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## FINANCING OF MITIGATION AND ADAPTATION TO CLIMATE CHANGES

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### FINANSOWANIE KOSZTÓW ZAPOBIEGANIA I ADAPTACJI DO ZMIAN KLIMATU

**STRESZCZENIE:** Zapobieganie zmianom klimatu powinno w efekcie przyczynić się do redukcji kosztów adaptacji. Wydatki na adaptację są zróżnicowane pod względem rozkładu geograficznego i są zazwyczaj ponoszone na przystosowanie się do zmian klimatu lub zapobieganie ich negatywnym skutkom, jakimi są między innymi klęski żywiołowe. Wydatki te należy odróżnić od wydatków na usuwanie skutków katastrof. Z punktu widzenia sprawiedliwości społecznej istotne jest którzy aktorzy ponoszą koszty, a którzy odnoszą korzyści, czy przyczyniają się do powstawania dodatkowych kosztów.

W artykule dokonano analizy i porównania źródeł finansowania kosztów adaptacji i zapobiegania zmianom klimatycznym, aby określić udział poszczególnych aktorów w ich ponoszeniu. Przeprowadzony przegląd literatury pozwolił na identyfikację źródeł finansowania tych kosztów. Analizowano możliwości wzrostu potrzeb finansowych w zakresie adaptacji w obliczu prognoz zmian klimatycznych, a także możliwości sfinansowania rosnących kosztów, w tym również dzięki nowym sposobom finansowania.

**SŁOWA KLUCZOWE:** katastrofy naturalne, koszty, adaptacja, zapobieganie, finansowanie

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## Introduction

Climate change mitigation is a human intervention aimed at reducing or minimizing the sources of greenhouse gas emissions<sup>1</sup>. Combating climate change aims to stabilize greenhouse gas concentrations in the atmosphere at a level that could prevent „dangerous anthropogenic interference with the climate system of the globe” according to Article 2 of the United Nations Framework Convention on Climate Change, signed in 1992. The same paragraph of the Convention on Climate Change indicates the relation between combatting climate change and adaptation to it, paying attention to the economic aspects in the context of sustainable development. The abovementioned emission limits „should be reached in time sufficient for the natural ecosystems to adapt to the climate change.”

On the other hand, adaptation is „a process to adapt to actual or expected climate change and its effects”<sup>2</sup>. Its aim is to mitigate or avoid negative impacts and to make use of the opportunities arising from climate changes. The issues of adaptation are described in a number of strategic documents, including the White Paper „Adapting to Climate Change: Towards a Comprehensive EU Adaptation Strategy”<sup>3</sup>, the „Management Plan of European Water Resources”<sup>4</sup>, the „EU Strategy for Adaptation to Climate Change”<sup>5</sup>, and the „Polish National Strategy for Adaptation to Climate Change (NAS 2020) with the perspective by 2030”<sup>6</sup>. Adaptation should assist in mitigating the effects of natural disasters caused by climate change or taking measures to reduce them (for example, increasing the storage capacity of basins). The Sendai Framework for Disaster Risk Reduction 2015–2030<sup>7</sup> indicates the need for preventive measures to tackle the new risks arising from climate change, to

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<sup>1</sup> O. Edenhofer et al. (eds), *Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, New York 2014.

<sup>2</sup> C.B. Field et al. (eds), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A, Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, New York 2014.

<sup>3</sup> White Paper on Adapting to Climate Change: Towards a European Framework for Action, COM, Brussels 2009, p. 147.

<sup>4</sup> The Plan to Protect Europe’s Water Resources, COM/2012/0673, Brussels 2012.

<sup>5</sup> The EU Strategy of Adaptation to Climate Change, COM/2013/216, Brussels 2013.

<sup>6</sup> Polish National Strategy for Adaptation to Climate Change (NAS 2020) with the perspective by 2030, Warszawa 2013.

<sup>7</sup> Sendai Framework for Disaster Risk Reduction 2015–2030, Geneva 2015.

reduce the current level of risk, and to strengthen the resilience of natural and anthropogenic climate variability. The coordination of adaptive actions and disaster risk management is recommended<sup>8</sup>. The condition for successful adaptation is to adjust the activities of individuals and entities on the local, regional, national, or international levels to the climatic conditions at each level of management. Adaptation is not only relevant for stakeholders who are directly threatened by losses arising from climate changes, because gaining potential benefits from these changes, which reduces the global costs in general, depends on the appropriate adjustment measures, considered as adaptive measures. An example might be to change the types of crops, which will bring higher yields in the already changed climate, and with the favourable relationship between supply, demand, and other market factors, may increase the income of farmers. The costs of adaptation include investment expenditures that limit the adverse effects of climate change and the costs of adaptation to new climatic conditions, for example, changing crops and introducing new technologies. The cost of adaptation is „the cost of any additional investments needed to adapt and to take advantage of future climate change”<sup>9</sup>.

The financing of expenditure on climate adaptation or disaster mitigation should not be considered in isolation from any losses arising from these catastrophes. They are the reason why efforts towards adaptation and mitigation are made. Therefore, the analysis also includes a comparison in this regard.

## Research questions and methodology

Several research questions were addressed concerning the financing of the costs of adaptation to and prevention of climate change.

1. Which sources are providing funding for climate change prevention, adaptation, and elimination of losses?
2. Are these the same sources?
3. Should we expect an increase in demand for financing adaptation, mitigation, and funding of losses in the future?
4. Will the current sources of funding be able to cover the additional costs In the face of a possible increase in the funding demand in this area resulting from the forecasted climate change?
5. Moreover, finally, is there a search for new means of financing?

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<sup>8</sup> The EU Strategy of Adaptation to Climate Change....

<sup>9</sup> C.B. Field et al. (eds), op. cit.; *Investment and Financial Flows to Address Climate Change. Background Paper on the Analysis of Existing and Planned Investment and Financial Flows Relevant to the Development of Effective and Appropriate International Response to Climate Change*, Bonn 2007.

An analysis of secondary sources, strategic documents, and statistical databases was carried out to answer these questions.

## The research results

Adaptation and mitigation can be understood very widely. The directions of adaptive actions in different sectors include, for example, adjusting the water, energy, agriculture, fisheries, forestry, transport, construction, and spatial planning sectors as well as the health and environmental protection sectors to climate change as well as stimulating innovation and promoting adaptation and education in this area<sup>10</sup>.

EU funds are targeted at specific projects. For example, the Operational Programme "Infrastructure and Environment 2014–2020"<sup>11</sup> aims to support environmental protection, energy security, the low-carbon economy, and adaptation to climate change. On the other hand, mitigation measures mainly concern the reduction of greenhouse gas emissions carried out by the development and promotion of and incentives for low-emission modern technologies, such as installations and equipment for reducing emissions at source and obtaining energy from low-carbon and renewable energy sources, and by promotion of and incentives to introduce energy-saving solutions, such as thermo-modernization of buildings. Funding in this regard, targeted toward specific objectives and actions described in the individual regional strategic programmes, is expected from EU funds for the 2013–2020 period. For example, the Malopolska province plans to obtain a total of 420 million PLN in EU grants from the Regional Operational Programme of Malopolskie Voivodeship for the following operations: 4.1 „Increasing The Use of Renewable Energy Sources”: 65 million PLN; 4.2 „Increased Energy Efficiency in Small and Medium Enterprises (SMEs)”: 19 million PLN; 4.3 „Improving Energy Efficiency in The Public and Housing Sector”: 96 million PLN; 4.4 „Reduction of Air Pollution”: 100 million PLN; and 4.5 „Low-carbon Urban Transport”: 140 million PLN<sup>12</sup>. For comparison, expenses on climate change adaptation operations are planned to be funded by 31 million PLN from operation 5.1, „Adaptation to Climate Change Regional Operational Programme for Malopolska Voivodeship”<sup>13</sup>.

<sup>10</sup> The EU Strategy of Adaptation to Climate Change....

<sup>11</sup> A Detailed Description of Priority Axes of the Operational Programme Infrastructure and Environment 2014–2020, Warszawa 2016.

<sup>12</sup> Regional Operational Programme of the Malopolska Region for 2014–2020, A Detailed Description of the Priority Axes of the Regional Operational Programme of the Malopolska Region for 2014–2020, Kraków 2015.

<sup>13</sup> Ibidem.

The World Bank is the largest external financier of projects related to water management implemented in more than 100 countries and has already provided more than \$100 billion in recent years<sup>14</sup>. Dams and other hydrological installations are funded among others by the financing agencies (bilateral aid agencies, multilateral development banks, export credit agencies, and the European Investment Bank).

Sources of financing can be classified as the entities' own funds and as external funding. Here the funding sources have been categorized:

- Self funding: the entity's own resources, and self-financing with instruments such as fees for ecosystem-based services<sup>15</sup>, the creation of special trade markets, such as emissions trading<sup>16</sup>, risk transfer instruments<sup>17</sup>, public-private partnerships, public and private sources (households, businesses)<sup>18</sup>.
- External financing:
  - public funds, for example the International Monetary Fund, EU funds, state funds administered by governmental agencies, local government funds; repayable and non-refundable assistance;
  - social and private funds raised by non-governmental organizations, such as foundations, associations, private sponsors, venture capital; non-refundable repayable financial support;
  - bank resources, such as the World Bank, the European Investment Bank, the European Bank for Reconstruction and Development; repayable financial support.

We can sort them by the specific sources of financing:

- international sources (international organizations, such as the UN and associated divisions – Food and Agriculture Organisation, Oxfam);
- transregional (e.g., EU structural funds, the Cohesion Fund of the EU, the EU Solidarity Fund);
- state (specific budget provision);
- regional;
- local.

Table 1 presents the identified sources of funding categorized by purpose of expenditure.

<sup>14</sup> The European Parliament's Resolution on Financing of Reinforcement of Dam Infrastructure in Developing Countries (2010/2270 (INI)), Brussels 2011.

<sup>15</sup> C.B. Field et al. (eds), op. cit., p. 964.

<sup>16</sup> J. Dyduch, *The Emission Trading Scheme*, Warsaw 2013.

<sup>17</sup> A. Dubel, *Analiza korzystania przez interesariuszy z dostępnych w Polsce instrumentów transferu ryzyka*, „Gospodarka Wodna” 2016 No. 6.

<sup>18</sup> O. Edenhofer et al. (eds), op. cit., p. 106; Ustawa o szczególnych rozwiązaniach związanych z usuwaniem skutków powodzi z dnia 24 czerwca 2010 roku (Dz.U. No. 123, item. 835).

**Table 1.** Sources of financing of climate change adaptation operations and mitigation of climate change such as disaster relief

| Purpose of expenditure                                     | Priorities of expenditure, financing sources, and the type of financing   |
|--|---|
| Preventing climate change and adaptation to climate change | Research and creating the potential: European Commission, REA and EASE, JRC, EIT agencies, Horizon 2020 programme (e.g., calls for applications DRS-9-2014 / 2015-11-2015 DRS, DRS-22-2015), and related programmes, KIC, Joint Investment Programme (JIP CBRN); 100% financed.   |
|  | Demonstration projects: Community Initiative LIFE, EU and national resources, for example: National Fund for Environmental Protection and Water Management; funding at the level of tens of percent   |
|  | Good practices in specific sectors: agriculture, fishing, civil and environmental engineering, water management, and nature protection, at transregional, national, regional, and local levels: the EU structural funds: including the CAP, the EU Cohesion Fund, the Interreg programme, the National Fund for Environmental Protection and Water Management, the Regional Fund for Environmental Protection and Water Management (including the Green Investment Scheme), the state budget, and the budgets of local governments; funding at the level of tens of percent; Loans and credits: The World Bank, EIB, EBRD, IMF; funding at the level of several tens of percent; Programmes of the United Nations: REED, UNDP, UNEP; FAO, Oxfam, WWF, and associations and foundations committed to sustainable development and environmental protection; co-financing of up to 100%. |
| Dealing with effects of natural disasters                  | The EU Solidarity Fund (EU Regulation No. 2012/2002 of 11 November 2002) is a supplementary subsidy for the state expenses of ongoing operations intended to repair damages that are not subject to insurance.  |
|  | Special-purpose reserve of the state budget   |
|  | Non-governmental organizations, such as Caritas Poland and the Polish Red Cross   |
|  | Commercial banks  |
|  | Insurance and reinsurance companies   |

Comparing the costs of adaptation and mitigation for their sources of funding indicates a greater share of own equity in funding (about 60–70% between 2010 and 2012) and significantly higher annual costs of investment in the mitigation of climate change<sup>19</sup>. In turn, the losses are often financed from the entity's own resources and then from external resources, such as international support, targeted subsidies, or insurance. FS EU has given support in 63 cases of natural disasters, such as floods, forest fires, earthquakes, storms and droughts, in 24 European countries, spending more than 3.7 billion EUR. JIP CBRN agents secured a 12 million EUR and allocated annual budgets of the EU from the perspective of financing until 2020 on research and potential building are estimated at 360 million EUR. Recorded losses

<sup>19</sup> O. Edenhofer et al. (eds), op. cit., pp. 104–107, 1214–1223; C.B. Field et al. (eds), *Climate Change 2014...*, p. 959.

attributed to the climate change which occurred between 2001 and 2011 amounted to about 56 billion PLN. In the absence of adaptation operations in the future, Poland is likely to bear consequential losses estimated at around 86 billion PLN for 2020 and an additional 119 billion PLN in the years 2021 to 2030 (prices from 2010), which would represent about 0.5% of Polish GDP. For the removal and mitigation of the effects of natural disasters in 2001–2011, Poland spent over 46 billion PLN in total, and estimated losses at that time turned out to be more than 10 billion PLN greater than the expenditure incurred<sup>20</sup>.

The costs of future adaptation that would be incurred depend largely on the level of the current status of adaptation, that is, the quantity, quality, and effectiveness of implemented solutions. The standard of adaptation is indicated by the scale of flood losses which would not have occurred if the adaptation and resistance levels were at an appropriate level. A clear indicator in this regard may be the losses in the areas with a high floods risk (10%).

Cost-effective adaptation measures for a particular region are easier to demonstrate than the cost-effectiveness of mitigation. Thanks to effective adaptation and improved resistance, property increases in price and acts as an asset deposit.

Adaptation, mitigation, and losses are all financed from the same sources, excluding the selected instruments and cases of funding dedicated to specific purposes. Between adaptation and mitigation, we may observe positive feedback resulting in *co-benefits* or *trade-offs*, which are widely described in the literature<sup>21</sup>. This is the evidence of the close relation between these processes. For example, reservoirs for water retention are a source of greenhouse gases, including methane due to the process of eutrophication<sup>22</sup>.

In the future, we should expect an increase in demand for financing of the costs of both adaptation and mitigation as well as the costs of losses associated with climate change. This increase in demand might be primarily due to rising losses caused by climate change and the desire to reduce the climate change by preventive and adaptive operations. By analysing historical data on the losses, a growing trend can be observed<sup>23</sup>, which is associated with an

<sup>20</sup> Strategic plan adaptation ...

<sup>21</sup> For example: J. Bayer, A. Dubel, J. Sendzimir, S. Hochrainer-Stigler, *Challenges for mainstreaming climate change into EU flood and drought policy: water retention measures in the Warta River Basin, Poland*, „Journal of Regional Environmental Change” 2015 No. 15(6), p. 1011–1023; C. Rosenzweig, F. Tubiello, *Adaptation and mitigation strategies in agriculture: an analysis of potential synergies*, „Mitigation and Adaptation Strategies for Global Change” 2007 No. 12(5), p. 855–873.

<sup>22</sup> European Parliament resolution on the financing ...

<sup>23</sup> EM-DAT: The CRED/OFDA International Disaster Database; *Ochrona Środowiska*, Warszawa 2010–2015, www.emdat.be [15/06/2016].

increase in the frequency of natural disasters and an increase in the value and vulnerability to damage of assets located in areas exposed to the risk of these disasters. To avoid increasing losses, governments and international institutions declare support for programmes and projects for mitigation (for example, subsidizing new technologies and the low-carbon economy) and adaptation (for example, precise irrigation of crops) as well as to create conditions for self-financing of these objectives by new acts of law (for example, trade permits for emissions).

It should be noted that the financing of losses and costs of prevention and adaptation will be even more possible in the future than today. As shown by international declarations and agreements<sup>24</sup> as well as ongoing debates<sup>25</sup>, institutions currently financing the cost of mitigation and adaptation to climate change expect an increase in these expenses in the future, due to the growing awareness resulting from projected climate change, and thus have the opportunity to prepare and plan appropriate policies for long-term financing of these costs. Also, awareness among businesses and ordinary people regarding the influence that they have on the climate and the consequences for themselves and the world is increasing. This awareness, coupled with incentives for co-financing by local governments and specific actions that impact positively on climate, increases the expenses of business entities and households in this area. Policies of the European Union and expenditure planned in the EU programming period up to 2020 are most likely to maintain this trend in the future. However, this positive scenario of funding development is conditioned by the existence of more affluent societies, no wars, and a stable financial system.

At the same time, new methods of financing are sought, including risk transfer<sup>26</sup> comprising insurance tailored to the sector's needs, such as indexing of crop insurance. When planning new instruments, it is advisable to consider the strategies that subjects exposed to risk follow in response to these risks. Also, sufficient resources for planned activities must be provided, the costs and risks associated with the source of funding should be as low as possible, the time taken to raise funds from that source should be as short as possible, and the formal requirements should place the lowest possible burden on potential beneficiaries.

<sup>24</sup> Among others, Sendai Framework for Disaster Risk Reduction 2015–2030, Geneva 2015; *Adoption of the Paris Agreement. Conference of the Parties*, Paris, 30 November – 11 December 2015 FCCC/CP/2015/L.9, Paris 2015.

<sup>25</sup> Among others: *Fourth Meeting of the Community of Users on Safe, Secure and Resilient Societies. Focus on Natural Hazards, Including Cascading Effects*, Brussels, June 2016.

<sup>26</sup> J. Handschke, M. Kaczała, K. Łyskawa, *Koncepcja polis indeksowanych i możliwość ich zastosowania w systemie obowiązkowych dotowanych ubezpieczeń upraw w Polsce*, Poznań 2015; A. Dubel, op. cit.



## Discussion of the results

The obligations for financing related to adaptation and mitigation are perceived differently by the developed countries and developing countries. This is evidenced by the debates and negotiations in international forums. Economic and social arguments of each signatory were included in the commonly accepted declarations, like COP 21 in Paris or RIO20+ in Rio de Janeiro. Developing countries, which bear the cost of losses to a greater extent, cannot afford to bear the cost of reducing emissions. Also, they do not want to cut emissions to the desired size so as not to restrain their development. Developed countries can afford better adaptive solutions and better technological solutions and energy that affect the limitation of emissions.

Future costs of adaptation and mitigation remain very difficult to estimate due to the uncertainties regarding the physical processes and the variety of possible adaptation and mitigation actions as well as limits in their implementation. An important criterion for implementing these measures is the cost-effectiveness. In the legal and strategic documents, we may find many references regarding recommendations or requirements for carrying out a cost-benefit analysis of the planned solutions.

## Conclusions

Comparing the sources of financing of the costs of adaptation and mitigation of climate change, the greater share of the entity's own funds in financing can be observed and is almost ten times higher than the expenses of investments in mitigation. There is a close relation and therefore the operations are very often funded from the same sources, excluding selected financing instruments dedicated to special purposes. The institutions expect an increase in the costs of mitigation and adaptation in the future regarding predicted climate change. New types of financing instruments are sought, including risk transfer and self-financing through the tools or payments for ecosystem services and the creation of specialized trade markets.

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