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**Rozwój trwały i zrównoważony**



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## Spis treści

Wstęp.....	7
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### Część 1. Teoretyczne aspekty rozwoju trwałego i zrównoważonego

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<b>Arnold Bernaciak:</b> Aktualne trendy relacji gospodarka–środowisko w Polsce w układzie presja – stan – reakcja / Current trends of relationships between economy and environment in Poland in a pressure – state – response framework	11
<b>Tadeusz Borys:</b> O dwóch komplementarnych ujęciach nowego paradygmatu konsumpcji / About two complementary approaches of a new consumption paradigm .....	22
<b>Andrzej Czyżewski, Piotr Kulyk:</b> Kształtowanie rozwoju trwale zrównoważonego w ekonomii rolnej w optyce historycznej i współczesnej / Creating permanently sustainable development in agricultural economics in historical and modern perspective .....	32
<b>Johannes (Joost) Platje:</b> Efficiency, fragility and unsustainable development / Wydajność, kruchość i niezrównoważony rozwój .....	46
<b>Łukasz Popławski, Bogusław Kaczmarczyk:</b> Problemy zrównoważonego rozwoju – wycena przestrzeni publicznej / Problems of sustainable development – evaluation of public space .....	58
<b>Agata Rudnicka:</b> Nowe standardy zarządzania jakością i środowiskiem a zrównoważony rozwój przedsiębiorstwa / New quality and environmental management standards vs. sustainable development of a company .....	65
<b>Ivan Telega, Maciej Malaczewski:</b> Wzrost gospodarczy, zasoby naturalne oraz środowisko w świetle schumpeterowskiej teorii wzrostu / Economic growth, natural resources and environment in the light of Schumpeterian growth model .....	74

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### Część 2. Globalny wymiar rozwoju zrównoważonego

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<b>Agnieszka Becla:</b> Problemy ekologiczne a Milenijne Cele Rozwoju w świetle idei zrównoważonego rozwoju / Ecological problems and Millennium Development Goals in the light of the sustainable development idea.....	93
<b>Adam Budnikowski:</b> Wybrane tendencje gospodarki światowej w latach 1946–2016 / Chosen trends of the world economy in the years 1946–2016	106
<b>Stanisław Czaja:</b> Czynniki niedostatecznej realizacji Milenijnych Celów Rozwoju – analiza globalna / Factors of the insufficient realization of Millennium Development Goals – global analysis .....	115

<b>Eugeniusz Kośmicki:</b> Współczesna globalna sytuacja kryzysowa a możliwości zrównoważonego rozwoju / Contemporary global crisis vs. a possibility of sustainable development .....	126
<b>Leon Olszewski, Barbara Olszewska:</b> Geoeconomiczne aspekty polityki rozwoju zrównoważonego / Geoeconomic aspects of sustainable development policy .....	137
<b>Bartosz Ziemblicki:</b> Zrównoważony rozwój z perspektywy prawa międzynarodowego i europejskiego / Sustainable development from the perspective of international and European law .....	149

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### **Część 3. Problemy rozwoju zrównoważonego w ujęciu sektorowym i lokalnym**

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<b>Hanna Adamska:</b> Realizacja koncepcji zrównoważonego rozwoju na obszarach wiejskich – studium przypadku / Implementation of sustainable development concept on rural areas – case study .....	165
<b>Anna Bernaciak:</b> Zmiany świadczeń dostarczanych przez ekosystemy w następstwie procesów rewitalizacji w miastach / Changes of the ecosystem services in the process of revitalization in cities .....	177
<b>Joanna Godlewska:</b> Teoretyczne i praktyczne aspekty rozwoju zrównoważonej turystyki na obszarach przyrodniczo cennych / Theoretical and practical aspects of sustainable tourism development in precious natural areas .	185
<b>Krzysztof Posłuszny:</b> Wybrane metody analizy wpływu procesów fragmentacji na emisje środowiskowe / Chosen methods of analysis of fragmentation influence on the environmental emissions.....	197
<b>Stanisław Korenik, Dorota Rynio, Alicja Zakrzewska-Półtorak:</b> Miejski obszar funkcjonalny Wrocławia jako rdzeń województwa dolnośląskiego / Wrocław functional area as the core of the Lower Silesia Voivodeship.....	207
<b>Paulina Legutko-Kobus:</b> Zarządzanie dziedzictwem kulturowym jako element implementacji rozwoju zrównoważonego na poziomie lokalnym / Management of cultural heritage as implementation of sustainable development at the local level .....	219
<b>Monika Paradowska:</b> Wyzwania dotyczące współpracy interesariuszy na rzecz zrównoważonego rozwoju transportu w polskich miastach / Challenges for cooperation with stakeholders of sustainable transport in Polish cities .....	229
<b>Przemysław Skulski:</b> Miejsce przemysłu obronnego w gospodarce – wybrane problemy / The place of defence industry in economy – selected aspects.....	242
<b>Marian Woźniak:</b> Perspektywy i wyzwania turystyki w koncepcji zrównoważonego wykorzystania zasobów naturalnych / Perspectives and challenges of tourism in the concept of sustainable use of natural resources ...	258

## Wstęp

Pojęcie trwałości w gospodarowaniu pojawiało się już kilkaset lat temu. W 1713 r. posługiwał się nim H.C. Carlowitz w odniesieniu do gospodarki leśnej, a w XIX wieku G.P. Marsh w relacji do niekorzystnych skutków rozwoju gospodarczego. Termin „rozwój trwały i zrównoważony” (*sustainable development*) oficjalnie po raz pierwszy pojawił się podczas Konferencji Organizacji Narodów Zjednoczonych (ONZ) w Sztokholmie w 1972 r. Od tamtego czasu powstało wiele definicji tego procesu, a większość z nich nawiązuje do tej, którą przedstawiono w *Raporcie Komisji Brundtland „Nasza wspólna przyszłość”* w 1987 r. Według niej rozwój trwały i zrównoważony opiera się na zaspokajaniu potrzeb teraźniejszości bez ryzyka uniemożliwienia zaspokajania potrzeb przyszłych pokoleń.

Prawo przyszłych pokoleń do zaspokajania ich potrzeb rozwojowych implikuje potrzebę stworzenia określonych ram instytucjonalno-prawnych stymulujących zmiany działalności ekonomicznej i społecznej w kierunku ochrony zasobów środowiska. Polityka rozwoju zrównoważonego jest formułowana i wdrażana w skali globalnej, regionalnej, makroekonomicznej i lokalnej. Niniejsze opracowanie ma na celu wskazanie współczesnych trendów zmian jej podstaw teoretycznych, a także charakterystykę wybranych obszarów działań realizacyjnych.

Pierwsza część opracowania obejmuje teoretyczne, wielowymiarowe aspekty rozwoju trwałego i zrównoważonego. Zawiera odniesienia do nowego paradygmatu konsumpcji (jako jednego z podstawowych procesów gospodarczych), zmian relacji gospodarka-środowisko wraz ze sposobami ich identyfikacji, a także problemów nierównoważenia rozwoju. Opisano również wkład teorii zrównoważonego rozwoju do ekonomii rolnej, a następnie elementy zastosowań owej teorii w wycenie przestrzeni publicznej i funkcjonowaniu przedsiębiorstwa.

Drugą część opracowania poświęcono prawnym, politycznym i praktycznym problemom rozwoju trwałego i zrównoważonego w wymiarze globalnym. Problemy te zaprezentowano zarówno w perspektywie historycznej, jak i współczesnej w odniesieniu do kryzysu ekonomicznego i wiodących inicjatyw międzynarodowej polityki rozwoju. Poruszono też aspekty geoekonomiczne.

Trzecią i ostatnią część poświęcono problematyce rozwoju zrównoważonego w ujęciu sektorowym i lokalnym. Koncepcje równoważenia rozwoju poszczególnych sektorów gospodarki czy obszarów funkcjonalnych wyrastają z szerszego nurtu myśli ekonomicznej. W tym sensie są częścią i swoistym rozwinięciem (lub uszczegółowieniem) teorii rozwoju zrównoważonego. W wymiarze sektorowym w niniejszym opracowaniu uwzględniono przemysł, rolnictwo, transport i turystykę z uwzględnieniem polityk regulujących te dziedziny życia gospodarczego. W ukła-

dzie terytorialnym odniesiono się do uwarunkowań rozwoju obszarów miejskich i terenów wiejskich.

Prezentowane artykuły stanowią wkład do dyskusji nad ewolucją teorii rozwoju zrównoważonego i możliwościami jej urzeczywistnienia w praktyce, nad uwarunkowaniami wdrażania działań formułowanych na szczeblu Unii Europejskiej oraz na poziomie państw członkowskich (w tym adresowanych do podmiotów w skali lokalnej). Dotyczy to zarówno polityk makroekonomicznych, jak i sektorowych – w tym polityki środowiskowej. Skuteczność i efektywność tych działań może być odpowiedzią na wiele współczesnych wyzwań gospodarczych, społecznych i politycznych.

*Karol Kociszewski*

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## EFFICIENCY, FRAGILITY AND UNSUSTAINABLE DEVELOPMENT

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## WYDAJNOŚĆ, KRUCHOŚĆ I NIEZRÓWNOWAŻONY ROZWÓJ

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**Summary:** While efficiency improvements are supposed to contribute to sustainable development, due to different unexpected side effects they can make a system more fragile. The world has become so complex and interconnected, and logistics chains so long and intricate, that there are serious limits to the use of efficiency improvements in order to make society more sustainable. This may even threaten the existence of the system, and at least make it unsustainable. In this article, the author discusses various ideas and examples in the context of Taleb's notion of antifragility, being a feature of systems that strengthen themselves under stress and are prepared for future challenges concerning their sustainability. This concept questions the sustainability of increased production and productivity by way of efficiency improvements. Society should be prepared to deal with future unexpected high impact events, which although are unlikely to happen, may threaten the existence of the system.

**Keywords:** efficiency, fragility, antifragility, sustainable development, unsustainable development, Black Swans.

**Streszczenie:** Uważa się, że poprawa wydajności przyczynia się do zrównoważonego rozwoju, jednak różne nieoczekiwane efekty uboczne mogą sprawić, że system stanie się bardziej kruchy. Świat stał się tak złożony i wzajemnie powiązany, a łańcuchy logistyczne tak długie i zawiłane, że powstały poważne ograniczenia w takim wykorzystaniu poprawy wydajności, aby powodowała ona bardziej zrównoważone zachowania społeczeństw. Wręcz przeciwnie, mogą one nawet zagrozić istnieniu systemu, a przynajmniej sprawić, że jest on niezrównoważony. W niniejszym artykule autor poddaje dyskusji różne idee i przykłady dotyczące zaproponowanego przez Taleba pojęcia antykruchości (ang.: antifragility), będącej cechą systemów, które wzmacniają się pod wpływem stresu i są przygotowane na przyszłe wyzwania dotyczące ich podtrzymałości. Pojęcie to kwestionuje podtrzymałość zwiększonej produkcji i produktywności wskutek poprawy wydajności. Społeczeństwo powinno być przygotowane do radzenia sobie z przyszłymi wydarzeniami, które mogą mieć ogromne konsekwencje i mogą zagrozić istnieniu systemu, ale też których prawdopodobieństwo zdarzenia się jest bardzo niskie.

**Słowa kluczowe:** wydajność, kruchość, antykruchość, zrównoważony rozwój, niezrównoważony rozwój, Czarne Łabędzie.

## 1. Introduction

The aim of this article is to show that there are serious limits to the use of efficiency improvements in order to make society more sustainable. Theoretically, radical efficiency improvements can lead to such a significant reduction in resource use, as well as the creation of substitutes for depleting resources, that sustainable resource management can be achieved [Weizsäcker et al. 2009; Ptak 2015; Munguia et al., 2015]. However, while it remains a question whether technological development and innovation can keep up with the increasing demand for goods and services [Meadows et al. 1972; Meadows et al., 1992], the increasing complexity in global supply chains increases the probability of negative effects of resource use appearing some time, somewhere, some place [see: Taleb 2012; Kovalenko, Sornette 2013; Will et al. 2015; Platje 2015a; Platje 2015b]. When considering the social, economic and environmental aspects, creating more goals to be achieved, such trade-offs become more likely. Furthermore, the final result of continuous efficiency improvements may be a more unsustainable society, as more and more different fragilities and weaknesses appear in a world which is increasingly interdependent and complex.

This argument is along the line of Taleb's *Antifragile* [2012]. While it may be that seemingly sustainability increases, a global disaster may have large and irreversible consequences. If a crisis is local or national, there are other areas and countries which eventually may support. In case of a global crisis, there may be no-one to support others. The discussion in this article is not aimed at providing answers and solutions, but to provide some insights into the dangers of efficiency improvements. Such improvements are easily acceptable, as they promise increased or at least the same production and consumption. However, independent of the question whether rebound and boomerang effects lead to an increased resource use, such improvements may lead to a difficult to assess reduced resilience. Using Taleb's idea of antifragility, a direction of research could be towards self-strengthening systems that are able to deal with the increasing number of low-probability, though high impact threats (of which financial markets, ecosystems and the problem of climate change may be the most visible).

## 2. Efficiency – some issues

In the discussion about efficiency, it seems often to be forgotten that what is efficient, depends on the goal that is intended to be achieved [Bromley 1989; 1991]. Although limits to growth have been discussed by different authors [e.g., Boulding 1966; Meadows et al. 1972], the goal of profit, productivity improvement, increase in output and increase in GDP, just to mention some, seem to be so ingrained in economic theories, that they are often taken for granted. As sustainable development aims at achieving multiple goals, many measures of efficiency can be used. As resources are scarce, not all goals can be achieved at the same time. As a consequence,



there will be trade-offs between different goals, creating challenges for policy for sustainable development. A well-known problem is that many measurement problems exist, in particular in the field of environmental valuation, while costs and benefits are often indirect, long-term and not directly visible [Platje 2011]. In this context, when the goal of the individual, organization or system is unclear, it will be a real challenge to determine the positive effects of efficiency improvements, while there certainly will be side effects.

Just as a general example of side effects, efficiency improvement in agriculture may lead to lower food prices due to increasing supply in a situation of inelastic demand, which leads to wider access to food. However, as individual farmers, *ceteris paribus*, see their income decline, there may be a need for scale enlargement. When accompanied by mechanisation, this may trigger off further efficiency improvements. Large scale production may lead to reduced need for workers. When there is no other work available in the countryside, many people may move to cities. When no jobs are created in cities, this can lead to pressure on wages, unemployment, the development of slums and an increase in social problems in urban areas (a process visible in large cities of developing countries [Todaro 1997]. Rural areas depopulate, leading to less demand for social services, like schools, health care, etc. While the tax base for supporting these services decreases, rural areas also may become less attractive for families with children, in particular when schools close down. Then, also negative multiplier effects may appear. For example, shops close down, leading to less demand for local products and local jobs. Furthermore, the large scale agriculture also may put pressure on the environment, when, for example, eliminating meadows and other sources of biodiversity, or using artificial fertilizers in intensive agriculture.

Generally speaking, efficiency improvements are often from the socio-economic point presented by the following scenarios: a). more is produced with the same input, b) the same is produced with less inputs. These scenarios can be traced back in many standard economic textbooks [e.g., Begg et al. 1994]. This seems to be related with the observation already expressed by Adam Smith [Smith 1998 (1776)] that people prefer more to less. This concerns in particular non-agricultural goods, as the physical capacity of people to increase food consumption is rather limited,<sup>1</sup> while the want for other goods seems to be unlimited. There are many reasons why it is difficult to reduce the total production and to resign from growth (an increase in production) [Platje 2011]. As resource intensity is unlikely to decrease enough in order to keep up with the increasing production, a scenario “doing less with less” [Shapiro 1978] might be the only way to achieve sustainability in the field of natural resource management. However, this may require a reduction in the level of production and consumption by the higher developed countries, while reducing radically the use of

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<sup>1</sup> Of course, on average people may gain weight, and increase in this way their capacity to consume food products. However, this increase is rather slow compared to equipment such as mobile phones, computers etc.

resource intensive methods to improve the quality of life in the less developed countries. Besides the many problems which would need to be solved, there is one hypothesis requiring deeper research drawn from behavioural economics the author wants to draw attention to.

As Kahneman and Tversky, as well as other scientists [Kahneman 2011] have shown, on average an increase in income by, say, 100 euro, provides in general half the utility compared to the disutility of losing 100 euro. An important implication is that not the level, but the change in income is relevant for peoples' satisfaction. This may be one determinant explaining why people in a growing, but poor economy, may be happier than people in a highly developed, though stagnating economy. However, an additional element is that examples of higher prosperity may lead to a dissatisfaction with the current way of life, a phenomenon well known in development economics [Todaro 1997]. From the point of view of people from developed countries the people in the poor countries are living in unimaginable extreme poverty. While the poverty cannot be denied, important is the word "unimaginable". Can they imagine happiness among people not having the same access to goods and services as they have at home? At such a moment, there exists the threat that there will be pressure to convince the people in the undeveloped countries to aim for the way of life in the high developed countries. This contributes to challenges in sustainable development, and would require significant efficiency improvements in order to satisfy the new demands. Although this argument is disputable, it is used to draw attention to another phenomenon requiring deeper research. The author, being a Dutchman living more than two decades in Poland, had on different occasions discussions with citizens on the socio-economic situation in Poland. Poland was more or less at the same level of development as Ukraine at the turn of the 1990s, when the economic transformation to a market economy took off. After 25 years of transformation Poland is a rich developed country compared to Ukraine [World Bank 2015]. While many problems still exist (many people working for low wages without perspective for quick improvement, pension system, etc.), the situation has improved. However, many people in discussions argued that the socio-economic situation was bad, as in Germany it was much better. When mentioning Ukraine as a reference point, this was put away as irrelevant, and sometimes even as nonsense. Although this as such does not prove anything, it shows that dissatisfaction in case of increased performance may appear, and growth and also efficiency improvements may trigger off demand for even more improvements. Using ideas from Kahneman [2011], this brings up a hypothesis for further research: A loss of income is more painful for the rich than the poor. For the rich a loss is felt as dissatisfaction, while for the very poor it is just trouble and poverty versus deeper trouble and deeper poverty. As a consequence, very rich countries may fear a recession more than very poor countries.

### 3. Sustainability, efficiency, fragility and antifragility

It is important to remember that only a system, not an organization or individual, can be sustainable [Taleb 2012; Platje 2015a; Platje 2015b]. If through efficiency improvements the individual company would gain such economies of scale that it would obtain, for example, a monopoly, then the company is the whole market. This makes the market fragile. Like a glass, which falls of a stone floor, when something goes wrong, damage is not easily impossible to repair [Taleb 2012]. Although large companies have incredible innovation potential, it is the small companies which by trial-and-error make the small improvement which may later be used by these large companies [Harford 2011]. When many small companies exist, of which many fail, there are still many left to come up with new ideas. While the individual large company may be more resilient than the individual small company, the consequences of failure are completely different. While the failure of a large firm may be less likely, the impact on the economy and society as a whole is much bigger, in particular when an area relies on such a company to a large extent. At such a moment, while the positive impacts of growth are clearly felt, the negative effects of failure are also deeper than compared to small companies.

In general, a system can react differently to different types of stress or pressure [Kovalenko, Sornette 2013]. If a system is fragile, stress creates conditions that may lead to its destruction. In case of robustness or resilience, a system can recover from not-too large stress. A system able to adapt and transform to large stress in fact restructures or completely changes. This may be the case with a market with many small players, in contrast to markets relying on one large enterprise which may be in deep stagnation for a long time after the collapse of such an enterprise.

Taleb [2012] developed the notion of antifragility, which goes beyond resilience. It is about systems that benefit from uncertainty and stressors. They learn from reversible mistakes and can adapt, transform, but are also more prepared for negative Black Swans. What Taleb calls negative Black Swans [Taleb 2007], are small probability, high impact events, which are most of the time unpredicted or thought impossible to happen in advance. Examples are the fall of the Soviet Empire at the turn of the 1990s, the nuclear disaster in Fukushima, but also the financial crisis of 2007/2008. Interestingly, while in financial economics models are used that presume perfectly working markets, which should lead to the impossibility of such unexpected events to happen, when these events happen, they are often neglected and/or considered to be an external factor [Mandelbrot, Hudson 2008; Taleb 2012]. When not taking these events into consideration, then the low probability of a complete collapse of a system is defined away. And when not considering this possibility, the probability of it happening increases in case of efficiency approaches which are based on obtaining small benefits by removing different types of seemingly unnecessary spare resources, redundancies and buffers [Taleb 2012]. Resilience to deal with negative Black Swans is reduced while fragilities appear.

A few examples will be presented to explain the issue of Black Swans and reduced system resilience caused by relatively small efficiency improvements. It is like with keeping cash, which could be invested in company shares and bring a much higher average return. While according to Keynes's precautionary principle cash can be kept for the case of a better investment opportunity appearing, it is also a useful buffer in case of a complete crash on the stock market. Even when losing all assets on the stock market, the cash allows for having a source of living or to invest in the cheap stocks (assuming the value of money is maintained and no high inflation appears). A similar argument goes for the reserve requirement ratio of banks. When it is, say 10%, this leads to a lower money multiplier, and reduced lending opportunities which may reduce the potential for economic growth. Leaving aside the discussion whether the money created is invested productively or sustainably, the financial crisis of 2007/2008 shows that the cost of a collapse of banks can lead to serious threats to the economic sustainability of the whole world, seriously increasing government debts and leading to crises in different countries. And this government debt has to be paid back some day by someone – either by increase of production (which can negatively influence the environmental sustainability when the ecological footprint remains too high due to too slow eco-innovation), or by redistribution (the funds have to come from somewhere). When too much has to be paid back at once, relative to the government budget, like was the case with Greece some years ago, this can be a serious threat in particular due to the increased global interconnectivity. While in the 1990s, for example, the Swedish banking crisis could be solved by the Swedish government, the fall of the Lehman Brothers created a threat of the global economic system [Admati, Helwig 2013].

Now returning to the issue of antifragility, Kovalenko and Sornette [2013] argue that Taleb's antifragility is vulnerable. That it also can collapse when exposed to extreme stress. They also criticize that many antifragile systems presented by Taleb are less productive than their fragile counterparts, making well-defined aims important. It seems that the authors have a point that Taleb does not explicitly define the goals of an antifragile system. While productivity, efficiency and growth can be very clear goals, Taleb's goal seems to be a system, organization or individual who can survive negative Black Swans, and catch the positive Black Swan appearing. Such goals are by definition general. The positive Black Swan may be the appearance of the Internet, and catching the opportunities appearing due to this new technology. Eastman Kodak is a clear example of a failure to do this, while Apple until now seems to manage the challenges. It is about creating options. To "have a Plan B" in case of extreme stress and problems, or having backups, while creating options that may lead to catch the positive Black Swan. Let us take the example of a company investing in many small projects in many countries. Like with large companies that invested in many post-Soviet countries after the fall of Communism, just in case something would happen and they would need to be there. While the probability of losing money is high, the strategy is based on many small investments with low

downsides (e.g., the investments are financed by equity, which will not lead to a collapse of the company when failing like it may be the case when financing with debt), while the upside can be a high profit when being at the right time and the right place in the market. A similar strategy is putting a lot of small amounts of money in, as Taleb [2012] argues, biotechnology projects. While the probability of failure of each individual project is high, the losses are relatively low. When one project succeeds, the benefits can be very high.

Kovalenko and Sornette seem to omit an important issue. Fragility increases the moment efficiency improvements are achieved by reducing buffers, slack and redundancies. These buffers seem to be unproductive when no negative Black Swans appear. But the fact they have not appeared yet, does not mean they cannot appear in the future. This efficiency is featured by low upsides (some benefits) and high downsides (loss of resilience and increasing fragilities). An antifragile system has lower downsides, and may require resignation from efficiency and productivity improvements. While Taleb's examples can be questioned and the issue appears to what extent they go beyond resilience, the idea seems to have some similarities with what Kovalenko and Sornette [2013] call adaptiveness and transformation. However, the crucial issue is the Black Swans. Does a system have enough buffers, redundancies and other elements of resilience to survive extreme stress, but also the ability to learn and innovate in order to be prepared for new future challenges?

An example of antifragility can be, as Taleb argues, decentralized political systems. Centralized political systems are more fragile. Kovalenko and Sornette [2013], using arguments from Clausewitz, argue that the nation states gathered more resources for war. This does show that a clarification of what is meant by efficiency is needed. This differs depending on whether we talk about efficiency in creating wealth for the population, or efficiency in being prepared to deal with an outside enemy that can destroy a country [Toynbee 2000]. History shows that while a state can be efficient in gathering funding for wars, these wars can lead to serious fragilities. For example, it has been argued that one of the reasons that the Soviet Empire collapsed was that while as a nation state they effectively accumulated sources for military purposes, the efficiency of doing so was smaller than in the USA. It has been estimated that about 25% of GDP was used for military purposes compared to a much lower share in the USA. Innovativeness was focused on the military, while not satisfying the developmental goals of the citizens [Ellman 1993, p. 23]. On the other hand, the USA showed a huge innovative potential, and they could win the Cold War. Thus, in order to be antifragile as a country, a wider approach towards efficiency should be used than only looking at resources for the military. It is doubtful that an efficient creation of resources for the Military can really be seen as a kind of productivity. It can be argued that it will lead to a wide range of fragilities in the long run, in particular when using the military potential in a too general way.

For example, it has been argued that the instability in the Middle East was deepened by the way of intervention – the crude use of military means weakening

the socio-political system. First of all, without direct risk of the attacker (what Taleb [2012] calls “skin in the game”) it is extremely difficult to win a war, let alone to “win the peace”. The local population in Iraq was rather unwilling to risk its own life when, for example, US soldiers and military leaders did not give a good example [Harford 2011]. Furthermore, an important issue is what was the source of dissatisfaction leading to the Arab Spring. As Kovalenko and Sornette [2013] argue, a rapid rise of food prices may trigger off revolutions. The reasons for the increasing food prices are often complex. It may be the result of more draughts due to climate change and water mismanagement, leading to lower agricultural output in a situation of continuous population growth [Femia, Werrel 2012; Gleick 2014]. Dissatisfaction may have increased due to increasing expectations of wealth by a well-educated population having examples from the developed world, etc.

When the Saddam Hussain regime was eliminated, a kind of institutional vacuum [Poznański 1996; Van de Mortel 2000] appeared. Old rules were gone while new ones are not established yet. Furthermore, the Saddam army was dissolved [Harford 2011]. This large group of people needed a new source of income. In such a situation it can be expected a serious enemy will appear, as it is not a surprise that trained army officers will find employment in a similar type of business. With the whole administrative system being in a high state of turbulence, in a situation where the main impulse for a change in power structures was outside military invasion (Iraq accompanied by uprising caused by, putting it simply, increasing food prices (Lybia), it can be expected the process of institutional change will be inefficient. And at that moment it may be that the monster, the Greek mythological hydra (used by Taleb as an example of antifragility) is created and fed. This monster, when you cut off one of its heads will grow two new ones. Analogically, by throwing more bombs, you may create more followers of extremist and terrorist groups, not being interested in creating a democratic, stable civil society. While this analysis is disputable, the most important message is that efficiency in collecting resources for military purposes can easily lead to creating the basis for very unsustainable development.

Another example given by Taleb concerns production: artisans (antifragile) vs. industry (fragile). Nomadic/gatherer hunter (antifragile) vs. urbanisation (fragile). Also here the antifragile is much less productive. Following Schumpeter’s line of thinking, large companies and economies of scale have had an incredible increase in production and wealth as a consequence. However, a question remains whether the system is sustainable. The authors criticizing Taleb seem to assume that productivity and growth as such are good. While this seems to be generally accepted, in particular among economists and politicians, a long tradition exists questioning the feasibility of continuous growth [e.g. Boulding 1966; Meadows et al. 1972]. Taleb tries to develop a new, disputable, concept based on “out of the box thinking”, arguing that, for example, open-mindedness is a basis for being antifragile. Kovalenko and Sornette [2013] try to “debunk Taleb” based on arguments that Taleb uses himself to show increasing fragilities in the context of increasing interconnectiveness and

complexity of globalising financial and economic systems. Of course, many antifragile systems are less productive than their fragile counterpart, as it is the increasing efficiency and productivity that fragilizes the system through the elimination of different types of buffers, redundancies, etc. This fragilization, before going into a critique on the concept of antifragility, should first be discussed in the context of resilience. Fragilization means a decrease in resilience. The question regarding sustainable development is whether resilient systems as such can provide a satisfying level of productivity and efficiency that satisfies human wants. Then, it should be compared to the notion of antifragility – to what extent does antifragility go beyond resilience, and does it really mean that a system becomes stronger under stress, and is able to deal with or prevent unexpected future events that can ruin the whole system. Also, it is important to develop Taleb's idea that a unit or system can be fragile in one part, and antifragile in another part.

The unit needs to be mortal in order for the system to be antifragile. The large group of, for example, entrepreneurs can learn from mistakes made by others in business models, approaches, innovations etc. This learning-by-doing creates an incredible innovation potential, and can be in particular observed in what Jane Jacobs [1986] calls "import-replacing-cities". While there can be large companies creating enormous productive improvements and developing incredible innovations (she provides the example of the airplane producer Lockheed), a large number of small- and medium-sized companies are needed when a new element lacks for the development of the innovation. In the large group, it is more likely that someone will find a solution sometime, while the many who failed can relatively easily find a new source of income compared to the situation of a few large companies in case of failure [Harford 2011]. An issue is that while such an import-replacing city can be antifragile in the economic field, a question remains whether the city is antifragile regarding access to natural resources. As long as environmental resources are overused and the ecological footprint remains too high,<sup>2</sup> no system can be antifragile in the long-run. Thus, while one company which is "too big to fail" (as otherwise the a city would get into a deep recession – just think of Detroit and General Motors closing its factories) can fragilize the system, the environmental aspect remains the bottom-line as argued in ecological economics [Costanza et al. 1991].

An issue that remains underdeveloped is the multilevel aspect of antifragility in the context of sustainability of global systems. Taleb touches upon the problem by his discussion on units that can strengthen itself at the expense of the other units and/or system. This can be big banks that cannot fail as otherwise the whole financial system would collapse. It can be a large company strengthening its position by putting costs on suppliers. At a different level it concerns the issue of, e.g., cities and/or countries fragilizing / weakening the countryside, other cities, other countries etc.

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<sup>2</sup> An ecological footprint of 1 means that a country, city or any unit exactly uses as much natural resources as it can produce itself. In 2010 the Global footprint exceeded 1.5 [Global Footprint Network 2010].

This is not only about intentional exploitation, but maybe more important, about processes in imperfect markets which have the weakening of other units as a consequence. This may be the disappearance or stagnation of small villages and small towns. Using the same logic, it may also concern countries and areas. The issue is, as long as there remain enough cities which can handle economic and social shocks (the pool of cities must remain large enough), and enough rural areas that support food production, then the mortality of individual cities or areas does not decrease the resilience of the whole group together. It rather makes it stronger. There must be room for failure, as otherwise no learning processes can take place and resources cannot be reallocated to new ventures and more promising areas of development. This general discussion already shows that antifragility as an element of sustainability does not necessarily mean stability equity or equality for everyone at one moment in time. It should make us aware that too much emphasis on individual units and their survival hampers or stops the trial-and-error, undirected and unintentional evolutionary processes that make a system able to deal with any type of challenge in the future. Antifragility does not mean that the whole group will survive a negative Black Swan. It means that enough units remain to recover from the shock (resilience) and that, among other things, learning processes can take place preventing such shocks in the future and being ready for other types of surprises that may come.

#### **4. Concluding remarks**

While the concept of antifragility is interesting for the sustainability discourse, the concept needs serious exploration. The core issue is that too much efficiency increases fragilities in a system, and as such makes it unsustainable, i.e., open to destructive crises. Too much efficiency and productivity growth generates more possible negative Black Swans in a world of increasing complexity. This leads to a threat of non-linear collapse. This needs to be researched in the context of radical eco-innovation, aiming at reducing the resource intensity more than the production increases [Keijzers 2003]. Logistic chains are so long and complex, with so many players, that the increase in output efficiency taking place in all parts of the chain, including all products and producers, will be an incredible challenge. In the face of information problems and difficulties in identifying direct responsibility for any type of action in such a situation, there may be different unexpected surprises of eco-innovation when not taking place in the whole production and distribution chain. Concluding, we can be sure that there will be surprises in the future. The issue is whether we are prepared for them, and able to manage them, and can strengthen different types of systems important for sustainable development in order to deal with new, unexpected challenges.



## References

- Admati A., Helwig M., 2013, *The Bankers' New Clothes – What is Wrong with Banking and What to Do About it*, Princeton University Press, Princeton.
- Begg D., Fischer S., Dornbusch R., 1994, *Economics*, fourth edition, McGraw-Hill, London.
- Boulding K.E., 1966, *The Economics of the Coming Spaceship Earth*, [in:] Jarrett H. (ed.), *Environmental Quality in a Growing Economy*, Essays from the Sixth RFF Forum, Resources for the Future/Johns Hopkins University Press, Baltimore MD, pp. 3–14.
- Bromley D.W., 1989, *Economic Interests and Institutions: the Conceptual Foundation of Public Policy*, Basil Blackwell, Oxford.
- Bromley D.W., 1991, *Environment and Economy – Property Rights and Public Policy*, Basil Blackwell, Oxford.
- Costanza R., Daly H.E., Bartholomew J.A., 1991, *Goals, Agendas and Policy Recommendations for Ecological Economics*, [in:] Constanza R. (ed.), *Ecological Economics – the Science and Management of Sustainability*, Columbia University Press, New York, pp. 1–20.
- Ellman M., 1993, *General Aspects of Transition*, [in:] Admiraal P.H. (ed.), *Economic Transition in Eastern Europe*, Basil Blackwell, Oxford, pp. 1–42.
- Femia F., Werrel C., 2012, *Syria: climate change, drought and social unrest*, <http://climateandsecurity.org/2012/02/29/syria-climate-change-drought-and-social-unrest> (access 12.10.2014).
- Gleick P.H., 2014, *Water, drought, climate change, and conflict in Syria*, *Weather, Climate and Society*, vol. 6, no. 3, pp. 331–340.
- Global Footprint Network, 2010, *Ecological Footprint Atlas 2010*, [http://www.footprintnetwork.org/en/index.php/GFN/page/ecological\\_footprint\\_atlas\\_2010](http://www.footprintnetwork.org/en/index.php/GFN/page/ecological_footprint_atlas_2010) (access 13.10.2014).
- Harford T., 2011, *Adapt – Why Success always Starts with Failure*, Little, Brown, London.
- Jacobs J., 1986, *Cities and the Wealth of Nations – Principles of Economic Life*, Pelican Books, New York.
- Kahneman D., 2011, *Thinking, Fast and Slow*, Penguin Books, London.
- Keijzers G., 2003, *Creating Sustainable Directions – Collaborative Stakeholder Approach of Governments and Business*, Erasmus Universiteit, Rotterdam.
- Kovalenko T., Sornette D., 2013, *Dynamical diagnosis and solutions for natural and social systems*, *Planet@ Risk*, vol. 1, no. 1, pp. 7–33, doi: arXiv:1211.1949 [physics.soc-ph].
- Mandelbrot M., Hudson R.L., 2008, *The (Mis)behaviour of Markets*, Profile Books, London.
- Meadows D.H., Meadows D.L., Randers J., Behrens W., 1972, *The Limits to Growth – a Report to the Club of Rome*, Universe Books, New York.
- Meadows D.H., Meadows D.L., Randers J., 1992, *Beyond the Limits – Global Collapse or a Sustainable Future*, Earthscan, London.
- Munguia N., Velazquez L., Ellenbecker M., Esquer J., Ojeda S., Will M., Delakowitz B., 2015, *Energy measures at the Mexican Maquiladoras*, *Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu (WSB University Research Journal)*, vol. 15, no. 7, pp. 907–914.
- Platje J., 2011, *Institutional Capital – Creating Capacity and Capabilities for Sustainable Development*, Wydawnictwo Uniwersytetu Opolskiego, Opole.
- Platje J., 2015a, *Sustainability and antifragility*, *Economic and Environmental Studies*, vol. 15, no. 4, pp. 469–477.
- Platje J., 2015b, *Beyond resilience – new institutional economics, fragilities and indicators of unsustainability*, *Central and Eastern European Journal of Management and Economics*, vol. 15, no. 4, pp. 295–315.
- Poznanski K.Z., 1996, *Poland's Protracted Transition*, Cambridge University Press, Cambridge.
- Ptak M., 2015, *Financing renewable energy projects through regional operational programmes*, *Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu (WSB University Research Journal)*, vol. 15, no. 7, pp. 887–896.

- Shapiro S.J., 1978, *Marketing in a consumer society*, Business Horizon, vol. 21, pp. 1–13.
- Smith A., 1998 (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, reprint edited with an introduction by Kathryn Sutherlands (1998), Oxford University Press, Oxford.
- Taleb N.M., 2007, *The Black Swan – the Impact of the Highly Improbable*, Penguin Books, London.
- Taleb N.N., 2012, *Antifragile. Things that Gain from Disorder*, Penguin Books, London.
- Todaro M.P., 1997, *Economic Development*, sixth edition, Longman, London.
- Toynbee A.J., 2000, *Stadium historii*, Państwowy Instytut Wydawniczy, Warszawa.
- Van de Mortel E., 2000, *An Institutional Approach to Transition Processes*, Tinbergen Institute, Research Series, Erasmus Universiteit, Rotterdam.
- Weizsäcker E. von, Hargroves K., Smith M., Desha C., Stasinopoulos P., 2009, *Factor 5: Transforming the Global Economy through 80% Increase in Resource Productivity*, Earthscan, London.
- Will M., Haidig J., Platje J., 2015, *Dysfunctional leadership – management in the CSR-case*, Central and Eastern European Journal of Management and Economics, vol. 3, no. 2, pp. 155–160.
- World Bank, 2015, *Indicators – economy and growth*, [www.data.worldbank.org/indicator](http://www.data.worldbank.org/indicator) (access 12.05.2016).