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Tradition and innovations in managing flood risk in Poland

Key words: flood risk, flood risk management, innovation, innovativeness

S u m m a r y: The paper presents traditional and innovative solutions in managing flood risk in Poland. A short report on the problem of flood losses and presence of this risk in the world is the introduction to the above discussion.

It constitutes one of the main dangers of catastrophic nature (right after earthquakes) which affect the modern humanity. The risk of earthquakes is at a relatively stable level, but the risk of floods causes more and more victims and losses in the economies of the world.

The term “flood risk” appears in many legal acts and source materials available, both Polish and international, among which special attention has been paid to the EU Floods Directive. It introduces major changes in flood risk management, also for the Polish standards.

The traditional attitude to managing the analysed risks most often comes down to the way of thinking and acting in the face of flood hazard. Expecting flood levees to perform as expected when living in the natural flood areas of rivers and mountain streams may result in increased hazard and worsening of the situation. Tradition manifests here in the way flood works are executed and in risk management (lack of active protection measures for the endangered entities/ areas, hoping that “technology will make it”, shifting responsibility for execution of protection work on particular units managing water resources in the country). Innovative solutions are based on application of modern technologies and/ or materials, as well as other tools, such as the law (act which regulate the discussed emergencies, comprehensive flood protection programmes), early warning systems, education, insurance or ART financial instruments in the capital market. The paper analyses the most important of them.

The conclusion presents in brief the results of inspection of the Supreme Audit Office in the scope of flood protection in Poland and synthetically summaries the above discussion with attention paid to implementation problems for innovative solutions in the analysed scope.

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1. Introduction

Flood events and the resulting losses belong to the most common and turbulent manifestations of extreme natural disasters.

According to the *United Nations Development Programme* (UNDP) concerning consequences of natural disasters, with the example of the last two decades of the 20th century and the level of exposure and susceptibility to various disasters in particular countries of the world, on the average almost 196 m people in at least 90 countries are exposed to the flood risk every year. The number of casualties in floods per million of residents in the analysed period was highest in Asia and in the Pacific area (14.11), and lowest in Northern America (0.31). In Europe, this indicator was 1.68 (1, pp. 9, 14).

According to UNESCO, about 9 m people lost their lives in floods in the 20th century. At the end of the last century, ca 150–170 floods were recorded every year in the world (2).

According to the definition in Article 2 of Directive 2007/60/EC of the European Parliament and Council of 23 October 2007 on assessment of flood risk and flood risk management (referred to in the literature as the Floods Directive), “flood risk” is a combination of the probability of occurrence of flood and the related prospective negative consequences for human health, the environment, cultural heritage and business activities, whereas flood is a temporary covering with water of the area which is not covered with it under standard conditions (3, Article 2, p. 27). This definition includes events caused by rivers, mountain streams, as well as mediterranean periodical water streams, which applies only to the countries on the Mediterranean Sea in the belt of its specific climate, and storm floods, which may occur in sea coast areas, but it may not take into consideration floods caused by sewerage systems. The quoted act of the EU law applies to all member countries as of 26 November 2007.

Similar definitions of flood are used in Poland (in professional literature in this scope, in conference materials, in IMGW documents and in legal regulations in force). According to them, flood means freshet of river or sea waters, which causes measurable losses in property and social losses. Freshets are a natural phenomenon, necessary and ultimately useful for the environment, but floods constitute an example of disaster risk whose occurrence causes damages in the economy and in the society (more: see e.g. 4, p. 14).

Therefore, flood risk management aimed at limitation of its negative consequences becomes a priority, and in the all Europe context, not only for individual countries. In Poland, flood phenomena occur every year, the difference only consists in their intensity and reach (the area of inundated land), and, as a result, in the value of the losses incurred. The recent floods of 2010 and early 2011, apart from tragic experience, resulted in new acts regulating the issues related to flood protection and compensation of losses, thus there is quite large and current set of materials for the discussion.

The objective of this paper is indication of solutions in the area of flood risk management used in Poland, with special attention paid to their traditional and innovative nature.

2. Traditional flood risk management in Poland

The problem of flood disasters cannot be eliminated, as it is not within the realm of human activities (due to inevitability of this type of natural phenomena). According to scientific research in the field of hydrology, now and then the reach and consequences of floods exceed the forecasts. The most probable causes of extreme natural phenomena, apart from the popularised *global warming* as a derivative of pollution of the natural environment, are the Sun activity (which decides about the strength of the solar wind) and the volume of sun light reaching the Earth, thus causing formation of clouds. This activity is nowadays very strong, resulting in warmer climate, and high temperatures feed phenomena based on pressure, such as hurricanes and tornadoes, which in turn cause further disaster, like floods or fires.

Traditional methods of managing flood risk manifest mostly in the attitude to its essence. The basic objective of such management is liquidation of the consequences of floods and preventing their occurrence by controlling the flow and levels of water in river beds.

Liquidation of damages is an obvious activity resulting from the necessity of saving people and their property. The provision of the Constitution on the obligation of the state to protect citizens and their property should be understood in a broader way, as the task of the state to undertake actions to prevent actualisation of risk/ hazard. Protection against flood constitutes also, as indicated in the Water Law of 18 July 2001 (5), the task of government and local government administration. The point is to create legal standards, formal procedures and means for creating conditions for protection of citizens against phenomena threatening life and health and causing high losses in property. Most of waters and water devices, including used for flood protection, is managed by regional and voivodeship water management administrations, that is local government budget units reporting to voivodeship speakers.

The President of the National Water Management Administration (KZGW), reporting directly to the minister for water management, supervises regional ZGWs in Gdańsk, Gliwice, Krakow, Poznań, Szczecin, Warsaw and Wrocław, and units of the state hydrological, meteorological and hydrogeological services. Additionally, flood protection is also the duty of such departments as the Ministry of Agriculture and Rural Development; Infrastructure; Home Affairs; and Administration; and the Government Security Centre (6, p. 16).

Flood management is part of crisis management, pursuant to the Act of 26 April 2007 on crisis management (7). The crisis management system deals with occurrence of hazards which require undertaking special measures by public administration. The

centres for crisis activities included in the system deal with events which create hazard for integrity of the territory, life, health, property or infrastructure of strategic importance for the society, cultural heritage or environment (the so-called incident situation, that is protection of building structures, equipment, installations and services of key meaning for security of the state and its citizens and efficient functioning of bodies of public administration). However, this applies to such degree of hazard which does not require announcement of any extraordinary rules (martial law, state of emergency or natural disaster situation). Crisis management may thus be used in case of natural events such as floods, hurricanes, droughts or technical breakdowns, pursuant to the provisions of the Act of 18 April 2002 on natural disaster situations (8, Article 3).

The Voivodeship Drainage and Water Devices Management (WZMiUW) and the Regional Water Management Authority (RZGW) constitute the appropriate entities which deal with broadly understood water management, investments in this respect and managing the issues related to flood protection. Examination of the causes of building disasters and co-operation with the bodies of state inspection remain in the realm of the organs of construction supervision (voivodeship and county inspectorates of construction supervision and their managers, as well as the Chief Inspector for Construction Supervision). Additionally, apart from the said Water Law, the Building Law of 7 July 1994 (9) also specifies the scope of competencies of regional and voivodeship administrations of drainage and water devices.

The organisation of water management in the country is presented in Figure 1.

Unfortunately, there is no certain preventive measure against floods, and using the known and traditional technical solutions applied for this purpose is not, according to specialists in this field, unanimously positive. Traditional methods of flood risk management thus include technical measures and methods, such as:

- river bed embankments along the river flow;
- reservoirs which regulate retention (storage reservoirs, relief canals, dry canals);
- accumulation reservoirs and devices (which are used for management of water resources, control wave height: by opening and closing in the proper moments of the flow of water, they reduce wave height, thus minimising the risk of river bed overflow, additionally providing electricity), i.e. the gates in the ditches, locks, weirs, dams on rivers;
- river regulation (their banks and bottoms);
- polders (natural inundation areas beyond retention embankments);
- planting vegetation in inundation areas and wastelands (the so-called phytoimprovement).

Innovative solutions are also used, described in more detail in section 3 of this paper. However, these methods are more often related to the traditional approach to flood protection.

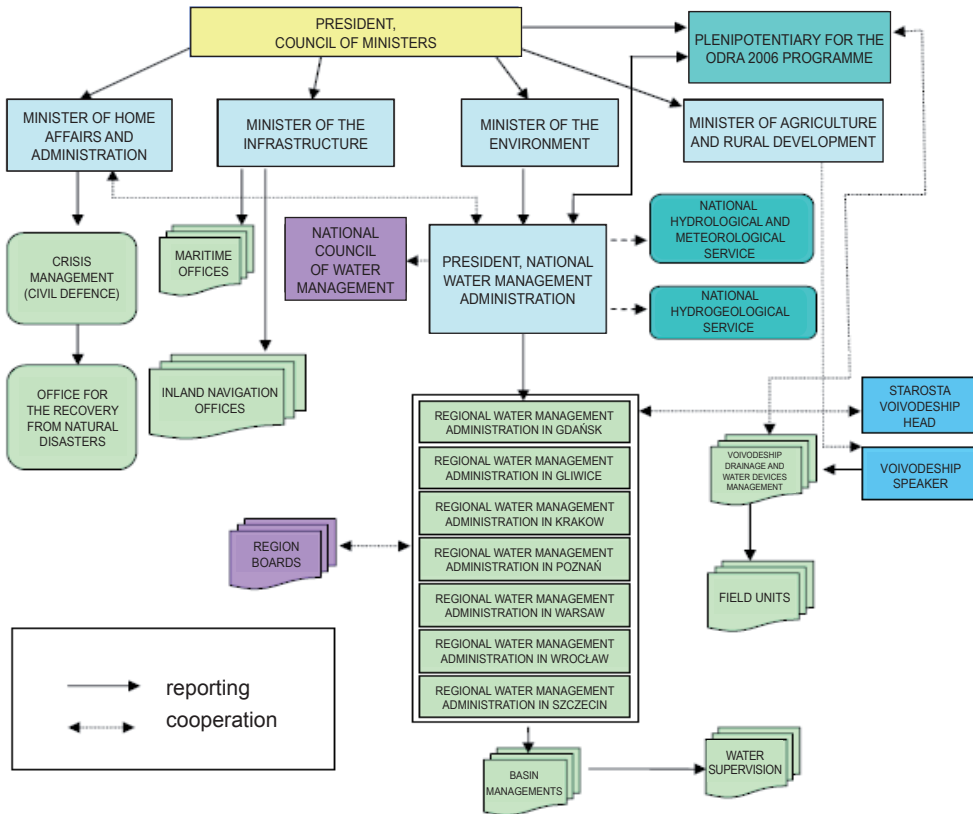


Figure 1. Organisation of water management in Poland

Source: (10, p. 14).

3. Innovativeness in flood risk management methods

Innovative solutions¹ in reference to actions commonly called by a collective term “flood prevention measures” boil down in Poland mostly to using new technologies in construction, rebuilding or expansion of flood protection measures. Modern methods include various types of shields and cores (e.g. made of cohesive soils, geomembranes, vinyl chloride, polyethylene, PEHD), vertical filtration barriers made of hardening suspended matter, leak-tight walls executed where there is no room for expansion of the levee or aprons sealing sub-floor on the draining side made of ma-

¹ In this article, new solutions/ actions regarding flood risk management, different from previously used, are being regarded as innovative solutions.

terials similar to those for shields and cores (mostly geosynthetic) (11). Direct examples of such solutions include mobile flood prevention systems in the form of flood barriers made of retention beams and walls with locking mechanisms built of them (12),² flood barriers and gates (13)³ or the Beaver protection system, awarded in June 2011 during the EDURA 2011 fair in the category of “Measures of protection for people and property” (14).⁴

Innovativeness manifests also in activities of technical nature, contrary to these whose objective is river regulation. They consist in recovering the natural flow of rivers and are named renaturalisation, as it was done with the river of Rhine in Germany.

Some innovative legal solutions may help in executing flood prevention investments. Their innovativeness consists in application of procedures not applied so far in such cases, which are to facilitate and accelerate execution of the activities used for flood protection, which is in fact improving and reforming the use of such solutions in practice. One of these solutions is the Act of 8 July 2010 on special principles of preparation for execution of investments in the scope of flood prevention building facilities (15), hereinafter referred to as a special act. It is based on a similar special road regulation (16), introducing extraordinary mechanisms of acquisition of private estate properties for this purpose to the process of flood prevention investments execution (the point is to take over the estate property for public objectives with the damages without the necessity of running the expropriation process).

Government programmes developed with a view on comprehensive protection of Poland against floods and mitigating their consequences may be also considered innovative. These programmes refer to the areas of river basins of the basic rivers in the country, that is Vistula and Odra, as well as Żuławy Wiślane. According to the premises, they allow effective, properly planned and included in planning documents execution of tasks and investments protecting against disastrous floods, as well as reforming the system of managing waters in the country. The scope of programmes and their main objectives are given in Table 1.

In the programmes given in Table 1, the draft State Water Policy is the superordinate and priority measure (the official abbreviation: Projekt PWP), and its time span shall be longest (it is longer than the average period, which results from international obligations, but mostly in the EU).

²The German technology of the company IBB, used in practice on a larger scale in the floods in 2002 and 2006, not only in Germany but in the UK, France, Switzerland, Austria, Belgium, the Netherlands, Luxembourg and the United States.

³Polish Technology of the Company Pierot Ltd, more commonly known for fire protection.

⁴Swiss technology representing pumped barrier consisting of two parallelly connected hoses filled with water.

Table 1

Characteristics of water management programmes in the scope of flood protection

Programme	Time (years)	Basic objectives	Tasks/ investments
1. State water policy up to 2030 (including stage 2016)—prepared by the National Water Management Administration based on the “Project of National Strategy of Management of Waters 2030 (including stage 2015)” PROEKO CDM Sp. z o.o.	2010–2016 2016–2030	<ul style="list-style-type: none"> a) common access of people to pure and healthy water, b) limitation of hazards caused by floods and droughts and reduction of risk of emergencies and their negative consequences, c) keeping good condition of waters and the related ecosystems, d) meeting justified water needs of the economy, e) the reform of the system of water management and financing (development by the end of 2013) of solutions in the field of organisation, financing and legal aspects and verification of the reformed system of waters management by the end of 2016), f) improvement of territory coherence as well as equalisation of regional disproportions 	<ul style="list-style-type: none"> • the Upper Odra area: construction of the flood reservoir tank Racibórz Dolny, improvement of flood protection in Kotlina Kłodzka, modernisation of the water reservoir Nysa and increasing outflow of flood waters from this area, modernisation of Wrocławski Węzeł Wodny including hydrotechnical structures and flood embankments; • the area of Śródkowa and Dolna Odra: liquidation of places difficult for ice breaking (rebuilding, modernisation and maintenance of regulation development), improvement of the outflow of flood waters; • the area of Upper Vistula: cleaning up water management for a set of tanks (Przeczyce, Kuźnica Wareżyńska, Pogoria), modernisation of flood prevention structures in the valley of Przemsza, construction of the water reservoir Kąty-Myscowa on the River Wisłoka, completion of construction of the tank Świnna Poręba; • the area of Upper Vistula: ecological protection of the water step in Włocławek, improvement of flood safety reservoir in Wrocław, repair of side barriers, reinforcing banks and clearing away mud on the River Bug mouth to Zegrze Lake; • the area of Lower Vistula: protection of Żuławy Wiślane against floods
Program Żuławski 2030	1st stage by 2015, 2nd stage by 2030	<ul style="list-style-type: none"> • ensuring protection against flood 	<ul style="list-style-type: none"> • 43 projects (modernisation of the flood protection infrastructure—reconstruction, rebuilding, expansion, non-technical activities: hazard recognition, prevention with natural protection methods, increasing awareness of local communities and representatives of the administration and institutions in the scope of flood risk management)

Programme	Time (years)	Basic objectives	Tasks/ investments
Program dla Wisły i jej Dorzecza 2020	opening in 2000, updating in 2006	<ul style="list-style-type: none"> ensuring protection against flood: the goal will be achieved when risk of flood losses drops by 2020 to the level of 25% against 1997 (until 2006, this risk was to reach 60%) 	<ul style="list-style-type: none"> protection against flood: active (flood prevention reservoirs, small retention, polders, ice breaking), passive (flood embankments, regulation of rivers and mountain streams), non-investment (spatial planning, expropriation, tax and insurance systems), education, crisis action plans
Program dla Odry—2006	opening in 2001, updating in 2008	<ul style="list-style-type: none"> modernisation of Odrzański System Wodny and radical improvement of flood safety in the basin of Odra (the concept of protection against flood in the “General strategy of protection against flood in the basin of upper and middle Odra after the high flood 1997”) 	<ul style="list-style-type: none"> elimination of flood damages, developing preventive plans for spatial management and protection of water purity and the natural environment, modernisation and construction of flood embankments, organisation of polders, construction of retention reservoirs and small retention facilities, modernisation of the Odra river bed and the Opole water system node

Source: Author's own study on the basis of (6, p. 18; 17, p. 28; 10; 18; 19; 20).

Innovative solutions not only for Poland but also for all countries of the European Union have been introduced by the so-called EU Floods Directive. The obligations resulting from the Directive consist in preparation of the initial assessment of flood risk (by the end of 2011), flood hazard maps (by the end of 2013), flood risk maps (similarly to hazard maps, by the end of 2013) and plans for flood risk management (by the end of 2015). The order of publicising the above documents by public announcement is also important. Additional documentation on flood risk in the area of member countries will be made available by electronic means with the European Water Information System for Europe *WISE* (<http://www.water.europa.eu/>) and implementation activities for the guidelines of the Directive by particular members of the EU will be checked in this way as well. The implementation schedule for the Directive in Poland, prepared by the National Water Management Administration in 2008, is given in Figure 2.⁵

The solutions introduced by EU are mostly based on non-technical methods. Technical means are to extend duration of wave control (i.e. keeping it at the level which does not pose hazard to people and their property) and limit the reach and level of losses by construction, maintenance and rebuilding flood prevention structures and

⁵ The novel to the Water Law (necessary to implement the Floods Directive in Poland), announced first in 2009, which should have been included in the Polish law by the end of November 2010, was passed as late as in January 2011, and became effective on 18 March 2011.

devices, while non-technical means emphasise prevention of floods and the resulting losses by education and legal actions (preparation of local communities to floods, increase in awareness of such hazards and possibilities of insurance coverage, the proper spatial management), protection of the areas exposed to flood risk (development of the section between the levee and the river bed, increasing the retention area in the form of polders) and development of risk management methods not only at the level of authorities, but for each citizen at risk. The non-technical solutions include highly innovative measures, like application of financial instruments in the capital market to transfer flood risk.⁶ These are disaster bonds (“*Act of God*” Bonds), derivative instruments (*forwards, futures, options, swaps*), CatEPut (*Catastrophe Equity Put Option*) or securitisation products (e.g. ABS bonds: *Asset Backed Securities*, LBS: *Liability Backed Securities*). They determine access to cash from the moment of occurrence of the event agreed earlier (in this case: floods) which are the so-called *triggers*, i.e. events which “release” the capital. This is where their name came from: ART (instruments of Alternative Risk Transfer). They are used less commonly than insurance and reinsurance (which have become a practically traditional solution), and are often based on physical indexes or loss indexes, and for their effective sale or trading CATEX type exchanges are necessary (*Catastrophe Risk Exchange*) (21).

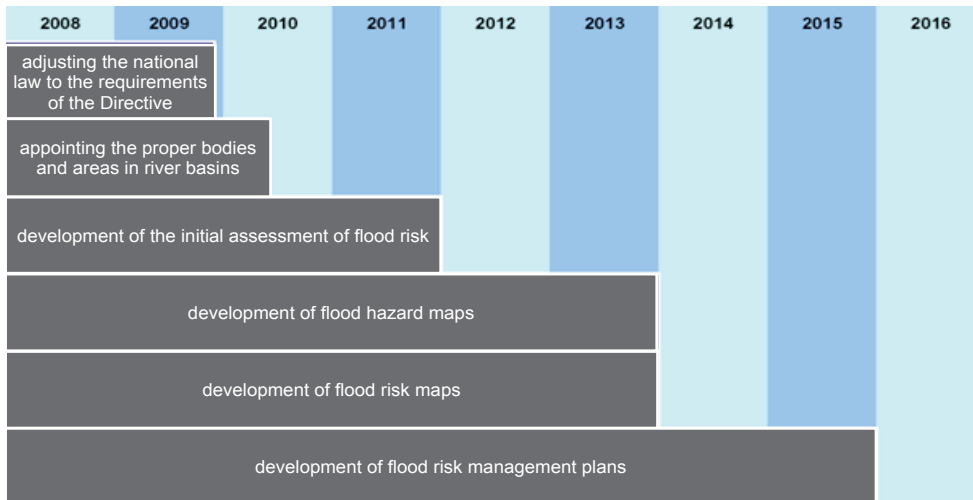


Figure 2. The schedule of implementation of the Floods Directive requirements

Source: (22).

⁶The specific solution of a fiscal nature (thus falling among non-technical methods) has been suggested by Professor Grzegorz Kołodko. It is a solidarity tax levied on the wealthiest citizens as a single fiscal instrument. The aim would be to prevent the deepening of the financial deficit or an increase in public debt as a result of catastrophic flood losses. The idea came up in the face of losses that occurred in May, June and August of 2010, as well as at the beginning of 2011 (23). Examples of flood risk management proposals do not fall within the scope of this paper, but may be the subject of a separate research article.

4. Conclusions

Flood risk management is a difficult enterprise, the execution of which is with public authorities, and effectiveness of the used solutions which constitute investments of public use affects national economy and the whole society.

According to the Supreme Audit Office (NIK), which published the report “NIK on floods (1994–2010)” in the end of January 2011, the situation in the scope of flood protection in Poland is bad. None of the inspected communes and powiats was assessed positively, and major problems refer to maintenance of flood prevention structures/ devices. Deficiencies in coordination of actions in the flood protection scope was also indicated (for eight years, the national flood protection plan set forth in the Water Law has not been developed). Finally, it may be said that despite access to the EU sources of financing, flood risk management has not been reformed and a homogeneous system applicable in any place throughout Poland where flood risk occurs has not been developed (24).

The activities with signs of innovations which were undertaken in Poland in this area are mostly of technical nature. Thus, one could speak about technological innovations related to the process of limiting flood losses (prevention and liquidation). New solutions, different from the currently used, in reference to flood risk management methods appear in the Polish acts of the law and ordinances. These expand the scope of possibilities of the proceedings in case of disasters events such as floods, but due to various impediments (lack of financial means, traditional attitude to flood risk among decision makers, fear of the risk related to costs and critical social opinion, etc.) are not always applicable. Additionally, there are no solutions in the analysed scope to support innovativeness in managing disaster risks such as floods, which is related to the fact that the process of managing such risks is difficult due to tragic consequences of its execution and due to the fact that this risk most often results from forces of nature beyond human control and due to its special, public nature. Therefore, the level of innovativeness in managing flood risk in Poland may be regarded as low.

The most demanded innovative action from the point of view of flood risk management in Poland would be to reform/ improve the entire system of water management in the country, in which protection against flood and minimising flood losses is just one component. The beginning should be with organisational structure and division of competencies, which seem to be pretty complex and unclear, and then move on to financial, legal and technological possibilities, which are very important for successful implementation of new actions. High costs of implementation of innovative solutions (research, laboratory tests, tests of new technology, costs of changes in legal regulations, personal costs and the whole execution of the enterprises) constitute the basic difficulties for execution of innovative and repair actions, for both a company and local government or the state. Lack of coherence and continuity in

financing the flood prevention system in Poland may effectively inhibit all manifestations of innovativeness in this field.

Bibliography

1. *Reducing disaster risk: A challenge for development. A global report. United Nations Development Programme*. 2004. New York. ISBN 92-1-126160-0.
2. *UN report on the future of the Earth*. [online, accessed: 19-05-2011]. Available online: www.unesco.org.
3. “Directive 2007/60/EC of the European Parliament and Council of 23 October 2007 on assessment of flood risk and flood risk management”. *Official Journal of the European Union*, L 288, 2007-11-06.
4. F a l B. 2002. “Przepływy rzek w Polsce w drugiej połowie XX w.” *Gazeta Obserwatora IMGW*, no 5.
5. Water Law of 18 July 2001. Dz. U. 2001, no. 115, Item 1229 as amended.
6. S u m a r a A. 2010. “Powódź w aspekcie aktów prawnych w wytycznych programowych: Rozmowa z Prezesem Krajowego Zarządu Gospodarki Wodnej Leszkiem Karwowskim”. *Geoinżynieria—Drogi, Mosty, Tunele*, no. 4.
7. Act of 26 April 2007 on crisis management. Dz. U. 2007, no. 89, Item 590 as amended.
8. Act of 18 April 2002 on natural disaster situations. Dz. U. 2002, no. 62, Item 558.
9. Building Law of 7 July 1994. Dz. U. 1994, no. 89, Item 414 as amended.
10. *Projekt polityki wodnej państwa do 2030 r. (z uwzględnieniem etapu 2016)*. 2010. Warszawa: Krajowy Zarząd Gospodarki Wodnej.
11. K e n d z i a R. 2011. *Działania, zabezpieczenia przeciwpowodziowe, innowacyjne technologie*. [online, accessed: 2011-06-20]. Available online: http://kignet.kig.pl/innowacje/pliki/1/Dzialania_przeciwpowodziowe_%20R%20Kendzia.doc.
12. *I-B-B Ing.-Büro Boedecker Systemy Przeciwpowodziowe: System ochrony przeciwpowodziowej obiektów i powierzchni*. [online, accessed: 2011-05-20]. Available online: <http://bramy-przeciwpowodziowe.pl/ibb/pl/bariery-przeciwpowodziowe>.
13. Pierot sp. z o.o. 2011. *Ochrona przeciwpowodziowa: Bariery, zapory i grodzie*. [online, accessed: 2011-05-20]. Available Available online: <http://ochrona-powodziowa.pl/serwis/pierot.html>.
14. Krolpol. 2011. *Światowe Standardy Bezpieczeństwa, Ochrona przeciwpowodziowa*. [online, accessed: 2011-05-25]. Available online: http://www.krolpol.com.pl/ochrona_przeciwpowodziowa.htm.
15. Act of 8 July 2010 on special principles of preparation for execution of investments in the scope of flood prevention building facilities. Dz. U. 2010, no. 143, Item 963.
16. Act of 10 April 2003 on special principles of preparation and execution of investments in the scope of national roads. Dz. U. 2003, no. 80, Item 721 as amended.
17. S u m a r a A. 2010. “Z naturą trudno wygrać, ale trzeba się bronić”. *Geoinżynieria—Drogi, Mosty, Tunele*, no. 4.
18. *Projekt Narodowej Strategii Gospodarowania Wodami (z uwzględnieniem etapu 2015)*. 2009. Warszawa: PROEKO CDM sp. z o.o.
19. *Program Wisła 2020*. [online, accessed: 2011-06-10]. Available online: <http://www.zmn.org.pl/download/polski.pdf>.
20. *Pełnomocnik Rządu do Spraw Programu dla Odry—2006: Informacja o realizacji zadań „Programu dla Odry—2006” w roku 2010*. Wrocław, 2 June 2011. [online, accessed: 2011-06-10]. Available online: http://www.programodra.pl/Inf_i_spr/Informacja_etap_III_2011_06_02.pdf.
21. *The catastrophe risk Exchange, inc. (catex)*. [online, accessed: 2011-06-30]. Available online: <http://www.catex.com/>.

22. Krajowy Zarząd Gospodarki Wodnej. 207. *Dyrektywa Powodziowa*. [online, accessed on 2011-06-30]. Available online: <http://www.kzgw.gov.pl/pl/Dyrektywa-Powodziowa.html>.
23. K o ł o d k o G. 2011. "Powódź—spotkanie natury z polityką". *Rzeczpospolita*, Issue 8631 of 25 May.
24. Najwyższa Izba Kontroli. 2011. *NIK o powodziach (1994–2010)*. [online, accessed: 2011-06-05]. Available online: <http://www.nik.gov.pl/aktualnosci/nik-o-powodziach.html>.

Tradycja i innowacje w zarządzaniu ryzykiem powodziowym w Polsce

Streszczenie: Artykuł przedstawia rozwiązania tradycyjne i innowacyjne w zarządzaniu ryzykiem powodziowym w Polsce. Wprowadzeniem do powyższych rozważań jest krótkie zobrazowanie problemu strat powodziowych i zagrożenia tym ryzykiem na świecie. Stanowi ono jedno z głównych zagrożeń o charakterze katastroficznym (zaraz po trzęsieniu ziemi) dotyczących współczesną ludzkość. O ile ryzyko trzęsień ziemi utrzymuje się na względnie stałym poziomie, o tyle ryzyko powodzi zbiera wciąż większe żniwo wśród ofiar i dotkniętych stratami gospodarek świata.

Pojęcie ryzyka powodziowego przybliży wiele aktów prawnych oraz dostępnych materiałów źródłowych, zarówno polskich, jak i międzynarodowych, wśród których szczególną uwagę zwrócono na unijną Dyrektywę Powodziową. Wprowadza ona istotne zmiany także dla polskich standardów zarządzania ryzykiem powodzi.

Tradycyjne podejście do zarządzania analizowanym ryzykiem sprowadza się najczęściej do sposobu myślenia i działania w obliczu zagrożenia powodziowego. Oczekiwanie, że wały powodziowe spełnią rolę, jaką im przypisano, na zamieszkałych naturalnych terenach zalewowych rzek i potoków górskich, może doprowadzić do wzrostu zagrożenia i pogorszenia sytuacji. Tradycja pojawia się tutaj w sposobie wykonywania prac przeciwpowodziowych, jak i zarządzania ryzykiem (brak aktywnego zabezpieczenia zagrożonych podmiotów / obszarów, liczenie na to, że „technika wytrzyma”, przerzucanie odpowiedzialności za wykonanie prac ochronnych na poszczególne jednostki gospodarujące zasobami wodnymi w kraju). Rozwiązania o charakterze innowacyjnym opierają się na zastosowaniu nowoczesnych technologii i/lub materiałów, a także innych narzędzi, takich jak: prawo (ustawy regulujące omawiane sytuacje kryzysowe, kompleksowe programy ochrony przeciwpowodziowej), system wczesnego ostrzegania, edukacja, ubezpieczenia czy instrumenty finansowe ART z rynku kapitałowego. W opracowaniu przeanalizowano najważniejsze z nich.

W zakończeniu przedstawiono krótko wyniki inspekcji Najwyższej Izby Kontroli w zakresie ochrony przeciwpowodziowej w Polsce oraz dokonano syntetycznego podsumowania powyższych rozważań, zwracając uwagę na problemy wdrożeniowe rozwiązań innowacyjnych z badanego zakresu.

S ł o w a k l u c z o w e: ryzyko powodziowe, zarządzanie ryzykiem powodzi, innowacja, innowacyjność
