et al., 2011). It is widely accepted that environmental degradation and poverty are closely linked and both should be tackled together in poor mountainous regions (Cao et al., 2009; Cao et al., 2010). In other words, conservation projects must

properly deal with the trade-offs between human livelihoods and conservation (Sunderland et al., 2008; Sandker et al., 2009; Bielinska et al., 2015). Selection of practical methods linking conservation with development is a premise for conservation projects.

There are many ways to link conservation with livelihoods. Among these ways, the promotion of alternative livelihood strategies (such as orchard development, tourism), which would divert local populations away from their (ostensibly) harmful traditional practices towards new forms of employment, is a prevalent method (Brown, 1998). By virtue of better spatial suitability, orchard development on degraded uplands as one of typical alternative income generating activities is widely used in developing countries. The method of orchard development was considered successful in reconciling sustainable livelihoods and ecological conservation (Wang et al., 2011; Wang et al., 2012; Soltani et al., 2012). In detail, orchard development could provide many jobs and produce revenues. Moreover, the maintenance of orchards on degraded uplands is benign for the environment, as these systems show low rates of soil erosion and high levels of biodiversity (Loumou and Giourga, 2003).

However, orchard development was not the panacea for conservation. The economic viability and sustainability of orchard management would directly decide the long-term effect of conservation projects (Khakbazan and Hamilton, 2012). Practically, two main factors threaten traditional orchard cultivation on degraded uplands, favoring its abandonment: competition from intensive orchards in flat and fertile land, and higher natural threats and risks deriving from poor site conditions. Moreover, increasing rural labor costs deriving from urbanization and industrialization is also another disadvantage. These disadvantages worsened the economic viability of orchard management on degraded uplands.

Like many other parts of the world, orchard development in partial sites with better natural endowments and socio-economic conditions is one of the important alternative livelihoods to link conservation with development in China (Wang et al., 2015a). A lot of literatures highly evaluated the achievements of orchard management in ecological and socioeconomic aspects based on current surveys (Cao et al., 2009; Wang et al., 2011; Li et al., 2011). However, orchard development and management has a long duration (e.g. 30 years). Economic evaluation based on one complete rotation of orchard management would be rational. Excessive optimism and over-evaluating on orchard management based on survey data of full bearing age fruit trees may conceal the economic risk, challenge, and unsustainability emerging in the near future. Thus, economic viability and sustainability analysis based on scientific methods – (esp. the whole duration of orchard man-

agement) is vital for conservation effectiveness assessment.

Based on above analysis, economic feasibility and sustainability is pivotal for sustainable orchard conservation. If a lot of orchards were abandoned due to poor economic profit, the results would not only bring about negative livelihood impacts, but also lead to new soil erosion (Wang et al., 2015b). Both failures in conservation and development would induce other socio-economic problems. To avoid the dilemma, the governments should adopt a series of measures to ensure the sustainability of the orchard management. The assessment of economic viability and sustainability would be a prior step for governmental policy-making.

In this article, a study case that achieved preliminary success in conservation through orchard development was selected. Our major goals were to examine the economic viability and sustainability of orchard management from a long-term perspective. Several economic analysis methods including Net Present Value (NPV), Internal Rate of Return (IRR), and sensitivity analysis were used for assessment. And we also put forward some advice to promote the sustainable orchard management.

2. Methods

2.1. Study area

Changting County is located in western Fujian Province of Southeast China (25°18'40"N to 26°02'05"N, 116°00'45"E to 116°39'20"E), and situated on the southern part of WuYi Mountain (Figure 1). It is characterized by a humid, subtropical monsoon climate with high mean precipitation (1730.4 mm yr⁻¹) and warm annual temperatures (a mean of 18.3°C and a minimum temperature of 7.9°C), and it is primarily covered by loose granite red soils (Wang et al., 2015a). Historically, it was covered by luxuriant vegetation with light soil erosion. However, a half-century period of human destruction worsened soil erosion, leading to extreme decreases in biodiversity and soil fertility (Wang et al., 2011).

To mitigate ecological degradation, the county government has made great efforts in conservation since 1950s. Some limited and phased ecological restoration had been achieved. However, the impoverished rural households returned to the predatory deforestation driven by higher livelihood pressure (Wang et al., 2011; Wang et al., 2012). Fortunately, the recent conservation project started from 2000 has achieved integrated success in conservation and livelihoods (Cao et al., 2009; Wang et al., 2011; Wang et al., 2012). Different from foregone conservation projects, the kernel of new conservation policy was to combine the conservation and development through alternative livelihood strategies. The degraded ecosystem treatment transferred from solely governmental activity to governmental protection and soci-

ety-oriented (mainly farmer-oriented) pattern under the guide of local government.

Besides the large-scale government-oriented ecological treatment (such as closing hillsides to facilitate afforestation, tree planting and afforestation, collapse mound treatment), developing economic forests (mainly orchards including tea gardens) on open forest land or barren hills with convenient transportation and relatively light soil erosion by the rural households was one of important measures (Wang et al., 2011). To promote the activity, the government encouraged the planting of fruit trees by providing compensation of \$ 237.72ha⁻¹ (1 U.S. \$=6.31 RMB in 2012, the same below). And to encourage rural households to use organic fertilizers to improve plant growth, the local government offered subsidy of \$ 16.10 for each additional pig (Cao et al. 2009). As a result, according to the statistical data of Changting Bureau of Water and Soil Conservation, the newly planted fruit trees (such as red bayberry, ginkgo, Chinese chestnut, peach, tea) amounted to 2623.03 hectares sponsored by the governments from 2000 to 2009, accounting for 3.19% of the total treatment area. In addition, to encourage individual participation and reduce the cost of management, the government propelled the transfer of land ownership to residents who were willing to plant trees (Wang et al., 2011).

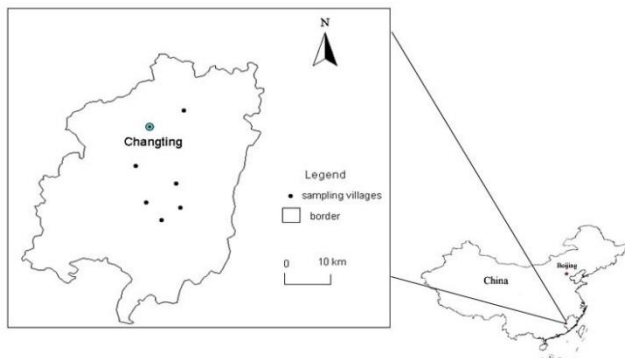


Figure 1. The location of the study area

2.2. Data Collection

To specially research the economic feasibility and sustainability of orchard management for participants who contracted and planted large-scale economic fruit trees. We adopted typical sampling survey to avoid omission by random sampling. According to in-depth interviews of Changting County's Bureau of Agriculture, Bureau of Forestry, Bureau of Water and Soil Conservation, we conducted 30 face-to-face interviews with typical rural households (with more than 6.67 ha orchards) based on an inventory of households during August 15 to August 31 in 2012. Then we accomplished 30 valid questionnaires (Including 10 red bayberry growers, 10 chestnut growers, and 10 other fruit growers). As a result, we gained 30 effective and accurate questionnaires about farmers with large-scale orchards.

Moreover, we designed a cash flow table of past orchard management to gain input-output conditions. The economic analysis needs a lot of precise cost and benefit data with a long duration. Owing to poor economic profit, many orchards (such as chestnut, peach, pear orchards) were abandoned or extensively managed in Changting County. Only profitable orchards with a better market demands could be intensively managed during a long period (Figure 2).



Figure 2. Photographs of abandoned red bayberry orchards(Top) and intensive managed red bayberry orchards(Bottom) in Sanzhou Town, Changting County.

Given data availability, we choose the most profitable orchard management – red bayberry management – to show the overall economic benefits of orchard investment in Changting County. The intensive orchard management would need extremely more input than extensive management. To gain comparability and scientific results, we solely selected red bayberry orchards which were developed in 2001 and intensively managed since 2001 for survey. The interviewed householders recalled the input and output of their orchards during the past management by memory or account books. After detailed face-to-face interviews, we obtained the ultimate cash flow data of red bayberry management in Changting County. The specific survey data could be seen in subsequent parts. To promote the comparability of data in different years, all prices were converted to comparable prices of 2012 to remove the effect of inflation.

2.3. Calculation of NPV and IRR

Orchard management is a kind of private investment. A rational economic benefit is the most important precondition. Based on previous literature, Net Present Value (NPV) and Internal Rate of Return (IRR) are two vital assessment criteria for investment decision-making. If orchard management is a wise investment, the NPV should be positive and the IRR should be higher than the guiding rate of interest. The related calculation formula is shown as follows:

$$NPV = PV(\text{benefits}) - PV(\text{costs}) = \sum_{t=0}^n \frac{B_t}{(1+r)^t} - \sum_{t=0}^n \frac{C_t}{(1+r)^t} \quad (1)$$

Where NPV is net present value of the project, B_t is the economic benefits in year t , and C_t is the corresponding costs. In addition, r is discount rate, expressed the annual rate of interest or inflation rate, and n is the duration of the project in years.

The Internal Rate of Return is the interest rate that satisfies the equation:

$$\sum_{t=0}^n \frac{B_t - C_t}{(1+R)^t} = 0 \quad (2)$$

Where R is the internal rate of return of the project, the other indicators are the same as above.

2.4. Sensitive analysis

The cost-benefit analysis is based on limited information about past and current costs and benefits, the results would only clarify the past economic viability. However, past experience cannot represent future economic sustainability because of great changes in input and output prices. Sensitivity analysis is used to test the assumptions and to specify the uncertainty of economic benefit. It is a method for examining the quantitative effect of a certain change on each parameter to output values, and it improves understanding of the critical elements on which the outcome of an intervention depends (Shigematsu et al., 2013). The variables we focused on were wages, inputs, market prices, and final transferring prices of orchards.

In the sensitivity analysis, we used the limits of the analysis based on the historical price trends in research site. In order to generate rational scenarios of element and commodity price changes, we collected a great deal of credible history data to determine limits of change. As far as the material input price is concerned, great changes have taken place since 2001. According to the statistical data of National Bureau of Statistics of China, during 2001-2012, the average retail price of granular urea made in China, ammonium bicarbonate, DAP, and NPK(15-15-15) increased by 45.14%, 39.36%, 41.52%, and 38.90% respectively. Their mean increment is 41.23%. Thus, we set two cases to quantify the response to different material input prices: increasing by 20% (half increase extent of chemical fertilizer during 2001-2012) and 40% (total increase extent of chemical fertilizer during 2001-2012).

As for the increase of labor costs, the rural labor costs in Changting County increased more rapidly in 21st century. According to our survey, the wages of one unskilled and middle-aged woman for doing some relatively easy farm work (such as weeding, pruning bushes, picking fruits) increased from 22 RMB in 2001 to 60 RMB in 2012, increased by 172.73%. Referring to historical growth, we examined two cases to show the influence of increasing wages on NPV and IRR of orchard management: increasing by 50% and 100% respectively.

As far as the price of fruits is concerned, the average price of fruits remained relatively steady in recent years. In detail, the average wholesale price of red bayberry increased from 9.70 RMB kg⁻¹ in 2007 to 13 RMB kg⁻¹ in 2012, increased by 33.97% during 5 years. We set two cases to quantify the impact of changing fruit price on NPV and IRR: increasing by 20% and 40%. In addition, the final transferring price of orchards could influence the outcome of cost-benefit analysis. The value to a large extent depends on future expectations of orchard management. Owing to great panic derived from a contagious disease in red bayberry trees, many orchard managers have forced to sell their orchards at low prices since 2012. We set the transferring price at 2000 RMB mu⁻¹, 4000 RMB mu⁻¹, and 5000 RMB mu⁻¹ to quantify the impact of orchard selling price on the profitability of red bayberry plantations.

3. Results

3.1. Economic benefits of orchard management

Before proceeding to economic analysis, the specific rotation of orchard management and the discount rate should be defined. Owing to the sampling orchards being developed in 2001, we could not gain the whole rotation data. However, the transferring price of 12-year-old red bayberry orchards per acreage and past cash flow data could also be used to calculate the economic feasibility. The time horizon in the cost-benefit analysis was set at 12 years to correspond to the cash flow data during 2001-2012. Moreover, the discount rate should be determined to consider the time value of money. According to the official data of China, during the period of 2001-2012, the mean annual rate of interest of commercial bank loan for 5-year term was 6.23%. And the mean annual rate of interest of private lending was about 10%.

Most rural households with no formal mortgage had to turn to private lending. Thus, 8% was selected as the discount rate to calculate the present value of orchard management.

After calculation, we got the precise cash flow of red bayberry management and NPV and IRR. As shown in Table 1, the total net cash inflow of red bayberry management per mu amounted to 4929 RMB (Including orchard transferring value). The NPV of red

Table 1. Red bayberry cash flow in Changting County, Unit: RMB, our field survey in 2012

Item	Total	Year												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Cash inflow														
(1) Fruit Yield (kg)	1900							120	250	300	400	480	350	
(2) Cash inflow	20670							960	2000	3000	4400	5760	4550	
Subtotal	20670							960	2000	3000	4400	5760	4550	
Cash outflow														
(1) Land rent	84	84												
(2) Soil preparation	1500	1500												
(3) Seedling	167	167												
(4) Patch planting	20		20											
(5) Fertilization	4630	360	350	360	350	360	360	380	380	400	430	450	450	
(6) Weeding	1650	200	150	150	100	100	100	120	130	140	140	160	160	
(7) Pesticide	1770	20	50	50	120	150	150	170	180	200	220	230	230	
(8) Tree pruning	2520			50	100	200	200	220	250	250	250	500	500	
(9) Fruit picking	3150							150	250	500	700	700	850	
(10) Tool	1250	150		150			150		200	100	250		250	
(11) Soil and water conservation facility	800		500								300			
(12) Others	1200	50	50	50	50	50	50	100	100	150	150	200	200	
Subtotal	18741	2531	1120	810	720	860	1010	1140	1490	1740	2440	2240	2640	
Net Cash inflow	4929	-2531	-1120	-810	-720	-860	-1010	-180	510	1260	1960	3520	1910	3000
NPV	-618													
IRR	6.54%													

Notes: (1) The cash flow calculation is based on 1/15 ha; (2) All the prices is constant at 2012 (1 USD=6.31 RMB in 2012); (3) The fruit yield fluctuates due to climate and life cycles.

Table 2. NPV and IRR of red bayberry orchard management under different material input price and wage change

Indicators	Base case	Input price +20%	Input price +40%	wage+50%	wage +100%
NPV (RMB)	-618	-1675	-2882	-3525	-6432
IRR (%)	6.5	4.1	1.45	-0.11	-6.85

Note: the area unit is mu, 1mu=1/15 hectare, the same below.

Table 3. NPV and IRR of red bayberry orchard management under different output price and orchard transferring price change

Indicators	Base case	Fruit price +20%	Fruit price +40%	OP-1000	OP+1000	OP+2000
NPV (RMB)	-618	1274	3165	-986	-250	118
IRR (%)	6.54	10.70	14.11	5.55	7.44	8.25

Note: OP=orchard transferring price; OP-1000, OP+1000, OP+2000 means that the final orchard transferring price is 2000RMB, 4000RMB, 5000RMB respectively.

bayberry management was -618 RMB per mu. The negative value showed that orchard investment was uneconomic during 2001 to 2012. And the IRR was 6.54%, which was also lower than the discount rate. Through above economic analysis, it could be concluded that the investment in red bayberry management was not feasible in research site.

3.2. Sensitive analysis of orchard management

To evaluate the effects of future changes in input/output price on profitability of orchard management, a sensitivity analysis was carried out. As previously mentioned, the change scope of the input price was generally set at 50% and 100% change during 2001-2012. Results showed that orchard management was sensitive to increase of input costs.

The reduction of NPV and IRR was 171.04% and 36.54% with 20% increase in material input price. And the reduction of NPV and IRR was 366.34% and 65.66% for the 40% material input price increase (Table 2). The change extent in NPV and IRR were all higher than related change in material input price. As for the response of wage increase, results showed that the reduction of NPV and IRR was 470.39% and 101.68% for the 50% wage increase. The reduction of NPV and IRR was 940.78% and 103.06% with 100% wage increase (Table 2).

Results showed that orchard management was more sensitive to increase of fruit price (Table 3). The NPV became positive with the increasing fruit price. The increase of IRR was 63.61% and 115.75% with 20% and 40% increase of fruit price respectively,

which was greater than material input price with the same change. Moreover, orchard management became profitable when fruit price increased 20%. The final orchard management also affected the outcomes of the cost-benefit analysis. The NPV was -986 RMB μ^{-1} , -250 RMB μ^{-1} , and 118 RMB μ^{-1} , when the orchard transferring price was 2000 RMB μ^{-1} , 4000 RMB μ^{-1} , and 5000 RMB μ^{-1} – respectively.

4. Discussion and Conclusions

Our results demonstrated that orchard management in Changting was not as profitable as previously discussed (Cao et al. 2009). The NPV of red bayberry management was -618 RMB per μ , and the IRR was 6.54%, which was also lower than the discount rate. The negative value of NPV and smaller IRR all proved that orchard investment was uneconomic during 2001 to 2012. Many factors determined the economic viability of orchard management, such as poor natural endowment (esp. severe soil erosion, poor soil fertility), a great deal of investment in water and soil conservation, delayed fruit bearing period, and future expectations.

Among these factors, future expectations to a large extent decided the final transferring price of orchards. However, a strange contagious disease with the symptoms of rotting roots and death occurred and spread in 2012. Most orchards were affected by the disease. So far, no agricultural professionals could provide effective countermeasures. As a result, the relatively poor profit in 2012 could be partly attributed to the contingency. The disease not only affected the orchard output, but also induced great panic and pessimistic expectations of future orchard management. If right prescription could be proposed, the transferring price of orchards would increase greatly. The outcomes of the cost-benefit analysis would be remarkably different.

Results of sensitivity analysis indicated that the profitability of the orchards was most sensitive to wages. The variation of economic benefit was the highest for wages if all the costs and price had the same variation scope as the past 12 years. With increasing industrialization, urbanization, and agricultural labor productivity in China, wages of rural labors have increased remarkably during the past decade. Being a more labor-intensive system, orchard management showed a significant economic loss resulting from increasing wages. Higher labor costs could promote the advance of agricultural technology and labor-saving activities. But the technology lag and labor-intensive characteristic of orchard management would aggravate current difficulties. As a result, rapidly increasing rural wages became the crucial threats for sustainability of orchard management. In addition, fruit price is another relatively sensitive factor to the profitability of orchards.

Orchard abandonment is usually related to a variety of socio-economic and environmental consequences. As far as the socio-economic consequences are concerned, orchard abandonment could not only result in waste of land resources, but also produce negative effects in employment and rural livelihoods. As previously discussed, orchards had ever been a significant socio-economic role, as it provided an important source of income and employment for some rural households. Moreover, orchard abandonment would also have negative environmental consequences (Duarte et al., 2008). The primary environmental impacts included increased soil erosion, homogenous landscape, increased risks of wildfires, changes in future land use, and decrease in biodiversity (Viana, 2003). Among these aspects, the most important negative impact in research area was increasing soil erosion, which may have wide on-site and off-site adverse effects.

Thus any policy intervention towards improving market promotion, enhancing transportation infrastructure, integrating leisure tourism with fruit picking, scientific and normative orchard management in the hilly region that reduces the costs of labors and increases the fruit price would increase profitability to the farmers' investment over orchards.

First, market promotion and better traffic accessibility could expand market size and induce rising price of production.

Second, integrating leisure tourism with fruit picking is a popular sales method, which could save a lot of labor costs.

Third, scientific and normative management is the most important basis for sustainability of orchard management.

According to our survey, the contagious disease of fruit trees may well be derived from extensive management, because orchards with intensive management were less affected by the disease. In addition, normative management could reduce pesticide residue of fruits in order to form positive market image and geographical brand.

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Contemporary Concepts of a City in the Context of Sustainable Development: Perspective of Humanities and Natural Sciences

Współczesne koncepcje miast w kontekście zrównoważonego rozwoju: perspektywa humanistyczno-przyrodnicza

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Abstract

The article's purpose is to present, in the first place, mutual dependences between theoretical and practical speculations concerning urban space, shaped on the base of the sustainable development principle, difficult to implement in practice. Secondly, the text is supposed to serve closer explication and regularization of terminology referring to sustainable urban development. Thirdly, it concerns more precise reflection on the problem of sustainable city, frequently compared to eco-city, green, compact or smart city, as concepts of non-identical from their definition. Fourthly, the text aspires to bridge the gap in editorial market, as far as the wide range of subject literature, is concerned and lack of review studies referring to sustainable urban development.

Key words: sustainable urban development, sustainable development, sustainable city, eco-city, green city

Streszczenie

Artykuł ma na celu ukazać, po pierwsze jakie zależności zachodzą pomiędzy teoretycznymi a praktycznymi rozważaniami na temat przestrzeni miejskiej kształtowanej w oparciu o trudną wdrożeniowo zasadę zrównoważonego rozwoju. Po drugie, tekst służy bliższej eksplikacji i uporządkowaniu terminologii z zakresu zrównoważonego rozwoju miast. Po trzecie, artykuł poświęcony jest bliższej refleksji nad problemem miasta zrównoważonego, konfrontowanego częstokroć z koncepcją eko-miasta, miasta ekologicznego, zielonego, kompaktowego, czy też miasta inteligentnego, jako konceptami z założenia nietożsamymi. Po czwarte wreszcie, tekst pretenduje do miana nieobecnego na rynku wydawniczym, a obszernego z uwagi na zastosowaną literaturę, przedmiotu opracowania przeglądowego z zakresu zrównoważonego rozwoju miast.

Słowa kluczowe: zrównoważony rozwój miast, zrównoważony rozwój, miasto zrównoważone, eko-miasto, miasto zielone

Introduction

Modern city development runs at a rapid pace. In the space of last years we have had to do with transformations of urban space caused by certain processes, like: urbanization, suburbanization, deurbanization, but also reurbanization (van den Berd et al., 1982),

which from the very beginning have been accompanied by industrial-technological development. Another factor, taken into account while estimating the situation of contemporary cities, is globally observed progressive and steadily dynamic growth of cities

population, which in turn generates a variety of problems of both, social-economic and environmental character.

Therefore, a city, due to its exceptional character has become a research subject of theoreticians and practitioners, representing a diversity of knowledge branches. As every complex construct, a city, because of its heterogeneity and complexity, has also become a subject of closer inspection, reflection, interpretation and last but not least – a subject of an attempt of closing it in a definition and redefinition. It should be emphasized, however, that a city in interdisciplinary conceptualization, i.e. humanistic-natural, has been perceived as a living, and in consequence still changing, organism, with a key role, comparing to organ instrument, of particular functional spaces, combined together with a sophisticated informative-communicative network. The emphasis has been put on the fact, that a city – despite, the so called material structures (consisting of architectonic arrangements, networks of streets, plumbing, wiring, energetic and sewer systems) also possesses nonmaterial or spiritual structures, equally important for a city tissue (including people and their multi-territorial activities), regarded by many researchers as priority ones for transforming and developing a *living city*.

The immediate necessity of further strategy and in consequence optimal direction of a city future development appeared together with changes in perceiving a city by philosophy and disciplinary sciences (including natural sciences), where a city is a ductile forming composition, evolving constantly. Aware of catastrophic results of urban development, including progressing demographic and ecological crisis, economic decline, the scientists started to postulate the real emergency of implementing the rules of sustainable development, which should be a remedy for increasing problems of contemporary world, both in global and local scale, including urban space, being within our interests.

Taking all facts listed above into consideration, the article's purpose is to point out interdependencies between theoretical discourses on urban space developing in accordance with the rule of sustainable development and its practical interpretation and application. Moreover, the authors tried to arrange the definition confusion, observed in numerous studies on sustainable city development, what in turn can be related to unrestricted use of non-identical definitions, as it is in case of terms, like: sustainable city, eco-city, ecological city, green city, compact city, smart city, etc. In order to explicate the questions in a more proper way, the authors subjected to analyses current literature on the problem of sustainable urban development and undertook the effort of systematizing the definitions listed above. Selected issues from the sustainable city development questions are also presented.

Philosophy of a city in the context of sustainable development

A city has always been the subject of philosophers interests, whereby the issue was initially considered in two ways, either in the context of social idea or urban-architectural formation. Therefore, in the space of centuries we have been observing shaping urban space in accordance with philosophical principles, predominant in particular epochs. One of the first reports concerning a city character can be found in Aristotle's works, his *Politics* in particular, in which the philosopher postulates to situate a city in the center of the dependent territory, concentrate its inhabitants and create conditions for their activity (Gendźwiłł, 2006). He also suggests to create a city that way to provide its dwellers protection and make them happy (Gutowski, 2006).

During mediaeval period, on the grounds of Christian philosophy, many cities structural arrangements referred with their shape to a cross.

In the Enlightenment times, newly created urban complexes were designed to meet social needs of combining dwelling and work places, what in turn was compatible with predominant rationalist doctrine of that epoch and popular idea of community of dwelling (Paszkowski, 2011). Next philosophical trends had also great impact on newly created architectonic-urban concepts, which in perspective aspired to create an ideal city.

Contemporary various philosophical reflections touch the problem of a city and urbanization, as well, quoting e.g. works of Lopes De Souza (2000), De-Shalit (2003), Fraser (2008, 2009) or Akkerman (2014).

It should be remarked, however, that concepts of a city were frequently of an utopian character, like their extreme and sophisticated examples of Plato, Thomas Morus, Tommaso Campanella and Francis Bacon. Blum defining utopia idea, including the utopia of a city, had a feeling that *society was capable of constant or progressing improvement in a planned manner* (Gutowski, 2006). The definition above is compatible undoubtedly with the concept of a city utopia, although it should be remarked, that there is a difference between an utopian city and an ideal city, often mistaken with it. An ideal city is a separated project, aesthetically-architectural from its assumption (Alberti, 1960; Eaton, 2002; Rosenau, 2006), while an utopian city is subjected to social utopian concepts, and its arrangement is supposed to serve building social order (Kanter, 1968; Velho, 1973; Davis, 1981).

Philosophy of a city is directed at harmonious and permanent mutual infiltrating of two surfaces, i.e., formal and contextual. A city form consists of its spatial structure and infrastructure background, being a material city dimension. Bartnik (1993) defines it as somatic city dimension, expressed in the space, buildings, street etc., while in fact, a city context is

composed of people and their activity, building the so called – subjective city dimension. Following Bartnik, it can be stated that philosophy of a city is the ground of all the disciplinary sciences dealing with a city, although it is unaware sometimes. Urban space creation has always required basing on a certain urban theory on philosophical grounds, though (Paszowski, 2011). That spirit is the context for speculations on sustainable city development, which apart from practical implications of its implementation, contains in the first place, theoretical conditions, originating from (what should be stressed) philosophy of sustainable development.

It must be added, that the concept of sustainable urban development is a direct consequence of approval and application of the idea of eco-development, claiming, among others, the need of redefining the mutual relation – human-nature, while the concept of sustainable urban development, mentioned above is as range and topics are concerned, much more comprehensive, than the concept of eco-development, because *the question of economic, social, cultural development and the problems of natural environment is treated as integral, interrelated, interdependent and 'interconditioning unity'* (Tyburski, 2013, p. 83). As Hull remarks, the philosophy of sustainable development has its base in four kinds of convictions: 1) *perceiving natural world and human (human community) place in it and relations and interactions with nature*; 2) *accepted understanding of a human and social world created by him*; 3) *approved values and human life purpose and accepted ideas and social visions*; 4) *understanding and evaluation of technique and its role in shaping of the relation: human-nature* (Hull, 2003, p. 17-18).

Specifying sustainable development, the attention is usually turned to its key features, which are depicted in constructs of sustainable urban development, such as e.g. tendency to achieving an order (social, economic, spatial, environmental) during the planning process and development implementation; the necessity of constancy, i.e. accentuating interests of future generations; self-maintenance – which means basing on renewable resources and their substitutes, creating reserves for future development and what is crucial, integral, systemic and holistic thinking (Tyburski, 2013).

Theoretical conditioning of sustainable development appears frequently as a research subject of scientific papers (inter alia: Dołęga, 2005; Gawor, 2006; Pawłowski, 2008, 2011; Papuziński 2005). Eco-philosophy was and still is the philosophical current, taking up vast issue of sustainable urban development, focusing e.g., on theoretical background of shaping a city following the idea of sustainable development, inter alia, Tyburski (2011, 2013), Leżnicki (2011), Sztumski (2013), Leżnicki, Lewandowska (2014a, 2014b).

Concepts of a city in the context of the principles of sustainable development

Human anthropogenic activity has taken its toll particularly intensely in the space of urban centers inhabited by us and constantly redefined, being the direct results of wide-ranged techno-interference of a human into natural space, called *urban landscape* (Leżnicki, Lewandowska, 2014).

Cities cumulate majority of economic activity, including food and energy production, transportation services and intensive land use, what on the one hand contributes to a variety of profits, on the other hand, creates a number of problems and concerns, starting with social-economic problems (i.e. unemployment, social differences, increase of social stratification and social pathologies), ending up with environmental degradation (air and water pollution, excessive noise and waste and the inconveniences of its recycling). Facing these difficulties, every city doubtlessly deals with the task of eliminating or at least diminishing their affects (Lewandowska, 2014a). To conduct the activity in order to improve the inhabitants' life quality, we should direct, as e.g. Mega (1996) remarks, our efforts to obey prevention and forethought rules to protect urban organism in certain circumstances. The reasons listed above require from urban environmental management accordance with rules of sustainable development, which has become at present one of the most crucial and difficult in application issues for the nearest future (Hens, 2010).

As it was remarked before, rich subject literature delivers a number of concepts concerning city development seen in the context of sustainable development (see fig.1). Literature describing the relation human-nature presents one of the first urban concepts which was garden city concept (Howard, 1965; Batchelor, 1969; Buder, 1990; Ward, 2005), which has its contemporary counterpart in the idea of a green city. This one in turn assumes strong bond of architecture with nature, what implies the need of increasing biologically active area. This attitude is to provide the balance between natural environment and a city, which is crucial for stopping the process of biodiversity decline (observed in particular interest of significant *Rio Convention on Biological Diversity*, 1992), and in the estimation made by Brennan, O'Connor (2008), Kirpatrick et al., (2013). Theoretical assumptions of a green city are frequently analogous with practical guidelines for sustainable urban development, what is particularly clear while making city rankings, basing on the so called *green city index* (inter alia, European Green City Index, US and Canada Green City Index).

Ecological city is regarded as mistaking term as it contains contradiction in itself, which can be explained evoking to the term ecology. Ecology in its



Fig. 1. Concepts of a city in reference to the principles of sustainable development, source: the authors' own research

original meaning defines science of the whole range of interactions between flora and fauna in biotic and abiotic environment (Umiński, 1996; Krebs, 2001; Dołęga, 2011). A city is of course a subject lying within the spheres of ecology interests as an integral component of the environment, but not strictly natural environment, rather its social-cultural part, i.e. transformed as a result of human activity. Each human activity influences natural environment, redefining it and giving it new context. The term *ecology* has become fashionable recently, has been equipped with common dimensions becoming colloquial term, what in consequence had an impact on its common misusing, which is also the case of improper meaning of another term – ecological city. In this situation, we can at the utmost speak about, the so called, ecological interpretations of urbanization processes or ecological activity for environmental protection of urban space (Wojtyszyn, 2001). This is what White, among others, wants to say (2012), indicating how to build an ecological city, when his interpretation of the term *ecological* refers solely to urbanized structure and space (i.e. implementation ecological solutions and technologies) and not holistic perceiving natural environment.

Alternating idea, the so-called compact city, referring to assumption of urban space concentration, concerns creating cities of smaller sizes, what in consequence should lead to the landscape protection against greedy activities of developers, minimizing of waste producing and diminishing pollution. It must be added here, that if the concept of compact city is close to concept of sustainable development, it is incompatible with the idea of sustainable development. Bruggess, for instance, observes that: *there are also a number of other economic, social, cultural and political justifications for compact city initiatives and different and often contradictory policies for sustainable urban development* (Bruggess, 2010, p. 9). Compact city concept, taking the above into consideration, does not have to harmonize with the concept of sustainable urban development (Burto et al., 1996; Lin, Yang, 2006; Westerink et al., 2013). The concept of smart city, being currently in common discourse, appeared together with technological

-informative development as a continuation of earlier city concepts connected with scientific-technological progress, being specific transition from scientific city (Ford, 1913; Inhaber, 1974), through edge city (Garreau, 1991; Henderdon, Mitra, 1996), to digital city (Ishida, 2002). Smart city possesses a number of meanings and definitions. It is a digital city perceived as a place inhabited by population implementing dynamic information and communications technologies. Smart city's potential is measured, within the discussed concept, by broadband Internet access, effective education for knowledge-based economy, policy of the Internet popularization, increase of innovativeness level, scientific-technological centers presence or even implementation of activities for absorption of talented employees (Batty et al., 2012). Smart city is also distinguished by three factors' integration, i.e. presence of creative class, collective intelligence of urban population and artificial intelligence in form of digital infrastructure (Kominos, 2002). City perceived that way develops on the grounds of the network-centric organization of the elements, like: knowledge, technologies, human resources, infrastructure diversity and urban environment access (Caragliu et al., 2009; Szymańska, 2013; Szymańska, Korolko, 2015). Smart city is frequently defined as sustainable city, due to implementation of modern environmental friendly technologies and systems of sustainable development.

The term eco-city is frequently identified with the term sustainable city, what in turn could be justified only under condition of using the wide range of the definition referring to implementation of all rules of sustainable development into urban tissue. The concept of eco-city was formed for the first time by Richard Register in 1975 and it assumed in the beginning, among others, the need of *rearranging a city in the balance with nature* by the means of appointing, the so called *slow streets*, growing and picking fruits from roadside trees, appointing bus transport lines, promoting pedestrian and cycling traffic, suspending building local dual clearway (Register, 1987). Therefore, it was eco-city definition in a narrow view. Nowadays, eco-city is often named using in simplification the term of healthy city or arranging a city taking into account ecological requirements, combined with social-economic conditions (Leźnicki, Lewandowska 2014a). This concept assumes, that eco-city is supposed to be a friendly city, innovative, cost-effective, well equipped with adaptable solutions, neutral for natural environment and healthy for its dwellers, what is emphasized by many researchers (Engwicht, 1992; Roseland, 1997; Kline, 2000; Ma, 2009; Yigitcanlar, 2009; Joss, 2010).

However, there are no commonly obligatory definitions, nor the ones which would define univocally contemporary concepts of urban development in accordance with sustainable de-

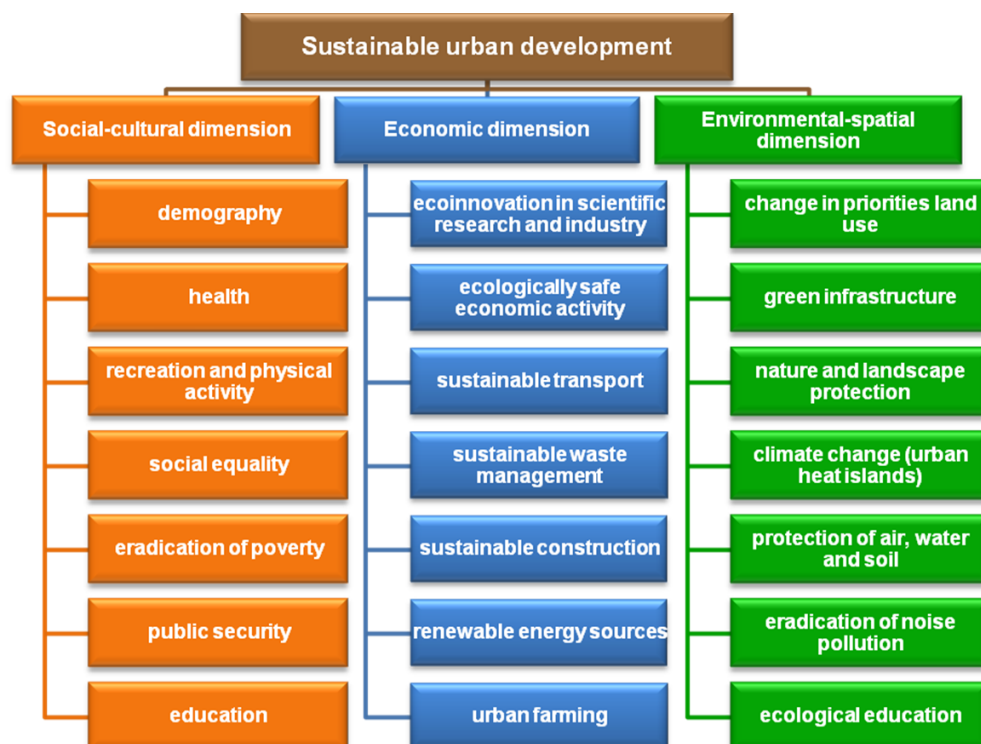


Fig. 2 Dimensions of sustainable city development, source: the authors' own research

development. Scientific literature often uses terms: green city, eco-city or sustainable city, as identical definitions. It is difficult to indicate which of them appeared as the first one, but studying subject literature, a conclusion can be drawn, that the idea occurring the most often is the term *sustainable city*¹. It seems to be the most precise qualification for a city functioning according to sustainable city patterns, as it contains the word *sustainable*, which refers to all three key development aspects, i.e. economic, social and natural. Sustainable urban development means, on the one hand, improvement of life quality of its present inhabitants, but it is also connected with actions tending to address the needs of future generations, not limiting simultaneously regional welfare. Paszkowski adds to the questions above, that: *ideal sustainable city is the structure exploiting the environmental resources to such an extent, to which it can renew it. It is a city of gradual, deliberate and intentional development* (Paszkowski, 2011, p. 196). The literature also delivers many city models referring to sustainable development. We can quote models of self-reliant cities, redesigning cities, externally dependent cities and a model of fair shares cities (Haughton, 1997). All quoted model examples are regarded as equal types of sustainable cities. To be called a sustainable city, it must fulfill a number of baseline criteria, which are generally discussed in subsequent part of the text.

Dimensions of sustainable city development

Making a general review of subject literature, apart from a variety of scientific disciplines subjecting the problems to analysis, three predominant dimensions or key aspects of sustainable urban development can be distinguished, i.e. social-cultural, economic-financial and environmental-spatial. Discussing the questions listed below, detailed problems are analyzed (see fig. 2). The crucial aspects of sustainable city are presented in the following part.

Socio-cultural dimension of sustainable urban development

During discourse on social-cultural dimension of sustained development, the questions presented in fig.2 belong to the most crucial ones. Stability in demographic situation is an important element, because it enables city development, not leading, however, to its overpopulation or depopulation. Next significant aspect of sustainable urban space concerns access to medical services of the highest level for all city inhabitants, provided by local authorities (Tsouros, 2009). Healthy life style popularized by city authorities together with implementing bio-political projects and bio-fitness culture are also of great importance.

Social equality supporting is another task for city policy-makers (Burton, 2000), as well as eradication

¹ The authors estimate, taking into account the Internet data base of scientific publications, that by the year 2014

about 15 thousand scientific publications were using the term *sustainable city*

of poverty and promotion of equal gender opportunity (Johnason-Latham, 2007). Modern urban space should be designed in a way, which reduces possibility of social conflicts occurrence (Godschalk, 2004) and thereby ensure security of all city dwellers (Kahagram et al., 2003). Another aspect is providing access to education and educational action, promoting sustainable development and environmental protection (Ahalberg et al., 2003, 2005). Care for city inhabitants' ecological awareness contributes to social support for pro-ecological investments. Thanks to education and upgrading professional skills – economic development of a region is possible, and what has been very significant in recent years – scientific and innovative sector, as well.

Economic dimension of sustainable urban development

Activity on behalf of eco-innovativeness is promoted in economic sphere of city development, because innovative ecology in production is directed at reducing or eliminate environment pollution, what can be applied in many various economy branches (Kemp, 2010). Before it is implemented in practice, its conceptual phase, i.e. scientific research is significant. Ecological innovations and technologies implemented in environmental protection are determinants and impulses for economic development and contribute to employment policy development and can, to a large extent, ensure production safety.

Sustainable city is also characterized by another crucial element, which is sustainable transport, propagating, on the one hand, using public transport (e.g. railway, tram network), on the other hand – cycling paths development (Richardson, 2005).

Sustainable city should implement reasonable waste management, as well, with the most desirable actions in this field – waste production prevention, next – waste processing for using it and recycling. In other cases – treatments of waste neutralization by burning it and eventually storing it (Biegańska, Ciula, 2011). These operations are taken up in order to diminish all possible negative effects of waste management system's elements on natural environment.

Increase of green architecture presence in urban tissue is also regarded as one of priorities in implementing sustainable development elements into city structure. From practical point of view, green architecture is strictly connected with sustainable construction, determined by defined regulations, like: e.g. effective use of renewable energy sources and energy efficiency, using environmental friendly and reusable materials, prevention of air, water and soil pollution, integration with natural and social environment and sustainable land use (Iwanek, 2009; Kamionka, 2010). Sustainable construction can therefore, solve a number of environmental problems by introducing innovative technologies, improving energy efficiency and increasing in whole energy pro-

duction participation of renewable energy sources (Chodowska-Miszczyk, Szymańska, 2014).

Urban farming development is also one of recommended sectors of sustainable city activities (Smit et al., 1996; Mougeot, 2006), which provides fresh and healthy food for local inhabitants.

Environmental-spatial dimension of sustainable urban development

All aspects of sustainable development should be depicted in practice, what means – in spatial planning, which consists of the stages, following one another: background of spatial policy, elaborating local plans or strategy of land use planning, the plan implementation, and finally – monitoring of actions resulting from the plan functioning. The idea of sustainable development employed in spatial planning process guarantee among others: providing care for environment quality, proper resources management, including first of all rational land use, taking up pro-ecological solutions in technical-technological area and care for proper public area organization, with particular stress on significant participation of biologically active area (Rogatka, Lewandowska, 2014). Green areas in cities are extremely important, therefore activities promoting green infrastructure, which Benedict and McMahon (2006) define as *a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for (...) communities and people' should be taken up. Green area functions as, among others, catalyst of climatic conditions, neutralizing occurrence of the so called 'urban heat islands'*.

Nature protection in cities concentrates on activities directed at preserving a kind of optimum state for fauna and flora and their habitat in urban ecosystem, caring for ecosystem proper functioning in direct urban population contact with natural environment (Muller, 1998). Protective treatments should also turn attention to keeping biodiversity, including air, water and soil (Lewandowska, 2014b).

Noise pollution neutralizing is another significant task of urban areas authorities, due to its danger for living organisms' health, what in consequence affects work efficiency. Recommended situation is the state, when people can decide by themselves on character of their acoustic surrounding and are not forced to stay and live in unbearable noise (Goines, Hagler, 2007).

All the actions listed above will never be implemented, if local communities and self-government authorities are not taught a lesson on ecological education, which tasks are: 1) *building ecological thinking*, 2) *popularizing reliable knowledge on environment condition and dangers of pollution*, 3) *mobilizing for initiating recovery measures and searching*

for remedies against next dangers, 4) teaching environmentally friendly attitude (Tyburski, 2013, p. 314).

Summary

It must be stressed that contemporary concepts of urban development relate in many aspects to the idea of sustainable development. As it was pointed out, there are many city concepts, which definitions interlace. Therefore, it can only be postulated to unify terminology and limit definition range of ideas outlined in the text, with the most recommended term *sustainable city*, while the other names reconnect only to some of the aspects of the idea of sustainable development. In case of green city, it will be harmonization of relations between human-nature, in case of eco-city, the stress will be put on pro-ecological technologies implementation within city space, taking smart-city into account – the attention will be concentrated on the necessity of modern electronic-information technologies application, while in compact city – sustainable transport and changes in land use policy will be promoted. The vast majority of researchers are of an opinion, that regardless this or that city concept, all of them should care for not only the benefits of present, but first and foremost future generations and environment for future existence and this is the principle of city present designing.

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The Judaeo-Christian Tradition as a Source of a Paradigm of Sustainable Development¹

Tradycja judeochrześcijańska, jako źródło paradygmatu rozwoju zrównoważonego

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Abstract

The economic development of the last two hundred years has had no precedent in human history. Its dynamic was mainly a result of knowledge and technological progress, but was also associated with the adoption and acceptance of utilitarian values and thus the formulation of social aims in terms of profit for the producer and utility for the consumer. This attitude, perforce a short-term one, triggered an unusually fast increase in production, which allowed many societies to make a civilization leap, albeit at the price of an imbalance in global social and ecological conditions.

An attempt to restore ecological and social balance involves a change of economic paradigm to one that takes into account social needs and the limitations of nature. The economics of sustainable development is a concept, where economic objectives and the time horizon have been reformulated to include not just the question of economic development, but also ecological and socio-cultural aspects, and development itself is considered from a long-term perspective. It is a relatively modern concept, that only started to be considered as an alternative to conventional economic attitudes in the second half of the 20th century. The roots of the concept of sustainable development are usually traced back to a German culture of a forest resource management. However, the idea of development taking into account the spheres of ecology, social relations and economics seems to have its beginnings already in sources from earlier Judaeo-Christian civilisation.

The texts of The Old and New Testament and supplementary writings of Judaism and Christianity create a coherent image of social development, where the areas of ecology, social needs and economic activity take equally meaningful positions. Contrary to the opinion, popular in the 1960s based on the quote from *Genesis* (*let them have dominion over all the earth*), that Judaeo-Christian civilization is responsible for ecological catastrophe, both Judaism and Christianity sources contain a strong ecological message. Regarding social development, the problems of equitable social relations are a core issue in the Old and New Testament. The third area of in-depth analysis studies economic processes at micro- and macro-levels that are limited just by the rules of social fairness and the limitations of nature.

The paper presents a selection of sources contained in Judaeo-Christian writings relating to issues of development in the areas of ecology, society and economics, which lay the foundations for the modern paradigm of sustainable development.

Key words: Sustainable development, Judaeo-Christian civilization, ecology, society, economics, Old Testament, New Testament

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Streszczenie

Rozwój gospodarczy ostatnich dwustu lat był w historii ludzkości zdarzeniem bez precedensu. Jego dynamika wynikała przede wszystkim z postępu wiedzy i technologii, ale wiązała się również z przyjęciem i akceptacją wartości o charakterze utylitarnym, a co za tym idzie sformułowaniem celów społecznych w kategoriach zysku producenta i użyteczności konsumenta. Takie podejście, z konieczności krótkookresowe, wyzwoliło niespotykane szybki wzrost produkcji, umożliwiając dokonanie cywilizacyjnego skoku wielu społeczeństw, jednak za cenę zachwiania globalnej równowagi społecznej oraz ekologicznej.

Próba przywrócenia równowagi społecznej i ekologicznej musi wiązać się ze zmianą paradygmatu gospodarczego, na ten uwzględniający potrzeby społeczne oraz naturalne ograniczenia. Ekonomia zrównoważonego rozwoju jest koncepcją, w której cele ekonomiczne oraz horyzont czasowy zostały przeformułowane, obejmując poza rozwojem gospodarczym również obszary ekologii i społeczno-kulturowy, a rozwój rozumiany jest w perspektywie długookresowej. Koncepcja ta traktowana jest, jako stosunkowo współczesna i dopiero w drugiej połowie XX wieku zaczęto rozważać ją, jako alternatywę dla konwencjonalnych metod gospodarowania. Jej korzeni upatruje się w niemieckiej kulturze gospodarowania zasobami leśnymi, jednak koncepcja zrównoważonego rozwoju sfery ekologicznej, społecznej i gospodarczej wydaje się mieć swój początek już u samych źródeł cywilizacji judeochrześcijańskiej.

Teksty Starego i Nowego Testamentu, oraz uzupełniające je pisma uznawane przez judaizm i chrześcijaństwo, tworzą spójny wizerunek rozwoju społecznego, w który sfery ekologii, potrzeb społecznych i gospodarki zajmują równie istotne pozycje. Wbrew powszechnej jeszcze w latach 60. opinii, oskarżającej, w oparciu o fragment *Księgi Rodzaju* (*napelniajcie ziemię i czyńcie ją sobie poddaną*), oskarżającej tradycję judeochrześcijańską o katastrofę ekologiczną, jej źródła zawierają silnie proekologiczny przekaz. Jeśli chodzi o rozwój społeczny, zarówno w Starym, jak i Nowym Testamencie, problematyka sprawiedliwych relacji społecznych stanowi trzon tematyczny wspomnianych tekstów. Trzecim obszarem, pogłębionej analizy są procesy gospodarcze zachodzące zarówno na poziomie mikro i makroekonomicznym, których ograniczeniem jest właśnie zachowanie zasad sprawiedliwości społecznej oraz ograniczeń płynących z natury.

W artykule przedstawiono wybrane, zawarte w źródłach judeochrześcijańskich, zagadnienia rozwoju w ramach trzech obszarów: ekologicznego, społecznego i gospodarczego, tworzące zręby współczesnego paradygmatu rozwoju zrównoważonego.

Słowa kluczowe: rozwój zrównoważony, cywilizacja judeochrześcijańska, ekologiczny, społeczny, gospodarczy, Stary Testament, Nowy Testament

Introduction

From the beginning of our era right up until the start of the 19th century, there was no rapid economic development with a slow pace of change being characteristic throughout the world. A clear acceleration in economic development only came with the industrial revolution, especially in what is broadly understood as the Western world. The pace of these changes, expressed in GDP *per capita*, is shown in Table 1. The sudden growth in production was accompanied by population growth and an increase in life expectancy.

For example, life expectancy increased from 24 years in the year 1000, to 36 in 1982 and 63 in 2003, and to 76 years in the West (Maddison, 2007, p. 69). Such growth was made possible thanks to increasingly efficient use of resources and technical progress, as well as support from new academic disciplines – economics and management – and changes in mentality leading to the strengthening of utilitarian values. These phenomena, coupled with the world-changing industrial revolution, laid the foundations for the dynamic form of capitalism we know today, accompanied as it is by practically con-

Table 1. Level of GDP per capita according to region, during the period 1 to 1998 A.D. (based on prices from 1990, in \$). Source: Adapted from: Maddison A., *The World Economy. A Millennial Perspective*, OECD Publications, Paris, 2001, p. 264.

Region/Year	0	1000	1500	1600	1700	1820	1870	1913	1950	1973	1998
Western Europe	450	400	774	894	1024	1232	1974	3473	4594	11534	17921
Eastern Europe	400	400	462	516	566	636	871	1527	2120	4985	5461
Former USSR	400	400	500	553	611	689	943	1488	2834	6058	3893
USA			400	400	527	1257	2445	5301	9561	16689	27331
Australia, New Zealand, Canada			400	400	400	753	2339	4947	7538	13364	20082
Latin America	400	400	416	437	529	665	698	1511	2554	4531	5795
Japan	400	425	500	520	570	669	737	1387	1926	11439	20413
China	450	450	600	600	600	600	530	552	439	839	3117
India	450	450	550	550	550	533	533	673	619	853	1746
Africa	425	416	400	400	400	418	444	585	852	1365	1368
World	444	435	565	593	615	667	867	1510	2114	4104	5709

stant economic growth, which of course brought part of the world into an era of widespread prosperity (above all, in the *Triad* region, in other words, North America, Western Europe and East Asia), but at the same time posed some dramatic dilemmas, concerning the sense of constant growth and the price paid for it, measured in terms of pollution and exploitation of the natural environment, diseases of civilization and disruption of the demographic balance. However, inequality in economic changes also brought the world into an era of unprecedented social inequalities. It became clear that simply following only the dictates of economic growth poses a threat to nature, social order and thus to humanity. Seeking a path to development that would make it possible to improve the quality of life, whilst at the same time respecting the natural environment and the subjectivity of the individual became a matter of necessity, as has been shown by numerous studies and reports, such as successive editions of the *Living Planet Report*, for instance, including the 2014 edition, which warns of the effects of excessive consumption, *business models that focus on short-term profits and fail to account for externalities and long-term costs*, as well as of holding onto *inefficient, outmoded (...) ways of generating (...) energy and producing food, leading to ecological overshoot* (Living Planet Report, 2014). J. Randers also warns of the latter in his book *A Global Forecast for the Next Forty Years. 2052*, especially in the context of a lack of political will to put an end to destructive human activity, as a result of which, according to the author's estimations, until the 2050s, the world population and the world economy will continue to grow more slowly, but still sufficiently fast as to further worsen the climate crisis, accompanied by a growth in the level of poverty of the poorest members of global society, meaning that though there will still be enough food, energy and water to satisfy demand, there will not be enough to meet our needs (Randers, 2012). Threats concerning climate change, vanishing biodiversity, inequality and other social problems are the effect of the short-term, and thus also short-sighted perspectives adopted by society with reference to the economic and political systems it creates. The culture of the West, oriented towards the now and the near future, which thanks to its strength and values has spread a cult of efficiency, consumption and constant growth, finding itself faced with the problems discussed, is however making attempts to come up with recommendations as to how to find a way out of this dramatic situation, now known to us as the idea of sustainable development, presented in 1987, in the UN Report of the World Commission on Environment and Development (The Brundtland Commission) as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (Hauff, 1987, p.

46). Based on another approach, sustainable development is understood to mean economic growth accompanied at the same time by protection of the quality of the environment, where both processes have a mutually reinforcing effect. It is essential to this form of development for there to be a stable relationship between human activities and the natural world, thanks to which the chances of future generations to enjoy a quality of life which is at least as good as our own do not decrease (Mintzer, 1992).

H. Rogall defines sustainable development in very specific detail when he writes: *sustainable development seeks to guarantee everyone alive today and future generations sufficiently high ecological, economic and social-cultural standards within the limits of what can naturally be sustained by the Earth, applying the principle of intra-generational and inter-generational justice* (Rogall, p. 44). This definition proposes there to be four dimensions to sustainable development – namely, the economic, ecological, social and cultural, which in practice makes the economic process a complex and interdisciplinary one, which reaches far beyond the bounds of mainstream economics and requires a rejection of the orthodox economic paradigm in favour of recognizing the economic and social spheres and the natural environment as an integral whole. This approach is not a novel concept, however, but rather a return to the universalist way of understanding reality, which is no stranger to the science of economy and appeared, for example, in the thinking of the Physiocrats, the classical economists, the theory of K. Marx, and, more recently, in that of A. Sen. Going even further back, it was formulated within the framework of general systems religious belief, including in Judeo-Christian civilization. The purpose of this article is to demonstrate a direct relationship between cultural heritage arising from this civilization, and the concept of sustainable development, understood as simultaneous development in both the economic and social spheres, taking into account respect for the limited potential for renewability of nature, where the objective of economy is not to maximize profit and utility, but the quality of life of people in their ecosystem.

The ecological aspect in the heritage of the Judeo-Christian tradition – do not destroy and repair

The ecological aspect of how societies function was most fully and clearly manifested in pagan cults, in which nature held a dominant position due to being attributed qualities of subjectivity and agency. By rejecting an anthropocentric vision of the world and making man an equal-ranking part of the natural system, religions of the Far East – and more specifically, Taoism, Buddhism and Hinduism – also created sets of values conducive to the respect of nature.

It was only with the message of the Abrahamic religions, or *religions of the Book*, that human beings were raised to a level superior to the other creatures that inhabit the earth, as first formulated in the Book of Genesis: *Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth* (Genesis 1:28)². This principle was to become an important source of Western individualism and legitimized the supremacy of the needs of the individual over the balance of nature, but the wider message of Judaism concerning ecology, contained in the Pentateuch, the Talmud and rabbinical commentaries protected the interests of nature against the excessive arrogance of man. The most important imperative in guiding human conduct was *do not destroy or waste* (from the Hebrew *Bal tashchit*), which is considered to be founded on the *Book of Deuteronomy*, Chapter 20:19-20. This passage contains a ban on the cutting down of fruit trees when laying siege to a city. The destruction of fields, vineyards and orchards may have been a possible tactic of warfare, but it was one that was rejected by the Judaic tradition. At the same time, that principle applied not only to armed conflict, but it also extended to other areas of human activity, as explained by Samson Raphael Hirsch, the nineteenth-century German rabbi: *Do not destroy anything! Be a 'mentsh' [responsible person] (...). I lent them* (ed. the gifts of nature) *to you for wise use only; never forget that I lent them to you. As soon as you use them unwisely, be it the greatest or the smallest, you commit treachery against My world, you commit murder and robbery against My property, you sin against Me!* (Gottlieb, 2006, p. 247). Anything which may indirectly or directly serves the interests of man may not be over-exploited, destroyed, polluted or wasted. This attitude is complemented by the rule contained in the Talmud of *healing / repair of the world* (from the Hebrew *Tikkun olam*), which refers to the responsibility of Jews to perfect the world (Bildstein, 2005, p. 17).

The above principles, because of their general nature, set out a path for relations between man and nature, and are supplemented by more detailed principles which contribute to the ecological profile of Ju-

daism. The ancient Israelites were agricultural tribespeople. The climatic conditions under which they had to operate were marked by a scarcity of rain and the threat of desertification. Their lives thus depended on the cycles of nature, and this was reflected in the specific festivals they celebrated³. The Torah however remained central to life, as the means by which all aspects of human life could be analysed and experienced. Through the Torah, everything became holy, including nature (e.g. *Book of Exodus* 19:18-19), by means of which God spoke to a man, supplied his needs, and nature in turn became the means by which the Israelites fulfilled their obligations to God (*Book of Exodus* 23:10-19). Such admiration and respect for nature was manifested amongst other things in the Jewish tradition of the blessing⁴ of nature and the pleasures which flow from it. One of the specific commands of an ecological nature was concerned with speciation and the prohibition of crossing species. According to the *Book of Genesis* (1:1-25), the work of creation was founded on the division of beings, whilst at the same time recognizing the diversity of species. The principle of not mixing species (in Hebrew: *Kil'ayim*) was repeated in the *Book of Leviticus* (19:19): *Thou shalt not let thy cattle gender with a diverse kind: thou shalt not sow thy field with mingled seed* and in the *Book of Deuteronomy* (22:9-12), and was subsequently expanded upon in the Jerusalem Talmud, where the ban on crossing different types of grains, vines, animal species and textiles is discussed in detail (Gottlieb, 2006, p. 44). Today, this rule is particularly subject to discussion in the context of GMOs. Some contemporary commentators consider that man created in the image of God should act as his partner in perfecting the world, while others take the point of view that transgenic foods are a violation of the rules against the crossing of species and amount to destruction of the natural order established by God (Omobowale, Singer, Daar, 2009). Transgenic foods may also involve the unwitting consumption of unclean foods. *Kashrut*, the dietary laws which restrict which foods are fit for consumption (or *kosher*) in Judaism, due to certain species being considered unclean, can also be understood in an ecological context⁵. Cloven-hoofed ruminants, which are notable

² Quotes from the Old and New Testament are taken from the 1611 King James Bible (KJV), Cambridge Edition, Cambridge, circa 1900.

³ For example, *Sukkot*, during which there were rites of blessing of rain, and also bunches of branches of palm, myrtle, willow and citrus trees symbolizing fertility, youth and vitality (Gal-Ed, 2005, p. 138); *Shavuot*, associated with the harvest, when houses and synagogues were decorated with greenery and flowers, and fruits and dairy products were consumed (op. cit. p. 65-82) and the spring festival of Passover, when the first ears of barley are cut, to be offered to God as a sacrifice. After seven weeks, on the fiftieth day of the said holiday of *Shavuot*, a sacrifice of the first grains of wheat is offered (op. cit. p. 31-62).

⁴ For example, the blessing spoken upon seeing the first blossoming tree of spring: *Blessed are You, Hashem, Our God, Sovereign of the universe, who ensured that nothing is lacking in His world and created in it good creations and good trees in order to pleasure mankind with them. You causeth the grass to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth; And wine that maketh glad the heart of man. Blessed be Hashem, Our God, Sovereign of the universe, who creates the fruit of the vine* (translation of Polish text based on: *Tu Biszwat, czyli Nowy Rok Drzew/ Tu BiShvat, or 'New Year of the Trees'*, www.jewish.org (01.12.2015).

⁵ There are numerous explanations of kosher rules, some of which explain the uncleanness of some animals as being due to their significance in the cults of neighbouring

for making the most efficient use of plant food, may be consumed, while amphibians, reptiles and aquatic crustaceans, as well as any predators, are considered unclean. For ecological reasons, it is prohibited to consume animals, whose purpose is to control the populations of other species and eliminate parasites (for example, frogs, toads or newts which feed on mosquito larvae) (Gottlieb, 2006b, p. 57-58). Based on the principle of *kashrut*, Judaism requires that the consumption of meat be restricted, a requirement which not only has an ecological dimension, but an ethical one too – the killing of animals was a sacred activity that had to be carried out by a qualified *shochet* (slaughterer), which could have been a way of restricting the unconsidered and excessive killing of animals⁶. The Torah requires mercy and pity to be taken on animals (*Book of Exodus* 23:4-5, 12; *Book of Deuteronomy* 22:4, 25:4). One of the bans on consumption concerned the consumption of body parts and blood of animals that are still alive, which was specified in greater detail in the *Seven Commandments of the Sons of Noah* (Mello, 2002, p. 157)⁷, and it is written elsewhere that: *Thou shalt not see thy brother's ass or his ox fall down by the way, and hide thyself from them: thou shalt surely help him to lift them up again* (*Book of Deuteronomy* 22:4), while the *Book of Proverbs* also says that animals should be treated with respect (12:10). The prohibition on cooking the meat of a young animal in its mother's milk can be regarded as a sign of ethical reflection on the fate of the animals (*Book of Exodus* 23:19, 34:26, *Book of Deuteronomy* 14:21). It is also worth recalling the concern for the sustainable management of resources and for the conservation of species that can be understood from a fragment of the *Book of Deuteronomy* (22:6-7) about the need to spare the life of the mother of young chicks. This concern for ecological balance was also echoed in the idea of the Sabbath year, which required that nature be given a period of rest, ordering that crops be left fallow, which improved the fertility of the soil, with any crops that grew being intended for the poor and wild animals (*Book of Exodus* 23:10-11). In addition, the weekly Sabbath was intended for both people and animals (*Book of Exodus* 23:12).

The tradition of Judaism, being deeply related to nature, thus created a strong ecological message, which

became the natural heritage of Christianity. However, at a textual level, that pro-ecological message is less clearly echoed in the *New Testament*. Christianity, being a re-interpretation of Judaism based on the spirit of Greek philosophy, provided a far more abstract point of reference. In contrast to the clear and unambiguous directives of the *Old Testament*, the general, universalist moral theory presented in the *New Testament* allows it to be read in an extra-historical context. Until as late as the 1960s, the predominant point of view was still that Christianity had not made any contribution on ecological matters (Bakken, Engel, Engel, 1995), with some researchers looking for the sources of the 20th century ecological crisis in modernism, the capitalist economic system, as well as the extreme anthropocentrism and individualism that have developed on the basis of Western Christianity, and Protestantism in particular, which ultimately *disenchanted* nature and deprived it of its divine element (White, 1967). Understood in this way, Western Christianity allowed nature to be understood objectively, as a resource; to be treated with arrogance of a higher being, created in the image and the likeness of God. At the same time, because of the dualism characteristic of the Christian vision of existence, the material world has for many centuries been portrayed with contempt, as a source of sin. However, as already mentioned above, the abstract nature of Christian philosophy means that the problem is not the presence or absence of certain issues in the *New Testament*, but how the message of that source is interpreted. At a descriptive level, accounts in the *New Testament* which are drawn from nature are the source of many parables and comparisons (Najda, 2007), which is understandable because of the deeper relationship between nature and man at the time when the gospels were written. Here, the message concerning man's relationship to nature appears to be especially important. In the *New Testament*, the importance of ecological balance is underlined, by the promise of the salvation of all creation, not just mankind: *For the earnest expectation of the creature waiteth for the manifestation of the sons of God. For the creature was made subject to vanity, not willingly, but by reason of him who hath subjected the same in hope, Because the creature itself also shall be delivered from the bondage of corruption into the glorious liberty of the children of*

pagan cultures; while others explain it in terms of a threat to health or life resulting from the consumption of certain species.

⁶ Ritual slaughter of animals is considered inhumane today, but in a historical context, such an assessment is unfair. Animals could be killed by a qualified person, which minimized the risk of prolonging their agony, and death was caused by using a clean, sharp, unserrated knife of a suitable length to sever the trachea, nerves and arteries in one swift and resolute movement. At the same time, it was recommended that the animal not be observed by other animals during the course of the slaughter, to spare them pain and fear.

⁷ Historically, the eating of live animals was not unusual. For example, the earliest surviving Polish cookbook, the seventeenth-century *Compendium Feculorum*, contains the lines [translated from the Polish]: *take thee a live capon, pour wine vinegar down its throat using a funnel, tie it up and leave it to hang for five hours, then pluck with care, prepare and bake it in the usual way or cook it as you wish or by such means shall you a turtle cook, first by cutting off the legs and head alive, then when boiled, carefully remove the top shell, season well with salt and place the turtle on a platter* (Spychaj, 2009).

God. For we know that the whole creation groaneth and travaileth in pain together until now (Romans 8:19-22). As for the *1st Epistle to the Corinthians*, it says the following: *For the earth is the Lord's, and the fulness thereof* (1 Corinthians 10:26). In the letters of Paul, nature is thus considered to be an object that is of equal standing in God's grace, and the author shows his environmental awareness at least in his praise for not eating meat (Romans 14:21) and twice makes reference to the proper treatment of animals (1 Corinthians 9-10, 1 Timothy 5:18). In the *Gospels of Mark and Matthew*, nature is related to the divinity of Jesus, from the moment of his birth, which is marked by a shining star (Matthew 2:2), until the time of his death, when darkness engulfed the earth (Matthew 27:45), while, during the forty days of fasting in the desert, Jesus was accompanied by wild beasts (Mark 1:13), and the place of his last prayer was in an olive garden. The relationship between God and nature was made especially clear in the *Apocalypse*, where the natural catastrophes and cataclysms have often been interpreted as a lament for the earth as excessively exploited by the Roman Empire, or according to more contemporary interpretations, by humankind in general (Sintado 2015, p. 294-307): *and the third part of trees was burnt up, and all green grass was burnt up (...). And the third part of the creatures which (...) had life, died (...) and the third part of the waters became wormwood; and many men died of the waters, because they were made bitter* (Revelation 8: 6-13). Descriptions of nature as destroyed or nature as destructive to man in descriptions of the apocalypse are accompanied by a rupture of the relationship with God. Ideas of nature as resulting from God, and harmonious with Him, are reflected in 20th century Christian philosophy of being, not least in the views of T. de Chardin, who saw being in the broad, cosmic sense, but also from an ecological perspective, as the process of evolution of matter, from which life emerges and moves towards the point of pure consciousness. From this perspective, the relationship between the individual and nature ceases to make sense, because the whole of being is permeated with consciousness (spirit), and the position of man is defined as at one with nature, with the process of evolution embracing being as a whole. The whole of creation is moving towards the Omega Point and salvation is something to be found by creation as a whole. The ecological connotations of T. de Chardin's views were acknowledged by the Catholic Church several decades after their publication, even though the Holy Office⁸ continued to warn against the dangers of reading the works of T. de Chardin until as late as the 1960s, due to them containing ambiguities with regard to Catholic doctrine. J. Ratzinger did, however, call upon the philosophy of T. de Chardin both in his *Introduction to*

Christianity, which makes several references to a cosmic vision of that religion, and also, once as Pope, during the homily he gave in Aosta, where he calls the cosmos a *living host* (Benedict XVI, 2009). Ecological concerns also appeared in papal teachings during the pontificate of John Paul II, though portraying man as being responsible for the natural world, but external to it: *The man of today seems ever to be under threat from what he produces, that is to say from the result of the work of his hands and, even more so, of the work of his intellect and the tendencies of his will. (...) what this manifold activity of man yields (...) turns against man himself. (...) Man (...) is afraid that what he produces (...) can become the means and instrument for an unimaginable self-destruction, compared with which all the cataclysms and catastrophes of history known to us seem to fade away. This gives rise to a question: Why is it that the power given to man from the beginning by which he was to subdue the earth turns against himself, producing an understandable state of disquiet, of conscious or unconscious fear and of menace, which in various ways is being communicated to the whole of the present-day human family and is manifesting itself under various aspects* (John Paul II, 1979). Here, man is thus somehow abstracted from nature (of his own fault). Again, in an earlier document published by Paul VI, *Gaudium et Spes* (a work in the creation of which K. Wojtyła was also involved), the question of moral responsibility for the environment was also raised, though in the context of objective considerations – saying that, when treated with due respect, the earth will *bear fruit and become a dwelling worthy of the whole human family* (Paul VI, 1965). A move away from a deeply anthropocentric approach to ecological issues first became visible in the works of Benedict XVI, observing that *the book of nature is one and indivisible* (Francis, 2015; Benedict XVI, 2009), after all man does not create himself, he *is spirit and will, but also nature* (Francis, 2015; Benedict XVI, 2011).

Even though the issue of ecology had been raised in papal teaching since the 1960s, Pope Francis's *Laudato si'* is the first document to be fully dedicated to the issue. Moreover, it also includes important comments on sustainable development.

The majority of the document relates to real problems and environmental threats, and the position adopted is very much in the spirit of the vision of T. de Chardin, with Francis seeing man not as the crowning achievement of creation, but rather as a fragment of it: *The ultimate destiny of the universe is in the fullness of God, which has already been attained by the risen Christ, the measure of the maturity of all things. Here we can add yet another argument for rejecting every tyrannical and irresponsible domination of human beings over other crea-*

⁸ In 1965, the institution's name was changed to the Sacred Congregation for the Doctrine of the Faith.

tures. *The ultimate purpose of other creatures is not to be found in us. Rather, all creatures are moving forward with us and through us towards a common point of arrival, which is God, in that transcendent fullness* (Francis, 2015). Christian eco-philosophy, or eco-theology to be more precise, is something that has developed not only within the Catholic faith. In the Protestant tradition, alongside T. de Chardin's theory of being, such thought was based on the writings of A. N. Whitehead, whose process philosophy described the world as interrelated processes, of which man is an integral part, meaning that all choices and acts of individuals have an influence on surrounding reality. This concept provided the inspiration for the works of J. B. Cobb (1995), who emphasized the continuity and dependency between humans and living nature, and advocated abandoning the anthropocentric point of view and the associated marginalization of the significance of the *nonhuman world*⁹. The Eastern Orthodox Patriarch Bartholomew, in his Message to 19th Session of the Conference of the Parties to the UN Framework Convention on Climate Change (COP19), wrote: *There is no distinction between concern for human welfare and concern for ecological preservation. The way we relate to nature as creation directly reflects the way we believe in God as Creator of all things. The sensitivity with which we handle the natural environment clearly mirrors the sacredness that we reserve for the divine* (Patriarch Bartholomew, 2013).

Both the ecological tradition of Judaism, and later – Christianity – go far beyond the command *to subdue the earth*, defining the boundaries of the first of the planes of social development in terms of sustainable development.

Social balance in the Judaeo-Christian tradition

Judaism developed one of probably the most sustainable concepts of how society functions, protecting against the growth of excessive social inequalities, permanent accumulation of capital, the burden of debt on successive generations, hunger, and even the loss of a sense of purpose in professional life. The source of such practical solutions, as in the case of the Christian tradition, was in the commandment to love thy neighbour, as well as in the expectation of mercy, and not sacrifice, as expressed in the *Book of Hosea* (6:6). The mechanisms to prevent social inequalities, accumulation of capital and power and inheritance of one's parents debts were the institutions of the Sabbath year and the Jubilee year. The former appeared in cycles every seven years, referring to the

seventh day of rest, which also explains why land (including orchards and vineyards) was not cultivated during the Sabbath year, and was allowed to lie fallow, while yields of crops from the Sabbath year could be used by both their owners as and all those in need: the poor, travellers, etc. It was also a year for the release of debts: *At the end of every seven years thou shalt make a release. And this is the manner of the release: Every creditor that lendeth ought unto his neighbour shall release it; he shall not exact it of his neighbour, or of his brother; because it is called the LORD'S release (Deuteronomy 15:1-2)*. Every forty-nine years (seven times seven), however, there was a Jubilee year, during which, in addition to the principles of the Sabbath year, any sales of land were cancelled, with the land being returned to its original owner¹⁰, and all slaves were also liberated. As T. Sedláček writes: *These provisions express a conviction that freedom and inheritance should not be permanently taken away from any Israelite. Last but not least, this system reminds us that no ownership lasts forever and that the fields we plow are not ours but the Lord's* (2011, p. 78). There was also a redistribution of wealth in the form of the leftovers of the harvest: *And when ye reap the harvest of your land, thou shalt not wholly reap the corners of thy field, neither shalt thou gather the gleanings of thy harvest. And thou shalt not glean thy vineyard, neither shalt thou gather every grape of thy vineyard; thou shalt leave them for the poor and stranger (Leviticus 19:9-10)* and *tzedakah*, broadly understood to signify charity, which consists of, among other things, a tithe¹¹ of one's income being passed onto the temple, which is handed out every three years to the most disadvantaged, as well as of other forms of material support too. Charity in Israeli society was seen not in terms of an act to guarantee future salvation, but as a shared obligation, which also should be met in a discreet way in order to maintain social cohesion as a primary goal.

The concept of social balance in Judaism was not limited only to the tools of redistribution described above. Instead, they were rather the method of implementing of the main determining themes of the Judaic concept of social justice: care for the community, care for the needy, in other words, charity, and the aforementioned obligation to repair the world. Judaism (just like Christianity too in fact) was a religious and social system created for a relatively small group of people, and one of its fundamental values was therefore a focus on the common good and the importance of nurturing community. This is evident not only in the mechanisms described above, but also

⁹ Eco-theology, a field of thought which developed from the end of the 1960s, is part of the process of reflection on the religious sources of sustainable development, but because of the breadth of the subject, the issue is only touched upon briefly here.

¹⁰ Originally, the land was divided among the different tribes of Israel.

¹¹ A tenth part of income or the harvest. In the case of the particularly rich, it was, however, a fifth part, though it would not be so big as to subject the rich man to an unsatisfactory quality of life. According to J. Attali, the Talmud even says that the rich should eat well and prosper, so as not to be tempted to advise the poor to follow his example of frugality! (Attali, 2003, p. 95).

in later tradition: as one Hasidic proverb says: *The community of the living is the carriage of the Lord* (Easwaran, 2005, p. 147). And in the Babylonian Talmud, it says: *When the community is in trouble let not a man say, 'I will go to my house and I will eat and drink and all will be well with me'* (Babylonian Talmud, Taanit 11a). Care for the community can also be seen in the order to provide support to the most vulnerable members of society, even if they are not necessarily native to that society, as is shown in the following verses: *And if a stranger sojourn with thee in your land, ye shall not vex him. But the stranger that dwelleth with you shall be unto you as one born among you, and thou shalt love him as thyself* (Leviticus 19:33-34) and *He doth execute the judgment of the fatherless and widow, and loveth the stranger, in giving him food and raiment. Love ye therefore the stranger: for ye were strangers in the land of Egypt* (Deuteronomy 10:18-19; Exodus 22:21) or *For the poor shall never cease out of the land: therefore I command thee, saying, Thou shalt open thine hand wide unto thy brother (...) (Deuteronomy 15:11) and: thou shalt not wrest the judgment of thy poor* (Exodus 23:6). The command to improve the world also has a social dimension, which in this context must be understood as the elimination of poverty and injustice from the world through the mercy and justice: *He hath shewed thee, O man, what is good; and what doth the LORD require of thee, but to do justly, and to love mercy* (Micah 6:8). The message of the *New Testament* makes the principle of charity a key element of Christian social ethics. Commands to ensure the fair distribution of wealth, give alms, eliminate inequalities and guarantee support for the most needy, in other words, attitudes that strengthen social capital and foster widespread prosperity are replaced in the *New Testament* by a more generalized commandment of love and an imperative of solidarity.

When discussing the context of social development, it is also worth paying attention to the importance of work in the Judaeo-Christian tradition. In the *Old Testament*, it was something that was seen as important, due to man's obligation to repair the world. This is also why it was treated as a form of divine blessing, as an authorization to continue the work of God by caring for the Garden of Eden. After original sin, the privilege of shaping the world in the likeness of the Creator became an unpleasant chore, one to be fulfilled with sweat on one's brow, but work still remained a way of achieving human potential. Physical work seem to be held in particular esteem. David, before he became king, kept a flock of sheep, as did Amos, the judge Gideon was a farmer before an angel called upon him, whilst he was threshing grain, to rescue Israel from the Midianites. In the *New Testament*, Jesus and Joseph were said to be carpenters, while John, James and Peter were fishermen. According to the rules of the *Old Testament*, it was important that the work was not done under conditions

of coercion (Attali, 2003, p. 36), it not being allowed to force anyone to work. The sick, the old and young are particularly protected from working under harmful conditions. According to the *Old Testament* of work, it also had an important economic dimension, thanks to its relation to growth in wealth (*Proverbs* 10:4; 12:24, 27; 13:4; 18:9, etc.), which was a desired state, and evidence of God's blessing.

In the *New Testament*, both Jesus and his disciples worked, but the very act of work itself, especially physical labour, was viewed more ambiguously, because, as a result of sin, it had become a matter of human destiny and obligation (*1 Thessalonians* 4:11; *2 Thessalonians* 3:10-12), could be a source of humiliation – the function of tax collector was portrayed with a certain disdain (even though the principles of social justice expressed in the teachings of Jesus – of rendering unto God what is God's and unto Caesar what belongs to Caesar – demonstrate an acceptance of the system of redistribution of wealth), as is the physical work of tending to pigs mentioned in the *Parable of the Prodigal Son* – but could also be a way of devoting oneself to the worship of God (*Colossians* 3:23; *1 Corinthians* 10:31), and be seen as a natural necessity, as expressed in the quotation, *if any would not work, neither should he eat* (*2 Thessalonians*, 3:10). Both in the *Old* and the *New Testament*, work, however, did not constitute an end in itself, and the balance between work and leisure was meant to be guaranteed by the seventh day of rest, to be devoted to contemplation of the effects of one's actions. God after all did not rest after he had completed the act of creation out of tiredness, but to admire the effects of his work. A day of rest from work is to be understood as a call to stop what you are doing and admire what has been achieved – and ultimately as salvation from the oppression of the continuous treadmill of work.

The message of the Bible concerning social order is perhaps the main theme of the work. The observations made only represent a small fraction of the social phenomena which are commented on therein, those that are of particular relevance in the context of contemporary problems – such as the issue of inequality of distribution of income, the stratification of wealth, problems associated with the accumulation of capital, and with social capital, or those related to employment. These issues are an integral part of any model of sustainable development, and play a key role in creating the next plane of any such model.

The significance of material goods and the rules of economic life in the Judaeo-Christian tradition

According to the *Old Testament*, the material world and material goods were not a taboo, and earthly life could be a revelation of God's blessing: *And all these blessings shall come on thee, and overtake thee, if thou shalt hearken unto the voice of the LORD thy*

God. Blessed shalt thou be in the city, and blessed shalt thou be in the field. Blessed shall be the fruit of thy body, and the fruit of thy ground, and the fruit of thy cattle, the increase of thy kine, and the flocks of thy sheep. Blessed shall be thy basket and thy store. Blessed shalt thou be when thou comest in, and blessed shalt thou be when thou goest out. The LORD shall cause thine enemies that rise up against thee to be smitten before thy face: they shall come out against thee one way, and flee before thee seven ways. The LORD shall command the blessing upon thee in thy storehouses, and in all that thou settest thine hand unto; and he shall bless thee in the land which the LORD thy God giveth thee. (...) And the LORD shall make thee plenteous in goods, in the fruit of thy body, and in the fruit of thy cattle, and in the fruit of thy ground, in the land which the LORD swore unto thy fathers to give thee. The LORD shall open unto thee his good treasure, the heaven to give the rain unto thy land in his season, and to bless all the work of thine hand (Deuteronomy 28:2-12). Wealth, and even luxury were not unwelcome to God, and in the *Book of Exodus* (26:3-13), they were even demanded, in the description of the splendour of the tabernacle dedicated to him, and he also expected a portion of income as a way of paying honour to him (*Proverbs* 3:9). Wealth was evidence of divine favour (*Proverbs* 10:22), and its accumulation was in keeping with divine law, being seen both as an activity to be engaged in for the glory of God, while at the same time also being the fruit of his grace (*Deuteronomy* 8:17-18; *1 Chronicles* 29:11-12). Such a blessing was enjoyed amongst others by Moses, Jacob, Isaac, Abraham, Boaz, David, Solomon and Nehemiah; but material goods were not allowed to become a golden calf and an end in itself (*Job* 31:25): *Labour not to be rich: cease from thine own wisdom! Wilt thou set thine eyes upon that which is not?* (*Proverbs* 23:4-5), and also were not allowed to be derived from dishonest practices: *Ye shall do no unrighteousness (...) in meteyard, in weight, or in measure* (*Leviticus* 19:35). *Wealth gotten by vanity shall be diminished: but he that gathereth by labour shall increase* (*Proverbs* 13:11). The owner of wealth not only enjoyed a privilege, but above all had a burden of responsibility to the rest of the community (*Ecclesiasticus* (*Book of the Apocrypha*) 29:1-28), to use it in the best interests of all, according to the principle of justice (*Deuteronomy* 15; 24:6; *Ezekiel* 18:7-8), to make use of it to foster virtues of generosity and solidarity, but also entrepreneurship (*Deuteronomy* 15) and in the service of God (*Matthew* 25:14-30). In several passages, the influence of the ethics of moderation is also noticeable, for example: *give me neither poverty nor riches; feed me with food convenient for me: Lest I be full, and deny thee, and say, Who is the LORD? or lest I be poor, and steal, and take the name of my God in vain* (*Proverbs* 30:8-10). Wealth was a gift, and its function was to guarantee social order, for example,

through its redistribution in the form of gleanings of the harvest, *tzedakah* and the fulfilment of recommendations in the Sabbath and Jubilee years. Relative equality and widespread prosperity are the founding principles of economic governance according to the *Old Testament*. This was to be seen in the method of distribution of land, which could not be sold (because it belonged to God, *Leviticus* 25:23-28), but only leased, and returned to the original owner in the Jubilee year; the obligation to treat employees fairly and to pay them a wage that they can live on and which is paid on time (*Deuteronomy* 24:14-15; *Proverbs* 3:27-28); as well as a specific approach to financial matters. In the Judaic community, there was an order to provide support for the needy in the form of charitable loans, and, at the same time, a ban on collecting interest from members of the community is repeated in many places (*Exodus* 22:25-27; *Leviticus* 25:35-37; *Deuteronomy* 23:19-20; etc.). The *Old Testament* model of economic governance included not only an order to care about the needy, but also certain indications as to how to generate wealth. Chapter 11 of the *Book of Ecclesiastes* encouraged reasonable risk-taking, while protecting invested capital by spreading it over several different projects (*Ecclesiastes* 11:1-6). Judaism explicitly forbade many practices that had an impact which was not good for consumers and was negative from the point of view of free competition, such as for example: deliberately not paying debts, delaying payment, bribery, corruption, speculation, overcharging, false weights and measures, the sale of defective goods (Kietliński, 2006). As S. Wagner-Tsukamoto (2013) claims, the stories of Joseph and Solomon determined the direction of state economic policy. Both Egypt governed by the Pharaoh with Joseph's support, and Israel under the rule of Solomon, were countries of prosperity. Joseph achieved his position thanks to his proficiency in managing and understanding changes in economic situation, which he proved by interpreting the Pharaoh's dream of the fat and lean cows. The terrible effects of the lean years were able to be avoided thanks to appropriate fiscal policy (*Genesis* 41:34; 47:24-26) and the imposition upon subjects, in years of prosperity, of taxes amounting to one-fifth of the harvest. Egypt in the times of Joseph was characterized by religious and ethnic diversity, which provided the foundation for cooperation and development. The story of Solomon also describes the importance of the involvement of government in creating prosperity and promoting the public good and the importance of economic (and socio-cultural) pluralism. Solomon built up his power, amongst other things, based on his broad-ranging foreign policy, which was supported by a huge number of marriages concluded to strengthen ties in international politics. The collapse of Solomon's power came with the negation of the principle of equal treatment for all and the granting of special privileges to the tribe of Judah, which alienated the

other tribes and placed an unjust burden of higher taxes on citizens. Just as in Egypt under the government of the Pharaoh and his advisor Joseph, prosperity and success lasted as long as the government continued to act on behalf of the public good, by respecting pluralism, openness and supporting cooperation between different social groups. These values were destroyed in Egypt, with the advent of the new ruler and his decision to kill the first-born sons of the Israelites and the introduction of measures to force members of this tribe to carry out harder work than they ever done before. In both cases, the restriction of rights, freedoms and liberties coupled with a differentiation in the rights and privileges of different groups turned out to have an adverse effect on development, resulting in a loss of social, cultural and ethnic diversity.

The values of the *Old Testament* provide a clear template for action in the economic sphere, right up from micro- to macro-economic level. According to W. Sombart, this was to become the foundation of the capitalist system, which can be seen in the relationship of the Jews with God, a relationship that is based on a contract – in return for obedience to the divine commandments, reward on earth is obtained in the form of God's blessing, without which it is not possible to achieve success or wealth, meaning that wealth thus becomes a desired state, even a proof of piety. Prudence, saving and hard work, in other words those attitudes that M. Weber attributed to the Puritans (Weber, 2011), were, in W. Sombart's view, attributes that were previously particularly characteristic of the Jews (Sombart, 2001), before going from the attitudes that enable the development of capitalism.

In the *New Testament*, the attitude towards material goods and wealth is less enthusiastic, as is attested to by numerous well-known quotes (*Matthew* 19:21-24; *Luke* 18:25-27; *James* 5; *Revelation* 9:17-22, etc.). Here, the view of material goods is clearly influenced by Platonic idealism and the resulting indifference to the material world, as well by the Stoics' distrust of wealth and honours. At the same time, the founding principles of Christian ethics were characterized by considerable similarity to the attitudes of the sect of the Essenes¹², which recognized equality, work on behalf of the group, the sharing of goods, and care for the needy and the poor as its basic values, and wealth as being associated with a source of suffering, oppression and social injustice, in the same way as slavery. Despite the ambivalent position to wealth in the *New Testament*, and a message that in most cases does not leave any room for ambiguity – *Ye cannot serve God and mammon* (*Matthew* 6:24), as T. Sedláček has counted, as many as nineteen out of thirty of Jesus's parables are concerned with questions of an economic nature (Sedláček,

2012, p. 146), which proves that economic phenomena were still given significant weight in the Gospels. The model of economic life here differs from the specific orders and prohibitions contained in the *Old Testament*. However, despite the fact that the negative attitude of the *New Testament* to wealth is often emphasized, in fact, it is not wealth itself, but the dishonesty, injustice and anti-social behaviour of the rich which are condemned. Joseph of Arimathea was wealthy, Nicodemus, the Roman centurion, donated his riches for the building a synagogue and took pity on an ailing servant (*Matthew* 8:5-13, *Luke* 7:5), while a rich Ethiopian official also felt the call to Christianity (*Acts* 8: 25-40), and Paul the Apostle, originally known as Saul of Tarsus, was not a poor man, but a Roman citizen, born into a Pharisaic family. However, it is neither the attitude to wealth, nor to the methods by which it is obtained that constitute Christianity's most important contribution to shaping attitudes that support economic development. In Christianity, the values of Judaism were transformed in the spirit of the philosophy of Ancient Greece, with particular emphasis on the freedom of choice (*1 Corinthians* 6:12, *Galatians* 5:1; *2 Corinthians* 3:17; *1 Peter* 2:16; *Luke* 4:18) and the personal responsibility of the individual (*2 Corinthians* 5:10; *Galatians* 6:7-8; *Matthew* 27:24; *Ephesians* 2:10; *Romans* 14:12; *Luke* 10:30-37, 12:48; *Colossians* 3:23; *2 Thessalonians* 3:11-18), thus contributing to the emergence of an individualistic society that gave rise to the world's fastest-growing civilization in economic terms, namely Western civilization. Many theorists have pointed to Christian values as the source of the capitalist economy, including M. Weber and R. Merton who saw pro-development values in the Protestant model, as well as J. Gimpel, M. Novak and N. Rothbard, who attributed them to Catholicism. M. Weber's thesis concerned the influence of puritanical Protestantism, as well as the deep individualism and virtues of hard work, savings and moderation related to it, on the emergence of industrial capitalism (Weber, 2011). R. Merton (Shapin, 1988) saw a correlation between the piety of Protestantism, and the development of experimental science and the elimination of illiteracy. According to M. Novak, it was in fact the medieval Catholic Church that created the conditions that made the development of capitalism possible, and it did so not in the centres of large cities, where, according to the proponents of a pro-capitalist profile of Protestantism this process was supposed to have begun, but in rural areas, where Cistercian monasteries for the first time introduced a rationalized approach to management and technological change, allowing for the greater mechanization of work, and in effect creating competing business entities. In relation to this, M. Novak made reference to the work of J. Gimpel, ac-

¹² One of the three most important ancient Jewish religious sects, alongside the Pharisees and the Sadducees.

according to whom Cistercian monasteries were some of the most economically efficient entities that existed in Europe, and perhaps even worldwide during in the period under consideration (Isaac 2005, p. 183) and that the work they did was not done in the usual spirit for the time during feudalism, but instead was conducted according to the principles of the capitalist economy. N. Rothbard (1976), referring to Thomism and the Spanish Scholastics, also traces the sources of capitalism back to Catholic values. The common aim of the work of these authors was to prove that the various branches of Christianity made it possible to put the Western civilized world on the path to rapid economic growth and development thanks to values that were religious in origin and supported the development of capitalism.

The message inherited from the Judaeo-Christian tradition, in addition to its ecological and social aspects, thus also leaves an equally important amount of room for economic development, as the final element necessary for sustainable development.

Conclusion

The economic growth and development that have characterized the world for the past the 200 years have had no precedent. This phenomenon has helped to bring about an increase in the quality and length of life of many of the inhabitants of our planet, practically eliminating problems of hunger and illiteracy in developed regions and reducing the level of such problems in developing countries. Such impressive material development has, however, been achieved at the expense of the environment, exploited by an economy of greed and the objectification of living natural resources, and at the expense of social relations on a global scale, where the gap in wealth between the richest and poorest countries (and individuals) has never been as deep before as it is today. At the same time, work and consumption have become perhaps some of the most important forms of conducting social relations, and this has come about as a result of the holding up of short-term utilitarian values, obsessed with the profit of businesses and utility to the consumer, as the founding values of the economic process. Today, Western society, which has been built on the foundations of Judaeo-Christian civilization, is increasingly recognizing the need for an understanding of economic development, as one of the elements of progress, on an equal footing with progress of a social and environmental nature. An attempt to shake the foundations of the neo-classical economic paradigm, which is visible in the increasingly bold formulation of economic goals at variance with utilitarian principles, an increase in the popularity of approaches represented by the social economy, happiness, moderation, or, it being the main topic of this text: the economics of sustainable development, are proof of the mental shift which

may be a contributory factor in bringing about a transition to the next phase of capitalism. These approaches, which take account of social needs other than just those which can be met through consumption and work – needs concerned with distributive justice, which respect the limitations of nature, and, at the same time, recognize material development as a desirable process – have their genetic code in the roots of Judaeo-Christian civilization.

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Agriculture vs. Alleviating the Climate Change

Rolnictwo a łagodzenie zmian klimatu

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Abstract

Climate changes related to the greenhouse gas emissions (GHG) are seen as one of the major threats to sustainable human development. The agricultural sector is responsible for about 13.7% of global greenhouse gas emissions, therefore the action must be undertaken, which would have to reduce the GHG emissions from agriculture and/or adaptation of agricultural production to the new conditions, so that the productivity of the sector, i.e. agriculture, is not diminished.

The *Climate-Smart Agriculture* is a viable alternative. This term should be understood as targeting the agricultural practices to reduce its negative impact on the environment, and consequently also on the climate. Two strategies are used in the process of climate-friendly agriculture management, noting that agricultural practices can mitigate the climate changes (reduction of GHG emissions), or adapting agriculture to the already noticeable changes (development of soil and water quality, sustainable agronomy, animal breeding, or crop rotation).

Key words: agriculture, climate, Climate-Smart Agriculture, greenhouse gases

Streszczenie

Zmiany klimatu, związane z emisją gazów cieplarnianych (GHG), są postrzegane jako jedno z najważniejszych zagrożeń dla zrównoważonego rozwoju ludzkości. Sektor rolny odpowiedzialny jest za około 13,7 % światowej emisji gazów cieplarnianych, dlatego należy podjąć działania, które miałyby na celu ograniczenie emisji GHG z rolnictwa i/lub dostosowanie produkcji rolniczej do nowych warunków, tak aby produktywność sektora, jakim jest rolnictwo nie zmniejszała się.

Realną alternatywę stanowi rolnictwo przyjazne klimatowi (Climate-Smart Agriculture). Przez to pojęcie rozumie się ukierunkowanie praktyk rolniczych na zmniejszenie jego negatywnego wpływu na środowisko, a w konsekwencji także na klimat. W sposobie zarządzania rolnictwem przyjaznym klimatowi wykorzystuje się dwie strategie działania, zauważając, że praktyki rolnicze mogą łagodzić zmiany klimatu (zmniejszenie emisji GHG), lub dostosować rolnictwo do już zauważalnych zmian (kształtowanie jakości gleb i wód, zrównoważona agrotechnika i hodowla zwierząt czy zmianowanie upraw).

Słowa kluczowe: rolnictwo, klimat, rolnictwo przyjazne klimatowi, gazy cieplarniane

Introduction

The concept of sustainable development assumes postulate of the necessity to meet the basic needs of both current and future generations. Therefore, we should definitely care more about the environment, using the raw materials more economically (Gawłowski et al., 2010). In addition, a major challenge is to ensure the access to food, without which the human population is not able to develop.

One of the available options is an intensive industrial agriculture based on monoculture crops as well as the use of artificial fertilizers and chemical plant protection means. Seemingly, it is consistent with the concept of sustainable development, as it is able to deliver large amounts of food at very reasonable prices. Unfortunately, this happens at the expense of quality (which may pose a risk to human health), as well as the expense of crowding out smaller farms, which produce even better food, they cannot compete with the giants in terms of prices. Moreover, industrial agriculture is growing at the expense of unacceptably high levels of environmental degradation: decline in soil fertility, destruction of ecosystems, and biodiversity loss (Sobczyk et al., 2012). As a result, crops are much less resistant to extreme climate conditions, which occur more frequently and are becoming increasingly violent (Bogdański, 2012; Nelson, 2009; Panagiotis, 2004). Ability of plants for adaptation to a changing climate is also reduced.

Solution to the climate crisis requires replacing the model of industrial agriculture with an alternative that respects the natural limits of the agricultural production space potential and utilizes its regenerative abilities.

Agriculture is one of the key elements in the struggle against the climate changes, which pose additional challenges for agriculture, especially in developing countries. On the one hand, it is seriously endangered by the consequences of global warming, and on the other, the agriculture itself is a significant source of greenhouse gas emissions. Agriculture lies at the intersection of climate change alleviation and adaptation activities. The agricultural sector is responsible for about 13.7% of global greenhouse gases emissions (GHG) (Tubiello, 2013; Kolasa-Więcek, 2012), and is also a key factor in deforestation, which further contributes to 7-14% of global emissions (Harries, 2012; Hosonuma, 2012). At the same time, climate changes will have significant negative effects on many farming communities, especially small and poor farmers, who have limited capacity of adaptation to climate change, further exacerbating poverty, and food insecurity (Howden, 2007; Morton, 2007). Thus, both mitigation actions aiming at reducing the greenhouse gas emissions and adaptation to maintain current yields, gain the rank of a global importance. Experts agree that, in this situation, mere continuation of current practices is not

enough feed the growing population of the world in the upcoming decades (FAO, 2013; Vermeulen, 2012).

Achieving significant progress in adapting and mitigating the effects of climate change in the agricultural sector will contribute to the success of a number of different policy and international initiatives. Mitigating the climate changes is critical to realization of the overall objective of the UN *Framework Convention on Climate Change* (UNFCCC) for stabilizing the greenhouse gases concentrations in the atmosphere, and in particular, in terms of reducing the greenhouse gas emissions from deforestation and the degradation processes (Wollenberg, 2011). Adaptation in agriculture is necessary to achieve the *Millennium Development Goals* established by the Organization of the United Nations, especially the elimination of extreme poverty and hunger (Sanchez, 2005). As highlighted above, agriculture will be deeply affected by climate change. It is an important sector in terms of greenhouse gas emissions, and therefore it will face the pressure to mitigate the climate changes by reducing the greenhouse gas emissions. It is therefore required to undertake the action for Climate-Smart Agriculture.

The notion *Climate-Smart Agriculture* (CSA), i.e. climate-friendly agriculture, was first used by the Organization of the United Nations on Food and Agriculture Organization (FAO) in 2010. It assumes that at a growing number of world population and increasing needs for food, the agriculture in a form less harmful to the environment and climate can be a solution to many problems. Through the use of appropriate practices, it will help to reduce the greenhouse gas emissions, but at the same time it will provide greater food security and better living conditions in rural areas.

In September 2013, during the UN climate summit in New York, a Global Alliance for Climate-Smart Agriculture was announced, which joined the governments of 20 countries, 30 international organizations and corporations.

The current global system of food production and distribution is responsible for roughly half of greenhouse gas emissions. Its change is critical to inhibit or mitigate the global warming and surviving under conditions of warming climate. From 44 to 57% of all greenhouse gas (GHG) emissions come from the global food system (IPPC, 2001; Smith, 2007).

Because of the prospect of advancing climate change and increasing demand for food by 70% by 2050, the agricultural practices must change to meet these challenges (Bogdanski, 2012). The Climate-Smart Agriculture initiative aims at: achieving the sustainable and equitable growth in agricultural productivity and related income; increasing the resistance of food systems and agricultural livelihoods to the consequences of climate change wherever possible; reducing and/or eliminating the greenhouse gas emissions related to the agriculture.

Acting together, the alliance wants to strive for world food security by adapting the agricultural practices, food systems, and social policies to the climate change and the need for better protection of natural resources.

The Climate-Smart Agriculture is a comprehensive response to the interlinked challenges of food security and climate changes.

Agriculture

It is commonly assumed that farming is the source of 11-15% of all GHG emissions (Scherr, 2012; Smith, 2014). Agricultural activity is a source of greenhouse gases, and at the same time an absorber for carbon dioxide, which in particular is stored in soil organic matter and plant biomass (Uliasz-Bocheńczyk, Mokrzycki, 2015).

The main sources of greenhouse gas emissions in agriculture are (Olecka, Sadowski, 2008):

- Carbon dioxide emissions (CO₂) resulting from the use of fossil fuels in agriculture (fuel, electricity, gas), changes in carbon resources in agricultural soils and the use of fossil fuels during the production of goods intended for agricultural production (fertilizers, animal feed, pesticides, etc.);
- Methane emissions (CH₄) during anaerobic fermentation: enteric fermentation at ruminants, anaerobic digestion during the use and storage of manure and other wastes from livestock production, anaerobic fermentation on flooded rice fields,
- Nitrous oxide emissions (N₂O) associated with the use of mineral and organic fertilizers and the management of manure.

To a lesser extent, agriculture also produces small particles in the form of salts that reflect the sunlight in the atmosphere, such as ammonium nitrate (NH₄NO₃) and sulfates.

With regard to the emission absorption, the agriculture and forestry, in contrast to other sectors of economy, are able to bind atmospheric carbon dioxide through photosynthesis and make its sequestration within the soil and biomass. Especially meadows, wetlands, and forests contribute to the absorption of significant quantities of carbon dioxide. However, it may also lead to the loss of these carbon resources, e.g. due to changing in the land use (through deforestation, plowing the grasslands, draining the wetlands, etc.) or exceptional weather conditions (e.g. hurricanes, fires, etc.) leading to rapid release of the stored carbon in a form of CO₂ to the atmosphere (Pawłowski, Cao, 2014). According to FAO, the expansion of industrial agriculture is responsible for 70-90% of the global deforestation, and at least half of that for cultivation of only a few export crops. This means that the contribution of agriculture in deforestation is responsible for 15-18% of global GHG emissions (Scherr, 2012).

The impact of agriculture on greenhouse gas emissions can also be estimated at the level of individual farms, using the balance and taking into account the emissions of greenhouse gases (carbon dioxide CO₂, methane CH₄, and nitrous oxide N₂O), and on the other hand, the CO₂ removal (emissions reduction) as a result of the carbon sequestration within soils and the production of renewable energy and bio-materials. Three main sources of emissions are: animal husbandry, crop production, and manufacture of agricultural production means. Balance *emissions-absorbing* reflects the performance of farms in terms of greenhouse gas emissions (Olecka, Sadowski, 2008).

The emission-absorption of greenhouse gases balance – called the Life Cycle Assessment (LCA) – can also be determined for particular agricultural products (milk, beef, arable crops, biogas, etc.). In the case of farms having a number of production plants, these balances are considered for each of them individually. Thereby, different types of production can be compared in regard of their climate efficiency.

Agri-food industry

Another element of the industrial food system, that contributes significantly to the greenhouse gas emissions, is transport. Transportation of food is the source of a quarter of transport emissions, or 5-6% of the total global GHG emissions.

Another link in the chain of industrial food production is processing. The processing of food into ready-to-eat meals, snacks and beverages requires huge amounts of energy, mostly originating from burning the fossil fuels. Similarly – the packaging. According to the report by Grain: *Processing and packaging allows the food industry for filling the shelves with hundreds of different products, but it also generates huge amounts of greenhouse gases – from 8 to 10% of global emissions* (Grain, 2012).

Refrigeration is a key element of the global supply systems of modern supermarkets and fast food restaurants. Considering the fact that cooling is responsible for 15% of the total global electricity consumption and leakage of chemical freezing media is an important source of GHG emissions, it can be safely assumed that the cooling of foods is responsible for 1-2% of the global emissions. Further 1-2% is the retail sale of food products.

Industrial food system discards up to 50% of the produced food in the course of a long journey from farms to middlemen, processing, shops, and restaurants. A large part of this waste decomposes in landfills to produce significant amounts of greenhouse gases. Up to 3.5-4.5% of global GHG emissions originates from the waste, and the source of 90% of them are materials derived from the food system. Therefore, the wastes from food production and

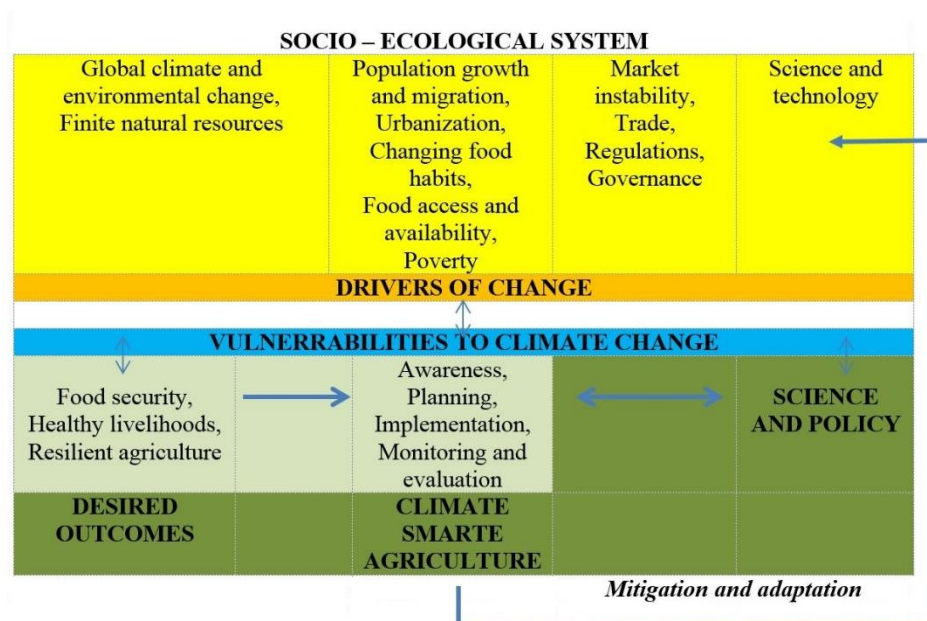


Figure 1. Diagram illustrating how climate-smart agriculture can be utilised as an agent for developing resilience, mitigation and adaptation within the socio ecological system.

Table 1. Technological innovations relevant to CSA categorised according to climate change objective (CSA Booster, 2014).

Climate variability risk	Multiple – constraint mitigation	Resource management optimization	Smart spatial allocation
<ul style="list-style-type: none"> information systems (local data-agronomic models), insurance options, alert systems for extreme events, preventive infrastructure, new varieties and protection practices, institutional changes i.e. regulation in food markets. 	<ul style="list-style-type: none"> life – cycle assessment (LCA), logistic optimization, information and control system (e.g. for inputs and manure handling). 	<ul style="list-style-type: none"> combined farming systems and food processing, irrigation systems and water management optimization tools, sustainable land management practices, tools to model links between resources and agricultural and non – agricultural use, participatory approaches for resource management. 	<ul style="list-style-type: none"> shifts to other land use, sourcing practices and strategies of retailers, firms (e.g. in agricultural cooperatives), simulation tools for spatial distribution of land use at different scales, integrating agriculture with other activities.

distribution are responsible for 3 to 4% of the global greenhouse gas emissions.

Climate-Smart Agriculture

Global demand for agricultural products, both food, fiber and fuel, is constantly linked with population growth and changes in diet. As a result, there is an increase in *per capita* income and – where there are no additional land for agricultural purposes – the need for alternative energy sources. Thus, agriculture needs to produce more in the same area of land, while adapting to a changing climate and has to be more resistant to threats from extreme weather events such as droughts and floods (Smith, 2007). During the World Science Conference held in 2013 on Climate-Smart Agriculture (Davis, CA, USA), the participants analyzed the status of the global science and best practices on climate and agriculture

around the world. They reiterated the consensus reached at the World Science Conference in 2011 on Climate-Smart Agriculture (Wageningen, the Netherlands), agreeing with a broad strategy based on a science and policy in order to strengthen the food security, climate change alleviation, and adaptation of changes (Wageningen Statement, 2011). Existing and promising works within the CSA were identified and programs for interdisciplinary research and science-based activities supporting CSA were formulated.

The term *Climate-Smart Agriculture* (CSA) has been adopted to represent the strategies that can contribute to meet above challenges by increasing the resistance to weather conditions, adaptation to climate changes, and reduction of greenhouse gas (GHG) emissions from agriculture, which contribute to the global warming (Figure 1) (WB, 2011, 2013; FAO 2013).

Technological innovations have been highlighted as playing a key role in transitions to sustainable practices in the future, including the context of Climate-Smart Agriculture. Innovations within Climate-Smart Agriculture are shown in Table 1 (SA Booster, 2014).

The importance of agriculture for climate protection depends on both the size of the area, on which the production is carried out, as well as the specifics of the sector – this is the range of human activities, which can affect a wide range of conditions and shape the natural processes.

A considerable share of, especially methane and nitrous oxide in emissions, shows that undertaking the action in the agricultural sector is an important issue. There are three main lines of action in agriculture, which can contribute to more effective climate protection (Karaczun, 2006, Smith et al., 2007):

- Reducing the greenhouse gas emissions into the atmosphere,
- Increasing the amount of carbon bound in the biosphere,
- Avoiding greenhouse gas emissions.

The most important activities in agriculture in order to protect the climate should include (Karczun, 2008):

Some changes in agricultural techniques:

- Measures to increase efficiency in the use of nitrogen fertilizers. This can be achieved, for example, through the use of improved technology for nitrogen application, matching the nitrogen supply to the needs of plants, appropriate systems to maximize the use of animal manure in crop production, leaving the plant residues containing nitrogen in the field, and finally reducing the use of nitrogen fertilizers. It is extremely important to keep fertilization based on the plans and on the basis of crop's fertilization needs;
- Observance of the proper crop rotation and the introduction of intercrops, which increase the carbon binding in the biosphere and may reduce the need of soil for mineral nitrogen fertilizers;
- The use of plowless tillage techniques, which reduces the carbon loss from the soil and reduces emissions of N₂O;
- Improving the efficiency of irrigation techniques. About 18% of the cultivated areas in the world is artificially irrigated often in an inefficient way leading to a loss of energy and may increase the emission of nitrous oxide from those areas;
- Increasing the carbon binding by biomass, for example, by a greater amount of humus contained in the soils of arable lands, support for perennial crops (orchards, nurseries of ornamental species). A special role will

be played by activities for the introduction of new and preservation of existing woodlots, ecological areas, and permanent grasslands.

Changes in animal husbandry:

- Improvement of animal feeding. This can be accomplished, for example, by better balancing the rations ensuring better use of feed, including the elimination of unnecessary amounts of amino acids and adding the formulation binding nitrogen compounds, which are the source of N₂O emissions;
- Improving the livestock maintenance systems. This can be done by adding the biotechnological preparations reducing N₂O emissions, into the manure and litter, reducing evaporation surface of droppings in lairs and litter;
- Reducing CH₄ emissions from the stored manure and liquid manure through the lowering of temperature of stored excrement by means of recovery and accumulation of heat energy or the construction of installations for the biogas recovery from liquid manure fermentation.

Support for bioenergy and energy utilization:

- Promoting the use of renewable energy sources (RES). Agriculture can be a source of renewable raw materials for energy production (energy crops, biofuels); there is also the possibility of using RES as a source of energy used in agricultural production;
- The use of incentives to implement the energy-saving investments in agriculture. Activities in this field are typical works of a double benefit – allow not only the reduction of emissions, but give the benefit to people undertaking them. Although agriculture is not a very energy-consuming sector of the economy, there are many opportunities to improve the efficiency of energy use, including animal husbandry, cultivation under cover, or at cultivation works.

The above examples of activities do not exhaust all possible ways to protect the climate in agriculture, however, they point to a wide range of possible actions, the implementation of which can contribute to an effective climate protection.

Adapting agriculture to climate changes

There are various definitions of the adaptation of agriculture to climate changes. Riebsame et al. (1995) argue that it is *any action aimed at the reduction of negative, or at the increase of positive impacts of climate change*. The adaptation can also be planned or spontaneous, that is carried out in advance or *ad hoc*. An example of planned adaptation is breeding of varieties resistant to drought and temperature changes,

while spontaneous adaptation consists in adapting the date of sowing/planting crops to changing climatic conditions (Table 2).

Table 2. The potential consequences of climate change depending on stimulating factor

Phenomenon and trend of changes	Potential consequences for agriculture
Warming, Decrease in number of cold/freeze day/night, Increase in number of hot days	Increased yields in colder regions, Decreased yields in warmer regions, Increased incidence of pest infestation
Increase in frequency of hot periods and heat waves	Decrease in yields in warmer regions due to heat stress
Increase in the incidence of frosts in late spring and early autumn, Increase in the frequency of heavy rainfall	Destruction of crops, soil erosion, inability of tillage due to wet ground
Increase in the frequency of droughts	Soil degradation, lower crop yields, destruction of crops, increased mortality of livestock
Increased incidence of extremely high sea level	Salinity of irrigation water and delta areas

The adaptive options include a wide set of methods aimed at reducing the vulnerability and increasing the adaptability of farming systems in relation to climate change. These options include technical solutions that relate to the risks associated with climate changes, stress factors in the environment, development of early warning systems, and creating systems of crop insurance. They also include a number of farm practices (such as the protection of soil and water, crop diversification, and improving the growing conditions), which would make that agricultural systems to become more resilient to climate changes, diversify the livelihoods of farmers and ensure the continuity of services supply from ecosystems (Howden, 2007).

Mitigating the climate change

Climate change will have significant and generally negative consequences for agriculture and its development, especially in the lower latitudes. Since 1980, climate change has contributed to a reduction in global yields of corn and wheat, respectively by 3.8% and 5.5% (Lobell, 2011). Increased climate variability over the coming decades will increase the frequency and intensity of occurrence of both floods and droughts, as well as increase the risk of production in relation to crops and livestock, and reduce the ability of farmers to cope with the problems of climate change (Thornton, 2010). Climatic changes are a threat to food access for populations, both on rural

and urban areas, by reducing the agricultural production and increasing the risk of market distortion (Varmeulen, 2014). The negative effects can be alleviated through the adaptation of agriculture from relatively small changes in production practices to large transformational changes in the systems of agricultural and food products.

Climate-Smart Agriculture is to focus on diversification (using complementarity between crops, through systems of crops and livestock in the area of risk management). Diversification is a key element in building the adaptability (Bruce, 2014).

The mitigating options for agriculture can be broadly divided into three categories of practices: (1) actions to increase carbon resources above and below ground, (2) activities that reduce emissions directly from agricultural crops (carbon dioxide, methane, nitrous oxides) in any place in the agricultural production cycle; and (3) actions to prevent deforestation and degradation of ecosystems with high carbon content for the establishment of new rural areas (Smith, 2007; Wollenberg, 2012).

Food systems contribute significantly to global warming and are responsible for about 19-29% of global emissions, most of which coming directly from the activities of agricultural production (i.e. N_2O and CH_4) (Vermeulen, 2012).

Because of the need to increase production in many developing countries, greenhouse gas emissions from agriculture are likely to rise, mainly due to continued expansion in livestock production, fertilizer use, and changes in land cover (Bennett, 2014). However, sustainable intensification, with a focus on improving the production efficiency, is necessary to achieve the purpose of mitigation of climate changes: to achieve lower emissions of N_2O and CH_4 per unit of production. Sustainable intensification on existing agricultural lands is also a major potential source of reduction of land cover changes, especially forests abundant in carbon, as well as wetlands (Wollenberg, 2011). Although less intense, lower production efficiency may generate local environmental benefits. This strategy may need to devote to the cultivation lands situated elsewhere to compensate locally lower yields, leading to greater overall environmental benefits (Wyszyński et al., 2008). Globally, the total yields – mainly cereal crops and oil – have increased by 135% in 1961 and 2005, while the area of arable lands has increased by only 27% (Burney, 2010), although the expansion degree of agricultural lands varies significantly between regions. However, increased efficiency, due to the intensification, may increase the incentives for expansion (Rudel, 2009; Ewers, 2009). To achieve the purpose of climate change alleviation, we must go far beyond the simple goals of agriculture intensification. Both concepts, both sustainable intensification of agriculture and Climate-Smart Agriculture recognize this reality.

Summary

To provide the proper functioning of agriculture is a particular challenge for sustainable development of mankind, especially in the context of climate changes.

Adapting of agriculture to climate changes and their mitigation can be generated by various means, for example: increasing the soil quality by improving its buffer properties; moderating the hydrological cycle; improving the soil biodiversity; regulating the cycle of carbon dioxide, oxygen, and plant nutrients; increasing the resistance to drought and floods, as well as carbon sequestration.

There are substantial opportunities to realize the objectives of adaptation and alleviation of climate changes in agriculture and to adopt an integrated approach to the landscape, which contribute to achievement of the objectives in the field of climate change, food security, provision of ecosystem services, and other purposes. Although there is no a single general pattern to capture synergies between adaptation and mitigation of climate change, their combined analysis in landscape planning, research, technical assistance, government policies, and funding mechanisms can significantly help in achieving this objective. A renewed and strengthened commitment to sustainable agriculture, protection of agriculture, agroforestry, and other best management practices in agriculture, as well as increased pressure on the integrated landscape management, can contribute to the development of agricultural and landscape systems, while contributing to the food security, fight against poverty, and conservation of biological diversity in areas particularly affected by the climate change.

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Barriers in the Advancement of Solar Energy in Developing Countries like India

Bariery w rozwoju energii słonecznej w krajach rozwijających się na przykładzie Indii

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Abstract

The present paper puts an emphasis on the current energy market scenario and different types of barriers associated with the advancement of solar energy in a developing countries like India. Solar energy, best suited for urban environment, can be housed in a limited space and is characterized as a pollution free, environmentally friendly, as well as noise-free source of electricity. Among the available renewable energies, solar energy is considered to be an integral one, owing to its reduction in cost at an exponential rate day-by-day. The present study deals with the potential of solar energy market in the Indian sub-continent along with several other problems that it needs to overcome in order to be established as an independent system.

Key words: solar energy, solar market, renewable energy

Streszczenie

Artykuł omawia scenariusze związane ze współczesnym rynkiem energetycznym, wskazując na różnorodne typy barier, na które napotyka rozwój energii solarnej w krajach rozwijających się, takich jak Indie. Energia słoneczna doskonale sprawdza się w warunkach miejskich, przeznaczone do jej pozyskiwania instalacje nie potrzebują dużo miejsca i nie zanieczyszczają powietrza, a ponadto nie emitują hałasu. Wśród różnorodnych źródeł energii to właśnie energia solarna wydaje się być najbardziej korzystna, biorąc pod uwagę jej nieustannie malejące koszty. Niniejsza praca przedstawia potencjał rozwoju rynku energii słonecznej w Indiach, zwracając szczególną uwagę na problemy, które należy rozwiązać, aby mógł on funkcjonować, jako niezależny system.

Słowa kluczowe: energia słoneczna, rynek energii solarnej, energia odnawialna

1. Introduction

Solar energy refers to that source of energy which is directly produced from sunlight or the heat that sunlight generates. The fundamental materials for solar cell devices are semiconductors, which produce electricity using photon from solar rays. Another category under solar cell is the popular Photo-Voltaic (PV) technology which is also used worldwide for the generation of electricity. At remote places, debarred of electricity grids, PV power supply is the best suited and most economic option available.

Crystalline silicon PV cells are the most common photovoltaic cells in use today. They are also the earliest successful PV devices. Hence, crystalline silicon solar cells constitute a good example of typical PV cell functionality.

PV technology has many applications, both for stand-alone systems and also for integration into buildings. PV may be used, for instance, in monitoring stations, radio repeater stations, telephone kiosks, street lighting etc. A substantial market for PV technology involves commercially available battery chargers for boats and caravans, solar driven cars,

garden equipment such as solar fountains, satellite solar panels etc.

Majority of the power distribution companies in India are suffering from heavy losses and are unable to meet their renewable purchase obligations (RPO). In such adverse situation, it makes sense for these companies to switch from conventional energy sources to renewable energy sources, in order to reduce cost of electricity generation and render service to community at a much cheaper rate. It is also expected that in the near future, the demand for solar energy among the power consumers will be an emerging issue in the Indian solar market.

The expansion of solar energy market is limited owing to the presence of several barriers. In order to sustain the growth of market, the associated barriers need to be identified and addressed adequately (Chakraborty et al., 2015, Sadhu et al., 2015, Goldman et al., 2005). Along development of solar market, the barriers are vanishing at a faster rate. Thus, elimination of barriers keeps the solar energy market lively. Consecutive sections of this paper describe the basic and detailed characteristics of these barriers.

Cost effectiveness of many solar energy technologies – as compared to conventional energy commodities at either the wholesale or retail levels – has not been achieved till date (Das et al., 2015). Therefore, any significant deployment of solar energy will not be possible unless major policy incentives are introduced. Governments of many countries have realized this and have supported solar energy development through a broad range of fiscal, regulatory, market and other instruments. A number of recent studies, such as the present in-depth analysis of various policies to promote renewable energy – including solar, both at the global level and for a particular country, such as India – are described in details in literature (Chakraborty et al., 2015, Chaurey et al. 2004). The strong growth in solar energy markets, notably those for grid-connected solar PV and solar thermal water heating, has been driven by a sustained implementation of policies in Europe, United States and some developing countries.

2. Current Market Status of Solar Energy Technologies

2.1. Solar Energy Technologies

Solar Energy Technology can be classified as passive or active. Passive solar energy technology collects the energy without converting the heat or light into other forms, i.e., through the incremental use of daylight or heat through building designs (Bradford, 2006, Chiras, 2002, Florida Solar Energy Center, 2000). On the other hand, active solar energy technology either stores or converts the solar energy for diversified applications. Active solar energy technology is classified into two different groups – Photovoltaic (PV) and Solar thermal. In Photovoltaic

technology, solar energy is directly converted to electrical energy when sun rays incident upon a semiconductor device. Commercially used PV technologies are – (a) crystalline Si-based PV cells, and (b) thin film technology, made from diverse range of various semiconductor materials, e.g. amorphous Si (a-Si), Cadmium telluride (CdTe) and copper indium gallium (di)selenide (CIGS). Solar thermal technology utilizes solar heat for thermal electricity generation or heating application. Therefore, solar thermal technology is further subdivided into two categories viz., solar thermal non-electric and solar thermal electric (Sorensen, 2000, Wolff et al., 2008, Muller-Steinhagen et al., 2004). The applications of solar thermal non-electric technology involve solar water and air heaters, cooking systems, cooling systems, etc., while those for solar thermal electric technology involve the use of solar heat aimed at producing steam for electricity generation. The latter technology is known as Concentrated Solar Power (CSP). The CSPs available in the market are Power Tower, Fresnel Mirror, Solar Dish Collector and Parabolic Trough.

2.2. Current Market Status

Solar energy is accepted worldwide as the largest source of renewable energy supply (Mills et al., 2008, EPIA, 2011, PVRES, 2010). Figure 1 depicts the accelerated growth of solar energy throughout the recent years in India. In 2007, the amount of solar energy produced in India was even less than 1% of the total energy demand (Dincer, 2011). At the end of December 2010, the grid-interactive solar power was merely 161 MW (Roul, 2007). An amount of 25.1 MW of power was added in 2010 and 468.3 MW in 2011. By the end of April 2015, the installed grid connected PV energy generation is increased to 3.74 GW. India is the leader in terms of solar energy production per watt installed (Tembhekar, 2009).

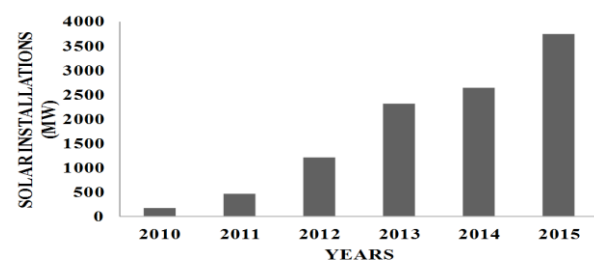


Fig. 1. Upsurge of Solar Installed Capacity in India

3. Different types of barriers involved in the advancement of solar energy technologies

The proliferation of solar energy technology meets certain types of barriers (JNNSM, 2012). In such context, this paper presents an in-depth discussion pertaining to the disparate barriers that impel the stationing of solar energy technologies for electricity generation and thermal purposes. By and large, barriers can be identified as – Economic, Technical, In-

stitutional, Environmental and Social. The different types of barriers are described in the following sections.

3.1. Economic barriers

The economic barriers which hinder the advancement of solar thermal and solar PV are described below.

Solar Thermal:

- i. The creditworthiness risk goes high owing to the high upfront cost coupled with the lengthy payback periods and small revenue streams.
- ii. Additional cost is enforced for Backup Heater which is essential for reliable heating in Water Heating System.
- iii. The limitation of rooftop area available for Building Integrated System hampers widespread application.
- iv. The use of Copper for water heating and distribution purpose adds to the overall cost.
- v. The cost of domestic water heating system is lower than the cost of solar thermal based water heating systems.

Solar PV:

- i. Installation of solar PV plant is riskier when creditworthiness is assessed by the financial institutions, because of their dearth of experience with projects.
- ii. In the developing countries, the immediate obstacles are the high initial installation cost and lack of viable financial support from banking sectors.
- iii. The costs of different solar modules are decreasing day-by-day. However, the cost of the necessary items associated with them does not reduce at the same pace; thereby directly leading to a hike in the overall cost involvement in the establishment of a solar PV plant.
- iv. Solar PV technology has a lower efficiency in comparison to conventional energy; hence coping with economic viability is a challenging task.

3.2. Technical Barriers

Solar Thermal:

- i. The disadvantages of concentrated solar power systems are the high thermal losses and the energy storage system.
- ii. The availability of standardized solar water heater does not meet the demands of assorted consumers' profiles; hence the orientation supply in the design of solar water is necessitated.

- iii. The heat carrying capacity through fluid is a technological hindrance.
- iv. The lack of integration between the typical building materials, designs, infrastructure and existing appliances, and with the standards, has restrained widespread application of solar water heating.
- v. Considering the central receiver system, the favourable technologies are the molten salt-in-tube receiver, and the volumetric air receiver. Hence, both technologies, well-suited for large scale applications, are to be procured from abroad. The installation and use of such technology requiring skilled professionals are a dearth in the Indian context.

Solar PV:

- i. Limited production of components like solar inverters, batteries and other power conditioning appliances associated with solar PV plant.
- ii. In the context of the current market scenario, low efficiency of 4-12% for thin-film and 22% for crystalline PVs are big constraints.
- iii. The use of Cadmium & Tellurium which are by-products of Zinc & Copper and needed for certain thin-film cells can only be available in abundance, provided the growth of zinc mining and copper processing industries is at rise.
- iv. The supply-demand disparity of the materials for PV since 2004-2005 has led to localization of the growth of solar power generation.
- v. There is no adequate infrastructure required to obtain concurred metering and billing.

3.3. Institutional Barriers

Solar Thermal and Solar PV:

- i. Inadequate understanding amongst elite national and local institutions regarding the fundamental systems and financial factors.
- ii. Insufficient resources to educate numerous technicians required to work efficiently under new solar energy infrastructure.
- iii. Short-comings of effective and appropriate laws like Renewable Portfolio Standards (RPS) for expediency and lack of motivation for wider adoptions.
- iv. Strategic issues including the need to protect financing from diverse sources and allowances from different agencies such as, for example, MNRE (Ministry of New and Renewable Energy), IREDA (Indian Renewable Energy Development Agency), the Planning Commission, and the Ministry of

Agriculture and Rural Development in a country like India.

3.4. Environmental Barriers

Solar energy is identified as one of the environmentally-friendly energy generation technologies; certain minor environmental issues associated with it are discussed below:

- i. The requirement of large areas of land for solar energy projects attracts the attention of numerous environmental groups, according to whom clearing and preparing large area for solar project has no net environmental merit.
- ii. Large PV plants encounter environmental barriers owing to non-availability of a bigger area of land required for large solar projects.
- iii. The need of water resources for solar thermal plants is also a barrier. Large amount of water is needed for cooling the steam used to power the electric turbines. Gujarat and Rajasthan, characterized by dry and arid areas, suffer from shortage of water and thus the establishment of solar thermal project requiring huge water supply becomes an inadvertent environmental barrier.
- iv. Safe disposal of batteries and CdTe solar panels becomes difficult in absence of proper recycling processes.

3.5. Social Barriers

The social barriers coupled with solar energy projects are not widely discussed because these obstacles are not widely reported in India. The boost of solar power is for the overall social development of India. 300 million people in India have no access to electricity. Hence, solar power is a step forward for the social development with the biggest support towards education and communication. Social acceptance of solar energy is very important and significant for the popularization of solar power technologies.

In spite of the abundance and numerous advantages of solar energy, its expansion meets with a gradually increasing discontent. Social barriers associated with solar PV and solar thermal are discussed below:

- i. In the case of rooftop solar PV plant installation, neighbours can object to the shadow cast by the solar panels which blocks the sun rays from falling onto their building.
- ii. Opposition to Solar projects arises when neighbouring communities are relocated from their ancestral land or deprived of access to grazing land due to the development of a large solar plant.
- iii. Potential social barriers to solar energy advancement in India include the lack of information about the environmental benefits

of solar power. Solar energy technologies are relatively new and most customers, being less familiar with it, are unable to make conversant choices.

- iv. Although solar energy is technologically mature and its price is competitive in comparison to the conventional alternatives in many geographical settings, the conflict of choice owing to the lack of awareness in terms of cost involvement and facilities – when compared to fossil fuel-based or nuclear power based energy generation – still remains.
- v. The long-term cost-effectiveness of solar energy against that of fossil fuels is not properly addressed in public discussions leading to a sustained misperception of solar energy as being an excessively expensive.
- vi. In India, 72% of power generation is from conventional power plants. Hence, investors are more interested in sticking to the system of conventional power generation rather than switching to other possible alternatives.

In regard to the technical barriers, the main hindrance comprises low conversion efficiency of the PV modules, performance drawbacks of batteries and inverters, and sparse supply of raw materials like silicon. A major concern regarding the standalone PV system is the storage of electricity production, owing to shorter battery life in comparison to that of the entire module (Zhang et al., 2012, Margolis et al., 2006).

On the other hand, solar thermal application has two main technical barriers. Firstly, it is difficult to define the heat carrying capacity of the heat transfer fluids and secondly, the thermal losses from the storage systems (Zeng et al., 2014, Beck et al., 2004). Moreover, owing to the limitations in context to system design and assimilation, the operating expenses of the entire system are boosted up. Also, the lack of integration with building materials, designs, codes and standard results in an inadequacy of solar energy applications.

In the case of concentrated solar power, the associated technologies need to be focused more on large scale applications (Herrmann et al., 2004). The solar energy which is supposed to emanate and sustain itself in terms of energy-infrastructure, revolves around the topologies used by conventional energy technologies.

Even though the industrial production cost of the solar modules decreases, sellers still do not reduce the selling price, which results in a higher purchase rate for the consumers in the commercial market. This technology thus experiences a stalling faith in the growing commercial market, ignoring its social, environmental and hygienic benefits and thereby resulting in the lack of cost reduction (IEA, 2006).

Barriers are also associated with the financial issues and as such, finances themselves become another major barrier (Becker et al., 2000). The financial institutions assessing solar energy projects have lesser longevity, which is coupled with lengthy payback periods and small revenue system (Jacobsson et al., 2000, Anthony, 2006, Goldman, 2005).

Another impediment for both PV and solar thermal technology comes as Institutional; a type that rises from the originality of such a technology. This refers to hindrances like insufficient trained people, along with the limited availability of professionals who are capable of implementing adequate training. Moreover, installation and maintenance issues arise which can only be resolved with Institutional support.

A key policy for overcoming the social barriers is the engagement of local stakeholders in the planning process in order to nullify contradictory issues, build harmony and arrive at a general consensus. The local traditions, beliefs and superstitions of the community need to be considered before planning of the projects takes place, in order to avoid further problems in the progress stage of the solar project. Project developers need to involve the local communities to present their views regarding proposed projects. Pasqualetti and Miller (1984) calculated that, when all steps involved in the fuel cycle are considered, the total land needed for solar power is comparable to those needed for conventional resources such as coal. The base costs of solar power may exceed that of fossil fuels, but it is still more cost-effective than the recurring cost characterizing the latter. Stakeholder dialogues and positive outreach campaigns are necessary to reduce the opposition for solar energy. The awareness concerning the advantages of solar energy needs to be developed among common people.

Only through the combined efforts of government, private sectors, and civil society, the sustainable development of solar power in India is possible. In 2015, India has achieved the highest generation in solar capacity ever, with a total value of 1.112 GW. Indian government has announced scaling up of grid interactive solar project from 20 GW to 100 GW by the year 2021-2022 under National Solar Mission.

4. Conclusion

Solar energy possesses tremendous potential in bridging India's energy demand-supply gap in the near future. The price of solar power in India has decreased from a significant amount of Rs. 18/kWh in 2011 to Rs. 5.15/kWh in 2015, while that for thermal power is pushing up at price of Rs. 4/kWh with subsidies. It is thus clear that the possible alternatives to solar energy are going to be more expensive in near future.

There are various challenges for this industry, including lowering the production cost, increasing

R&D activities, consumer consciousness, improvement of standards and more financial support. It is important to overcome these challenges for rapid growth and mass acceptance of the technology. Some of the immediate actions to enable growth include efficient implementation of renewable energy certificates, usage of carbon trading as a source of income, improvement of financing facility, encouragement in private investment, quick implementation of net metering scheme, policy mixing, rapid implementation of grid-powered energy in regions of Rajasthan and Gujarat, development of off-grid usage in various applications such as cellular towers and encouraging localized mini grids in areas that lack connectivity today. Research and development activities need to be strengthened in private sectors and educational institutions. Millions of productive jobs will be created from the need to develop infrastructure, which is required for the new industries and results from the establishment of massive solar projects. Publicizing job creation, in addition to environmental and energy access reimbursement, will strengthen the economic case for clean energy policies and build public support for these initiatives. The combined effort of government, private sectors, and civil society will bring a revolutionary change in building solar power in India. If these initiatives work as planned, materializing the dream of converting India into a world leader in solar energy market would not be far away.

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Farm Education as a Component of Sustainable Development in Selected Countries of the European Union

Gospodarstwa edukacyjne jako element zrównoważonego rozwoju w wybranych krajach Unii Europejskiej

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Abstract

Experience gained in numerous European countries indicates the need for a comprehensive approach to education for sustainable development. The goal of this paper is to demonstrate that an increasingly important role in this process is played by educational farms. Moreover, the very notion of providing such services appears to be a natural element of educational efforts in rural areas and is closely related to the undertaking by farmers of various types of non-farming activity. Analysis of many years of experience of European countries in operating educational farms, combined with the results of international surveys, shows clearly that the provision of educational services on farms is a beneficial element of practical education. Furthermore, educational farms are an innovative example of didactics in rural areas, with their focus on thematic cohesion with respect to sustainable social, economic and environmental development.

Key words: education, sustainable development, educational farms, agritourism

Streszczenie

Doświadczenia wielu krajów europejskich wskazują na konieczność kompleksowego podejścia do edukacji na rzecz zrównoważonego rozwoju. Celem artykułu jest wskazanie, że obecnie coraz większą rolę w tym procesie zaczynają odgrywać gospodarstwa edukacyjne, zaś sama idea świadczenia tego typu usług wpisuje się w działalność edukacyjną na obszarach wiejskich i pozostaje w ścisłym związku z podejmowaniem przez właścicieli gospodarstw rolnych szeroko pojętej działalności pozarolniczej. Analiza wieloletnich doświadczeń krajów europejskich w zakresie funkcjonowania gospodarstw edukacyjnych, a także wyniki badań międzynarodowych wskazują jednoznacznie, że świadczenie usług edukacyjnych w gospodarstwie rolnym to dobry kierunek w zakresie praktycznej edukacji. Ponadto zagrody edukacyjne stanowią innowacyjny przykład edukacji na obszarach wiejskich, koncentrując się na spójności tematycznej w zakresie zrównoważonego rozwoju społecznego, gospodarczego i środowiskowego.

Słowa kluczowe: edukacja, rozwój zrównoważony, gospodarstwa edukacyjne, agroturystyka

1. Introduction

The dynamic development that began in Europe with the Industrial Revolution in the late 18th century entailed intensive exploitation of natural resources. This upset the balance in the biosphere, causing irreversible changes to the environment. The notion of sustainable development is focused on achieving a balance between three objectives: economic, social,

and environmental (Pawłowski, 2009). The 1987 Report by the World Commission on Environment and Development thus defines sustainable development as: *development that meets the needs of the present, without compromising the abilities of future generations to meet their own needs* (WCED, 1987). Development is closely linked to the environment; hence these two issues should be addressed jointly.

Working towards changing social attitudes and the greater focus on meeting the needs of the environment call for comprehensive education (both formal and informal) of children, teenagers, and adults (Hłobił, 2012; Kaczmarek, 2012). An important role is played by various entities and their initiatives that promote connection with nature, understanding of its needs, and increased sensitivity to it, and which also highlight the need to achieve a state of symbiosis between humans and the natural environment (Hernik, 2003). These are particularly significant in the case of informal education for sustainable development. This goal is addressed by, amongst others, educational farms, which succeed in merging theory with practice – they teach and operate in accordance with the principle of sustainable development.

2. Education for sustainable development

The concept of sustainable development demands certain types of educational action. This issue has been addressed by, amongst others, Springett (2016). There must be a coherent and clear message at every stage of teaching. At the same time, it should be emphasised that the basic assumptions of the concept are not to be treated selectively, but should be seen as equally important. There are several issues that call for special attention in the educational process. While all of the stages leading to sustainable development are important for the entire global community, and the greater part of society seems to be aware of this fact and to understand it, it should still be underlined that not all local communities have equal awareness. Any education offered should therefore be adapted to local communities¹, taking into account their cultural heritage, as this improves its likelihood of being understood. It should thus be easier to persuade communities to modify their current habits and behaviour by embracing a more rational use of all of the resources offered by our planet (where flora and fauna are just as important as mineral resources). Education may take a variety of forms; one of them is educational farms, as *some traditional farming technologies are likely to have increased biodiversity, as biodiversity protection strategies have become part of farming processes* (Wrzaszcz, 2012). If, at the same time, the assumption is adopted that awareness of sustainable development is to be cultivated in students at every level of education, it can be optimistically forecast that future generations will have a natural propensity to engage in matters affecting the global community. *Only education is able to equip people with adequate tools and instruments. However, simply providing information about environmental issues is not enough. (...) Having information is not the same as*

having awareness and being responsible (Mikina, 2010).

The many years of experience of countries that have been providing systematic education focused on enhancing sustainable development can provide certain guidance; moreover, it suggests the most effective models for selection and implementation in other countries. A proven, well-performing system is the Norwegian model of environmental education, based on close cooperation between schools and farms. The participation of students in the functioning of such farms is combined with a school-based curriculum. In this way, students acquire the new competences, skills, and sensitivity that are needed to develop actions towards environment development. Another participant in the process is farming associations, which organise study visits for students and provide them with opportunities for hands-on learning in the field of farming and food production. In the late 1990s, Scottish specialists developed an educational method known as *storyline*, which Cresswell (1997) described as a form of active learning based on specific examples described in the form of stories. Students were given the opportunity to demonstrate creativity by producing their own visions of the place where the story takes place (Gustafsson Marsh and Lundin, 2006). The teacher's task was to moderate the activity, ask key questions and register crucial facts to help the story evolve. The storyline method involves study visits during which students can test their ideas against the reality, share opinions, and build alternative development scenarios. The young people will then relate their experiences to their parents or other interested parties, which means that their work gains extra relevance and is treated seriously by both parties. The storyline method was verified experimentally in the course of a research project conducted by a team of Swedish researchers, involving students aged 14. The storyline was set on a farm, and its focal point was sustainable development as seen from the local perspective. The research results showed some very positive outcomes, for teachers and students alike. The storyline method proved very successful in enhancing the understanding of relations between farming and sustainable development (Lundström, Ljung, 2011).

The experience gained in many developed European countries shows the need for a comprehensive approach to education for sustainable development (ESD). The major issues in this regard can be described on the basis of the British experience. As a result of work and research by a UNESCO special committee (the Education Committee of the UK National Commission), a report was produced titled *Education for Sustainable Development in the UK in 2010* (2010). It identifies and analyses problems,

¹ In line with the concept of nested markets proposed by European rural sociologists (Knapik, 2014).

progress and experiences related to the achievement of objectives in the second half of the United Nations *Decade of Education for Sustainable Development* (DESD) 2005-2014. The most important aspects of the goals set are a common policy, cooperation, and partnership for comprehensive education. These efforts bring together agents representing various elements of civic society: local authorities, business organisations, entrepreneurs, trade unions, universities, NGOs, and professional groups. The key conclusions drawn from this cooperation include:

1. Education for sustainable development requires the introduction of specific solutions into local policy through its representatives – local authorities and agencies;
2. Forms of education such as *sustainable school*, *eco-friendly school*, *global education* should be supported and promoted by the local authorities and representatives of NGOs;
3. Despite the observation of increased educational efforts towards sustainable development in 16 fields of science, progress has not been symmetrical – generally speaking, teaching of adults and within local communities is still at a very early stage;
4. The level of cooperation is unsatisfactory, and this translates into unutilised potential of the synergy effect achieved through combining theoretical experience (education) with hands-on experience – that which can be learnt through the involvement of local communities and non-profit organisations.

UNESCO member states have formulated the principles of a *Global Action Programme* (GAP) with respect to education for sustainable development. The Programme is to be implemented in the first part of the subsequent decade. The principles were officially announced at a conference in Japan in 2014, in the form of five priorities:

1. Increasing the significance of education in sustainable development policies, and of sustainable development in education policies;
2. Development (but also modification) of theoretical and practical knowledge;
3. Building of the potential of teachers and coaches/instructors;
4. Mobilisation, enhancement and utilisation of young people's potential;
5. At the local level – streamlining of the introduction of certain solutions in the area of sustainable development policies (*Shaping the Future We Want*, 2014, p. 181).

3. Conditions affecting the functioning of educational farms

The notion of rendering pro-environmental services at farms aligns well with educational efforts made in rural areas and is closely related to the undertaking by farmers of various types of non-agricultural ac-

tivity. The main motivation for farmers' interest in such initiatives (as well as others) is the opportunity to supplement the income earned through farming. However, there is also another non-economic factor that often encourages farmers to undertake additional activity, namely the social goal related to a need to *share with others the values inherent in farming and country life* (Bogusz, Kmita-Dziasek, 2015). Bearing in mind the objectives of farms and their diversity, in conjunction with their social mission, a distinction should be made between educational farms, special farms for the disabled, care farms, and social farms.

An interesting definition of an educational farm (the so-called educational homestead) has been formulated in Poland. According to the definition approved by the Ministry of Agriculture and Rural Development, such a farm should be run in a rural area by rural residents, and it should perform at least two of the following functions: education in the field of plant and/or animal production and the processing of crops, education aimed at increasing environmental and consumer awareness, and also with respect to the material cultural heritage of rural areas: handcraft and folk art as well as traditional occupations (Samel, Jęczyński, 2012). Moreover, it is essential that such a homestead features farm animals and crops, so that these can be demonstrated to children, teenagers, and other interested persons (Kmita-Dziasek, 2016a).

Educational farms serve a number of economic and social functions. They are a crucial element of the multifunctional development of rural areas and serve as a (primary or supplementary) source of income for their owners. Moreover, the running of educational farms is, to some extent, independent of geographic conditions and natural resources. Among their social benefits, the most important is the pro-environmental education of children and teenagers provided by farm managers. Equally important elements are the creation of new social ties or strengthening of existing ones, and the instilling of positive attitudes in young people. Therefore: *Educational farms are farms which receive visitors for educational purposes, where they learn one or more specific aspects of its business operations, about the rural and natural environment around the farm and about issues regarding food, culture and the rural tradition* (Canavari et al., 2011).

Such farms are regularly visited by school children and teenagers or other groups of people who wish to gain practical knowledge in the field of agriculture and farm work. Educational farms should be run by sufficiently competent personnel and have the equipment needed to provide pro-environmental education (Open Farms..., 2016). Such an approach to educational farms is taken across the EU, with particular emphasis placed on their openness, understood in at least two ways: the provision of open access to such farms and sharing of knowledge and the

readiness to tackle new challenges in terms of methods and forms of providing education. These issues are highlighted in other definitions of the educational farm: *farms as sites of learning award the opportunity to impart knowledge related to the field of agriculture. These farms are sites on which to gather experiences with plants and animals and which illustrate the meaning of sustainable and product-oriented production of food* (Leitfaden Bundesinitiative..., 2003).

On the other hand, Haubenhofer et al. (2010), summarising other approaches to the educational farm, point to the significance of farms in helping children and teenagers to connect with nature – plants and animals – and providing them with knowledge concerning food, food production, animals, and modern agriculture. They promote pro-social behaviours, contribute to the healthy psychological development of young people, and help them develop motor skills. In Western Europe educational farms have been successfully operating for many years. In the light of this, Poland can be seen as a surprising example of a traditionally farming country where efforts to set up such entities have a relatively short history.

In Poland, there are currently over 200 educational farms registered in the Educational Farms Base, although their number is increasing every year (Educational Farm, 2016). Their basic function is didactic activity. According to the classification used by the National Network of Educational Farms, two types of such entities can be distinguished:

- farms whose activity is focused on educating school children, with the aim of *helping school children learn more about living on a farm and where food comes from, as well as helping them discover natural rural surroundings*. This seems particularly important since children, especially residents of large cities, currently have very limited contact with traditional country life, and have some very inaccurate ideas about the sources of the food that they eat;
- farms offering special activity programmes (often in the form of workshops) that supplement or facilitate therapy or the mental and physical development of children with various disabilities (Kmita-Dziasek, 2015-2).

The National Network of Educational Farms was established in 2011, its main goal being to promote folk tradition and culture and the concept of education provision on farms, and also to *boost farmers' professional prestige and share knowledge on the subject of food origins*. These goals are aligned with the special educational programme for rural areas developed by the Ministry of Education (National Network of..., 2015).

In most cases educational farms are parts of functioning agritourism farms that combine tourism with farming activity. According to Bogusz and Kmita-Dziasek (2015), almost 80% of educational farms in

Poland offer accommodation, although in most cases these are small operations (up to 20 beds).

As explained by Sammel and Jęczynek (2012), *in line with the concept of sustainable development, tourists who decide to spend their leisure time in the country also wish to learn and experience things*.

Another objective realised by educational farms is helping children and teenagers discover knowledge related to the material cultural heritage of the countryside, traditional occupations, handcraft, and folk art. For this reason, the thematic scope of educational activities covers handcraft, vanishing professions, customs and rituals, as well as traditional cooking techniques (Kielian, 2015).

Various European experiences testify to the important role of educational farms within a modern education system. People running classes for children and teenagers at educational farms are highly valuable teachers with great didactic and methodological potential. As concerns future-oriented education, the activities provided by farms as sites of learning may greatly contribute to the development of specialist, methodological and social competence (Flath, 2010).

Moreover, the educational activity of farms is aligned with the currently widely accepted importance of education for sustainable development. It is noted in the European literature that it is unlikely that the school of tomorrow will exist in isolation from practical training. It thus appears that farming and gardening may be appropriate fields for empirical studies, which are an important part of the optimum learning process (Jolly and Krogh, 2010).

In many European countries, educational farms have been operating successfully for many years. The most active in this regard are the residents of rural areas of Italy, where currently more than 2500 accredited educational farms operate with state financial support. Many of them have been inspired by the activity of the Alimos non-profit organisation, which promotes sustainable consumption. It initiated the establishment of the first network of educational farms in the Emilia-Romagna region in 1997.

The organisation offers training materials as well as all necessary information for farmers interested in establishing an educational farm. Such a facility must meet certain standards in terms of equipment, safety, and the education provided. It should also be adapted to receiving guests of all ages (Open Farms..., 2016).

The support provided by Alimos to educational farms is one of the first experiences in Italy and remains a reference point for organisations initiating their own programmes and projects aimed at diversifying their operations. Italian educational farms offer activities for both children and adults; they are sites of active teaching, providing knowledge concerning various types of farming activities, products, and landscapes (Paesi Bassi e Belgio..., 2016).

Italian educational farms do more than impart theoretical and practical knowledge of agricultural production, animal husbandry, food production and processing. They also contribute to propagating local traditions, customs and folklore; they are strongly rooted in the place where they operate – they promote it and enhance its image. Italian regions make significant efforts to have such farms. Administrative regions such as Veneto, Emilia-Romagna and Lombardy have their own logos and certificates issued to all educational farms meeting obligatory standards in terms of adequate educational services, equipment and other conditions, the most important of which relate to insurance, optimum levels of safety and hygiene, logistic amenities, and transport (Educational Tourism in..., 2016).

In Spain, the legal regulations concerning educational work carried out by farms do not apply directly to the farmers who are involved in teaching children and teenagers. The law is addressed to leaders and experts among local communities, who are properly qualified and have relevant competences in managing educational activities (Canavari M. et al., 2011).

Increasingly popular in Spain are farms which provide professional education to preschoolers and primary school students. A good example is the farm located in Talamanca de Jarama (near Madrid), which features special theme rooms as well as venues intended for teaching children about rural life – gardens, orchards, as well as farm animals. The school has a picturesque location along the banks of the Jarama River, surrounded by wooded areas, which helps create direct contact with nature. The children take care of the animals and work in gardens and orchards. The animals are kept in suitable hygienic conditions and their welfare is closely monitored. The children also take part in workshops where they learn to make cheese, bread and cakes (Farm School..., 2016).

Lopez de Abechuco Calzada (2012) emphasises the importance of such farms particularly at the pre-school and early-school stages of education, as they play a role in developing appropriate attitudes as well as developing and strengthening children's sensitivity to nature and animals, while also contributing to building pro-social mindsets. They are a source of basic knowledge, both theoretical and practical, about farm work, animal feeding and care, working in orchards and food production. The educational methods used in such schools, such as brainstorming, observation and experiments, are conducive to children's full engagement in the educational process. Direct interaction encourages cooperation with peers. Children learn to work in teams and share responsibilities with others. They also gain knowledge and skills pertinent to a healthy lifestyle.

In Romania, approximately one-third of the population resides in rural areas and derives its main income from farming. To meet the increasing require-

ments of the market and growing competition, it is necessary to take on new challenges to make more efficient use of existing resources. There is a need to support farmers and rural communities in their efforts towards the development of rural areas. For this purpose the Center for Entrepreneurship and Executive Development (CEED) launched the project Rural Economic Education and Development (REED), which was the key element of a rural area development programme, providing support to farmers, job creation and the development of human capital and entrepreneurship in rural areas. A pilot project ran from September 2012 until 2015 (Rural Economic Education..., 2016).

As concerns educational farms in Belgium, a noteworthy organisation is Fédération Belge Francophone des Fermes d'Animation (FBFFA) – an association of 15 francophone farms located in both rural and urban areas close to Brussels. Its task is to promote education aimed at various target groups, diversified in terms of age and specific needs, e.g. disability. There is a link between the diversification of educational approaches and the potential of specific farms belonging to the association (Fattorie Didattiche..., 2016).

An interesting educational project, to be implemented from 1 June to 30 September 2016, involves volunteer activity combined with the operation of an educational farm located in Stoumont, in the heart of the Ardennes. The farm can accommodate both individual guests and groups, offering farm sightseeing, educational sessions, wildlife observation trips, and thematic weekends. It also boasts a wide range of programmes and activities for school groups, disabled children, trainees, and dysfunctional families. Moreover, the farm runs training for socially and economically disadvantaged individuals and groups on social and cultural initiatives in order to support their social reintegration. In summer, educational sessions for children are organised, with classes lasting from 9 am to 4 pm. Volunteers can assist at these sessions or with farm work, selecting activities depending on their skills and preferences. The minimum period of activity to obtain project participation credits is two weeks (Support the Programmes..., 2016).

4. Educational farms – results of empirical studies

To provide a more accurate description of European educational farms, the authors decided to refer to research results from two separate sources. The first is the research material included in the summary report from the FARMLAND international project. This was implemented by a consortium of six partners from five EU countries – Italy, Belgium, Spain, Romania, and Poland – led by the Agricultural Consultancy Centre in Brwinów, Krakow Branch (Poland). The research objective was to diagnose the needs and

expectations of persons who organise education at farms, as well as their development prospects, and to identify training needs in specific countries². The following analyses are based on the *Survey Report on Analysis of Agricultural Innovative Trends and Training Needs* (Ansanelli et al., 2014).

The second source is the results of analogous original research conducted in 2015 among owners of educational farms who are members of the National Network of Educational Farms in Poland.

It is found that educational farms, as an innovative example of didactics in rural areas, exhibit thematic cohesion with respect to sustainable social, economic, and environmental development. With regard to the reasons for undertaking educational activity in rural areas in specific countries, it was found that in Italy the main arguments included diversification and acquisition of an additional income source, pursuit of a different life, and also the possibility of developing business operations using EU funding. The results were similar in Spain, where the respondents first of all pointed to diversification and generation of additional income, as well as the running of sustainable farms. In Romania, the main reason for providing educational services was the need to continue to support farms, including in terms of an additional source of income, through sustainable development, competitiveness, and diversification. In Belgium, the main driver was higher profitability, followed by diversification and stability of income, but also the running of farms compliant with the concept of sustainable development. Analysis of the reasons for launching educational services at farms in Poland shows that a frequent reason was the desire to increase environmental and cultural awareness among farm guests, but also conscious utilisation of the potential of farms, leading to an additional source of income. It can be concluded that in all of the countries under analysis, the commencement of educational activity closely adheres to the concept of sustainable development, with respect to not only economic but also environmental issues, both natural and anthropogenic.

Most owners of educational farms and persons planning to establish them in the future offer or plan to offer educational services as a supplementary activity. Only in Poland was this type of activity treated as the dominant and most important by almost 90% of farms. In Italy, Romania, and Spain crop production was put first (respectively 80%, 85% and ca. 43% of cases), while in Belgium the primary activity was livestock production (almost 73% of relevant responses). It was also relatively common, especially in Poland, Spain, and Italy, for respondents to indicate agritourism as the principal form of farm in-

come, in which case educational services were supplementary to touristic activity.

As regards the types of operations run on the farms besides educational activities, in Italy the most common are farms involved in biodiversity protection (approx. 53% of responses), followed by activity related to traditional food processing (almost 47% of responses). Also common are special farms that offer services to the disabled (approx. 47%) and carry out direct sales of their products (just over 43%). A less frequent activity at such farms is the offering of agritourism services and involvement in organic farming. In Spain, educational activity is very frequently linked to agritourism (just over 25% of cases), followed by direct sales of products (approx. 22% of farms) as well as renewable energy production (20% of farms). In Romania, in the vast majority of cases, education is linked with organic farming (over 82% of cases), processing with traditional methods (82%), as well as direct sales (65%). In Belgium, education at farms is primarily combined with direct sales of products and agritourism (approx. 60% in both cases). In summary, it should be noted that in all of the countries under analysis, education is just one of several forms of activity at the farms in question, and is therefore not the sole source of income.

Analysis of the themes of educational packages offered in specific countries shows that in Italy most pertain to promoting traditional farming and food quality, medicinal plants and organic farming, including crop and livestock production. In Spain most topics are related to organic farming, especially livestock production, direct sales of products and properties of medicinal plants. In Romania, the greatest number of educational offers pertain to organic farming and direct sales of traditional products. In Belgium, common subjects include solar and wind energy and the use of biomass to produce clean energy, as well as promotion of traditional farming and food quality, direct sales and medicinal plants. In Poland, the subjects of educational programmes mostly focus on sustainable farming, emphasising the promotion of health and organic food. The programmes often demonstrate the process of delivering a product from the field to the consumer's table. Moreover, many programmes refer to the natural, cultural, and historical heritage of a given region. The importance of environmental protection and direct sales should be emphasised, as in all of the countries these often appear in the subject matter of educational services. In the case of educational activities it is undoubtedly of great importance by whom they are run. In all partner countries, the owners of farms covered by the study often have no permanent employees except for close relatives – according to responses, this applies

² *FARMLAND – Farm Activities for Rural Model Learning And Nature Didactic*, part of the *Lifelong Learning Programme 2007-2013 Leonardo da Vinci. Innovation Transfer*.

The authors contributed to the implementation of *FARMLAND in 2014-2015* by carrying out a project assessment following the first year of its operation, and by actively participating in a symposium summing up the project.

to 80% of farmers in Belgium, Poland and Italy, 40% in Spain, and almost 58% in Romania. These values are particularly important with regard to the provision of educational services by farm owners. When farms offer many different educational activities, the staff conducting them comprises not only the farmer, but also his/her family members or an employee (especially in summer, when there is greater interest in educational activities, and field work makes it impossible for farmers to spend much time teaching). Closely related to the topics of educational packages offered by farms are their needs for consulting services. In Italy, for instance, there is particular demand for training in pro-environmental activity, food processing, catering, marketing, direct sales, and also renewable energy sources. In Spain, consulting needs are linked to processing, marketing, and direct sales; the same applies to Romania, where consulting on eco-friendly food processing and production methods was listed in most cases. In Belgium, the predominant subjects of consulting are marketing and direct sales, followed by utilisation of biomass and renewable energy sources, and environment-friendly activity.

In Poland, the most important consulting needs of educational farms include processing and marketing, especially promotion, as well as legal and OHS regulations. It is significant that farms in the early stage of offering educational services expect comprehensive training, whereas established operations prefer specialised training focused on specific topics.

Summary

The concept of sustainable development can be applied in the social and economic sphere, in the context of promoting rural areas, and also in terms of education.

The many years of experience of educational farms in European countries such as Spain, Belgium and Italy may not only serve as a reference point for similar initiatives, new or developing, in Poland or Romania, but can also be adapted to the specific conditions of rural areas in those countries.

The establishment of educational farms in many countries is related not only to the possibility of creating an additional source of income for farms, but also results from a commitment to pass on – especially to children and teenagers – the natural, cultural, and historical heritage of rural areas, linked to a healthy lifestyle and environmental awareness.

With regard to educational farms, attention should be drawn to the aspect of innovativeness, which has recently received much emphasis in relation to the EU economy as a whole. Here, broadly defined sustainable development is promoted, along with the application of practical methods of forming pro-social and economic attitudes.

The research results presented in this study point to the fact that the rendering of educational services by

farms significantly contributes to the efficiency of other types of operations. What is more, given the broad thematic coverage of educational packages in specific countries (especially in terms of environmental protection and direct sales), along with the general demand for training for farm owners (which translates directly into the improved quality of services on offer) and the fast growing number of new farms, it may be concluded with confidence that a favourable course is being pursued in the development of practical education.

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Evaluation of Automobile Manufacturing Enterprise Competitiveness from Social Responsibility Perspective

Ocena konkurencyjności branży samochodowej z perspektywy odpowiedzialności społecznej

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Abstract

The article proposed an index system based on social responsibility, including the main index of Employee dimension, Government dimension, Customer dimension, Business partner dimension, Ecological benefits dimension and the sub-index which comprised 18 indexes to evaluate the automotive manufacturers competitiveness. Based on the index system, an evaluation model integrates by extension theory and AHP and groups eigenvalue method (GEM) was introduced. Using established evaluation system and evaluation model, an empirical analysis is elaborately explained. The key result of the evaluated show that the index system and evaluation model built in this research not only can overcome the shortcomings of other methods requiring large data but also can clear the mechanisms and determinants of how CSR produces competitiveness, so it has a good applicability in automobile manufacturing enterprise competitiveness evaluation.

Key words: social responsibility, automotive manufacturers' competitiveness, extension theory, GEM

Streszczenie

Artykuł przedstawia system wskaźników oparty na społecznej odpowiedzialności, uwzględniający główne wskaźniki na poziomie zatrudnienia, rządu, konsumenta, partnera biznesowego, korzyści ekologicznych i zawierający 18 elementów pozwalających ocenić konkurencyjność branży samochodowej. Na systemie wskaźników oparto ocenę modeli integrujących teorię rozszerzenia, AHP i GEM. Korzystając z przyjętego systemu i modelu oceny przeprowadzono następnie badania empiryczne. Uzyskane rezultaty pokazują, że zastosowana metodologia pozwala nie tylko rozwiązać problemy wynikające z niedociągnięć innych metod wymagających dużych baz danych, ale także pozwala na lepsze zrozumienie mechanizmów i uwarunkowań odnoszących się do tego, w jaki sposób koncepcja społecznej odpowiedzialności biznesu wpływa na konkurencyjność, a poprzez to znakomicie nadaje się do zastosowania w ocenie konkurencyjności branży samochodowej.

Słowa kluczowe: odpowiedzialność społeczna, konkurencyjność branży samochodowej, teoria rozszerzenia, GEM

Introduction

As the pillar industry of the national economy, automobile manufacturing enterprises' competitiveness strength have more direct influence to the regional economic development and the country's overall competitiveness, therefore, it has become an important indicator to measure the regional economy and national economic development situation, and also become the key point to accelerate Chinese automobile industrial development and to enhance the national economy. In terms of the selection of automobile manufacturing enterprise competitiveness evaluation index and evaluation method, there have some scholars studied. For example, combined with the characteristics of automobile manufacturers, Yan (2004) divided the automobile manufacturing enterprise competitiveness evaluation index into four level indicators, including: *the scale and profitability* indicators, *technical factors* indicators, *market capacity* indicators, *organization and management capability and corporate culture* indicators, which composed by the 33 secondary indicators, Yan also use fuzzy comprehensive method made an empirical evaluation, according to the result, he point that, as an important indicator to measure the regional and national economic development situation, the automobile manufacturing enterprise competitiveness is an integrate result of market efficiency, innovation, management and environmental factors. Yu (2004) analyzed the status of Chinese automobile manufacturing enterprises, and proposed *labor costs* should be considered as Chinese automobile manufacturing enterprise core competitive advantage, he also advanced that, foster and enhance the automobile manufacturing enterprises' overall competitiveness, we should performed in several ways, like: enhanced self-development capacity, improve labor productivity, accelerate development of service industries, etc. Zhao and Leng (2006) using eight indicators: *the main business income, net profit, net assets, ROE, the main business profit margins, net operating cash flow per share, the main business revenue growth, net profit growth* and factor analysis method, make an evaluate to the competitiveness of Chinese A-share market auto manufacturing enterprises, conclude that the size factor, profitability and development factors, management factors are the three main factors which influence automobile enterprise competitiveness. Zhang and Zhu (2009) pointed out that the competitiveness of automobile manufacture enterprise amount to its independent innovation capability, and built an automobile manufacturing enterprise independent innovation ability index system including internal conditions, external environment, innovation input and innovation output four dimension, they also using expert scoring method to determine the index weight and build a comprehensive evaluation model based on evidence theory. Wang (2005) utilize rough set theory to analysis and

screening the automobile enterprise competitiveness evaluation index system, pointed out that when evaluate the current competitiveness of automobile manufacturing enterprise, the index which reflects the scale and efficiency, such as: sales revenue and net assets, are the key index. In addition, Cong (2008) analyzed the auto companies' internationally competitive advantages and disadvantages in Yangtze River Delta, proposed improving the international competitiveness of enterprises, they should implementation an *open, competitive, restructuring and overall cost leadership* strategy. Qiu (2008) thought to improve the competitiveness of automotive manufacturers, flat management is an efficient way. Fan (2009) argued that increasing the economic efficiency of enterprises is the wise choice to improve the competitiveness of automobile manufacturing companies at the present stage. Zhao and Cai (2006) analysis the automobile manufacturing enterprise competitiveness from two aspects: *scale competitiveness* and *brand competitiveness*. Kang and Wang (2006) uses seven indicators including market share, profit margins, etc. evaluated the international competitiveness of Chinese auto manufacturers.

From the above, we can know that, although the scholars have made great achievements in the study of automotive manufacturers' competitiveness evaluation indicators and evaluation methods, but the researches integrate the social responsibility into competitiveness is rare. Previous competitiveness evaluation factors selecting mostly involve economic interests dimensions and technical innovation level, less involved the interests of customers, ecological benefits and other social responsibility dimension which enterprises should undertaken. Porter and Kramer (2006) believes that companies should integrate socially responsible management to corporate strategy, thereby creating shared value of the business and society, which is an important factor affecting the company's future competitiveness. Visser (2010) also noted that the current social responsibility has entered a new era, social responsibility management would turn from professional to diversify, that is, from the experts responsible to company's management and even integrated into the company's core business. From the above, we also can know that, on the choice of competitiveness evaluation methods, scholars usually use factor analysis or comprehensive evaluation model based on evidence theory or rough set theory or ANP, all these methods often require large amounts of data to support and their calculation process is very complex, which would cause lots difficulties in some practical applications. In order to solve the above problems, this paper will design an index system from the perspective of social responsibility, and establish an evaluation model combine AHP, GEM and extension theory. This evaluation index system and evaluation model not only can solve the previous difficulties, it also can provides a new thinking way for the auto-

mobile manufacturing enterprise competitiveness evaluation in the background of sustainable development.

The rest of this paper is structured as follows. In Section 2, based on the theory of social responsibility, and according to the automobile manufacturing enterprise production process and output performance characteristics, five dimensions of automobile manufacturing enterprise competitiveness evaluation index system been proposed; In Section 3, put forward AHP-GEM-Extension comprehensive assessment model, which can overcome the inconsistency of Saaty matrix construct; In Section 4, based on the proposed evaluation system and model, an empirical analysis is elaborately explained; In Section 5, the finally section, conclusions and some managerial implications are drawn from the study.

2. Design competitiveness evaluation index based on social responsibility

Theory and practice of corporate social responsibility has experienced nearly a hundred years, the debate about the concept of social responsibility has never stopped (Li and Xiao, 2008; Drucker 1984) believes that social responsibility requires managers should be aware of company policies and behaviour and to consider their business activities' impact to social, considering whether certain behaviours can promote the public interest and beneficial to the advances of social basic beliefs and social stability, prosperity and harmony. Koontz (1998) proposed that corporate social responsibility mean manager should seriously considering the impact of company's movements on society. McWilliams and Siegel (2001) defined the corporate social responsibility as *some behaviour beyond business interests and beyond legal requirements, all these behaviour is to promote social development*. Chen and Mao (2006) thought that corporate which shoulder social responsibility should take maximize the value to society as the goal in the process of social value creation, they should overstep immediate benefits and think about not only get their own development, but also contribute to the development of society. Schwartz and Carroll (2008) also pointed out that social responsibility refers to, when an enterprise in the pursuit of economic performance and their own development, they not only committed to the creation of social net, but also should take the sustainable development of society and the environment into account and concerned about their own contribution to greenhouse gas emissions as well as local economic growth and so on. If view from the logic of institutional theory, the essence of corporate social responsibility is a kind of institutional arrangements that can affect the overall behaviour of enterprises and individuals to some extent, and thus have an impact on the value creation process and the results. This new institu-

tional arrangements will have an impact on the existing institutional system, companies will experience an organizational change during the long mutual integration process of social responsibility and business operations (Yuan et al., 2011). As the process of Chinese economic integration globalization speed up, the practice of corporate social responsibility has made a rapid development in the past decade. However, there is still a widespread misconception in corporate that socially responsible behaviours are opposed to daily operations activities, it belonging to the *attached behaviour* which beyond the scope of corporate responsibility will increasing the enterprises operating costs and weaken their competitiveness. This wrong perception leading enterprises produce a psychological conflict to fulfill their social responsibility and hampered social responsibility promote. Some companies even forced to make some response under the external pressure, but their actions are often restrictions on the oral and written, lacking of create real social value.

Recent years, China has gradually become the major exporter. Chinese exports are mainly concentrated in the developed countries of Europe and America which take the labor issue as a social responsibility and try to link it to the trade. Through *purchase power*, these countries require multinational industry bear social responsibility, like improve labor treatment of the processing plant (especially labor-intensive industries), protection of the environment, etc. Some NGO, which involve Greenpeace, environmental protection, social responsibility and human rights, appeal repeated and asked social responsibility should link with trade. Also some industries and global industry organizations and non-governmental organizations even developed their own codes, according to the International Labor Organization (ILO) statistics, such codes have been more than 400, including SA8000 which is the most influential and more familiar in China. Under this background, China's enterprises are in full swing social responsibility certification activities, especially automobile manufacturing enterprises, because they have a large share of exports. Unlike general business, automobile manufacturing social responsibility relate to various aspects of the ecological chain of the automotive industry, it has a multiple layers. First automobile manufacturing enterprises should undertake basic social responsibilities, such as output quality products and services, make themselves earnings and so on. Second, although the car can create wealth and bring about social progress and improving quality of public life, but it is a special commodity which would consume a lot of energy, material and other supplies, so it will become a culprit of pollute the environment and threaten the life, thus automobile manufacturing enterprises also should bear other deep-seated social responsibilities which can highlight the corporate's image, such as environmental

protection, rational use of resources, labor rights, legal compliance, maintenance of public relations, concerns vulnerable groups in society and promote social harmony development. At present, Chinese automobile manufacturing social responsibility situation is not optimistic, displaying more serious labor conflicts, environmental pollution and crisis of social confidence, all these become important factors that hinder the further development of automobile industry. The underlying reason mainly because of the integration of social responsibility and corporate culture, strategy and operational is not well. Therefore, this paper will build a social responsibility competitiveness evaluation index system from the perspective of integration of social responsibility and automobile manufacturing competitiveness strategy, and it will have very important significance to strengthen the competitive advantage of automotive manufacturers and promote it undertake social responsibility actively and efficiently.

Many scholars have studied the relationship between social responsibility and corporate performance (Liu and Song, 2010). However, the researches analysis the enterprises competitiveness from the perspective of social responsibility is not much, few related literature mostly around different stakeholders (Bi Nan, 2012) or different social responsibility issues (He and Lu, 2008) to discuss performance social responsibility will produce positive effect on the competitive advantage, among them, the more representative view are: corporate bear social responsibility to meet the expectations of stakeholders, thereby improving corporate reputation, thus contributing to the competitiveness of enterprises (Bi and Feng, 2011); and if corporate social responsibility can be integrated into its core strategy, it can bring a competitive advantage and social advantages (Michael and Klame, 2006). Unfortunately, these studies have failed to examine the profound changes bring by social responsibility from the angle of enterprises competitiveness create process. In terms of the essence of competition ability creation, competitiveness integration of social responsibility can be seen as a business model innovation (Visser, 2010). This business model innovation is realized by the integration of social responsibility: through integrate with the core values to promote all employees establish the correct value; integrate with mission and the sustainable development strategy to propos value proposition of pursue a comprehensive value maximization; integrate with the whole process of automobile manufacturing operations to realize the value integration of all aspects of the value chain; eventually, change the enterprises original behaviour and establish new enterprises behaviour comply with social expectations, curing them as an important part of corporate value system and become the most strong and advantage competitiveness. Therefore, the essence of the building of competitiveness based on social responsibility is the integration of the two institutional

system, and the institutionalization of corporate social responsibility is the ultimate goal of the entire integrate process (Maon et al., 2009). To successful institutionalize the concept and the requirements of social responsibility to automotive manufacturers competitive system and become an important part of its competitiveness, we needs to decomposition competitiveness strategy which blend of the social responsibility into a series of competitive performance management indicators.

On the measure of enterprises competitiveness, Scholars have a lot of different opinions and proposed many evaluation index system (Fan, 1997; Yang and Zhang, 1999; Zhang, 1999; Wang, 2002; Jin, 2005). Among them, the most influential, and widely accepted by the academic community is *Enterprise Competitiveness Evaluation Theory and Method* which proposed by Jin (2003) and published in *China Industrial Economy*. The purpose of this research was to study the competitiveness indicators which integrated social responsibility, therefore, the competitiveness evaluation index design mainly from the perspective of social responsibility assume. Corporate social responsibility is the corporate responsibility to the main stakeholders (Clarkson, 1995; Freeman, 1984; Frederick, 1994), this article will take RAOD model which proposed by Canadian economist Clarkson (Clarkson, 1995) as the basis, and in accordance with Chinese reality, divide the automobile manufacturing enterprises' social responsibility into five dimensions: social responsibility to employees, social responsibility to government, social responsibility to customers, social responsibility to business partners, and social responsibility to the natural environment. When setting indicators, we will also take these five dimensions as the basis for dividing index dimensions. (1) The dimension of social responsibility to employees. Corporate fulfilling their social responsibility to employees is essentially maintaining their social reputation and image; it will help to attract high-quality personnel. Talent personnel is the most important resource for the survival and development of enterprises, have adequate highly qualified personnel is an important factor in gaining and maintain a competitive advantage. Corporate responsibility to employees mainly reflected in the payment for employees, including the remuneration and expenditure was spent on staff training. In this paper, we will use *the revenue growth* (Friedman, 1970; Archie, 1994; Clarkson, 1995; Abigail, 2001; Garriga, 2004), *employees' profit levels* (Harrison, 1999; Garriga, 2004) and *employee retention rate* (Kelvin and Jarrett, 2002; Jocelyn, 2003) to describe. (2) The dimension of social responsibility to government. Enterprise is the executor and builders of government policies and regulations, legitimate business and tax law is the most basic responsibility of enterprise to government. Enterprises actively undertake the social responsibility to the government is beneficial to get

government approval and get more policies inclination, for example, in terms of land administration, taxation, loans, etc. all these preferential policies would conducive to business operations. In this paper, we will use *the proportion of taxation to revenue increase* (Luetkenhorst, 2004; Lois, 2005), *scale competitiveness* (McGuire, 1988; Porter and Kramer, 2002) and *market competitiveness* (Porter and Kramer, 2002; Schwartz, 2003). (3) The dimensions of social responsibility to customer. Customers are the recipients and users of the enterprise's products or services, enterprise's survival and development are all dependent on the customer's identity, the stronger customer's identity, the more they spending, and the more profit companies can get, therefore, the ultimate goal of the enterprise competition is to win customers. With the advancement of technology and the development of society, customers' attention to the consume products and services is not limited to its basic functions, but also concerned about the negative impact during use and disposal process. Simultaneously, more and more customers also concerned about whether their own consumption behaviour cause harm to the natural environment and so on. Based on this, this paper will use *expects of customer satisfaction* (Maignan, 2001; Michael, 2006), *customer growth rate* (Maignan, 2001; Michael, 2006), *the safety grade of automobile* (Yu, 2004; Cong, 2008) and *market share expected* (Yan, 2004; Michael, 2006). (4) The dimension of social responsibility to business partners. Enterprise business partner generally refers to the partner which business activities in close contact with, such as partners, suppliers, distributors, and other peer companies. Business Partners agreed that: a responsible business must have good social relations and the lower operational risks, so if trading with them, the potential risky is also less. Therefore, corporate fulfilling social responsibility to business partners is equivalent to convey the signal to the various stakeholders they have a good public reputation, and helpful to get all parties trust and support. In this paper, we will use *investment efficiency coefficient* (Alexander, 1978; Clarkson, 1995; Abigail, 2001), *the success rate of the contract* (Jeff, 1997; Abigail, 2001), *the manufacturing cost* (Harrison, 1999; Abigail, 2001) and *crisis management capabilities* (Barney, 1991; Harrison, 1999; Hillman, 2001; Hart, 2004; David, 2005). (5) The dimension of social responsibility to ecological benefits. the current economic development demand enterprise to fulfill its responsibilities to the natural environment or ecological benefits and made the energy saving to strategic height. Automobile manufacturing enterprise produces lots of wastes, like *three wastes* or *noise pollution* in production process, resources and energy consumption during using process, and abandoned Cars, all these activities excessive consumption of resources and energy and so serious violate the social development theme *Man and nature harmony*. In order to improve

Table 1. Automobile manufacturing enterprise competitiveness evaluation index system

Guidelines layer	Indicators layer	Indicators data sources
Employees dimension C ₁	revenue growth C ₁₁	(new revenue - original income) / original income
	employee retention rate C ₁₂	number of employees at the end of the year / number of employees at the beginning of the year
	employees' profit levels C ₁₃	payments to employees and paid for employees in cash / main business income
Government dimension C ₂	the proportion of taxation to revenue increase C ₂₁	year tax / revenue increase
	scale competitiveness C ₂₂	using a 5-point score to obtain
	market competitiveness C ₂₃	using a 5-point score to obtain
Customer dimension C ₃	expects of customer satisfaction C ₃₁	using a 5-point score to obtain
	customer growth rate C ₃₂	number of new customers / number of original customers
	the safety grade of automobile C ₃₃	use weighted average of automobile production and test data volume by C-NCAP to describe.
	expects of market share C ₃₄	product sales / comparable domain sales
Business partners dimension C ₄	investment efficiency coefficient C ₄₁	revenue Increase / investment of previous period
	contract success rate C ₄₂	success rate = 1 - failure rate
	manufacturing cost C ₄₃	weighted average of Industry manufacturing costs
	crisis management capabilities C ₄₄	using a 5-point score to obtain
Ecological benefits dimension C ₅	atmosphere environment coordination C ₅₁	reduced emissions per ten thousand yuan output value/ original emissions per ten thousand yuan output value
	water environment coordination C ₅₂	reduced Wastewater emissions per ten thousand yuan output value/ original Wastewater emissions per ten thousand yuan output value
	expectations of energy consumption reduce rate C ₅₃	reduced energy consumption per ten thousand yuan output value/ original energy consumption per ten thousand yuan output value
	innovation capability C ₅₄	using a 5-point score to obtain

the natural environment, and to enhance the sustainable competitiveness, more and more automobile manufacturers began to pay attention to environmental responsibility and actively participate in the environmental related business among. This article will use *atmosphere environment coordination* (Deb, 2002; Bagnoli and Watts, 2003; David, 2005), *water environment coordination* (Bagnoli and Watts, 2003; Yan, 2004), *expectations of energy consumption reduce rate* (Wang, 2005; Fan, 2009), and *innovation capability* (Ranard and Forstater, 2002; Husted, 2006).

In summary, the automobile manufacturing enterprise competitiveness evaluation index system based on social responsibility was shown in Table 1.

3. Construction of Comprehensive Evaluation Model based on Extension theory

Extension theory is a new kind of knowledge system based on the concepts of matter-element and extension set. Its subject selection began in 1976, and its initiative paper was published in 1983. It was the stage for generating knowledge of extension theory from 1983 to 1992. By far, the primary frame of extension theory has been set up with the effort of many researchers. Matter-element theory and the theory of extension set are two theoretical pillars of extension theory. The combination of these two pillars with other science generates the respective knowledge, which is the soft part of extension theory. The biggest advantage of extension theory is it can makes it possible to develop the formalized description for activities of creative thinking, such as knowledge innovation, new products designing and strategy generating. With the combination of extension theory with management science, cybernetics, information science and computer science, extension engineering methods have been applied to some engineering fields such as economic engineering, management engineering, decision process and process control.

3.1. Construct the same levy matter-element model

According matter element theory to build the n-dimensional same levy matter-element model of the automotive manufacturing enterprise competitiveness, the model is as follows:

$$R_i = (N_i \quad C \quad V_i) = \begin{bmatrix} N_i & c_1 & v_{1i} \\ & c_2 & v_{2i} \\ & \vdots & \vdots \\ & c_n & v_{ni} \end{bmatrix}, i=1,2,3,\dots,n \quad (1)$$

Where: N_i representatives of the i-th automobile manufacturing enterprise competitiveness; C_1, C_2, \dots, C_n represents the main feature of the automotive manufacturing enterprise competitiveness (i.e. evaluation index), such as revenue growth, employee profit level, atmospheric environment coordination etc; $V_{1i}, V_{2i}, \dots, V_{ni}$ represents the magnitude

of automobile manufacturing competitiveness N_i to the corresponding C_r ($r=1, 2, \dots, n$).

3.2. Determine the classical field and section domain

According matter element theory to construct classical field and section domain model as follows:

$$R_0 = \begin{bmatrix} N & G_1 & G_2 & \dots & G_m \\ C_1 & \langle a_{11}, b_{11} \rangle & \langle a_{12}, b_{12} \rangle & \dots & \langle a_{1m}, b_{1m} \rangle \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ C_n & \langle a_{n1}, b_{n1} \rangle & \langle a_{n2}, b_{n2} \rangle & \dots & \langle a_{nm}, b_{nm} \rangle \end{bmatrix} \quad (2)$$

Where: R_0 is the same levy matter-element,

R_1, R_2, \dots, R_m is the body of same levy matter-element; G_r represents the divided r-th evaluation categories; C_i represents the i-th index; $V_{ir} = \langle a_{ir}, b_{ir} \rangle$ represents the N_r magnitude range under the stipulated of C_i , that is classical field of data obtained by the evaluation index of each category.

$$R_p = \begin{bmatrix} P & C_1 & V_{1p} = \langle a_{1p}, b_{1p} \rangle \\ & C_2 & V_{2p} = \langle a_{2p}, b_{2p} \rangle \\ & \vdots & \vdots \\ & C_n & V_{np} = \langle a_{np}, b_{np} \rangle \end{bmatrix} \quad (3)$$

Where: P represents all categories, V_{ip} on represents the magnitude range of P was taken from C_i , i.e., the section domain of P and $V_{ir} < V_{ip}$ ($i=1,2, \dots, n$; $r=1,2, \dots, m$).

3.3. Determine the matter-element to be evaluated and the index weight coefficient

For the automobile manufacturing competitiveness (q) which to be evaluated, we use the matter-element (formula (4)) to describe its scores for the evaluation index.

$$\begin{bmatrix} N & c_1 & v_1 \\ & c_2 & v_2 \\ & \vdots & \vdots \\ & c_n & v_n \end{bmatrix} \quad (4)$$

Formula (4) referred to the matter-element of automotive manufacturing enterprise competitiveness (q) to be assessment; V_i is magnitude of q for evaluation index C_i , that is, the score of index. In the past, determine the weighting coefficients in extension evaluation method most used AHP, but there would exit inevitable human factors during pairwise comparison judgment process and the final results of the evaluation will have more subjective influence in. Therefore, this paper will mix in the groups eigenvalue method (GEM), according to GEM, determining the weight coefficient index C_i is a_i , and that the method can effectively overcome the inconsistency when use AHP build expert judgment matrix and can effectively overcome subjective factors interference.

3.4 Calculate the correlation degree of each index

Establish the correlation function of the evaluation index on the grade r :

$$K_j(v_i) = \begin{cases} \frac{-p(v_i, V_{ij})}{|V_{ij}|} & v_i \in [a_{ij}, b_{ij}] \\ \frac{p(v_i, V_{ij})}{p(v_i, V_{ij}) - p(v_i, V_{ij})} & v_i \notin [a_{ij}, b_{ij}] \end{cases}$$

Among them:

$$|V_{ij}| = |b_{ij} - a_{ij}|$$

$$p(v_i, V_{ij}) = p(v_i, \langle a_{ij}, b_{ij} \rangle) = \left| v_i - \frac{a_{ij} + b_{ij}}{2} \right| - \frac{b_{ij} - a_{ij}}{2}$$

$$p(v_i, V_{ip}) = p(v_i, \langle a_i, b_i \rangle) = \left| v_i - \frac{a_i + b_i}{2} \right| - \frac{b_i - a_i}{2}$$

3.5. Calculate the comprehensive correlation of matter-element to be evaluated

According to the a_i (weighting coefficients of index C_i) and $K_r(V_i)$ (correlation degree of each index on rank r), Calculate the comprehensive correlation of matter-element to be evaluated:

$$K_j(q) = \sum_{i=1}^n a_i K_j(v_i)$$

3.6. Rating

Compare the size of each grade comprehensive correlation degree to determine assessment results. The larger the correlation of rank r , the better compliance degree of the automotive manufacturing enterprise competitiveness (q) with the rank set.

$$K_{j0}(q) = \max_{j \in \{1, 2, \dots, m\}} K_j(q)$$

Then, assessment q belonging to the rank r_0 .

Calculate level variable eigenvalues of the automotive manufacturing enterprise competitiveness (q):

$$j = \frac{\sum_{j=1}^m j \bar{K}_j(q)}{\sum_{j=1}^m \bar{K}_j(q)}$$

Where:

$$\bar{K}_j(q) = \frac{K_j(q) - \min_j K_j(q)}{\max_j K_j(q) - \min_j K_j(q)}$$

Level variable eigenvalues reflects the degree of automotive manufacturing enterprise competitiveness level (r_0) tend to another category.

4. Empirical Analysis

Now using the extension comprehensive evaluation model been built above to evaluate Shanghai five automotive manufacturing enterprise's competitiveness (q_1, q_2, q_3, q_4, q_5), the specific evaluate process is as follow:

4.1. Questionnaire reliability and validity of Measure

Design questionnaire according competitiveness evaluation index and distribute it in parts of the au-

tomotive manufacturing enterprise, productivity centers, high-tech industry management department and some universities in Shanghai. 200 questionnaires were distributed, 147 were recovered, excluding seven invalid questionnaires, the effective response rate was 70%. Using SPSS software estimate the obtained data's reliability and validity: the reliability coefficients of scoring matrix which constructed with the data obtained were over 0.75, reaching the required level of reliability; the correlation coefficient between the variables were greater than 0.5; the association of each factor score with the total score were also greater than 0.5, and larger than the correlation coefficient between the various factors. All these indicating that the questionnaire had good level of content validity and construct validity in the survey.

4.2. Evaluation Process

Taking all considerations, select 20 experts from parts of the automotive manufacturing enterprise, productivity centers, high-tech industry management department and some universities in Shanghai who familiar with circular economy, green manufacturing, social responsibility and establishment an experts panel. According to their own cognitive and questionnaire results, expert panel conducted an evaluation to the five automotive manufacturing enterprise competitiveness. First, expert scoring *Indicators layer* indicators, then multiplying their own weight which belongs to the *Guidelines layer* indicators (weight obtained from GEM method), at last, calculate the value of *Guidelines layer* indicators through adding all the value of corresponding *Indicators layer* indicators which been weighted. After expert score, the evaluation scores of five automobile manufacturing competitiveness indexes were shown in Table 2.

Table 2. Project evaluation score

Com- petitive- ness	C ₁	C ₂	C ₃	C ₄	C ₅
q ₁	84	72	74	69	80
q ₂	69	80	79	71	74
q ₃	90	81	89	84	87
q ₄	75	71	80	81	78
q ₅	71	72	67	73	67

Using GEM determined the five *Guidelines layer* indicators' weighting coefficients, shown in Table 3.

Table 3. Evaluation of weight values

evalua- tion index	C ₁	C ₂	C ₃	C ₄	C ₅
weights	0.24	0.17	0.17	0.19	0.23

In this empirical analysis, the classic domain of each index is:

Table 4 Correlation of each index about participating industry on the level of r

$K_n(v_i)$	Q_i	V_1	V_2	V_3	V_4	V_5
$K_1(v_i)$	q_1	-0.220 1	-0.339 1	-0.233 5	-0.432 2	-0.440 1
	q_2	-0.232 4	-0.224 0	-0.225 3	-0.215 8	-0.322 1
	q_3	-0.152 3	-0.324 1	-0.101 2	-0.115 2	-0.324 4
	q_4	-0.542 3	-0.234 9	-0.231 5	-0.635 4	-0.222 4
	q_5	-0.452 2	-0.234 0	-0.651 2	-0.113 5	-0.234 0
$K_2(v_i)$	q_1	-0.052 3	-0.042 1	-0.435 5	-0.352 1	-0.214 5
	q_2	-0.236 1	-0.234 4	-0.231 1	-0.152 3	-0.324 5
	q_3	-0.322 7	-0.069 8	-0.319 5	-0.235 4	-0.674 4
	q_4	-0.255 9	-0.221 3	-0.231 5	-0.223 4	-0.674 4
	q_5	-0.472 9	-0.539 9	-0.189 2	-0.215 9	-0.044 3
$K_3(v_i)$	q_1	-0.542 68	-0.334 2	-0.123 6	-0.435 1	-0.224 5
	q_2	-0.342 5	-0.213 0	-0.451 2	-0.166 3	-0.324 5
	q_3	-0.223 5	-0.434 2	-0.215 4	-0.165 8	-0.549 1
	q_4	-0.237 5	-0.649 0	-0.215 3	-0.645 3	-0.327 4
	q_5	-0.543 1	-0.322 7	-0.265 5	-0.424 1	-0.342 2
$K_4(v_i)$	q_1	-0.235 4	-0.234 5	-0.235 7	-0.095 1	-0.447 9
	q_2	-0.434 1	-0.214 5	-0.335 4	-0.325 5	-0.421 3
	q_3	-0.087 1	-0.042 2	-0.319 8	-0.235 5	-0.321 5
	q_4	-0.135 2	-0.321 4	-0.652 3	-0.164 2	-0.224 4
	q_5	-0.323 5	-0.365 4	-0.123 5	-0.343 3	-0.324 5

$$R_{it} = \begin{bmatrix} N_t & C_1 & X_{t1} \\ & C_2 & X_{t2} \\ & C_3 & X_{t3} \\ & C_4 & X_{t4} \end{bmatrix} \quad t=1,2,3,4$$

Where: N_t represents the evaluation grade of automotive industry competitiveness, when $t = 1,2,3,4$, N_t were 1 {excellent}, 2 {good}, 3 {medium}, 4 {poor}. $X_{t1}, X_{t2}, X_{t3}, X_{t4}$ represents the specified magnitude range of N_t on the corresponding feature. When $t = 1,2,3,4$, its magnitude range are as follows: $\langle 90, 100 \rangle$, $\langle 75, 89 \rangle$, $\langle 60, 74 \rangle$, $\langle 0, 59 \rangle$. In this case, the section domain is:

$$R_p = \begin{bmatrix} P & C & V_p \end{bmatrix} = \begin{bmatrix} P & C_1 & \langle 0, 100 \rangle \\ & C_2 & \langle 0, 100 \rangle \\ & C_3 & \langle 0, 100 \rangle \\ & C_4 & \langle 0, 100 \rangle \end{bmatrix}$$

According to the correlation function of each index to the rank which established above, using Matlab calculate the correlation of each index about participating industry on the level of r , the result was shown in Table 4.

Calculated the competitiveness of the selected five automotive industries according to the comprehensive correlation function and index weights in Table 3, evaluation results was shown in Table 5. From the evaluation results, we can know that: one automotive manufacturing industry belong to grades 1, three automotive manufacturing industries belong to grades 2, one automotive manufacturing industry belong to grades 3. That q_3 automotive industry evaluation results as excellent, q_5 automobile manufacturing evaluation results for the medium, and the rest of the automotive industry evaluation results are good. Depending on the level of automotive industry value variable characteristics r_* (the smaller the value, the higher the representative characteristic level), the

goodness order of automotive manufacturing industry competitiveness is $q_3 > q_4 > q_2 > q_1 > q_5$. So among the five automotive manufacturing industries, there are two automotive manufacturing industries (q_3, q_4) have relatively excellent competitiveness. And the evaluation result obtained by this method is the same with the results of final argument by productivity centers of Shanghai. These verified the index system and evaluation model built in this research is practicality.

Table 5. Evaluation results

q_n	N_1	N_2	N_3	N_4	r_0	r_*
q_1	-0.346	0.235	-0.133	0.319	2	2.21
q_2	-0.365	0.322	0.112	-0.214	2	2.09
q_3	-0.085	-0.244	-0.323	-0.123	1	1.83
q_4	-0.234	0.123	-0.434	-0.231	2	2.03
q_5	-0.315	-0.214	-0.132	-0.175	3	2.61

5. Conclusion

In recent years, some scholars have begun to focus on the relationship between social responsibility and competitiveness of enterprises and through the study found that social responsibility can improve their overall competitiveness. However, the vast majority of the related researches are limited to qualitative research, quantitative research is very little, empirical researches integrate with corporate social responsibility and corporate competitiveness is rarer. In this research, by drawing theory and method which been proposed by other scholars to assess the competitiveness of the automotive manufacturing industry, combining the basic theory of social responsibility, according to the characteristics of the automotive industry production process and output performance, we construct a automotive industry competitiveness evaluation index system with five dimensions and

build a AHP-GEM-Extension comprehensive evaluation model which can overcome the inconsistency of Saaty matrix first, then through questionnaires and interviews with experts, we made an empirical analysis to evaluate automotive manufacturing industry competitiveness. The empirical analysis result proved the index system and evaluation model built is practicality.

Select automotive manufacturing industry competitiveness integrates social responsibility as a research topic, theoretically, it can clear the connotation of automotive manufacturing industry competitiveness at the present stage and it also can clear the mechanisms and determinants of how social responsibility produces competitiveness. In practice, the study of through strengthen automotive manufacturing industries' social responsibility in order to improved its competitiveness and sustainable development can remind all enterprises manager attach great importance and correct treatment to the social responsibility, and call their attention to change their consciousness, strengthen their social responsibility management and practice, and strive to achieve harmonious of economic, social and the environment.

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The Impact of Public Environmental Protection Expenditure on Economic Growth

Wpływ wydatków publicznych związanych z ochroną środowiska na wzrost gospodarczy

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Abstract

The article analyzes the impact of public environmental protection expenditure on economic growth. Estimating the strength of this relationship is of particular importance in the context of the recent global economic crisis. The paper is organized as follows. Firstly, theoretical model showing the mechanism of public environmental protection expenditure impact on GDP is presented. Then the results of an empirical study are shown. The study is conducted for the eleven countries of Central Europe. Econometric panel model is applied, which takes into account both time and cross-sectional dimension of the analyzed phenomenon, because, as indicated in the article, relying only on the variation over time may lead to misleading conclusions. The estimations based on panel model, conducted for the years 2001-2012, shows that the increase in public environmental protection expenditure has a positive effect on economic growth. Due to the fact that the analyzed period is heterogeneous, that is it covers both the period before the global economic crisis, and during its lifetime, calculations were also performed for two sub-periods. Results reveal that public environmental protection expenditure has stronger influence on GDP during crisis. Hence, the study shows that public environmental protection expenditure have no negative impact on economic growth, and its positive effects are strongest in case of economies affected by the global financial crisis.

Key words: environmental protection, public expenditures, economic growth

Streszczenie

W pracy poddano analizie wpływ wydatków publicznych związanych z ochroną środowiska na wzrost gospodarczy. Oszacowanie siły oddziaływania tego typu wydatków nabiera szczególnego znaczenia w kontekście ostatniego kryzysu gospodarczego na świecie. W pierwszej kolejności przedstawiono model teoretyczny, ukazujący mechanizm oddziaływania wydatków publicznych związanych z ochroną środowiska na PKB. Następnie ukazano wyniki badania empirycznego. Badanie przeprowadzono dla jedenastu krajów Europy Centralnej. Wykorzystano ekonometryczny model panelowy, który uwzględnia zarówno zmienność badanego zjawiska zarówno w czasie, jak i pomiędzy poszczególnymi krajami. Jak wykazano bowiem w artykule, oparcie się jedynie na zmienności w czasie może prowadzić do mylnych wniosków na temat badanego zjawiska. Z przeprowadzonych na podstawie modelu panelowego estymacji dla lat 2001-2012 wynika, że zwiększenie wydatków publicznych związanych z ochroną środowiska wpływa pozytywnie na wzrost gospodarczy. Ze względu na fakt, że analizowany okres jest niejednorodny, tj. obejmuje zarówno okres sprzed kryzysu gospodarczego na świecie, jak i w trakcie jego trwania, obliczenia wykonano również w rozbiciu na dwa podokresy. Uzyskano, że wydatki publiczne związane z ochroną środowiska oddziałują na PKB silniej w okresie kryzysu gospodarczego. Zatem z przeprowadzonych badań wynika, że wydatki publiczne związane z ochroną środowiska nie wpływają negatywnie na wzrost gospodarczy, a ich pozytywne skutki ekonomiczne są szczególnie silne w przypadku gospodarek dotkniętych światowym kryzysem finansowym.

Słowa kluczowe: ochrona środowiska, wydatki publiczne, wzrost gospodarczy

1. Introduction

The main objective of public environmental protection expenditure is encouraging the sustainable use of natural resources and protecting the environment. However, at the same time, this expenditure may affect the economic growth. On one hand, public environmental protection expenditure is a part of total public expenditures, which in short run usually stimulate economy (see for example Auerbach and Gorodnichenko, 2012; Blanchard and Leigh, 2013). On the other hand, this kind of expenditure may increase costs in some manufacturing industries (Gray and Shadbegian, 1995; Morgenstern, Pizer, and Shih, 1997; Joshi, Krishnan and Lave, 2000), and in effect decrease economic activity.

The verification of the effects of public environmental protection expenditure is significant in the context of the discussion concerning the impact of fiscal policy on sustainable development. It shows, whether the increase in public spending, which have a positive effect on the environment, may also positively affect economic growth, which in turn is associated with economic and social development. As a result, it is verified in the paper, whether fiscal policy by means of public environmental protection expenditure may simultaneously reinforce three pillars of sustainable development, that is economic development, social development and environmental protection.

The macroeconomic effects of public expenditure is of particular importance in the context of the recent crisis in Europe¹. For this reason, the impact of the public environmental protection expenditure impact on GDP is analyzed in the paper. Empirical analysis is conducted for countries of Central Europe. Countries, which are selected for the analysis, are relatively homogeneous, what is highly important for the econometric estimation accuracy.

The paper is organized as follows. Firstly, theoretical model, which explains potential macroeconomic effects of public environmental protection expenditure is presented. Then, results of empirical research, based on econometric panel model are shown. The last paragraph of the paper concludes.

2. Theoretical model

The impact of public environmental protection expenditure on economic growth can be illustrated on the basis of a dynamic general equilibrium model². Environmental protection expenditure, as well

as other government spending (Turnovsky, 2000), affects the productivity of factors of production. Thus, if the production function is a power function we obtain:

$$Y_t = K_t^{\varepsilon_K} L_t^{\varepsilon_L} E_t^{\varepsilon_E}$$

where:

E_t – public environmental protection expenditure,

Y_t – output,

K_t – capital,

L_t – labour.

If production function has constant returns to scale, that is:

$$\varepsilon_K + \varepsilon_L + \varepsilon_E = 1$$

above production function can be written as:

$$Y_t = r_t K_t + w_t L_t + \varphi_t E_t$$

where :

r_t – marginal product of capital,

w_t – marginal product of labour,

φ_t – marginal product of public environmental protection expenditure,

$$r_t, w_t > 0.$$

Empirical studies indicate that government spending generally increases the productivity (see Linemann and Schabert, 2005), that is usually φ_t is higher than zero. However, in the case of public environmental protection expenditure the direction of public environmental protection expenditure on GDP is not so clear (Pearce and Palmer, 2001).

At the same time, public environmental protection expenditure has an influence not only on productivity but also on the level of households utility³. Taking this effect into account we obtain that households maximize the following expected value of the discounted sum of utilities:

$$U = E \left(\sum_{t=0}^{\infty} \beta^t u(C_t, L_t, E_t) \right)$$

where:

U – expected value of the discounted sum of utilities,

β – discount factor,

C_t – consumption.

In case of public environmental protection expenditure we have $\frac{\partial u_t}{\partial E_t} \geq 0$.

The public environmental protection expenditure impact on households utility can be described by the following utility function:

$$U = E \left(\sum_{t=0}^{\infty} \beta^t (C_t + \phi E_t)^{\alpha} L_t^{1-\alpha} \right)$$

¹ More about the role of sustainable development during crisis see Kossecki and Wachowicz, 2013; Lietaer et al., 2014.

² Dynamic general equilibrium models, which include public expenditures others than environmental protection

expenditures are described among others in Krajewski, 2014.

³ More about utility function in dynamic general equilibrium models see for example Dejong and Dave, 2007.

where:

$$\alpha \in (0,1), \phi \in (0,1) > .$$

The parameter ϕ determines the strength of the impact of public environmental protection expenditure on utility. This parameter is not lower than zero, similarly as in case of others kinds of government spending (Amano and Wirjanto, 1997).⁴

The overall impact of public environmental protection expenditure on households assets is described by the following expression:

$$S = -1 + \phi + \phi$$

On one hand, public environmental protection expenditure causes that economic resources are taken by the state from the private sector (this impact is shown by -1). On the other hand, public environmental protection expenditure provides following benefits to households:

- public environmental protection expenditure increase the utility of household consumption (the strength of this effect shows parameter ϕ),
- public environmental protection expenditure has impact on productivity (the strength of this effect shows parameter ϕ).

If S is lower than zero, public environmental protection expenditure has negative wealth effect (Barro, 1981). Otherwise it generates positive wealth effect.

Wealth effect, caused by an increase in public environmental protection expenditure, has an impact on GDP through two channels. Firstly, in a period of higher government spending demand increases. The change of aggregate demand is given by the formula:

$$\Delta AD_t = \Delta C_t + \Delta E_t$$

where:

AD_t – aggregate demand.

Under assumed utility function households take into account the level of effective consumption EC_t (Christiano and Eichenbaum, 1992), that is:

$$EC_t = C_t + \phi E_t$$

So we obtain:

$$\Delta AD_t = \Delta EC_t + (1 - \phi) \Delta E_t$$

Under constant interest rate households does not change decisions concerning the effective consumption and the amount of work (Aschauer, 1988), therefore:

$$\Delta AD_t = (1 - \phi) \Delta E_t$$

Thus, the change of aggregate demand, resulting from an increase in environmental protection expenditure, depends on parameter ϕ . On the other hand, an increase in aggregate supply, resulting from the growth of government spending, is given by the following formula (Aschauer, 1988):

$$\Delta AS_t = \phi \Delta E_t$$

where:

AS_t – aggregate supply.

Thus, public environmental protection expenditure increases aggregate supply if marginal product of this kind of expenditure is positive.

3. Empirical analysis

The empirical analysis of the impact of public environmental protection expenditure on GDP was carried out on the basis of panel model. This kind of econometric model is based on two-dimensional data, which includes both cross sectional and time dimension (Wooldridge, 2010).

All data comes from European Commission database Eurostat. According to Eurostat methodology public environmental protection expenditure includes all expenditures aimed at prevention, reduction and elimination of environment degradation and consist of the following domains:

- protection of air and climate;
- protection of biodiversity and landscape;
- protection and remediation of soil and water;
- waste management;
- wastewater management;
- noise and vibration abatement;
- protection against radiation;
- research and development concerning environment;
- other environmental protection activities⁵,

The empirical study covers Central European countries which have joined European Union since 2004 (so called new member states), that is the following countries: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Due to data availability the study covers period 2001-2012.

Firstly, before the results of panel model are described, the correlation analysis is presented and its limitations in the analysed case are discussed. Table 1 presents the correlations coefficients between the economic growth and public environmental protection expenditure for each country.

The obtained results may suggest that for most of the analyzed countries there is the inverse relationship between the economic growth and the level of public environmental protection expenditure. However, it should be stressed that in analyzed period two phenomena occurred simultaneously:

- the increase of the importance of environmental protection, resulting in higher public environmental protection expenditure;

⁴ However, it is worth noting that estimates of parameter ϕ are not homogenous (Ismail, 2010).

⁵ More about Eurostat methodology concerning environmental protection expenditure see <http://epp.eurostat.ec.europa.eu>.

- the economic crisis in the world, which led to a decline in GDP growth in the countries of Central Europe.

Table 1. Correlation coefficients between growth rate of GDP and public environmental protection expenditure in relation to GDP, source: own calculations based on Eurostat data.

Country	Correlation
Bulgaria	-0,65
Czech Republic	-0,17
Estonia	-0,19
Croatia	0,13
Latvia	-0,37
Lithuania	-0,53
Hungary	0,76
Poland	-0,37
Romania	-0,45
Slovenia	-0,51
Slovakia	-0,13

The scale of changes in the level of public environmental protection expenditure and economic growth in Central Europe show figures 1 and 2.

Figure 1. The average level of public environmental protection expenditure in Central Europe in years 2001-2012 (in % of GDP), source: own calculations based on Eurostat data.

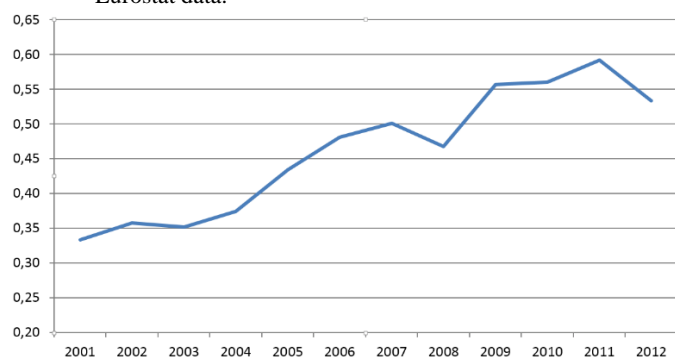
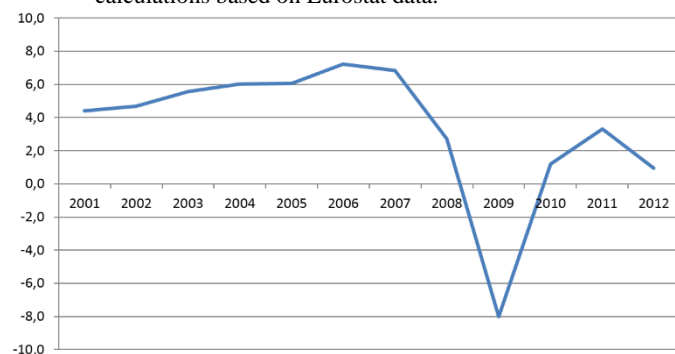


Figure 2. The average growth rate of GDP in Central Europe in years 2001-2012 (in %), source: own calculations based on Eurostat data.



Since a rapid decline in economic growth in 2009 resulted from the global crisis, not from domestic policy, the correlation analysis based only on time series may give misleading results. It means that such analysis show only spurious correlation, not real relationship between analyzed economic categories.

Therefore, in order to estimate the impact of public environmental protection expenditure on GDP the panel model was applied, which takes into account the diversity of the phenomena between countries. The average level of analyzed variables for each country is shown in figures 3 and 4.

There are relatively large differences between countries both in case of economic growth rate and public environmental protection expenditure. The advantage of panel model is that it takes this cross-sectional variability into account.

Including both time and cross-section dimension 132 observations were included in the analyzed panel (that is 12 time observations for each of 11 countries). The parameters of the following equation were estimated:

$$GDP_{t,k} = \alpha_0 + \alpha_1 \Delta EnvExp_{t-1,k} + \alpha_2 X_{t-1,k} + \xi_{t,k}$$

where:

$GDP_{t,k}$ – growth rate of GDP in country k in year t ,
 $\Delta EnvExp_{t,k}$ – first difference of public environmental protection expenditure in relation to GDP in country k in year t ,⁶

$X_{t,k}$ – vector of other exogenous variables,

$\xi_{t,k}$ – random factor,

$\alpha_0, \alpha_1, \alpha_2$ – parameters,

$t = 1, \dots, 12$ – time dimension (observations from 2001 to 2012),

$k = 1, \dots, 11$ – cross-sectional dimension (observations for: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia).

Public environmental protection expenditure is nonstationary variable (what can be observed on figure 2)⁷, so the first difference of this variable is applied.

The estimation of parameter α_1 is the most important in the context of this study. It shows the impact of increase in public environmental protection expenditure on economic growth rate in analyzed countries.

The estimate of parameter α_1 is equal 59,68 and t-student statistic shows that this parameter is statistically significant. The estimate of parameter α_1 higher than zero means that public environmental protection expenditure has positive impact on economic growth.

⁶ That is, expenditure's increase in time:

$$\Delta EnvExp_{t,k} = EnvExp_{t,k} - EnvExp_{t-1,k}$$

⁷ Nonstationarity was also formally verified by Im, Pesaran and Shin test (Im, Pesaran and Shin, 2003).

Figure 3. Environmental protection expenditure in countries of Central Europe (average for 2001-2012, in % of GDP), source: own calculations based on Eurostat data.

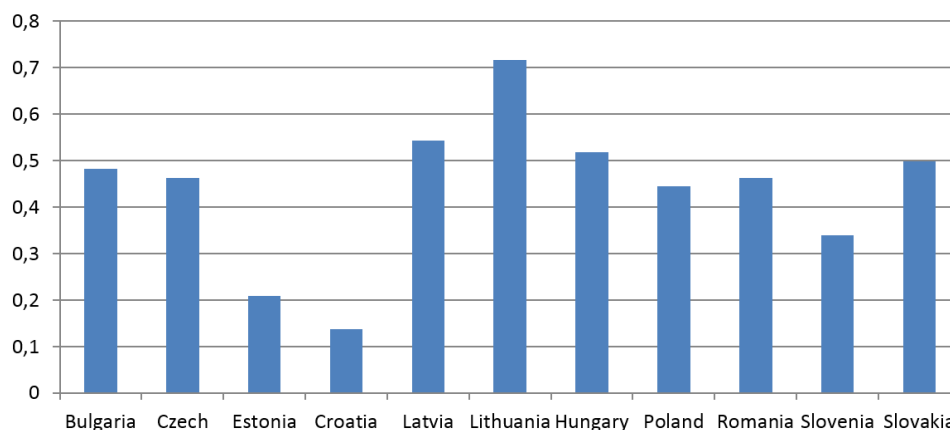
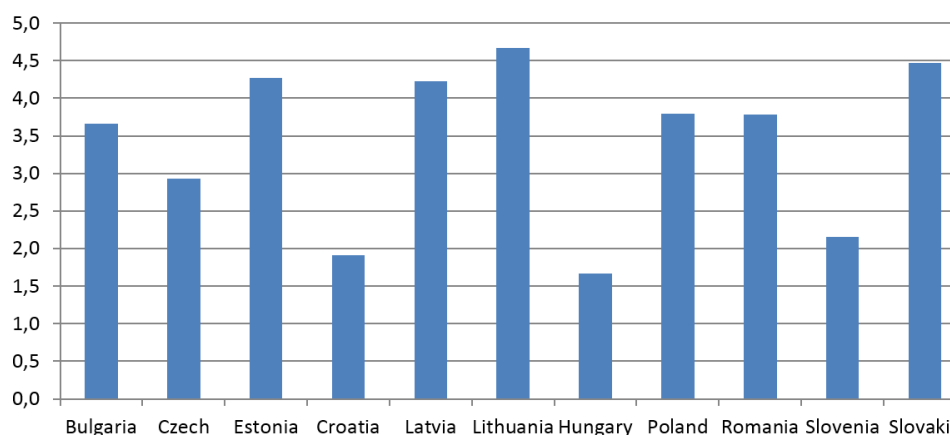


Figure 4. GDP growth rate in countries of Central Europe (average for 2001-2012, in %), source: own calculations based on Eurostat data.



In order to check the potential effects of the occurrence of time trend, the parameters of the following equation were also estimated:

$$GDP_{t,k} = \beta_0 + \beta_1 \Delta EnvExp_{t-1,k} + \beta_2 X_{t-1,k} + \beta_3 t + \zeta_{t,k}$$

where:

$\zeta_{t,k}$ – random factor,

$\beta_0, \beta_1, \beta_2, \beta_3$ – parameters,

$\beta_3 t$ – the effect of time trend.

Obtained results confirm that adding a time trend does not significantly change previous estimates. In particular, as before, it was obtained that an increase in public environmental protection expenditure has a positive impact on economic growth (the estimate of parameter β_1 is equal 66,23 and statistically significant).

Due to the fact that the analyzed period is heterogeneous, that is it covers both the period before the global economic crisis, and during its lifetime, calculations were also performed for two sub-periods. That is, the parameters of above equations were estimated for pre-crisis (till 2007) and crisis subperiod (since 2008).

Estimates of the parameters showing the impact of public environmental protection expenditure on GDP (i.e. α_1 and β_1) are much lower for the pre-crisis period, than after the outbreak of the financial crisis. For the model without time trend the parameter which measures the effects of public environmental protection expenditure increased from 19,55 before crises to 71,26 during crisis. For the model with time trend this parameter increased from 6,39 to 71,21 respectively. It means that during the global financial crisis the impact of public environmental protection expenditure on GDP was much stronger. The obtained results are consistent with the surveys for the overall level of public spending, which indicate that during the crisis fiscal policy is more effective (Baum and Koester, 2011; Eggertsson, 2011; Blanchard and Leigh, 2013).

4. Conclusions

The impact of public environmental protection expenditure on GDP in Central European countries was analyzed in the article. Eurostat methodology was applied, according to which public environ-

mental protection expenditure includes all expenditures aimed at prevention, reduction and elimination of environment.

Because, as shown in the paper, relying only on time series analysis may lead to misleading conclusions, econometric panel model was applied. This model takes into account both time and cross-sectional dimension.

The estimations, conducted for the years 2001-2012 for eleven countries of Central Europe, shows that the increase in public environmental protection expenditure has a positive effect on economic growth. The obtained results are stable regardless of the model specification, that is similar both for model without and with time trend.

Due to the fact that the analyzed period is heterogeneous, that is it covers both the period before the global economic crisis, and in the time of its duration, calculations were also performed for two sub-periods. Results show that public environmental protection expenditure much stronger affected GDP during global financial crisis. The obtained results are consistent with recent studies concerning fiscal policy, which indicate that effects of public expenditure is usually stronger during economic slowdown.

On the basis of the analysis it can be claimed that increasing public environmental protection expenditure brings not only positive results for environment but has also positive impact on economy.

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Impoverishment – The Threat for Sustainable Developments in Developing Countries

Ubóstwo – zagrożenie dla zrównoważonego rozwoju krajów rozwijających się

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Abstract

The Poverty may be a complicated and stereotypical drawback at both national and international levels. There are no bilaterally symmetrical measures known which would be suitable for worldwide application. However, every country takes specific initiatives to tackle poverty and international efforts go along with nation's efforts for up-rooting this crisis. Creating a compassionate International environment is a serious answer to the current drawbacks. This paper intends to review the poverty level as a threatening issue for sustainable development in top four international developing countries. Wiping-out poverty is a supreme international challenge which the world faces nowadays and there is an increasing demand for sustainable development, especially for developing countries. This paper strives to find out in what way impoverishment can have an adverse effect on the countries sustainable development, particularly in developing countries. This paper also aims to explain the cause of poverty, to chalk out a mechanism to wipe it out and to create opportunities for sustainable development.

Key words: developing countries, sustainable development, poverty, economy

Streszczenie

Ubóstwo jest skomplikowanym i często podlegającym stereotypowym wyobrażeniom problemem zarówno na poziomie danego kraju, jak i międzynarodowym. Nie ma dwustronnie symetrycznych narzędzi pomiarowych, które możliwe byłyby do zastosowania na poziomie globalnym. Zarazem każdy kraj podejmuje indywidualnie inicjatywy, wspierane przez organizacje międzynarodowe, aby wykorzenić ubóstwo i zażegnać kryzys. Uświadczenie istnienia problemu społeczności międzynarodowej to realna odpowiedź. W tej pracy dokonano oceny poziomu ubóstwa, traktowanego jako wyzwanie dla zrównoważonego rozwoju, w czterech największych krajach rozwijających się. Wymazanie ubóstwa z mapy świata to naczelne zadanie, przed którym obecnie staje świat. Oznacza to zarazem wzrost zainteresowania wdrażaniem zrównoważonego rozwoju, szczególnie ze strony krajów rozwijających się. Autorzy wskazują, w jaki sposób ubóstwo negatywnie wpływa na zrównoważony rozwój krajów rozwijających się. Ponadto, podjęto próbę wskazania przyczyn ubóstwa, dzięki czemu łatwiej będzie przygotować program naprawczy i stworzyć szansę na realne wdrażanie rozwoju zrównoważonego.

Słowa kluczowe: kraje rozwijające się, rozwój zrównoważony, ubóstwo, ekonomia

Introduction

Sustainable development in a materially backward economy emphasizes the creation of sustainable progress in the quality of life through increases in real income *per capita*, improvement in literacy, health, and enhancement in the quality of natural resources. It implies the socio-economic development of rural areas which does not decrease over time. Sustainable development is a rural development in a long-term perspective. It describes a process of development of a natural resource which is the basis for rural areas. The emphasis is put on the hitherto unappreciated role of rural environmental quality and environmental inputs in the process of raising real income and the quality of life. Materially backward economy is prevalent in the rural environment (Jhingan, 2006). Sustainable development is an equitable development where the income of all people increases and, as a result, provides an impulse for the economy which helps to *drag people* out of endemic poverty (Joshi, 2008).

20% of the world's population is afflicted by poverty. Impoverishment is not merely a state of existence; it is a complex phenomenon with several dimensions. Sometimes it is characterized by deprivation, vulnerability (high risk and low capability to cope with it), and impotency (Ravallion, 1996). These characteristics damage people's sense of well-being. Impoverishment is often long-lasting or transient. Transient impoverishment, if acute, will pass onto succeeding generations. In order to mitigate poverty, the poor try implementing all kinds of solutions. To grasp this phenomenon, it is essential to look at the economic and social context, along with establishments of the state, markets, communities, and households (families). Its variations cut across gender, ethnicity, age, residence (rural versus urban), and financial gain. In households, youngsters and girls typically suffer to a greater degree than men. Within a community, ethnic or religious minorities suffer more than the majority, whereas the poor in rural areas suffer more than the poor in cities; among the agricultural poor, landless wage workers suffer more than small landowners or occupants. These kinds of variations among the poor are extremely common. Many countries are struggling with poverty, rapid population growth and migration, replacement of subsistence by a market economy, and huge environmental influences. Many developing countries face a rapid decline of traditional systems of values. A major challenge is the need to enlarge, strengthen, and empower a stable civil society that will build the trust and public self-confidence which enables participatory governance. According to a survey conducted by Bloomberg, the world is pre-empted to increase GDP to 3.2 % in 2015 and 3.7 % in the following year, after extendible 3.3 % in each of the past two years. It is expected that China, the Philippines, Kenya, India and Indonesia, which accumulate 16%

of world gross domestic product, will produce more than 5% in 2015. The main focus of this paper includes such issues as the impoverishment level, sustainability and suitable mechanism for the sustainable development of those top five fast-developing countries.

1. Related work

Poverty is recognized as a threat for the developing countries; nevertheless, its assessment continues to be conducted completely in terms of financial gain (or expenditure). Poverty is a part of life. As a result, people born in a family in which parents have low-income become adults with a similarly low income. Low income is related to alternative indicators of deprivation, such as low levels of accomplishment and lifespan. Indeed, in recent decades, the increase of home income has been observed in several East Asian countries. Improvements in the financial condition are identical in these countries; however, there are variations in the improvement of welfare and human development, even though the countries are at a similar financial gain levels. Similarly, the development outcomes varied in the different areas and populations within a country (Alkire, Foster, Seth, Santos, Roche, Ballon, 2015).

Poverty reduction has been a major goal of development policy in the Republic of India. Therefore, the accomplishment of a minimum level of living for all Indians is the specific objective of all socio-economic endeavors initiated as part of numerous 5-year plans. The increase is hoped to be achieved by attaining improved buying power of the poor with an endowment of land and non-land assets and by generating employment opportunities, (Radhakrishna, Ray, 2004).

The incidence of poverty is governed by two factors, namely: average income and distribution. Reduction of poverty occurs rapidly when average income rises and inequality falls. While the poor have benefited from both growth and distribution effects in India over a period of last four decades, most of the poverty reduction has been driven by economic growth (Revallion, 2001). Agricultural growth has strong linkages to other economic sectors, most obviously to agro-processing and food marketing as well as to the demand for intermediate inputs and services. However, agricultural growth also has much broader linkages or multipliers and allows poor countries to diversify their economies to sectors where growth may be faster and where labour productivity and wages are typically higher. Creating jobs and livelihoods outside agriculture is vital to both rural and urban areas and to poverty reduction in general. Policy methods have to be compelled to specialize in the acquisition variables that have an effect on market development, community wealth, infrastructure, house quality distribution, and also on the affordability and appropriateness of natural resources conservation technologies (Reardon, Vosti, 1995).

2. China

Poverty in China refers to the state of relative or absolute material deprivation that affects hundreds of millions of people, particularly those living in rural areas. Since the beginning of far-reaching economic reforms in the late 1970s, growth has fuelled a remarkable increase in income *per capita* and a decline in the poverty rate from 85% in 1981 to 33.1% in 2008 (poverty being measured as the number of people living on < \$1.25/day) (Shah, 2010). The poverty rate in China fell from 26% in 2007 to 7% by 2012, according to a different measure produced by government (Kravtsov, 2013).

Figure 1 illustrates the poverty trend in China. China population is 1357 million (World Bank, United States Census Bureau, 2013). Out of that total population, 11.38% (362 Million) people earn less than \$ 2 a day. 36.5 % (486 million) of the total population lives for less than \$2 a day. Likewise, half of the total population of China i.e. 772 million people (58%), earn less than \$4 a day. One third of the total population is lives for less than \$5 a day.

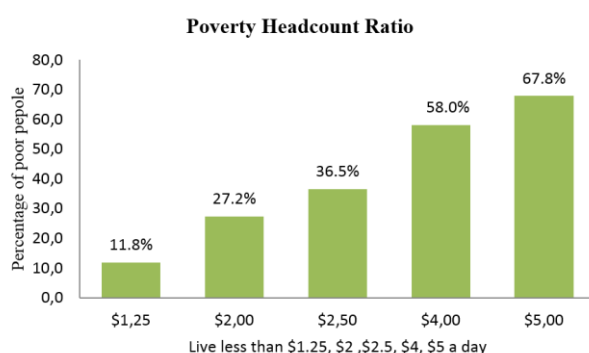


Figure 1. Poverty headcount Ratio, source: World Bank report, 2009

1.1. Hurdles to chain's development

Most regions of China are still in mid- and even the early stage of industrialization and urbanization. A large share of Chinese population lives in poverty, according to the country's new rural poverty line established in 2011 (rural residents' per capita annual net income is 2,300 yuan). Most of these people live in the regions with harsh natural conditions, making the alleviation of poverty extremely difficult. Due to the huge population base and the force of inertia, China's total population will continue to grow over a fairly long period of time. Meantime, the structural contradictions of China's labour supply and demand remain very severe with huge pressures on reemployment, employment of youth, and job creation during rural labour force movements. Moreover, the proportion of aging population is rising rapidly, enabling China to be the only country with over 100 million senior citizens. China's social security system, with universal coverage, has just been established; however, at a low level compared with other major developing countries.

2.2. Strategies for China's sustainable development

- Efforts should be made in order to conduct a restructure of economic policies.
- The initiative should be taken to control the total population and improve its quality.
- Necessary efforts should be made to draw special attention to the policies which support the poor population and comprehensively promote poverty alleviation.
- Steps should be taken to construct a resource-saving and environmentally-friendly society.
- Sustainable development and possibilities of its implementation should be improved and guaranteed by promoting them continuously.

3. Philippines

Poverty remains a critical social problem that needs to be solved. Philippines' poverty line is marked by a *per capita* income of 16,841 pesos a year. (Dela-Cruz, 2009). According to the available data from the National Statistical Coordination Board, more than one-quarter (27.9%) of the population fell below the poverty line in the first semester of 2012, which constitutes approximately a 1 percent increase since 2009. This figure is slightly lower as compared to the 33.1% in 1991 (Virola, 2009).

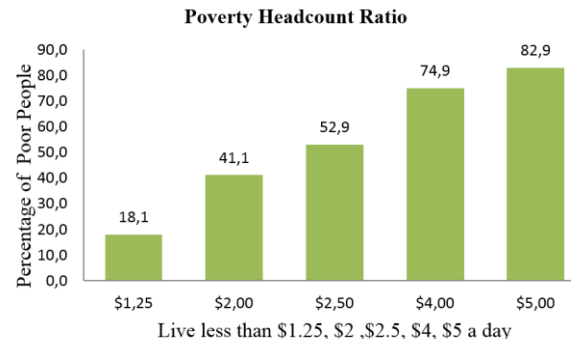


Figure 2. Poverty headcount Ratio, source: World Bank report, 2009

Many of the poor in the Philippines live in rural areas and work in agricultural fields; mostly they are farmers or fishermen. In recent years, the level of poverty in urban areas has increased. Migrants without employment or with low-paying jobs are unable to obtain enough money to build houses. The reason is following: Philippine cities have high proportions of informal settlers who are among the poorest people in the country. Furthermore, poverty is harsh in the parts of the country where conflicts occur at a frequent rate. The poor in the Philippines have a joint family system which comprises six or more members, with young age and old age dependents being the most numerous. In most of the poor families, heads of the families have only elementary education

or lower. These types of poor families hardly have any access to electricity, water and toilet facilities, and also have no assets for their families. They also have a limited access to health and education facilities. Among the citizens of Philippines, the poor people are the most affected by financial and natural disasters. Although they take much effort to solve these issues, their low income results in a further deterioration of their situation.

3.1. Hurdles to Philippines's development

In the Philippines, the key challenges to end extreme impoverishment pertain to country's development such as weak governance, scarcity of business enterprise, persistent corruption, elite capture and state capture, inadequate education and health services, the persistence of armed conflicts within the southern island of Mindanao, inadequate natural resources management and increased frequency, as well as intensity of natural disasters. The country's long history of policy distortions has led to patterns of growth that did not offer smart jobs to the bulk of Filipinos. Cities within the Philippines have not been prepared to keep up with the excessive growth of urban population, as proven in infrastructure and housing deficiencies, tied up with environmental pollution. The reluctance of non-public sector to speculate and build additional and higher quality jobs reflects the country's weak investment climate for companies of all sizes.

3.2. Strategies for Philippines's sustainable development

- The government of the Philippines must provide direct help to the poorest through social protection programs. The poorest families would benefit from a conditional money transfer program.
- The government should provide vaccinations for children and join them at school. In order to fund and implement this universal health program and improve the access to basic education, the government of the Philippines should go for fast revenue assortment, public expenditure management and effective native governance.
- The government of the Philippines must acknowledge that ending extreme impoverishment requires the ways and programs geared toward sustaining an inclusive, resilient growth.
- Philippines government must address the binding constraints in order to increase growth by: raising the standard of policies, rules and their implementation; strengthening the rule-of-law and anti-corruption measures; improving the performance of business enterprise; and promoting the human capability development.

- Efforts must be taken to assist the second-tier cities outside of Manila railway system to make them effective engines of growth in their localities and close areas.
- The government should develop peace and stability in conflict-affected areas of Mindanao, which is inhabited by many poor people.
- The government should enhance the environmental resilience through programs that mitigate the impact of natural disasters, therefore minimizing the impact on the poor.
- The government should implement programs that improve access to quality education and health services.
- Finally, through humanitarian help, add disaster- and conflict-affected areas, the government must take efforts to revive an immediate access to basic services for the poor.

4. Kenya

Kenya is a country of many differences, from its landscape to demographics, and, therefore, a lot of social and economic inequalities. Kenya is also one of the most unequal countries within the sub-region. 42% of its population, i.e. 38.3 million, live below the level of poverty. The access to basic quality services like healthcare, education, fresh water and hygiene, is usually a luxury for many individuals. Giant segments of the population, together with the growing number of poor people living in urban areas, are extremely prone to the environmental conditions, as well as economic and social shockwaves. As such, the progress on the *Millennium Development Goals*, particularly with reference to social insurance, is mixed. On another front, Kenya continues to face humanitarian challenges, in particular the presence of over 500,000 immigrants from Somalia and 30,000 new ones coming from South Sudan. In June 2011, Kenya faced formidable hurdles with the Horn of continent drought that left 3.75 million Kenyans and 150,000 refugees, principally from Somalia, in need of humanitarian help.

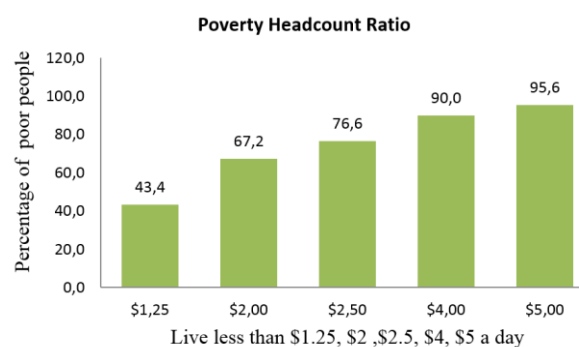


Figure 3. Poverty headcount Ratio, source: World Bank Poverty and Inequality Statistics, April 2015

Figure 3 shows the Poverty headcount ratio at the national poverty line (% of the population) in Kenya. The total population of Kenya is 38.3 Million. Among the total population, 43.4% Kenyans live for less than \$1.25 per day. 67.2 % of the Kenyan population lives for less than \$2.00 a day, at 2005 international prices. In comparison to the international rates, 95.6% of total Kenya population lives for less than \$5 a day.

4.1. Hurdles to Kenya's development

The reasons for Kenya's underdevelopment are normally identified as the lack of sufficient capital, technology and skilled manpower to allow for a sustained economic growth and development (Ochieng, Maxon, 1992). Since then, the Kenya's population expanded six-fold, thus turning the resource-rich country into a resource-poor one. The Kenyan political conflict is not concerned with alternative political programmes that could address the long-standing grievances of the bulk over landlessness, low wages, joblessness, lack of shelter, inadequate earnings, homelessness, etc. Because the country did not sustain its economic process over the past decades, it simultaneously did not complete its demographic transition from high birth and mortality rates to low ones.

Local primary industries, that entirely depend on the local resources and other people can take away most of their wealth and invest it outside the country, rather than reinvest it within the region. This is often the case with the mineral industries, where investors enjoy tax benefits and waivers and at the same time invest the wealth in other countries.

4.2. Strategies for Kenya's sustainable development

- The government should develop pro-poor policies that would aim to provide social assistance and other support to the poor and people living in rural areas; then, Kenya can fairly quickly enjoy a massive reduction of poverty by boosting its economy and reducing inequality.
- More recently, those holding to this view have pointed to the need to eliminate corruption and to stimulate the private sector of economy as additional factors that would facilitate and accelerate development.
- The government has to concentrate on increasing the amount of capital from agricultural expansion and foreign investment, starting with industrialization, importing technologies from developed world, and at the same time by drastically increasing the pool of manpower.
- The government should frame the policy to stimulate the wealth accumulation of people in the home country itself.

- Poverty and birth measures should be directly connected. A poor family has four to six children per household on average. The employing an awareness programme should be considered in order to control the population growth.
- The government should be at the forefront of plummeting poverty and encoding economic progress and development. Sadly, this is often not the case in Kenya. The government leads in the respect of having the highest wages, funded by the poor taxpayers, whereas the initiation of development projects is lagging behind.

5. India

The Economy of India is the seventh-largest in the world by nominal GDP and the third-largest by purchasing power parity (PPP). Indian economy is a developing one, with approximately 7% average growth rate for the last two decades. The World Bank and institutions of the United Nations use a broader definition for the comparison of poverty amongst nations, including India, which is based on purchasing power parity, as well as nominal relative basis (Chandy, Gertz, 2011). Each state in India has its own poverty threshold to determine how many people are below its poverty line and to reflect the regional economic conditions.

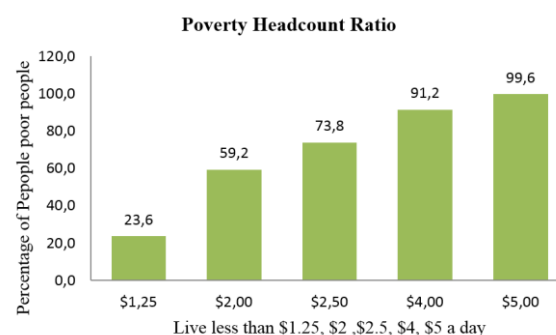


Figure 4. Poverty headcount Ratio, source: World Bank Poverty and Inequality Statistics, April 2015

Nearly 300 million people still live in extreme poverty in India and face deprivation in terms of the access to basic facilities, including education, medical, water, hygiene and electricity. The total population of India is 1252 million (World Bank, United States Census Bureau, 2013). Out of the total population, 23.6%, i.e. 288.41 million people, live under the poverty line with the income of \$1.25 a day. 59.2% of all people in India fall below the international poverty line of US\$ 2 per day. The number of poor is now estimated as 288 million, 200 million of which reside in rural India. Approximately 1158.13 out of 1252 million people, live under the income of

\$ 5 per day which shows the country's high poverty rate.

5.1. Hurdles to India's development

Unemployment and underemployment are major problems for India's sustainable development. Underemployment refers to a situation where the employment is insufficient in some important way for the worker, relative to a standard (Feldman, 1996). Unemployment Rate in India is reported by the Ministry of Labour and Employment and amounts to 4.9%. Citizens of India either own no land at all or lack the legal rights to own land and property. The lack of land ownership is a major limitation to the Indian economic growth and hinders the country's ability to develop and compete in the international sphere. A higher degree of population created a great demand for land and so agricultural land is used for the residential purpose which, in turn, affects the sustainable development of India. The caste prejudices still plague the society and even become influential factors at the time of elections. Politicians inspire and exploit these attitudes for their own benefits. Discernment of lower castes is widely prevalent and has kept a large percentage of our population backward. In this way, the development of India has been hampered.

5.2. Strategies for India's sustainable development

- The government should create the plan to ensure adequate nutrition and dietary improvement for the poor.
- The government should allocate minimum portion of budgetary expenditure for the pro-poor growth sectors as a share of GDP and of total government expenditure.
- Nominal percentage of poor covered by micro-credit and similar programmes should be introduced in order to reduce income/consumption inequality.
- New projects must be undertaken by the government to reduce the rate of growth of employment.
- The state and central government should take combined effort on social services, including education, public health care, family well-being, water supply and hygiene, welfare of scheduled castes, scheduled Tribes and different backward categories, labour and labour welfare, social security, nutrition, and relief for natural calamities, etc.

Conclusion

In developing countries like China, Philippines, Kenya and India, impoverishment is the main problem for sustainable development. It is caused by a huge population of these countries. In these

countries, children and adults are vulnerable to malnutrition because of poor diet, infectious diseases, lack of appropriate care and inequitable distribution of food within the household. Sustainable development is a vision, a way of thinking and acting; so that we can secure the resources and environment for our future generations. It will not be brought about by more policies. It must be taken up by society at large as a principle guiding the many choices each citizen makes on a daily basis, as well as the immense political and economic decisions that affect many people. Ultimately, the vision will become a reality only if everybody contributes to a nation where financial freedom, social justice and environmental protection go hand in hand, creating space for future generations and allowing them to live more contented than at present.

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Sustainable Urban Drainage Infrastructure

Zrównoważona infrastruktura odwadniania miast

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Abstract

Water is one of the most important resources, essential for all life forms. From the perspective of sustainable development there are three important challenges: water availability, water purity, and infrastructure, especially in cities. In this last case the problem is not only with water supply, but also with water runoff. Conventional pipe and curb systems, with their efficient ability to convey runoff rapidly to receiving waters, do not take into consideration these effects and new approaches have been developed in recent years to address these concerns. There is a growing trend towards managing water in a more sustainable way by activating its natural behaviors and process in the urban environment. Control and management near the source is now being promoted intensively and it is viewed in many countries as comprising an appropriate suite of techniques facilitating the similarity of natural processes and minimizing the hydrologic impacts. Such solutions rely on local treatment, retention, re-use, infiltration and conveyance of water runoff in urban areas and thus are in better agreement with sustainable development programme. The paper presents discussion about perspective development of urban drainage systems and a case study of successful implementation of decentralized stormwater system in Augustenborg (Malmö).

Key words: water runoff, stormwater, drainage infrastructure, sustainable development

Streszczenie

Woda stanowi jeden z najważniejszych zasobów, kluczowy dla wszystkich form życia. Z perspektywy rozwoju zrównoważonego występują trzy problemy: dostępność wody, czystość wody i infrastruktura, szczególnie w miastach. W tym ostatnim przypadku wyzwaniem będzie nie tylko pozyskanie wody, ale także jej odpływ. Tradycyjne systemy odwodnienia umożliwiają szybkie odprowadzenie ścieków opadowych do odbiorników rzecznych, nie uwzględniając negatywnego oddziaływania w zakresie jakości wód, co było powodem opracowania nowego podejścia. W ostatnich latach obserwowany jest trend do gospodarowania wodami w bardziej zrównoważony sposób, poprzez odtwarzanie warunków naturalnych w środowisku miejskim. Koncepcja zagospodarowania wód deszczowych u źródła ich opadu jest obecnie promowana w wielu krajach poprzez stosowanie rozwiązań technicznych, ułatwiających zachowanie naturalnych procesów hydrologicznych i minimalizowanie negatywnych oddziaływań ilościowych i jakościowych. Do tych rozwiązań należy zaliczyć lokalne oczyszczanie ścieków, retencję, gospodarcze wykorzystanie wód, infiltrację oraz transport powierzchniowy wód opadowych. Wdrożenie koncepcji zrównoważonego rozwoju wymaga zaangażowania lokalnej społeczności oraz władz samorządowych. W artykule omówiono przyszłe kierunki rozwoju infrastruktury odwodnienia miast oraz zaprezentowano przykład udanej implementacji koncepcji ich zrównoważonego rozwoju w dzielnicy Augustenborg (Malmö).

Słowa kluczowe: odpływ wody, woda deszczowa, infrastruktura odwadniająca, zrównoważony rozwój

Introduction

No life form can last without water, so this resource plays vital role in our biosphere. From the perspective of sustainable development there are three main challenges connected with water:

The first one is availability. A typical American household is using about 300 liters of water per day. Significant savings are possible, of course, but how do we transfer this to countries, where millions of people have no access to clean water – this makes over a billion people in the world.

The second is water purity. There are many places, where water is available, however is heavily polluted.

The third one is infrastructure connected with water supply and water run-off.

Generally speaking the amount of water available for people is shrinking. The excessive depletion of water is visible in China. In terms of ecology, it should be pointed out that, although the Chinese constitute 20% of the global population, they only have access to 7% of the world's water supply. In the municipalities water management in China is also problematic. For instance, in the very rapidly developing city of Shijiazhuang, characterized by excellent financial results, and inhabited by 2 million people, two-thirds of the groundwater resources have been exhausted. The high quality of the life of the residents of such cities as Shijiazhuang may soon suffer a sudden breakdown. After all, no human settlement can function without a water supply, least of all a two million person agglomeration.

In areas where water availability is higher, there are problems with water pollution, especially in big cities. Low quality of water leaving any town through urban surface water runoff systems means pollution of the environment and have a negative impact on human health, so is affecting basic issues of sustainable development. That's why this paper is concentrated on the problems connected with management of urban runoff water.

The use of combined sewage systems began to die out in the early 20th century, primarily because as cities expanded it became too expensive to construct infrastructure to transport mixed foul and *clean* runoff to wastewater treatment plants on the edge of the city. However, in older urban areas these systems are still used and cause problems with combined sewer overflows discharges. Traditional civil engineering solutions have a number of harmful effects:

- runoff from impervious areas increase the risk of flooding downstream and cause sudden rises in water levels and flow rates in rivers and streams;
- surface water runoff can contain contaminants such as oil, organic matter, pathogens and toxic metals. Although often at low concentrations, cumulatively they can result in poor water quality in rivers and groundwater, affecting biodiversity, amenity value.
- by diverting runoff to piped systems, the amount of water infiltrating the ground is reduced, depleting ground water and reducing flows in watercourses in dry weather.

Although combined sewer systems are replaced by separate systems, the problem of polluted runoff doesn't disappear. Stormwater runoff is the source of contaminants, which can lead to significant pollution of rivers, lakes, estuaries and ground waters (Braune

and Wood, 1999). Urban surface water runoff carries not only contaminants such as metals and hydrocarbons but also nutrients and sediments, pathogens and debris (D'Arcy et al., 1998; Miltner et al., 2004). Specially negative is the first flush phenomenon – it means high concentration of pollutants in relatively small volume in the beginning of runoff (Mrowiec, 2010). Steedman (1988) states that the typical result of the effect of urban surface water runoff is that the quality of any given stream is negatively correlated with the degree of urbanisation in its surrounding catchment. Urban expansion in the last decades overload the ageing drainage infrastructure (Jones and Macdonald, 2007). Traditional urban drainage systems are designed to dispose of surface water runoff as quickly as possible from the point at which it has fallen to a discharge point. This concept for runoff water in urban areas results in construction of large diameter sewers, huge storage reservoirs in downstream locations and centralised sewage treatment facilities (Butler and Davies, 2000, Villarreal et al. 2004).

Last decades bring a new approach to design and development of drainage systems aims towards maintaining or restoring a more natural hydrological regime. There has been rapid growth in the use of terms such as low impact development (LID) (Department of Environmental Resources, 1999), sustainable urban drainage systems (SUDS) (CIRIA, 2000), water sensitive urban design (WSUD) (Wong, 2007), best management practices (BMPs) and alternative techniques (Fletcher et al., 2015; Mrowiec, 2006). These terms are adopted to represent actions and practices that are used for a given set of conditions to manage the quantity and improve the quality of stormwater runoff in the most cost-effective manner. It means, that new approach should slow down the rate of flow through various controls as close to the source as possible, thereby promoting infiltration, the collection of solids through sedimentation, the uptake of nutrients and the reduction of contaminants through vegetation uptake and bacterial action (Scholz, 2006; Zawilski et al., 2014). In the beginning SUDS were implemented as single purpose facilities however this has now evolved into more integrated systems which serve a variety of purposes, including habitat and amenity enhancement (Fletcher et al., 2013). They are therefore designed with three objectives in mind (Backstrom et al. 2002):

- to control the quantity and influence timing of runoff from a development;
- to improve the quality of the runoff;
- to enhance the nature conservation, landscape and amenity value of the site and its surroundings.

For newly developed sites the possibilities to integrate of drainage facilities to the landscape and buildings is significantly easier than for existing

sites. On the planning stage some quantity impacts can be reduced through minimal disturbance techniques that include the following:

- reduce paving and compaction of permeable soils,
- siting building layout, clearing and grading to avoid removal of existing trees,
- minimizing imperviousness by reducing the total area of paved surfaces,
- disconnecting as much impervious area as possible to reduce runoff,
- maintaining existing topography and associated drainage flow paths,
- if possible lengthen flow paths, flatten site and lot slopes, maximize overland sheet flow and use of open swale systems,
- minimizing the influence of the equipment construction and material storage areas during building phase.

Sustainable approach to the stormwater management have the general advantage over conventional systems (Butler and Davies, 2000):

- a greater ability to attenuate flows and re-establish flow conditions similar to those prior to development,
- the pollutants remain distributed across the catchment rather than accumulating at single location,
- lower capital cost and, in many instances, maintenance costs,
- provision of aesthetically pleasing landscaping features within urban catchment.

The concept of sustainable development of urban drainage systems

Water Sensitive Urban Design (WSUD) is a much more global term used to describe an approach to planning and designing towns and cities through integrated and sustainable approaches to water management. It looks at the water cycle as a whole and how urban environments can best be developed to bring about healthy ecosystems by integrating the whole water cycle. General concept is as follows: urban water should be managed as close to the source as possible to restore small-scale water systems. WSUD can improve public awareness for stormwater by making stormwater visible in the design of public and private open spaces in the city. Decentralised stormwater management measures can improve not only the visual aesthetics but also the quality of life in a city. Green spaces and water are key factors for the quality of life in cities. Design of stormwater solutions should be adapted to the surrounding area (buildings, infrastructure, landscapes). It is therefore always necessary to consider conditions at the site, including topography, ground permeability, groundwater table levels, and water quality among other issues. The final choice is dependent on the primary

use (infiltration, retention, usage), the available space, and the topography of the surrounding area (Hoyer et al., 2011).

The conditions for stormwater systems in cities may change in the future. Significant reason is climate changes (increased frequency of high rainfall events, more dry periods). Many researchers have reported in their studies that the expected increase in design intensities due to climate change can reach 20%-80%, depending on the region (Willems et al., 2012). Another is the effect of demographic changes (population growth or reduction). For these reasons, water sensitive techniques should be developed, like any other urban infrastructure or architectural solution, to be flexible for future conditions, such as extreme weather events or future demographic and economic situations.

It is beyond the scope of this paper to describe all technical solutions that can be used to control the water-quality aspects of urban stormwater runoff but the selected ones are primary and represent the predominant removal mechanisms: bioretention, dry wells, infiltration trenches. Design of each type of facilities require careful analysis of many factors according to general scheme showed on figure 1. For existing built-up areas specially important is to fit the proper facility to the site conditions. Some devices constrains are difficult to meet in densely areas i.e.: minimal distance of infiltration trenches from buildings is recommended to 3,0 m; minimal infiltration rate of soil for bioretention purpose is $2 \cdot 10^{-6}$ m/s, minimal longitudinal slope for swale is 1% etc. The integration of these facilities into the landscape throughout the site offers more opportunities to mimic the natural hydrologic functions, and add aesthetic value. Small distributed systems offers also a major technical advantage: one or more of the systems can fail without undermining the overall integrity of the site flow control. Infiltration and retention of stormwater typically requires a large area and space in a city is often hard to come by. The best part of WSUD as a tool for stormwater management is that a wide array of solutions when appropriately designed can easily complement any recreational or natural environment.

Decentralised stormwater management measures rely heavily on maintenance and upkeep to guarantee performance. Maintenance is often not taken into account or is carelessly facilitated. Inadequate maintenance, on green roofs or bioretention ponds for example, not only affects performance but significantly detracts from the aesthetic value of the installation (Burszta-Adamiak, 2012).

Water Sensitive Urban Design integrates fields such as water management, urban planning, urban design and landscape architecture. This approach can be successfully implemented by a team consisting of civil engineers, urban planners, architects, urban designers, landscape architects and also the local authorities. Cooperation should take place as early as

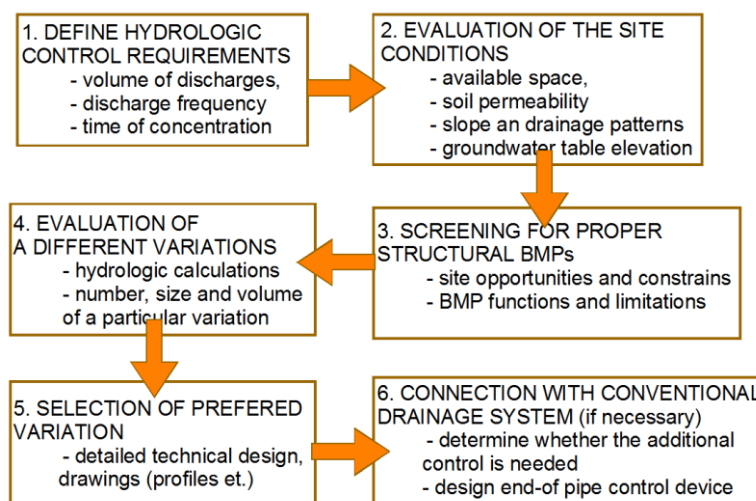


Figure 1. Scheme of selection and design infiltration/retention facility (Mrowiec, 2003)

possible in the planning and design process. The earlier cooperation takes place, the better the different demands can be coordinated and included in the final project.

Rather than technical issues, acceptance is often problem in the implementation of a WSUD concept, because it is relatively new and not fully understood by community. It is important to consider the demands of all stakeholders and involve them in the planning process. It is often necessary to involve residents, owners and users in the planning process – so acceptance and appropriate use and care of urban spaces can be sustained. The design process should be preceded to promote a better understanding of decentralized stormwater management. Exposure of examples of successful implementation can lead to broader acceptance and even generate enthusiasm for sustainable stormwater management. It is good idea to make comparison between conventional solutions and decentralized system using Life Cycle Assessment (LCA).

The most effective way to maintain clean surface waters is to eliminate the sources of pollution, not to remove pollution once it has gotten into the system. Thus, educational and institutional practices that result in behavioral changes which reduce the amount of pollutants entering to the stormwater system (i.e. disconnect illicit wastewater connections, control accidental spills, and enforce violations of ordinances designed to water protection) are crucial during implementation of decentralized systems. Education of the public to modify behaviour that contributes to prevent pollutant deposition on urban landscapes and its uncontrolled transport to receiving waters. The changes in activities, behaviours and attitudes of people are very difficult to achieve and require sustained efforts on the part of those attempting to implement them (Debo and Reese, 2002). The main advantage is that nonstructural practices are less expensive than structural ones, although it's very hard to measure their efficiency.

SUDS implementation – case study

Augustenborg is a highly populated inner-city suburb in Malmö, it covers over 32 hectares and was built in the 1950s. The buildings are 3÷4 stories high, situated close together, as well as 1÷2 stories. There are about 1900 apartments in the area, as well as various industrial buildings. Stormwater from the area was originally drained via a combined sewer system (pipe diameters between 225 and 750 mm). During intensive rain storms, flooding in basements and garages occurred causing material damage. In an effort to solve those problems, it was proposed that Augustenborg will be disconnected from the existing combined sewer and drained by means of an open stormwater system.

The new drainage system consists of a complex arrangement of different facilities and has been operational since 2002. Stormwater is conveyed through a complex arrangement of green-roofs, swales, shallow channels (400÷700 mm deep), ponds and wetlands. The modeling research made by Villareal (2004) found that the system is likely to be able to handle runoff volumes locally for all the return periods (up to 10 years) considered, as well as considerably attenuate peak flows. Results showed that the total annual runoff volume is reduced by about 25% compared to the conventional system.

The approach used in the city of Malmö, illustrates cooperation among stormwater management agencies (Stahre, 2006). Previously, stormwater was the responsibility of the city's drainage department. However, this new approach leads to more interaction among the different city's departments. A policy was written for the concept of sustainable development of stormwater systems. The policy's main objective is to obtain a common reference point and consensus among the city's departments on the concept of sustainable stormwater management. The policy document is kept fairly general and does not

include precise design guidelines for technical solutions (technical issues are left to the engineers). Two departments – Water and Wastewater and Park and City Environment – are the most involved in the implementation of the concept of WSUD. The experts from each department work together on water facilities – new devices are planned, designed, and financed jointly.



Figure 2. Stormwater system in Augustenborg: a) wet pond located between block of flats, b) dry retention basin, c) open natural channel (Photos: M. Mrowiec)

The development of a typical stormwater project in the city of Malmö has the following steps:

- general conception – common vision must be actively developed by departments,
- planning – the vision elaborated must be involved in the planning process as early as possible,

- additional partners – developers are typically interested in being involved,
- public promotion – public outreach is important for acceptance,
- Design stage – design process is based on the multiple purposes defined in previous stages (documentation must fulfill all legal requirements),
- financing – costs are shared among the involved parties according to their benefits (analysis contains investment and operational phases),
- realization – before construction phase, the maintenance responsibilities must be decided.

The experience of Malmö shows that the difficulties due to sustainable development of urban drainage systems are not technical. The major problems arising in the implementation are more institutional and are connected with cooperation among different departments of the city administration. It took several years for the City of Malmö to break the barriers among the departments to plan and implement jointly owned and operated water facilities. In addition, the new and difficult element in sustainable stormwater projects is the integrated approach where hydraulic criteria are combined with ecology, biology, and aesthetics considerations.

Conclusions

Sustainable development concept applied to urban drainage systems offers flow control and pollution removal, as well as secondary benefits of water quality and ecology improvements. Moreover, in being effective in terms of performance, they also can be cost-effective in terms of investment and maintenance, when compared with conventional systems. Sustainable development of drainage infrastructure means a mix of both high and low technical solutions to find a balance between investment cost and performance efficiency.

The example of Augustenborg shows that decentralized stormwater system can be implemented even in existing districts, developed over 50 years ago. For newly developed areas it should be treated as standard (not as *alternative*) approach to drainage systems. Practically it requires:

- a) cooperation and engagement of many institutions (departments) and
- b) information campaign aimed to local community, to be successful project.

Even if source control measures for urban drainage are gaining popularity in many countries, there are still many uncertainties attached to them in a widespread use. The perceived research needs are: performance indicators to qualify the sustainability of such systems in socio-economic, environmental and technical terms and development of more general efficiency criteria for source controls evaluation.

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Global Warming and the Irrelevance of Science Globalne ocieplenie i zbyteczność nauki

*Text of lecture delivered on August 20, 2015
to the 48th Session:
Erice International Seminars
on Planetary Emergencies*

In many fields, governments have a monopoly on the support of scientific research. Ideally, they support the science because they believe objective research to be valuable.

Unfortunately, as anticipated by Eisenhower in his farewell speech from January 17, 1961 (the one that also warned of the military-industrial complex): *Partly because of the huge costs involved, a government contract becomes virtually a substitute for intellectual curiosity.* Under these circumstances, when the government wants a particular scientific outcome the ideal arrangement is vulnerable. However, as I hope to show, the problem is not simply bias.

Rather, the powers that be invent the narrative independently of the views of even cooperating scientists. It is, in this sense, that the science becomes irrelevant. This was certainly the case in the first half of the twentieth century, where we just have to look at Lysenkoism (Medvedev, 1969) in the former Soviet Union, Social Darwinism, and Eugenics throughout the western world (Lindzen, 1996), as well as, in the 1960s, the unfounded demonization of DDT (Gordon, 2004). Each phenomenon led to millions of deaths. And, in each case, the scientific community was essentially paralyzed, if not actually complicit.

Will climate catastrophism join this list? It appears so. The position of the policy world is clear. Here is President Obama's constant refrain:

Climate change is contributing to extreme weather, wildfires, and drought, and that rising temperatures can lead to more smog and more allergens in the air we breathe, meaning more kids are exposed to the triggers that can cause asthma attacks.

Pope Francis, President Hollande, and virtually all state leaders have chimed in with similar proclamations.

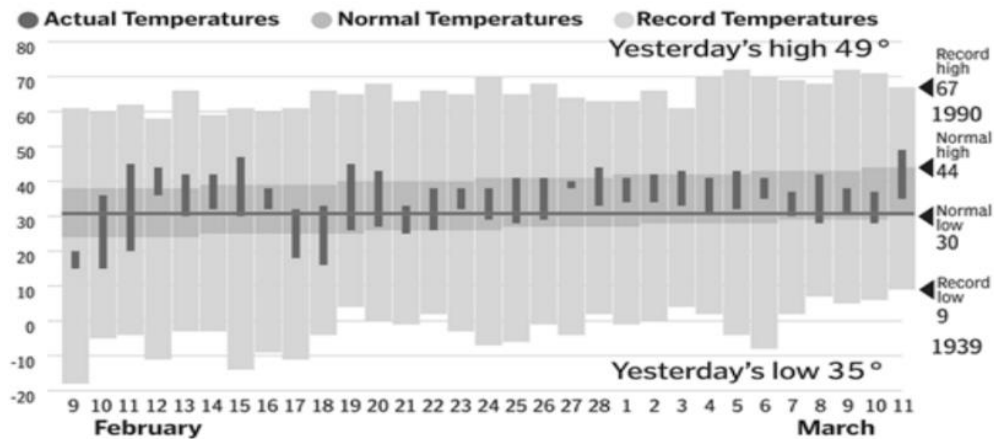
And yet, the whole proposition is largely without basis and highly implausible. The association with asthma that is regularly made by both Obama and Hillary Clinton is a good example of nonsense driven by focus groups who find this to be an effective scare theme. The other claims are no better. In the 70's the scientific community regularly designated warm periods as *climate optima*. That CO₂ was essential to plants and effectively a fertilizer was also widely understood. Thus, it was not surprising that the early environmental movement chose to promote fear of global cooling which, not surprisingly, was attributed to industrial emissions (most notably sulfates) (Ponte, 1976). When, however, in the late 1970's, it was recognized that sulfates could be scrubbed, that the irreducible product of industrial emissions was CO₂, that CO₂ emissions were likely to warm rather than cool, and that there was an hypothetical process whereby this warming could be amplified (by what came to be known as the water vapor feedback³ (Manabe, Wetherald, 1975), this whole narrative was turned on its head. The hitherto optimal warming was now put forth as a consequence to be feared. President Carter's science adviser, Frank Press, had the National Research Council investigate the matter, leading to the famous Charney Report (1979). This report summarized the results of the primitive climate models of that period, and found that they had a range of sensitivities to doubling CO₂ of from 1.5 to 4.5 degrees Centigrade⁴. The report regarded such results as possible but attached little credibility to the models, noting the need to better understand why the models behaved as they did. The report nonetheless provided a measure of

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³ For definitions of feedback and discussions of water vapor see Lindzen, 1993, Climate dynamics and global change, in: *Ann. Rev. Fl. Mech.*, 26, 353-378.

⁴ The Intergovernmental Panel on Climate Change (IPCC) has not changed this range except for the fourth assessment which increased the lower bound to 2°C. The fifth assessment brought it back to 1.5°C while peculiarly but revealingly claiming that there was no basis for preferring one value to another.



credibility to the warming hypothesis. The whole situation was eerily reminiscent of Orwell's *Animal Farm*, when *four legs good, two legs bad* became *four legs good, two legs better*. Repetition was the mechanism used to convince. So was the claim, already made by 1988 in *Newsweek*, that *all scientists agreed*. The larger public thus had no reason to actually dig into the science. Indeed, the actual science had already become irrelevant. This new narrative depended not only on the allegation of consensus, but also on lineage. It was always pointed out that the greenhouse effect had already been identified in the early 19th Century by Tyndall (1863), later by Arrhenius (1896), and still later by Callendar (1938). While this was true, it was also the case that the effect was generally held to be of much less importance than changes in the general circulation related to transport. For example, in an important collection of papers from 1955 (*Dynamics of Climate*, Richard Pfeffer, editor, Pergamon Press) with contributions from the leading climate scientists of the period (Charney, Phillips, Lorenz, Eliassen, Smagorinsky, etc.), increasing CO₂ was barely mentioned, and the greenhouse effect was not mentioned at all. The model favored for global cooling alarm was the Budyko-Sellers⁵ model which also focused on meridional heat transport. Only with the decision to push global warming alarm, did the greenhouse effect become central to the discussion of climate. Needless to add, consensus and lineage are not generally regarded as the backbones of science.

The implausibility or even outright silliness whereby global warming became global warming catastrophism (sometimes referred to as CAGW, catastrophic anthropogenic global warming) is so extensive that one hardly knows where to begin. It is crucial to emphasize catastrophism, because the situation is made even more incoherent by the intentional conflation of simple basic results that are widely

agreed upon, but which have no catastrophic implications, with catastrophism itself.

Currently, there really is quite a lot of basic agreement within the climate science world: climate change exists; there has been warming since the Little Ice Age ended around the beginning of the 19th Century (well before emissions are regarded as contributing significantly); human emissions can contribute to climate change; levels of CO₂ in the atmosphere have been increasing. None of this is controversial and none of this actually implies alarm. However, in the policy world, as emerges from virtually any reading of the current political discourse and its attendant media coverage, the innocuous agreement is taken to be equivalent (with essentially no support from observations, theory or even models) to rampant catastrophism. There are numerous examples of the issuance of unalarming claims (regardless of their validity or lack thereof) that are interpreted as demanding immediate action. Perhaps the most striking example involves the iconic statement of the IPCC: *Most of the warming over the past 50 years is due to man*. Is this statement actually alarming? First, we are speaking of small changes. 0.25°C would be about 51% of the recent warming. Given the uncertainties in both the data and its analysis, this is barely distinguishable from zero. Evidence of this uncertainty is shown by the common adjustments of this magnitude that are made to the record.

Some charts from the weather page of the Boston Globe of March 12, 2013 (any other date would serve as well) illustrate how small the changes really are. In the attached figure we see the high and low temperatures for each day in the preceding month (black), the average high and low temperature for each date (dark gray) and the record high and low temperature for each date (light gray). The width of the black horizontal line corresponds to the change in the global mean temperature anomaly over the past 150 years.

⁵ A critical discussion of these models can be found in Lindzen (1990).

High and low temperatures result from the advection of air roughly along the path of the jet stream (and this path changes from day to day and year to year). Record breaking temperatures (regardless of the year that they occurred) correspond roughly to the warmest and coldest temperatures on the temperature map for March 11.

Second, the recent warming episode is not at all unprecedented. The almost identical episode from about 1919-1940 could not be attributed to man.

Third, the observed warming is completely consistent with low climate sensitivity. Alarm requires, for starters (and only for starters), high sensitivity. By sensitivity, we refer to how much warming we expect for each doubling of CO₂. High sensitivity is generally regarded as 3°C or more. If we were to assume that ALL warming over the past 50 years were due to added greenhouse gases, we would conclude that the sensitivity was about 1°C. How do models with much higher sensitivity manage to replicate the past 50 years? They do so by subtracting from the greenhouse warming essentially unknown aerosols which they then include as due to human emissions. However, in a recent paper from the Max Planck Institute, Stevens (2015) finds that aerosols are limited and unable to compensate for the higher sensitivities. If man accounts for only 51% of the warming, then even modest warming becomes implausible.

Although it has become commonplace to fear warming, it is worth noting that the approximately 1°C warming since the 19th Century has been accompanied by the improvement of all indices of human welfare (including environmental quality).

Indeed, the very notion that climate is described by a single number that is forced by another single number, is itself a bit strange. For example, the force on a piston acting on a gas in a cylinder certainly does determine the pressure. However, as Budyko and Izrael (1991) noted long ago, climate change is characterized by a relatively stable tropics and changes in the equator- to-pole temperature difference. This, crudely speaking, has to do with heat transport. Pursuing the analogy with the piston, would we really expect the flow through a pipe to depend on the mean pressure in the pipe rather than the gradient of pressure along the pipe?

Why then do scientists go along with this? The situation has been described by me earlier as consisting in an iron triangle (Lindzen, 2013). At one vertex are the scientists who make meaningless or ambiguous statements. The scientific assessment of Working Group 1 of the IPCC is full of such statements. Then there is the second vertex: that of the advocates and media that *translate* the statements into alarmist declarations. The advocates also include the IPCC's WG2 and WG3 that deal with impacts and mitigation by assuming worst case scenarios from WG1. Politicians also are often part of the advocacy efforts. The third vertex consists in the politicians who respond to alarm by feeding more money to the scientists in

the first vertex. As far as the scientists are concerned, what's not to like? Should the scientist ever feel any guilt over the matter, it is assuaged by two irresistible factors: 1. The advocates define public virtue; and 2. His administrators are delighted with the grant overhead.

Of course, scientists are hardly the main beneficiaries. The current issue of global warming/climate change is extreme in terms of the number of special interests that opportunistically have strong motivations for believing in the claims of catastrophe despite the lack of evidence. In no particular order, there are the:

- Leftist economists for whom global warming represents a supreme example of market failure (as well as a wonderful opportunity to suggest correctives),
- UN apparatchiks for whom global warming is the route to global governance,
- Third world dictators who see guilt over global warming as providing a convenient claim on aid (i.e., the transfer of wealth from the poor in rich countries to the wealthy in poor countries),
- Environmental activists who love any issue that has the capacity to frighten the gullible into making hefty contributions to their numerous NGOs,
- Crony capitalists who see the immense sums being made available for *sustainable* energy,
- Government regulators for whom the control of a natural product of breathing is a dream come true,
- Newly minted billionaires who find the issue of *saving the planet* appropriately suitable to their grandiose pretensions,
- Politicians who can fasten on to CAGW as a signature issue where they can act as demagogues without fear of contradiction from reality or complaint from the purported beneficiaries of their actions. (The wildly successful London run of *Yes, Prime Minister* dealt with this) etc., etc.

All of the above special interests, quite naturally, join the chorus of advocates. Strange as it may seem, even the fossil fuel industry is generally willing to go along. After all, they realize better than most, that there is no current replacement for fossil fuels. The closest possibilities, nuclear and hydro, are despised by the environmentalists. As long as fossil fuel companies have a level playing field, and can pass expenses to the consumers, they are satisfied. Given the nature of corporate overhead, the latter can even form a profit center.

In point of fact many of the foremost scientific supporters of alarm acknowledge the absence of a basis for catastrophism. Here are some remarks the presidents of the Royal Society (Martin Rees) and of the

National Academy (Ralph Cicerone) published in the *Financial Times* (2010):

Straightforward physics tells us that this rise is warming the planet. Calculations demonstrate that this effect is very likely responsible for the gradual warming observed over the past 30 years and that global temperatures will continue to rise – superimposing a warming on all the other effects that make climate fluctuate. Uncertainties in the future rate of this rise, stemming largely from the ‘feedback’ effects on water vapour and clouds, are topics of current research.

Rees and Cicerone are counting on the fact that most readers won't notice that the so-called uncertainties are, in fact, the main issue; the straightforward physics is trivial.

They continue:

Our academies will provide the scientific backdrop for the political and business leaders who must create effective policies to steer the world toward a low-carbon economy.

Clearly, despite the implicit fact that the need for action is uncertain, the policy is taken for granted and even endorsed.

Here is an exchange from the BBC 4 interview of Ralph Cicerone on 13/07/2012. John Humphrys is the interviewer:

John Humphrys: *You don't sound, if I can use this word, apocalyptic. I mean, you're not saying 'If we don't do these things, we're going to go to hell in a handbasket, we're going to fry, in a few years'.*

Ralph Cicerone: *Well, there are people who are saying those things.*

John Humphrys: *But not you.*

Ralph Cicerone: *No. I don't think it's useful, I don't think it gets us anywhere, and we don't have that kind of evidence.*

The situation may have been best summarized by Mike Hulme, director of the Tyndall Centre at the University of East Anglia (a center of concern for global warming): *To state that climate change will be 'catastrophic' hides a cascade of value-laden assumptions which do not emerge from empirical or theoretical science.*

Even Gavin Schmidt, Jim Hansen's successor as head of NASA's Goddard Institute of Space Studies, whose website, Realclimate.org, is a major defender of global warming, does not agree with claims of extremes:

General statements about extremes are almost nowhere to be found in the literature but seem to abound in the popular media. (...) It's this popular perception that global warming means all extremes have to increase all the time, even though if anyone thinks about that for 10 seconds they realize that's nonsense.

Interestingly, basic meteorological theory tells us that extremes depend significantly on the tempera-

ture difference between the tropics and the poles – something that is expected to diminish in a warmer world.

On the other hand, there is quite a lot of *science on demand* as Eisenhower anticipated.

The well-established Medieval Warm Period is a problem for the narrative.

Michael Mann's Hockey Stick gets rid of the Medieval Warm Period.

The physics of moist convection requires that warming maximize in the tropical upper tropospheric troposphere, and models agree, but the data doesn't show this.

Ben Santer reworks the data to show the maximum.

Significant warming ended about 18 years ago showing that CO₂ is not the major factor in climate.

Tommy Karl adjusts and rearranges the data to eliminate the pause.

Quite a few independent studies show that the outgoing radiation from the earth indicate low climate sensitivity.

Andy Dessler ignores the physical and mathematical constraints to claim the opposite (at a truly negligible significance level).

Antarctic sea ice is increasing.

Jim Hansen absurdly claims that this is what one should expect from global warming (which, however, has not been occurring for 18 years).

Basic dynamics of the atmosphere calls for reduced extremes and storminess in a warmer world.

John Holdren invents a cockamamie theory of tropospheric polar jets to claim that such an imaginary jet is destabilized with warming, leading to more and more extreme storminess.

It should be noted that the first 4 items in the above list of *science on demand* represent dubious data manipulation, but represent little that is alarming. For example, Karl's *elimination* of the pause still leaves his resulting temperature series well below almost all model projections. That is to say, the models are still *running hot*. The last two items, on the other hand, simply represent the pure imagination of alarmists.

As Pat Michaels showed (2008), there is a remarkable bias in publications. For articles in *Nature* and *Science* during the period July 1, 2005 through July 30, 2006, he found a total of 116 publications dealing with climate data. Of these, 84 were *worse*, 10 were *better*, and 22 were *neutral* with respect to earlier claims. The relative numbers for *Science* and *Nature*, respectively, were 34,50 (*worse*), 5,5 (*better*) and 9,13 (*neutral*). Assuming existing studies were equally likely to be better or worse, this result would have negligible likelihood. Of course, given Michaels' findings, it is almost certain that the existing studies were already biased – thus rendering likelihood almost infinitesimal.

In point of fact, the Climategate 1 and 2 email releases showed explicitly the breakdown in peer review⁶.

We have, thus far, ignored the *impacts* industry where papers are published (and research is supported) attributing hundreds of things to the minimal warming that has occurred. The website:

<http://whatreallyhappened.com/>

lists some of these – ranging from acne to walrus stampedes to typhoid fever. Note that even in this extensive list, asthma is not mentioned.

Prof. Stefan Rahmstorf of the Potsdam Institute for Climate Impacts has reflected on the failure of his alarmist position to sway the world: *Sometimes I have this dream... I call the fire brigade. But they don't come because some mad person keeps telling them it's a false alarm. The situation is getting more and more desperate, but I can't convince the firemen to get going.* Such nightmares over a few tenths of a degree seems a little exaggerated. One expects that a counsellor might be more effective than a fireman. The take of political figures is generally misinformed, and commonly transcends the absurd. Senators McCain and Lieberman (Boston Globe, February 13, 2007) offered the standard misreading of the IPCC WG1's iconic statement: *The recent report by the Intergovernmental Panel on Climate Change concluded there is a greater than 90 percent chance that greenhouse gases released by human activities like burning oil in cars and coal in power plants are causing most of the observed global warming. This report puts the final nail in denial's coffin about the problem of global warming.*

Of course, the IPCC WG1 wisely avoided making the claim that 51% of a small change in temperature constituted a *problem*. This, they left to the politicians.

Secretary of State John Forbes Kerry goes much further in a lengthy speech delivered in Indonesia in February of 2015. Here are some selections:

When I think about the array of global climate – of global threats – think about this: terrorism, epidemics, poverty, the proliferation of weapons of mass destruction – all challenges that know no borders – the reality is that climate change ranks right up there with every single one of them. And it is a challenge that I address in nearly every single country that I visit as Secretary of State, because President Obama and I believe it is urgent that we do so.

(...) it's compelling us to act. And let there be no doubt in anybody's mind that the science is absolutely certain.

(...) I know sometimes I can remember from when I was in high school and college, some aspects of science or physics can be tough – chemistry. But this is not tough. This is simple. Kids at the earliest age can understand this. (...). It should come as no surprise

that Kerry proceeds to get literally everything wrong in his subsequent description of the science.

First and foremost, we should not allow a tiny minority of shoddy scientists and science and extreme ideologues to compete with scientific fact.

(...) This is not opinion. This is about facts. This is about science. The science is unequivocal. And those who refuse to believe it are simply burying their heads in the sand. Now, President Obama and I believe very deeply that we do not have time for a meeting anywhere of the Flat Earth Society.

As usual, political figures improperly associate science as a source of unquestionable authority rather than a successful mode of inquiry.

Secretary Kerry's unsurprising lack of understanding as to what science is, is duplicated by Gina McCarthy (Head of US EPA — which is spearheading America's War on Fossil Fuels — whose education consists in a B.S. in Anthropology from the University of Massachusetts, Boston Branch, and an M.S. in Environmental Health Engineering, Planning and Policy from Tufts University).

By now we all know that climate change is driven in large part by carbon pollution (typically conflating carbon with carbon dioxide) and it leads to more extreme heat, cold, storms, fires and floods.

We are way past any further discussion or debate. Scientists are as sure that humans are causing climate change as they are that cigarette smoke causes lung cancer. So, unless you want to debate that point, don't debate about climate change any longer because it is our moral responsibility to act. That responsibility right now is crystal clear. And that is why we have taken action.

(...) the science has spoken on this. A low-carbon future is inevitable. We're sending exactly the right signals on what, at least EPA believes to be, a future of lower pollution that is essential for public health and the environment, that EPA's not just authorized but responsible to acknowledge and push towards.

Of course, some political figures skip any embarrassing pretenses concerning science and move directly to their agenda. Christiana Figueres, executive secretary of U.N.'s *Framework Convention on Climate Change*: *This is the first time in the history of mankind that we are setting ourselves the task of intentionally, within a defined period of time, to change the economic development model that has been reigning for at least 150 years, since the Industrial Revolution.*

Ms. Figueres is not alone in taking this approach. Pope Francis' closest adviser castigated conservative climate change skeptics in the United States, blaming capitalism for their views. Speaking with journalists, Cardinal Oscar Rodríguez Maradiaga criticized certain movements in the United States that have preemptively come out in opposition to Fran-

⁶ For example: Costella, 2010; Watts, 2012.

cis's planned encyclical on climate change. *The ideology surrounding environmental issues is too tied to a capitalism that doesn't want to stop ruining the environment because they don't want to give up their profits.*

It is difficult to know whether the statements of prominent political figures represents dishonesty, ignorance or both.

Ms. Figueres may be the most honest. No proposed measures will have any discernible impact on climate (regardless of one's view of the physics) unless one rolls back the industrial revolution everywhere and permanently – and even then significant impact on global climate is dubious. Of course, no country outside the western world would even consider this, though they are perfectly happy to endorse the efforts of the West to do so.

A constant feature of the public presentation of the issue is the exploitation of public ignorance. A large poster appearing in the Paris Metro showed the World Wildlife Fund's signature panda leading young people in mass demonstration (intentionally mimicking the storming of the Bastille) calling for the elimination of CO₂. Presumably these young people have never heard of photosynthesis and fail to realize that advanced forms of life would largely cease for levels of CO₂ less than about 150 ppmv.

So where does the issue of global warming stand? In retrospect, we are confronting three rather different narratives. The first I would call the IPCC WG1 narrative. This narrative, while broadly supportive of the proposition that increasing greenhouse gas concentrations are a serious concern, nevertheless, is relatively open about the uncertainties and even contradictions associated with this position, and its public pronouncements tend to be vague with ample room for denial, carefully avoiding catastrophist hyperbole while also avoiding outright rejection of such hyperbole. The first narrative is very much the narrative of many of the major supporters of the global warming agenda. The second narrative is that of what are referred to as *skeptics*. To an extent, not generally recognized, there is considerable overlap with the first narrative. Thus, although skeptics might agree that alpine glaciers have been retreating since the early 19th Century, they are also aware that alpine glaciers were largely absent during the medieval warm period, and that their more recent retreat preceded by well over a century the period when anthropogenic greenhouse warming became moderately significant. Moreover, skeptics generally regard the fact that virtually all models *run hot*, i.e., their projections for the period 1979 to the present for the most part greatly exceed observed warming, strongly supports low climate sensitivity. They generally believe in testing the physics underlying the positive feedbacks in sensitive models rather than averaging models. Skeptics also are much more open to the numerous known causes of climate change (including long pe-

riod ocean circulations, solar variability, and the various impacts of ice), and do not regard CO₂ as the climate's ultimate *control knob*. The main difference between these first two groups, however, is that the second group openly opposes catastrophism while the first group does not. The third narrative is that of the political promoters of climate alarm including many of the environmental NGO's, and most of the mass media. The promoters of this narrative also include many of the contributors to WG2 (impacts) and WG3 (mitigation) of the IPCC. The latter generally emphasize alleged consequences of the worst case scenarios presented by WG1. It is this narrative for which the science is largely irrelevant. Few scientists will endorse the notion that the planet is at risk, though this is standard fare for the catastrophists. It is also this narrative that invariably claims virtually unanimous support. Such claims generally rely on bogus studies which, moreover, dishonestly conflate the points on which both the WG1 and the skeptical narratives agree, with the third catastrophic narrative. Anyone looking at any statement concerning global warming will readily identify which narrative is in play. Unfortunately, for most people, the third narrative is all they will see.

The overwhelming emphasis on the third narrative, has very serious implications for proposed policies alleged to deal with global warming such as the restriction of access to electricity for the 1.3 billion human beings currently without such access, and the increased poverty for billions more with its obvious implications for health and longevity, etc., not to mention foregoing the well-established agricultural benefits of added CO₂ (Goklany, 2015), a chemical essential to life as we know it rather than a pollutant (the US Navy regards levels of 5000 ppmv safe on nuclear submarines; ambient levels are currently 400 ppmv). It is clear that the issue of climate does constitute an emergency. However, as is so often the case, the emergency does not arise from science and technology, but rather from politics. It is worth examining whether science can play a role in the mitigation of this emergency. It is doubtful whether the answer will consist in research grants. However, science has much at stake. Its hard earned *raison d'être* as our most effective tool for objective assessment is being squandered, and with it, the basis for public trust and support.

If we do nothing to stop this insanity, science will rightly be regarded as just another racket. This might just be more collateral damage than we can readily afford.

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Mitigation of Greenhouse Effect by Reduction of the Methane Emissions

Łagodzenie efektu cieplarnianego poprzez redukcję emisji metanu

Sustainable development mainly pertains to social relationships. The pioneering report entitled *Our Common Future*, included the appeal for such behaviour that does not deprive future generations from conditions suitable for their development. This paradigm is mainly related to non-renewable natural resources and environment (Olkiewicz, Bober, Majchrzak-Lepczyk, 2015). Implementation of both paradigms is threatened (Cao, Piecuch, 2012; Glasby, 2002; Galdwin et al., 1995; IPPC, 2014; Cholewa, Pawłowski, 2009; Pawłowski, 2008), because dominance of free market, that is rooted in ruthless competition, eliminates from social life the co-operation which is the basis for the care for other people, both living now and yet to be born. Moreover, the belief in the infinite growth of production causes to a rapid depletion of resources, including non-renewable ones. The depletion of primary energy resources may be especially dangerous (Chefurka, Berg et al., 2002; Yohe et al., 2007; Banur, Opschoor, 2007). This is because it is difficult to imagine how modern civilization could function without energy.

The second important problem is the degradation of environment, especially the anticipated climatic changes, which according to IPCC report (2007) will lead to serious catastrophic changes in the Earth's ecosystems, especially that inhabited by the poorest. For, the CO₂ emissions are mainly responsible on the rich societies. The richest group of people, constituting 10% of world's population, emits 49% of CO₂, whereas the poorest people, which make up 50% of population, emit only 10% of CO₂. Therefore, the costs of remedial measures should be borne by the ones who emit the most.

Moreover, the actions aimed at decreasing of greenhouse gases emissions in order to mitigate the climatic changes should take the social context into account. From this standpoint, one should pay more attention to the intensification of natural processes of CO₂ sequestration, including the sequestration by forests and agricultural (Hooijer et al., 2010; Jones,

Donnelley, 2004; Kruger et al., 2015; Lal, 2010; Smith et al., 2007).

The impact of carbon dioxide on climatic changes is a well-known phenomenon. However, awareness about the role of methane, which is the second largest contributor to the greenhouse effect, is not well known. The characteristics of methane-emitting sources are presented in Table 1.

Table 1. Estimated global anthropogenic methane emissions from main sources, data for 2010 (EPA, 2010)

Source	%
Enteric Fermentation	29
Oil and gas industry	20
Landfills	11
Rice cultivation	10
Emissions from wastewater	9
Coal mining	6
Manure from farms	4
Biomass	3

The greatest amount of methane is emitted by oil and gas industry, as well as agriculture (cattle and rice cultivation) (Johnson et al., 1994).

Various actions are undertaken in order to mitigate methane emissions. The biggest emissions from enteric fermentation are the most difficult to control. They require decreasing consumption of beef in the most developed countries. Mitigation of methane emissions from the oil and gas industries requires reducing or eliminating venting and fugitive emissions from gas installations (Howarth et al., 2011; Mallya, 2016),

The most important approach to reduce methane emission from landfills is its extraction using series of wells and utilizing it as energy source or combusting in a flare. Residual emissions which lasted for tenth of year could be oxidized in passive filters (Staszewska, Pawłowska 2011; Stępniewski, Pawłowska 1996; Montusiewicz et al., 2008).

Since rice is basic food in the most of Asia, it is difficult to decrease emissions from that source. Reduction of methane emissions from wastewater requires upgrading sewage and wastewater treatment plants by wide application of anaerobic sludge digestion, biogas capture and its utilization as a source of energy or combustion in a flare (Bogner et al., 2008).

In the case of coal industry, two methods may be used. The most profitable one is recovery of methane from coal deposits by degassing coal seams prior to their exploitation through drilling holes which enable methane to flow out (Bibler et al., 1998).

Emission from manure can be mitigated by containing it in a sealed manure lagoon, while the collected methane is best used as a source of energy or, less profitably, combusted in a flare.

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Mitigation of emissions from other sources is complicated and the obtained results are insignificant in a global scale.

Since climate change in the most cases will affect the poorest people of the future generations to mitigate this effect in negative way the sustainable approach it is necessary require to undertake measures. The methods of mitigations which is based on utilization of biological process are the most sustainable.

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Leszek Gawor¹

Ten Years of *Problemy Ekorozwoju/ Problems of Sustainable Development*

Dziesięć lat *Problemów Ekorozwoju/ Problems of Sustainable Development*

2016 marks the 10th anniversary of the existence of *Problemy Ekorozwoju/ Problems of Sustainable Development*, a semi-annual journal which consistently promotes the idea of sustainable development.

The actual beginnings of *Problemy Ekorozwoju* are to be sought in casual and informal conversations, which took place at numerous academic conferences devoted to the idea of sustainable development, which was gaining popularity in Poland at the turn of the 20th and 21st centuries. In this context, it is worth mentioning the symposium on *Sustainable development in politics and scientific research*, which took place in Kazimierz Dolny on 3-4.12.2001; the conference on *Philosophical, economic, engineering and natural conditions of sustainable development* in Olecko on 20-21.06.2003; the conference on *Philosophical and social conditions of sustainable development* in the seat of the Wigry National Park in Krzywe near Suwałki on 17-19.06.2004; and finally the conference on *The philosophical foundations of sustainable development* in Kazimierz Dolny on 23-25.09.2006. These events brought together all those concerned with environmental issues, the questions of ecophilosophy and the concept of sustainable development. We need to acknowledge here the true *spiritus movens* of both these symposia and the foundation of the journal, a member of the Committee of Environmental Engineering of the Polish Academy of Sciences prof. Lucjan Pawłowski.

In January 2006, the first issue of *Problemy Ekorozwoju* was published. The subtitle described the nature of the journal as *Studies and philosophy and sociology*. The editorial team consisted of Editor-In-Chief, Artur Pawłowski from Lublin University

of Technology and Deputy Editor-In-Chief, Leszek Gawor from Maria Curie-Skłodowska in Lublin (later from Rzeszów University). They perform these functions to this day. The Editorial Committee included prominent Polish scientists who in their studies address, among others, the issue of sustainable development: Jerzy Błazejowski from the University of Gdańsk, Wojciech Bołoz from Cardinal Stefan Wyszyński University in Warsaw, Tadeusz Borys from Wrocław University of Economics, Józef M. Dołęga from Cardinal Stefan Wyszyński University, Włodzimierz Galewicz from Jagiellonian University in Cracow, Zbigniew Hull from the University of Warmia and Mazury in Olsztyn, Stefan Kozłowski from The Man and the Environment Committee of the Polish Academy of Sciences in Warsaw, Anna Latawiec from Cardinal Stefan Wyszyński University, Lesław Michnowski, a member of Poland 2000 Plus Forecast Committee at the Presidium of the Polish Academy of Sciences, Andrzej Papużyński from Kazimierz Wielki University in Bydgoszcz, Lucjan Pawłowski from Lublin University of Technology, Zdzisława Piątek from Jagiellonian University, Wiesław Sztumski from the University of Silesia in Katowice, Włodzimierz Tyburski from Nicolaus Copernicus University in Toruń, and Stanisław Zięba from the Catholic University of Lublin. The journal received the ISSN number 1895-69-12. The address of the editorial department has been (as it remains to this day) Lublin University of Technology, the Faculty of Environmental Engineering, located at Nadbystrzycka Street 40 b, 20-618 Lublin. The patronage over *Problemy Ekorozwoju* was taken by The Man and the Environment Committee of the Polish Academy of Sciences.

In the editorial to the introductory issue of the journal, the Editor-In-Chief formulated its guiding principles. He wrote, among others: *contemporary humans have possessed technological means which allow them to transform the world in practically any way. At the same time, people become lost amongst the goals of these transformations. Technological powers have been sufficient to entirely destroy the biosphere for years, and even if it does not happen, exhaustion of fossil fuels and other raw materials is a real and close perspective. Moreover, the state of the environment is continually deteriorating on a global scale. (...) At the same time, the disproportions between the poor and rich countries are growing. Although the global food production is sufficient to satisfy everyone's needs, millions of people are still suffering from starvation. Furthermore, social conflicts are intensifying, and the reason behind it is often poverty. Growing automation leads to an increase in unemployment*

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and results in forming groups of unnecessary people who dwell on the margins of the contemporary civilisation and are gradually excluded from it. These selected challenges are enough to show how complicated and difficult the situation of the contemporary world is. Can this apparent crisis be overcome? In order to make it possible, the concept of sustainable development has been formed. It is not just another programme of protecting the environment, as the perspective of necessary actions is much broader. The voice of naturalists is still important; however, the arguments of philosophical, economic and technological sciences are also to be taken into consideration.

This introduction clearly and distinctly outlines:

1. The ideological framework and the programme of *Problemy Ekorozwoju* in the form of the idea of sustainable development.
2. The goals of the journal – diagnosing all the phenomena occurring in the modern world which constitute a threat to the continued existence of human civilisation, as well as searching for the ways to prevent such trends, destructive for the humanity and
3. An interdisciplinary format of the journal, open to texts written by representatives of sciences from all areas and disciplines, as well as by practitioners – in a word, all these who have something significant to say in the context of current civilisational threats and the possibilities of avoiding them. That was the reason why the journal was especially open to texts addressing the issues of ecophilosophy as well as of philosophical, environmental and socio-political aspects of sustainable development. Such a framework, as evidenced by the contents of the twenty issues of *Problemy Ekorozwoju* published to date, is consistently respected and realised.

To celebrate the 5th anniversary of the foundation of *Problemy Ekorozwoju*, two articles were published analysing the journal's achievements to date. Zbigniew Hull and Ignacy S. Fiut studied the articles published in the journal for the presence of the issues of sustainable development and ecophilosophy. It turned out that over 90% of texts concerned the idea of sustainable development to a greater or lesser extent, while strictly ecophilosophical articles were far less numerous, namely 50% during the first two years of the journal's publication and 20% in the years 2009-2010². It proves the adequacy of the general formula of the journal, which became an important platform of transferring ecological,

ecophilosophical and sozological ideas, as well as issues concerning sustainable development. In this context, it would be worth studying publications from the subsequent five-year period, or from the whole ten-year period of the existence of *Problemy Ekorozwoju*.

An important date in the history of *Problemy Ekorozwoju* was 2008. It was then, starting from vol. 3, no. 1, that the journal came under the official patronage of the European Academy of Sciences and Arts in Salzburg, Austria. Thus, a new stage in the development of *Problemy Ekorozwoju* began thanks to the international character it acquired. As a result, the Editorial Committee was significantly enlarged. It was joined by (some of them even earlier): Johann Baumgaertner from the University of Milan, Italy; Dan Golomb, the University of Massachusetts Lowell, USA; Józef Hoffmann, Wrocław University of Technology; Gjalt Huppes, Institute for Environmental Studies, the Netherlands; John Ikerd, Columbia, USA; Chris Laszlo, Sustainable Value Partners, Inc., USA; Marek Haliniak, the Chief Inspector of Environmental Protection; Ishikawa Masanobu, Kobe University, Japan; Antoni Sanchez, Universitat Autònoma de Barcelona, Spain; Felix Unger, the president of the European Academy of Science and Arts, Salzburg, Austria.

It was also then that the second English title of the journal appeared: *Problems of Sustainable of Development*, with the subtitle *Journal of the European Academy of Science and Arts, Salzburg*. The address of the editorial department and the publisher did not change. In the situation of the newly acquired international character of the journal, it was understandable that the editors decided to gradually shift to publishing the obtained materials in English – the modern *lingua universalis* of the world of science. The journal began to print articles in two languages simultaneously and from vol. 1, no 1, 2013 it has been published in English exclusively (with Polish titles of the articles, their summaries and general information about the journal). Apart from its traditional form, *Problemy Ekorozwoju*/*Problems of Sustainable of Development* is also available on the internet under the same title.

The journal has acquired a strong position among academic journals. It was reflected when the journal was noted in Web of Science, where it ranked first among other Polish academic journals, with the impact factor of 0.5 for the years 2007-2011. In this period it was also on the second place in the Scopus database. This issue was described in detail by Yucheng Cao in an article devoted to the presentation of the position of the journal in the years 2006-2011 among other Polish journals addressing similar problems. The highest impact factor was

² It needs to be remembered here that the idea of sustainable development often appears in the context of ecophilosophy.

reached in 2012, when it was as high as 1,98. At present, it is lower – 0,804, but we believe that the new principles of reviewing, directed at a better placement of the published articles in the context of the profile of the journal, will increase this important factor again.

The first issues of *Problemy Ekorozwoju* included only articles by Polish authors, mainly from the circle of environmentalists and philosophers, in which the idea for the journal was first developed. Their achievements in the research into the idea of sustainable development have been noticed abroad, as evidenced by the fact that some of them (A. Pawłowski, Z. Hull, Z. Piątek, W. Tyburski, A. Papużyński, A. Skowroński, L. Gawor) were invited to contribute to a special issue of the English journal *Sustainable Development* entitled *Review of Research on Sustainable Development in Poland*, (Wiley-Blackwell, England, vol. 16, no. 2, March-April 2008). The subsequent issues of *Problemy Ekorozwoju/Problems of Sustainable Development* included articles by foreign authors, at the beginning – sporadically, and later on a regular basis. Until the end of the 2015, the journal published articles written by scientists from Austria, Brazil, China, the Czech Republic, France, Germany, India, Japan, Malaysia, the Netherlands, Norway, Serbia, Slovenia, South Korea, Sweden, Switzerland, Turkey, Ukraine and the USA. Thanks to this entirely international profile, the journal became a significant platform of exchanging environmentally involved ideas throughout the world.

The development of the journal also involved adding new members to the Editorial Committee. Its composition, published in full in the last issue from 2015, apart from the already mentioned members was supplemented over time by including the following people: Yucheng Cao, Zhejiang Agricultural and Forestry University, China; Ignacy S. Fiut, AGH University of Science and Technology in Cracow; Ryszard Janikowski, Katowice School

of Economics; Jan Krokos, Cardinal Stefan Wyszyński University in Warsaw; Micheal S. Pak, Korean Advanced Institute of Science and Technology, Daejeon, South Korea; Franciszek Piontek, the University of Dąbrowa Górnicza WSB; Michael Redclif, King's College, London, England; Delyse Springett, Massey University, New Zealand; Stanisław Skowron, Lublin University of Technology; Peter Strachan, Aberdeen Business School at Robert Gordon University, Scotland; Peter A. Wilderer, Institute of Advanced Studies on Sustainability, Munich, Germany; Tomasz Winnicki, the Faculty of Life Sciences and Technology, Wrocław University of Environmental and Life Sciences; Lech W. Zacher, Kozłowski University in Warsaw. Moreover, the position of Editorial Assistant was added to the editorial department, and this function is performed by Agnieszka Żelazna from Lublin University of Technology; while Katarzyna Wójcik-Oliveira, also from Lublin University of Technology, is responsible for the editorial department office.

We also need to mention the irreparable losses that the Editorial Committee of *Problems of Sustainable Development* suffered together with the whole environment of conservationists and scientists involved in the protection of nature. In 2007, Stefan Kozłowski passed away, in 2013 – Dan Golomb, and in 2014 – Józef Marcełi Dołęga. The journal published short notes *in memoriam* of these distinguished scientists.

During the ten years of its existence, *Problemy Ekorozwoju/ Problems of Sustainable Development* has acquired an esteemed position among academic journals in the country thanks to its authors. It is also respected abroad. It has become a significant platform of exchanging environmental ideas, especially those focused on the issues of sustainable development. Therefore, the future of the journal seems optimistic; we hope that the discussion around sustainable development will continue.

INSTRUCTIONS FOR AUTHORS

NOTA DO AUTORÓW

Problemy Ekorozwoju/Problems of Sustainable Development is a scientific journal published under the auspices of the European Academy of Science and Arts (Salzburg, Austria).

Annually two issues are published.

Scope of the journal:

- Ecophilosophy.
- Philosophical aspects of sustainable development.
- Social-political aspects of sustainable development.
- Earth resources management from the viewpoint of sustainable development.

The magazine publishes original papers not longer than 20 pages (40 000 characters) as well as reviews and letters no longer than 5 pages (10 000 characters).

Text pages should be of the A4 size, double line spacing, left and right margin of 2.5cm, 12-point *Times New Roman* font. The text should be organized as follows:

- Title of the article,
- Name and surname of the author(s),
- Address,
- e-mail,
- Abstract,
- Key words,
- Introduction,
- Text organized into paragraphs,
- References.

References quoted in the text should be given in parentheses and include the author's surname and the publication year e.g. (Tyburski, 2004).

The reference list should be given at the article end, arranged alphabetically by surnames of the first authors.

Reference should be listed as the following:

- Journal:
Surname and name initials of the author(s), year, article title, magazine title in italic, volume, issue, pages: from - to.
Example:
KOZŁOWSKI S., 2006, The Position of Poland in Europe, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, vol. 1, no 2, p. 93-98.

Problemy Ekorozwoju/Problems of Sustainable Development są czasopismem naukowym publikowanym pod patronatem Europejskiej Akademii Nauki i Sztuki (Salzburg, Austria).

Rocznie publikowane są dwa zeszyty.

Zakres tematyczny czasopisma obejmuje:

- Ekofilozofię.
- Filozoficzne aspekty zrównoważonego rozwoju i ekofilozofii.
- Społeczno-polityczne aspekty zrównoważonego rozwoju.
- Uwarunkowania gospodarki zasobami Ziemi w aspekcie zrównoważonego rozwoju.

W czasopiśmie publikowane są prace oryginalne i artykuły przeglądowe o objętości ok. 20 stron (40 000 znaków) oraz recenzje i listy do redakcji o objętości do 5 stron (10 000 znaków).

Teksty należy przygotować w formacie A4 z podwójną interlinią, lewy i prawy margines 2,5 cm, czcionka *Times New Roman* 12 pkt., z zachowaniem następującego układu:

- tytuł w języku polski,
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- imię i nazwisko,
- adres,
- e-mail,
- streszczenie (do 1 strony),
- słowa kluczowe,
- abstract (streszczenie w jęz. angielskim),
- key words (słowa kluczowe w jęz. angielskim),
- wstęp,
- treść artykułu,
- literatura.

Literatura w treści powinna być cytowana poprzez podanie w nawiasie nazwiska i roku publikowania pracy np. (Tyburski, 2004).

Zestawienie cytowanej literatury powinno być zamieszczone na końcu artykułu, uporządkowane alfabetycznie wg nazwiska pierwszego z autorów.

Wykaz literatury powinien zostać sporządzony według następujących zasad:

- Czasopismo:
Nazwisko i inicjały imion, rok, tytuł artykułu, nazwa czasopisma (kursywą), vol., numer, strony od-do. Przykład:
KOZŁOWSKI S., 2006, Miejsce Polski w Europie, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, vol. 1, no 2, p. 93-98.

- **Book:**
Surname and name initials of the author(s), title in italic, publishers' name, publication year. Example:
KOZŁOWSKI S., 2005, *The Future of Sustainable Development*, KUL, Lublin.
- **Publication in collective works (monographs):** Surname and name initials of the author(s), article title, title of the monograph (in italic font), surname and name initials of the monograph editor, publisher's name, publication year. Example:
PAPUZINSKI A., 2004, Philosophical Aspects of Sustainable Development Principle, in: *Philosophical, Social and Economic Aspects of Sustainable Development*, ed. Pawłowski A., Lublin University of Technology, Lublin, p. 25-32.
- **Internet:**
Name of the web site, address, date of access. Example:
Problemy Ekorozwoju/Problems of Sustainable Development,
ecodevelopment.pollub.pl (2.01.2014).
- **Książka:**
Nazwisko i inicjały imion autora, tytuł (kursywą), nazwa wydawnictwa, rok wydania. Przykład:
KOZŁOWSKI S., 2005, *Przyszłość ekorozwoju*, KUL, Lublin.
- **Prace wydane w monografiach zbiorowych:**
Nazwisko i inicjały imion autora, tytuł artykułu, tytuł monografii (kursywą), nazwisko i inicjały imion redaktora monografii, nazwa wydawnictwa, rok wydania.
PAPUZIŃSKI A., 2004, Filozoficzne aspekty zasady zrównoważonego rozwoju, in: *Filozoficzne, społeczne i ekonomiczne uwarunkowania zrównoważonego rozwoju*, ed. Pawłowski A., Politechnika Lubelska, Lublin, p. 25-32.
- **Źródła Internetowe:**
Nazwa strony, adres, czas dostępu. Przykład:
Problemy Ekorozwoju/Problems of Sustainable Development,
ekorozwoj.pollub.pl (2.01.2014).

Additional footnotes should be consecutively numbered and given at the bottom of each page.

Articles to be published should be e-mailed to: ekorozwoj@wis.pol.lublin.pl

Przypisy powinny być numerowane, a ich treść umieszczana na dole każdej ze stron.

Prace do druku proszę przysyłać drogą elektroniczną na adres: ekorozwoj@wis.pol.lublin.pl