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EDITORIAL

Contribution to the UN Post-2015 Development Agenda Based on the Concept of Resilience

Wkład koncepcji resilencji do Agendy Rozwojowej UN Post-2015

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Abstract
The authors of this paper suggest applying the concept of resilience in the process of setting up Sustainable Development Goals (SDGs) to be implemented in the United Nations Post-2015 Development Agenda. Referring to the synopsis of the scientific basis of resilience and sustainability presented by Bloesch et al., the proposed general goals and specific targets of sustainable development are introduced and discussed. The aims of the SDGs and the corresponding targets can only materialize when applying as guiding principles advanced knowledge (science), transfer of knowledge and skills (education and training), encouragement of creativity and ethical values (governance and policy). Moreover, the fundamental values of ecosystem function are to be acknowledged as well as the need to balance the three sub-systems of the eco-social triad. It appears necessary to focus on integrative resilience. The Post-2015 Development Agenda should stress the crucial role of self-regulation in ecosystems, and a corresponding cognitive regulation of social and economic systems with the aim to ensure system´s stability within given thresholds.

Key words: Post-2015 Development Agenda, goals, targets, resilience, adaptive cycle, economy, society, ecosystems

Streszczenie
Autorzy sugerują zasadność włączenia koncepcji resilencji w proces tworzenia Celów Rozwoju Zrównoważonego (Sustainable Development Goals, SDGs) i dokumentu ONZ Agenda Rozwojowa Post-2015. Odwołując się do naukowych podstaw resilencji i zrównoważoności, przedstawionych przez Bloescha, zaproponowano i omówiono tak ogólne, jak i szczegółowe cele zrównoważonego rozwoju. Są one możliwe do osiągnięcia tylko wtedy, gdy za zasady przewodnie uznane zostaną wiedza (nauka), przekazywanie wiedzy i umiejętności (edukacja i szkolenia),

wzmacniania kreatywności i przestrzeganie zasad etycznych (zarządzanie i polityka). Co więcej, należy uwzględnić także podstawowe wartości funkcjonalne pełnione przez ekosystemy oraz potrzebę utrzymania równowagi pomiędzy trzema podsystemami eko-społecznej triady. Niezbędnym wydaje się skoncentrowanie na resilencji. Agenda Rozwojowa Psot-2015 powinna podkreślać decydującą rolę samo-regulacji ekosystemów i analogicznych regulacji systemów społecznych i ekonomicznych, gdzie celem jest zapewnienie stabilności systemów w danych warunkach.

Słowa kluczowe: Agenda Rozwojowa Post-2015, cele ogólne, cele szczegółowe, resilencja, cykl adaptacyjny, ekonomia, społeczeństwo, ekosystemy

Introduction

At the turn of the 21st century the General Assembly of the United Nations ratified the Millennium Development Goals (MDGs) encompassing eight goals, 21 targets and a series of measurable indicators in the areas of poverty alleviation, education, gender equality and empowerment of women, child and maternal health, environmental sustainability, reducing HIV/AIDS and communicable diseases, and building a global partnership for development. It was agreed to meet these targets by 2015 at the latest. As this date is approaching and some targets are likely not to be met a debate on the framework of the international development beyond 2015 (Post-2015 Development Agenda) has started. At the Rio+20 summit held in June 2012 the 192 UN member states agreed to initiate a process of designing Sustainable Development Goals (SDGs), which are *action-oriented, concise and easy to communicate, limited in number, inspirational, global in nature and universally applicable to all countries while taking into account different national realities, capacities and levels of development and respecting national policies and priorities* (UN, 2012). It was further agreed to launch a process to develop a series of SDGs which should be treated as guidelines for the Post-2015 Development Agenda (Sachs, 2012).

An inclusive and transparent intergovernmental process on SDGs, open to all stakeholders was established by the UN Member States. The aim was to develop global SDGs upon which the UN General Assembly could agree. The outcome document mandated the creation of an intergovernmental Open Working Group (OWG) that will submit a report containing a proposal for SDGs for consideration and appropriate action to the 68th session of the General Assembly. It specifies that the process leading to the SDGs needs to be coordinated and coherent with the processes considering the Post-2015 Development Agenda and that initial input to the work of the OWG will be provided by the UN Secretary General in consultation with national governments. Whether consensus will be reached and whether planetary boundaries, the role of good governance and environmental goals will be reasonably well addressed is subject to hope and speculation (Galaz, 2014).

Several authors of this paper participated in the OWG process and used the concept of resilience for the development of SDGs to be considered in the process of defining the Post-2015 Development Agenda. The purpose of this paper is to show how the practical integration of the resilience theory results in a promising approach to the complex system dynamics of the so-called *eco-social triad* (Adams, 2006).

Proposed Goals and Targets

In formulating SDGs there is need to learn from past attempts while considering the essentials of existing scientific concepts, the present situation as well as the projection into the future. This is, of course, a difficult and controversial endeavor, and not easy to accomplish. It might even be impossible to match with and influence existing mainstream policy – driven mostly by national interests, governance deficits including corruption and nepotism, as well as human egoism, greed and angst (Schirrmacher, 2013). We recommend a pragmatic approach considering the eco-social triad concept as a guiding principle (Bloesch et al., 2015). The economy as a subsystem should play a role, equal to the role of the ecology. This requires compromises and tradeoffs.

The proposed SDGs are presented in a goals and targets format. The targets are listed in the shaded boxes; the respective explanations are given below the boxes. The principle message is that humankind ought to take readily understandable and applicable measures capable of keeping societies, economies and ecosystems resilient.

Goal 1: Maintain self-regulation processes, resilience and integrity of ecosystems

This goal contributes to the conservation of natural ecosystems and their services as well as to the strengthening of regulations for their protection. In this context the authors recommend taking into account the following targets:

- **Abandon or decrease the clear-cutting of tropical and boreal forests as well as the drainage of wetlands and peat bogs.**
- **Preserve and monitor marine and freshwater ecosystems and increase awareness of the importance of their protection.**
- **Strengthen the implementation of measures that truly protect ecosystems and interlink the protected areas.**

- **Develop regulations and international agreements to protect sensitive glacier regions (Arctic, Antarctic, Alps, Himalayan and others) from economic exploitation.**
- **Banish the discharge of untreated sewage as well as gaseous and solid waste materials into the environment (soil, water, atmosphere).**
- **Advance organic farming to further develop sustainable agriculture.**

Explanations:

Many natural terrestrial ecosystems have been replaced by monocultures to provide food, fiber and fuel to people. Due to the loss of biodiversity, such systems lack the resilience of natural ecosystems. Currently there still remain vast ecosystems on Earth including boreal and tropical forests, large wetlands and peat bogs that operate in a near natural regime, retain much of their integrity and continue to provide regional and global ecosystem services. These systems have to be protected and intensively studied to better understand their role in keeping the Earth system resilient.

Ecologically sensitive regions and nature parks must receive rigorous protection because of their important ecological and cultural values. However, protection and conservation of natural ecosystems in the form of nature parks is often insufficient (Watson et al., 2014). Ecosystems may not be treated as a *museum*. Protected areas are rather scarce, often isolated and not well managed or even threatened by exploitation and mass tourism. Ecosystem services are often misinterpreted as human common (e.g. by the Millennium Ecosystem Assessment, MEA 2005) and mostly not used adequately.

Preservation of marine ecosystems should focus on reduction of human-induced damage (e.g. overexploitation of fish stocks, discharge of micro-pollutants, plastic debris, and noise). As important is the restoration of degraded shores. Concerning inland water bodies, the physical destruction of rivers by dams and embankments, the disconnection of floodplains, and eutrophication of surface waters should be stopped or mitigated. Conservation programs should be based on scientifically sound principles. Restoration and conservation of *pristine* ecosystems need respect for naturally occurring dynamics; hence, unconventional, non-passive management should be taken in consideration (Galaz, 2014).

Glaciers, the Earth's largest freshwater reservoir, have begun melting at high rates in recent decades. In general, climate change has made mountainous areas extremely vulnerable. Due to the loss of permafrost various negative consequences are threatening the surrounding and downstream region. A large number of plants and animals are likely to become extinct. Preservation of glacial ecosystems functions is crucial to avoid disastrous consequences for these fragile ecosystems and most likely for the global system as a whole. Drastic reduction of greenhouse gas emission needs to be supplemented with measures at the local scale (*Think globally – Act locally*).

Discharge of excess amounts of untreated sewage into rivers, lakes and coastal waters not only raises human health risks. Moreover, it damages the self-regulation capacity of aquatic ecosystems. To maintain ecosystem´s resilience, both innovative wastewater treatment technologies and the development and dissemination of public awareness programs are needed. In principle, the causes rather than the effects of pollution should be tackled (i.e. no end-of-pipe solutions), which applies specifically to toxic and persistent organic substances.

Further development and implementation of sustainable agriculture is important concerning both, terrestrial ecosystems and societies. The excessive use of fertilizers, herbicides and pesticides through intensive agricultural practices has resulted in negative environmental impacts such as soil degradation, groundwater pollution and biodiversity reduction. Although organic farming is debated its ecological and social advantages seemingly exceed the disadvantages of conventional farming. Sustainable farming practices need to be further developed and implemented. An outstanding example is the Foundation Biovision, awarded with the alternate Nobel Prize in 2013, which applies biological methods in Africa to control plant diseases, propagates planting methods adjusted to the existing soil quality, and adapts the local farmer societies to local markets to sell their products (www.biovision.ch).

Goal 2: Foster the resilience of societies

This goal includes targets on mitigating poverty and enhancing equality. Following the concept of adaptive cycles (Walker and Salt, 2006) efforts in building readiness to deal with environmental and socio-economic changes are likely to foster societal resilience, and promote advances in sustainable development. The authors recommend taking into account the following targets that contribute to strengthening the resilience and stability of human societies:

- **Eradicate poverty and guarantee equal rights and social justice independent of gender, race, religion or ethnicity.**
- **Implement on the global scale the Human Right to Water and Sanitation.**
- **Develop ethically sound methods of population growth reduction.**
- **Improve the understanding of the dynamics of societal systems.**
- **Develop and communicate innovative methods of building capacity to overcome global threats.**
- **Develop guidelines for human behavior in respect to exploitation of natural resources causing impacts on environmental function.**

Explanations:
Satisfaction of essential human needs and elimination of poverty and inequality is to be understood as a prerequisite to societal resilience. The process of materializing these goals requires encouragement of site-specific solutions. In response to global, regional and local changes societal, economic and political actors are called upon favoring substitution of established practices by solutions based on contemporary scientific knowledge and technical innovations.
Basic services such as supply of potable water and sanitation are considered to be best provided or at least controlled by the public sector (public service). The required technical systems should be further developed and consequently established step-by-step in relation to economic conditions at the location under consideration (Grambow, 2013).
In this context, the question arises, whether indigenous and developing societies are living sustainably, and whether sustainable development requires the economy of developed countries to pay for mitigating environmental degradation. To present clear answers to these questions solid research is necessary. If industrialized countries share their financial assets with developing countries, they will benefit from reduced economic and social discrepancies, less armed conflicts and lower number of refugees.
Design and enforcement of water management concepts should respect not only the regional geographic, economic and climatic conditions but also the inherited way of living. Meeting the rising demand for decent and affordable water supply and sanitation is to be considered not only a challenge. It certainly is also a chance to overcome the widespread throw-away mentality in the densely populated areas of the world, in rural and urban areas as well as in informal cities alike. Thus, sustainable water management should include the concept of recovery of valuable substances from wastewater (including potable water and energy), reuse and recharge of groundwater reservoirs.
The tremendous growth of the human population in the last decades has led to increasing demands for food, water, land and raw materials, but also for education and job opportunities. Using standards set in the high income countries as guidelines to satisfy all those needs might exceed the carrying capacity of the Earth (Meadows et al., 1972, 2004). It appears inevitable to search and implement farsighted and ethically sound measures that lead to a significant decrease of the global population growth. Rigorous enforcement of female equality of opportunities is suggested as one of the measures to be considered.
Investment in research at the interface between social, economic, physical and biological sciences will presumably improve the understanding of the complexity and dynamics of ecosystems and human civilizations. The gain of knowledge and skills to master complex ecological, societal and economic problems is considered the key for truly sustainable development (von Hauff, 2012). Innovative modeling of non-linear complex systems using advanced parallel computing provides the chance to gain important insights into systemic risks and uncertainties. Results of computer-aided evaluations permit a better understanding of the vulnerability of societies and for choosing the most promising steps that keep the adaptive cycles rotating (Bloesch et al., 2015). A high level of adaptability to changes at the global as well as at the very local level is necessary to keep complex social structures and networks in the state of resilience.
Such targets focus also on making advanced knowledge and innovative methods available to the general public and to decision makers at large. Educational programs in schools and universities have to include specific onsite training and eventually solve problems peculiar to local and regional situations (Sterling, 2001).

Goal 3: Foster the resilience of economies

This goal contributes to the development of alternative economic models balancing private and social interests, hence strengthening the resilience and stability of the eco-social triad. We recommend replacing the Gross Domestic Product (GDP) as an indicator of economic performance by the Index of Sustainable Economic Welfare (ISEW) proposed by Daly and Cobb (1989). Global challenges such as meeting energy, water and food demands, mitigating climate change impacts and protecting ecosystems have to be addressed by the global community. Intensified international efforts have to be understood as a key measure in keeping economies resilient. It is important to develop awareness programs highlighting the role of each individual person in counteracting climate change and environmental destruction. The authors recommend taking into account the following targets:

- **Improve international cooperation and develop a new economic paradigm that favors sufficiency and farsighted qualitative growth.**
- **Finance the development of innovative technologies for water conservation, pollution reduction and recycling.**
- **Enhance the resilience of farming and food supply systems while respecting cultural traditions.**
- **Implement incentives favoring economic diversity of small and medium size enterprises with the aim to reduce vulnerability against unforeseen changes of ambient conditions.**
- **Stop land grabbing and exploiting natural resources of developing countries.**

- **Stop the artificial restrictions of export/import of agricultural products imposed by developed economies and foster self-determination of developing countries.**
- **Implement rigid controls and regulation of stock exchange and investment banking as well as commodity traders.**
- **Encourage individual understanding and responsibility for reducing environmental and ecosystem degradation.**
- **Improve modeling of economic and financial systems for the purpose of early warning and managing undesirable developments.**

Explanations:
Despite the continuing global economic crisis a proper economic paradigm has not yet been established. In contrast to the many existing economic theories, the *post growth economy* propagated by Paech (2012) can be seen as a guideline in the attempt toward a sustainable economic development. For that, the primacy of economy should be broken through ethical regulation of banks, stock markets and tax systems. From a sociological point of view, the economy should serve the people and not vice versa.
Because water is essential for life and for the production of virtually all goods and services, the investment in water management and water usage is key in planning future development. The global demand for water, food and energy is likely to increase in the 21st century and water scarcity is considered to become a global threat. To meet the projected growth of demand without undermining our planets carrying capacity, it is critical to make significant improvements in water supply to domestic, industrial and agricultural operations.
Large-scale farming often serves the economic interests of industries and foreign markets while vital requirements of local communities (clean water, fertile soil, healthy environment, well-being of local people) are disregarded. As a result, local economic and environmental systems become tremendously vulnerable. New production and distribution schemes (e.g. eco-labels and fair trade) need to be implemented that serve local consumers and preserve local land use.
Public funds have to be invested in research and development of technologies applicable for rural areas creating job opportunities and long-term economic development. Effective tax planning is a prerequisite in the current economic situation, for diverting tax incentives towards the renewable energy sector. This will safeguard sustainable development at large (KPMG report, 2012).

Goal 4: Safeguard and strengthen the resilience of the eco-social triad

This goal addresses the importance of balancing vital interests and limits of the three sub-systems of the eco-social triad (society, economy, ecosystems). The balance and resilience of the triad should be supported from the earliest stage of decision making. The authors recommend taking into account the following targets:

- **Invest in research focused on the interdependencies between the sub-systems of the eco-social triad.**
- **Maintain and enhance the resilience of human societies by developing and applying new inter- and transdisciplinary approaches and methods.**
- **Develop cross-sectoral approaches to water, food, energy production, and ecosystem management as a basis of advanced basin wide water resources management.**
- **Enhance the resilience of the eco-social triad to mitigate impacts of droughts and floods.**
- **Create awareness of the value and significance of natural resources, namely ecosystems and their services.**
- **Improve the handling of huge amounts of complex data (Big Data) as well as information and communication networks.**

Explanations:
Transdisciplinary research is likely to provide a sound basis for implementing sustainable political measures to keep the eco-social triad resilient. It is necessary to build the capacity to solve ecological problems and to extend the qualitative and quantitative knowledge about the nexus between natural and anthropogenic environments to find leverage points for effective intervention (Capra, 1982). Consensus should be achieved that sustainable development strategies serve ecosystem health, business opportunities and the well-being of people alike. The evaluation of different approaches that encourage individual responsibility towards the environment is necessary.
Finding the right balance between the bottom-line concerns of people in society, between different players in economy and species diversity in ecosystems is key to safeguarding the eco-social triad´s resilience and subsequent sustainable development. The conflicting interests must be recognized and taken into account while respecting the vital interests of the actors in each sub-system of the triad. For example, substituting clear-cutting of forests by paper recycling and use of recycled paper requires information and knowledge transfer across the social and economic sub-systems. It also needs a change of consumer behavior, advances in pulp and paper making, infrastructural and technical investment, change

of forestry and land-use practices, and incentives provided by governments. In essence, empathy, introspection, tolerance, innovation, courage and education are needed to contribute to societal, economic and ecological resilience, and thus sustainability.

Management of river basins requires a cross-sectoral and often transboundary approach to identify and overcome challenges around water, food and energy provision (Hayward, 2013). Innovative measures and tools are to be developed which enhance functionality and sustainability while balancing environmental, social and economic situations peculiar for the region to be served.

Water-related disasters (floods, droughts) are the worst and most recurrent of all natural and anthropogenic adversities, posing major obstacles to human security and sustainable development (Weisman, 2013). Sustainable development of the eco-social triad is a key factor in lowering the exposure to water risks.

Safeguarding and strengthening the resilience of the eco-social triad requires novel methods of managing large-scale information and infrastructures. In this context, the development of the Internet of Things (IoT) needs to be critically evaluated. In the IoT large-scale infrastructures observe the public space by sensors, process this information and influence people. Self-organizing digital networks often associated with cloud-computing allow IoT systems to increase adaptability, autonomy, reliability and usability. The IoT generates an exponential growth of data and signals (Big Data) which can no longer be handled by standard algorithms and data bases. Efficient algorithms are needed in, e.g., network traffic monitoring, machine learning, scientific computing, and signal processing (Mayer-Schönberger and Cukier, 2013). In parallel processing, fast Big Data algorithms search for data correlations to predict future trends and profiles of products and consumers. Fast and powerful algorithms are applied to detect data correlations. But, without interpretations, explanations, models and theories, data are blind and cannot automatically support sustainable development (Mainzer, 2014). Thus, IoT requires guidance and control by the scientific and social society.

Summary and Conclusions

The function of natural ecosystems provides the fundamental needs of human life, and the resilience theory is a promising basis for making progress in sustainable development (Bloesch et al., 2015). However, the present policy around the globe shows some major drawbacks reflected e.g. in excessive growth of the human population and the economy, continuous pollution and exploitation of natural resources, and still increasing emissions of greenhouse gases. The suggested sustainable development goals and targets reflect sound management and responsible governance and should help finding adequate and feasible measures to mitigate such impacts.

If the SDGs are to be successfully implemented in the UN Post-2015 Development Agenda, then we should consider the governing postulate that humankind ought to take readily applicable actions to keep ecosystems, societies and economies resilient. At the beginning of the 21st century it has become obvious, however, that the anthropocentric worldview needs to be corrected by granting the ecosystem function the same importance as the function of societal and economic systems. The favored eco-social triad refers to this change of paradigm. Taking into account and respecting the basic requirements of ecosystems in combination with empathy for all human beings and providing basic services to everyone is the magic formula that can help make societies more resilient and sustainable.

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References

1. ADAMS W. M., 2006, *The future of sustainability: Re-thinking environment and development in the twenty-first century*, Report of the IUCN-Renowned Thinkers Meeting 29-31 January 2006, 19 p.
2. BLOESCH J., von HAUFF M., MAINZER K., MOHAN S. V., RENN O., RISSE V., SONG Y., TAKEUCHI K., WILDERER P. A., 2015, Sustainable Development integrated in the Concept of Resilience, in: *Problemy Ekorozwoju/Problems of Sustainable Development*, Vol. 10, No 1, p. 7-14.
3. CAPRA F., 1982, *The Turning Point: Science, Society, and the Rising Culture*, Bantam, New York.
4. DALY H.E., COBB J.B., 1989, *For the Common Good*, Beacon Press, Boston, p. 401-455.
5. GALAZ V., 2014, *Global Environmental Governance, Technology and Politics: The Anthropocene Gap*, E. Elgar Publ. Cheltenham, UK.
6. GRAMBOW M. (ed.), 2013, *Nachhaltige Wasserbewirtschaftung: Konzept und Umset-zung eines vernünftigen Umgangs mit dem Gemeingut Wasser (Sustainable water mana-gement: Design and implementation of a sensible handling of water as a global common)*, Springer Vieweg, Wiesbaden.
7. HAYWARD K., 2013, Post-2015 perspectives: The future of water in the development agenda, in: *Water 21*, June edition, p. 12-14.

8. KPMG Report, 2012, *Taxes and incentives for renewable energy*, KPMG international, Zurich.
9. MAINZER K., 2014, *Die Berechnung der Welt: Von der Weltformel zu Big Data*, C.H. Beck, Munich.
10. MAYER-SCHÖNBERGER V., CUKIER K., 2013, *Big Data*, John Murray, London.
11. MEA, *Millennium Ecosystem Assessment, 2005. Ecosystems and human well-being. Synthesis reports*, http://www.millenniumassessment.org/en/Synthesis.aspx (30.12.2014).
12. MEADOWS D. H., MEADOWS G., RANDERS J., BEHRENS III. W. W., 1972, *The Limits to Growth*, Universe Books.
13. MEADOWS D., RANDERS J., MEADOWS D. H., 2004, *Limits to Growth: The 30-Year Update*, Chelsea Green Publishing Company, White River Junction, VT.
14. PAECH N., 2012. *Befreiung vom Überfluss; Auf dem Weg in die Post-Wachstumsökonomie (Liberation from plentifulness – Towards a post-growth economy)*, oekom Verlag, Munich.
15. SACHS J. D., 2012, From millennium development goals to sustainable development goals, in: *Lancet*, 379 (9832), p. 2206-2211.
16. SCHIRRMACHER F., 2013, *Ego – Das Spiel des Lebens*, Karls Blessing Verlag, Muenchen.
17. STERLING S., 2001, Sustainable Education – Revisioning Learning and Change, in: *Schumacher Briefings*, Vol 6.
18. UN, 2012, *The Future We Want. Outcome document adopted at Rio+20*, A/CONF.216/L.
19. von HAUFF M., 2012, Bildung für nachhaltige Entwicklung: Beispiel Indien (Education for sustainable development; India as an example), in: Buder R., von Hauff M. (eds.), *Arbeit im Wandel*, Aufgaben der Arbeitswissenschaft im 21. Jahrhundert, Stuttgart, S. 187-202.
20. WATSON J. E. M., DUDLEY N., SEGAN D. B., HOCKINGS M., 2014, The Performance and Potentials of Protected Areas, in: *Nature* 515, p. 67-73.
21. WALKER B., SALT D., 2006, *Resilience Thinking – Sustaining Ecosystems and People in a Changing World*, Island, Washington D.C.
22. WEISMAN A., 2013, *Countdown: Our last best chance for a future on Earth*, Little, Bown & Co.