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# Multipurpose water-marine cadastre in Poland - development directions

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*For the purpose of water management of the surface and subterranean inland waters in Poland are conducted rich databases of water cadastre for over 20 years. These databases are constantly updated and modernized.*

*The internal, national needs for good governance of the territorial Baltic Sea resources and the international needs for policy-shaping of space and marine resources management determine the creation of the marine cadastre in Poland. A number of important activities in the designation of the new directions of maritime policy development should be mentioned such as: adopted in 2006 "An European vision for the oceans and seas" called the Green Paper (EUROPEAN COMMISSION, 2006), created in 2005 and approved in 2007 framework document "An Integrated Maritime Policy for the European Union" called the Blue Book (EUROPEAN COMMISSION, 2007), or "An EU Strategy for the Baltic Sea Region".*

*The assumptions of maritime policies suggest that an important role in the formation and management of marine areas plays an access to relevant information. The integration of data from different systems and sources will be a key project for the creation of a multi-task, complete water-mariner cadastre, which is an important prerequisite for the success among others in trans-sectoral and cross-border co-operation. An open topic still is the way of this integration, however, the European Commission's efforts to build an integrated spatial information system (based on the guidelines of the INSPIRE DIRECTIVE 2007) and support for a variety of GIS systems, point the way, which intend to organize an exchange of information at European level.*

*Also in Poland, under the auspices of the Ministry of Infrastructure, conceptual works are ongoing to organize the management of maritime areas, to involve Poland in the European dimension of maritime policy, to draft legal documents and to organize the system of access and information exchange.*

**Key words:** water cadastre, marine cadastre, water management system, integrated spatial information system, integrated real estate information system (ZSIN)

## INTRODUCTION

The term of marine cadastre are developed recently in the international scientific forum. This new trend in science is being developed in a number of research studies presented especially in FIG forum (International Federation of Geodesy) such as: BINNS (2003), SUTHERLAND (2005, 2009), SREBRO *et al.* (2010), WIDODO (2004) etc. In all this studies the term "marine cadastre" is used as a matter of convenience to describe

any information system established to manage legal (and even informal) marine and coastal tenure (and other) information, and its linked spatial quantity (SUTHERLAND, 2005). Thus it can be seen that the issue of marine cadastre is not only the responsibility of oceanographers and computer (IT) scientists, but predominantly surveyors. For example different 3D topographic, geodetic, remote sensing, laser scanner and geophysical surveys have been performed and analyzed with the principal aim to supply the data various water systems (CEFALO *et al.,* 2011, BUBLE *et al.,* 2010, MARTIN-NEIRA, 1993). Geodetic measurements e.g. GNSS were used in almost every field even in the sea level monitoring (BAKER *et al.,* 1997, DAWIDOWICZ & ŚWIĄTEK, 2008, LÖFGREN *et al.,* 2011). All the works in which are received timely and accurate data should be promoted and the data should be stored and shared from efficient information systems. The reasons for maintaining such systems are obvious to all areas of human activities.

For the purpose of water management of the surface and subterranean inland waters in Poland are conducted rich databases of water cadastre for over 20 years. These databases are constantly updated and modernized. In the last few years there has been a need for the construction of the marine cadastre in Poland.

According to CZOCHAŃSKI (2009) and POLISH MARITIME POLICY (2009) the need for the marine cadastre development in Poland is caused by the following factors:

- increased interest in exploration and use of the Baltic area,
- GIS as the best tool for the development and exchange of spatial data,
- information on the sea - a new category for spatial information,
- new, wide field of applications maritime information - formerly only research on the marine environment - present maritime policy, transport and communication, planning, management, etc.,
- new conditions for spatial information management - with the adoption of the INSPIRE Directive and other programs, organization and exchange of information and information systems design for the Baltic Sea (such as Maps BSR, Baltic Environmental Atlas, Baltic GIS – portal (www.grida.no/baltic/)),
- the creation of a few years the concept of cooperation in the field of GIS and information exchange on trans-regional level,
- broadening the global data resources based on satellite images (eg, Landsat) and thematic databases - such as CORINE,
- development of ICT infrastructure, systems and GIS databases - between regional administrative institutions in the region – pomorskie vovoidship (UMWP – Marshal's Office, RDLP - Regional Directorate of State Forests, RZGW - Regional Water Management Board, RDOS – Regional Directorate for Environmental Protection, KWP – Regional Police Headquarters, PUW – Pomorskie Voivodeship Office and others),
- the national need for institutional cooperation related to the competence of management and planning in the coastal zone (the "both sides" of the coastline),
- need for international coordination of research, administrative, communications,
- the need for the sea environment monitoring and evaluation of its qualities and potentials for different needs,
- the need for international and inter-regional cooperation in planning development programs - including co-financed by the EU,
- the need for and the possibility of a relatively simple integration of the maritime area for spatial information system,
- the benefits of the use of GIS and regional and trans-regional cooperation.

## MATERIAL AND METHODS

The object of the research is existing water cadastre and concepts of creating marine cadastre. The study includes a number of key issues outlined in the diagram (Fig. 1).

The main objective of the study was evaluation of the water-marine cadastre development strategy in the context of European research and standards. It was realized among others by using

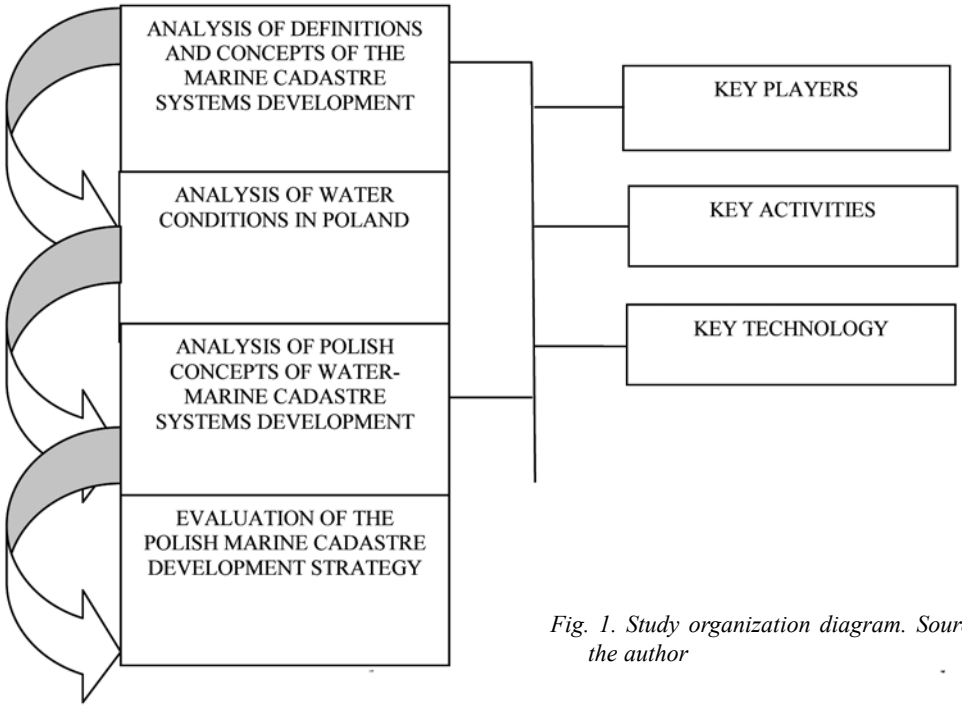



*Fig. 1. Study organization diagram. Source: prepared by the author*

the methods of strategic analysis like TOWS and SWOT, using the author's inquiry form.

The analytical method supplemented diagnosis of the existing system (water cadastre) and take into account the concepts of creating marine cadastre, which should not only rely on a comparison of the existing features of the system with those expected, but also include opportunities assessment of planned activities and that may arise threat by transforming water cadastre in water-marine cadastral system.

**Marine cadastre definitions - the scope**

In the scientific studies on the marine cadastre there are two basic definitions interpreted following different scopes and concepts (BINNS *et al.,* 2003):

1. Marine cadastre is a system to enable the boundaries of maritime rights and interests to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighboring or underlying rights and interests (ROBERTSON *et al.,* 1999).
2. It is a marine information system, encompassing both the nature and spatial extent of the interests and property rights, with respect to ownership, various rights and responsibilities in the marine jurisdiction (NICHOLS *et al.,* 2000).

The first definition is similar to the land cadastre, referring to boundaries and the second one referring to broader perspective. According SUTHERLAND (2003) all this definitions converge on the point that a marine cadastre is basically a marine information system in which the primary information held relates to rights and interests (along with related restrictions and responsibilities) to marine spatial extents. Moreover SUTHERLAND (2003) states that most (if not all) participants agreed that although the marine cadastre's primary focus is on rights, interests, restrictions, and responsibilities to marine spatial extents, they also desire access to more types of information related to those spatial extents.

An access to the necessary, reliable, current data is a prerequisite for efficient space management. These data will serve for research institutions, administrative and economic, providing information on key social, economic or environmental conditions. There are many research studies on the concept of database information

systems (DADIĆ *et al.*, 2002; KOCUR-BERA, 2010, 2011; CZOCHAŃSKI, 2009; MAIDMENT *et al.*, 2001; FORTES *et al.*, 2005).

During the construction of the marine cadastre system a problem did not seem to be a collection of data, but the integration and exchange of data resources between different information systems. After SUTHERLAND (2005) the concept of a marine cadastre must be considered within the broader context of the following:

1. More accurate information which is up-to-date, timely, complete and useful;
2. Appropriate use of data and technology standards (e.g. spatial data infrastructure) that supports hardware and software interoperability;
3. Stakeholder relationships (i.e. cooperation, collaboration, data sharing, etc.) that facilitate the sharing of information needed for better decision-making;
4. Institutional arrangements (i.e. organizational structures, policies, laws, etc.) that facilitate a higher probability of stakeholders achieving their various objectives;
5. The stochastic elements in the marine environment.

## Some of the international activities towards marine cadastres development

Polish accession to the European Union in 2004 and the desire for closer economic or research cooperation in the Baltic Sea region, in the last few years has created the need to develop institutional mechanisms that link activity, allowing the formulation of the principles of cooperation, policies, plans and programs of the area development. The efficiency of cooperation in the field of resource management and development in the Baltic Sea is a derivative of the organizational institution efficiency and the specific functional tools used to manage.

The assumptions of maritime policies such as: adopted in 2006 "An European vision for the oceans and seas" called the Green Paper (EUROPEAN COMMISSION, 2006), created in 2005 and approved in 2007 framework document "An Integrated Maritime Policy for the European Union" called the Blue Book (EUROPEAN COMMISSION, 2007), or "An EU Strategy for the Baltic Sea Region" suggest that an important role in the formation and management of marine areas plays an access to relevant information. The integration of data from different systems and sources will be a key project for the creation of a multi-task, complete water-mariner cadastre, which is an important prerequisite for the success among others in trans-sectored and cross-border co-operation. Still, an open topic today is the way of this integration. However, the European Commission efforts to build an integrated spatial information system based on the guidelines (INSPIRE DIRECTIVE, 2007) and support for a variety of GIS systems, point the way, which intend to organize an exchange of information at European level. Table 1. shows the scope of the infrastructure for spatial information database.

The issue of the integration of spatial information in the Baltic Sea Region is raised at international level for many years. It can be assumed that the foundation for joint action and creating awareness is the need to integrate space management given in the work of the VASAB, confirmed the Declaration of Wismar (VASAB, 2001). However, the beginning of international cooperation was associated with databases on hydro-biological issues for research and program activities of HELCOM (2009).

International projects have been implemented such as the Baltic Sea Experiment Projects (BALTEX) and the Baltic Drainage Basin Project (BDBP) and BGIS (Basic Geographic Information of the Baltic Sea Drainage Basin), GRID (Global Resource Information Database) or MapBSR.

Work is continuing on the observation systems development, sharing and using of remote sensing materials (included in the framework of the European Commission and the European Space Agency, conducted since 2001 - GMES - Global Monitoring for Environment and Security - in which one of the panel discussions concerned marine research and the coastal zone), the draft is the further development of information systems based on modern sources and methods

*Table 1. Spatial data themes. Source: own study*

| ANNEX I<br>SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(A), 8(1) AND 9(A) | ANNEX III<br>SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(B) AND 9(B) |
|---|---|
| 1. Coordinate reference systems<br>2. Geographical grid systems<br>3. Geographical names<br>4. Administrative units<br>5. Addresses<br>6. Cadastral parcels<br>7. Transport networks<br>8. Hydrography<br>9. Protected sites | 1. Statistical units<br>2. Buildings<br>3. Soil<br>4. Land use<br>5. Human health and safety<br>6. Utility and governmental services<br>7. Environmental monitoring facilities<br>8. Production and industrial facilities<br>9. Agricultural and aquaculture facilities<br>10. Population distribution — demography<br>11. Area management/restriction/regulation zones and reporting units<br>12. Natural risk zones<br>13. Atmospheric conditions<br>14. Meteorological geographical features<br>15. Oceanographic geographical features<br>16. Sea regions<br>17. Bio-geographical regions<br>18. Habitats and biotopes<br>19. Species distribution<br>20. Energy resources<br>21. Mineral resources |
| **ANNEX II**<br>**SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(A), 8(1) AND 9(B)** | |
| 1. Elevation<br>2. Land cover<br>3. Orthoimagery<br>4. Geology | |

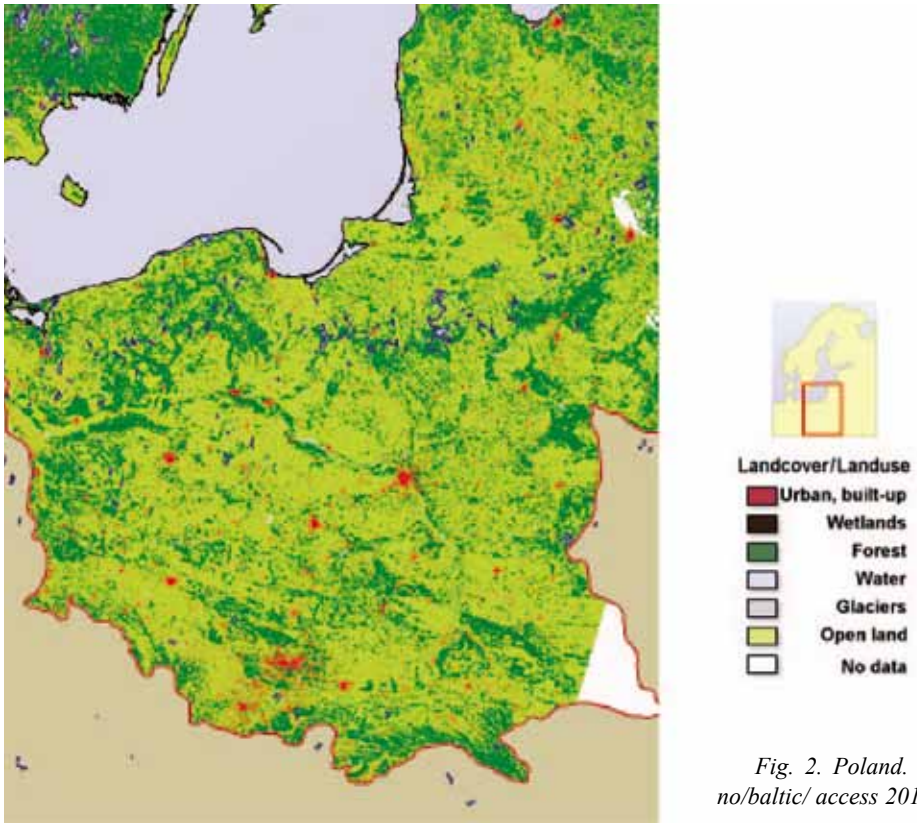



*Fig. 2. Poland. Source: http://maps.grida.no/baltic/ access 2013-11-18*

*Fig. 3. Baltic Sea Region. Source:* http://maps.grida.no/baltic/ access 2013-11-18

of distributing information - such as the HIRIS (High Resolution Information System of the Baltic Sea Regional Project). EuroGeographics association pursues pan-European project for the construction of spatial data structures (European Spatial Data Infrastructure - ESDI) which, operating under the auspices of the European Commission, brings together national mapping authorities of 41 European countries.

The most popular systems in the Baltic Sea Region include: Baltic Sea Region GIS - Maps and Statistical Database (http://www.grida.no/baltic/), Baltic Environmental Atlas (http://maps.grida.no/baltic/) (Fig. 2,3), Baltic GIS Portal (http://gis.ekoi.lt/gis/index.php).

In studies on the development of spatial information systems of the Baltic Sea Region dominate surveyors and computer scientists, may be mentioned such activist groups as: FIG (International Federation of Geodesy) Working Group 4.3 –Administering Marine Spaces joint with Commission 7- Cadastre and Land Management, PCGiAP - Permanent Committee on GIS Infrastructure for Asia and the Pacific.

**Water conditions in Poland**

ACT OF 18 JULY 2001, the Water Law (Journal of Laws of 2001, No. 115, item. 1229) splits water into surface waters and underground waters. All waters, except for the waters of the territorial sea and internal sea waters are inland waters. In the case of surface water, therefore, we are dealing with water: inland, territorial sea and internal sea waters.

According to the ACT OF 21 MARCH 1991 on the Polish sea areas and the maritime administration (Journal of Laws of 1991 No. 32, item. 131) - the territorial sea, internal waters and exclusive economic zone are marine areas of the Republic of Poland.

The sea and internal waters are an important part of the basin. According to the Water Law - the catchment area means the area of land and sea, made up of one or more river basins together with their associated underground waters and internal sea waters and coastal waters.

As coastal waters should be understood these waters in distance one nautical mile from the baseline of the territorial sea determined in accordance with the Act on the Polish sea areas and the maritime administration and internal waters of the Gulf of Gdansk and Council of Ministers REGULATION OF 29 APRIL 2003 on determination of the minimum and maximum width of the technical and protective belt and the method of determination of borders), (Dz.U. 2003 nr 89 poz. 820). According to this law:

a) the territorial sea is the Polish marine area with a width of 12 nautical miles (22.224m), measured from the base line of the sea,
b) the baseline of the territorial sea is the low-water line along the coast or the outer limit internal sea waters,
c) the external border of the territorial sea is the line, which every point is 12 nautical miles from the nearest point of the baseline, with the exception that the roadstead, which is normally done loading, unloading and anchoring of ships, situated wholly or partly outside the marine waters are included in the territorial sea.

The boundaries between inland surface

waters and internal sea waters and territorial sea waters identified the Council of Ministers REGULATION OF 23 DECEMBER 2002 on the border between inland surface waters and internal sea waters and territorial sea waters (Journal of Laws of 2002, No. 239, pos. 2035 with subsequent amendments). The provisions of the Water Act apply to inland waters and internal sea waters, excluding the internal sea waters of the Gulf of Gdansk. Provisions of this Act shall also apply to the waters of the territorial sea and internal sea waters of the Gulf of Gdansk in the protection against pollution from land-based sources and the flood.

Polish Terrain is located in the catchment area of the three seas: the Baltic Sea, Black Sea and North Sea. In the case of the Baltic Sea are mainly Vistula and Odra rivers, but also the Baltic Embankment.

There is asymmetry of the tributaries of the Vistula and the Odra (Fig. 4). They left basin are shorter and less abundant in the water in relation to the tributaries of the right - Wisla - 27:73, Odra - 30:70. It is related to the slope of the surface in the north-west and with the development of the terrain in the Tertiary and Quaternary. The estuary of the Vistula and Odra rivers are deltas.

*Fig. 4. Poland rivers. Source: http://www.geografia24.eu/geo120_mapa_polski/22Rzeki.jpg access 2013-11-18*

Poland is one of the European countries rich in lakes which are clustered mainly in the northern part of the country (Fig. 5), so in the area covering the last glaciations (Pomeranian Lake Region, the Mazury Lake Region). The vast majority of lakes in Poland are glacial lakes. Today's most complete and current catalog of Polish lakes is atlas developed by CHOIŃSKI (2006), including lakes of the area 1 ha. Three-part catalog of lakes (CHOIŃSKI, 2006) covers an area of 7,081 lakes larger than 1 ha (total area of 2,813.77 sq. km). Compared to 1954, the number of lakes has decreased to 2215, more than 11 percent. This was due to a rapid disappearance of the smallest lakes. Factor of Polish lakes is only 0.9% of the country, while in Sweden lakes cover more than 8.5% of the area, and in Canada about 7.6 percent.

*Fig. 5. Poland lakes. Source: http://www.geografia24.eu/geo120_mapa_polski/32JEZIOR.jpg access 2013-11-18*

### *Water cadastre in Poland*

Water cadastre is an information system for water management kept on the basis article 154, para. 3 of the ACT OF 18 JULY 2001 - Water Law. Sharing of data occurs in accordance with Article 155 para. 2-3 Water Law, ACT OF 3 OCTOBER 2008 on the provision of information about the environment and its protection, public participation in environmental protection and environmental impact assessments (Journal of Laws No. 199, pos. 1227), REGULATION OF THE ENVIRONMENT MINISTER OF 12 JULY 2006 on the scope of water cadastre information subject to the provision, the way they prepare and the fees for their preparation (Journal of Laws of 2006 No. 132, item. 927) and REGULATION OF THE ENVIRONMENT MINISTER OF 12 NOVEMBER 2010 on the fees for access to environmental information (Journal of Laws of 2010 No. 215, item.

1415). Information from the water cadastre can get to look at the headquarters of the Regional Water Management.

In Section I of the water cadastre are collected and updated the following data:

1. hydrographic network and the hydrological and meteorological observation and measurement stations;
1a) borders with catchment areas, water basins and regions;
2. groundwater resources, the location of major aquifers and groundwater observation landline;
3. the quantity and quality of surface water resources and groundwater;
4. the size of the collection of surface water and groundwater;
5. sources and description of pollution points and areas;
6. the biological condition of the aquatic environment and flood plains;
7. fishing districts and fishing waters fitness (grading);
8. water use and the characteristics;
8a) bathing water profiles;
9. water permits and integrated permits issued under the provisions of the Act - Law on Environmental Protection for the use of water;
9a) the number and types of substances particularly harmful to the aquatic environments;
10. water facilities;
11. zones and protected areas established under the Act;
11a) special flood hazard areas and areas at risk of flooding;
12. water companies.

Section II of water cadastre includes:

1. water and environmental country program ;
2. planning documents;
3. lists.

Water cadastre is carried out for the state area including the division into river basins and water regions. Water Cadastre for the state area is carried out by the President of the National Water Management and includes the information specified in paragraph 1-3 and 10 of Section I the cadastre and data specified in Section II of the cadastre. Water Cadastre for the water region is run by the Director of the Regional Water Management and includes the information specified in Section I and II water cadastre.

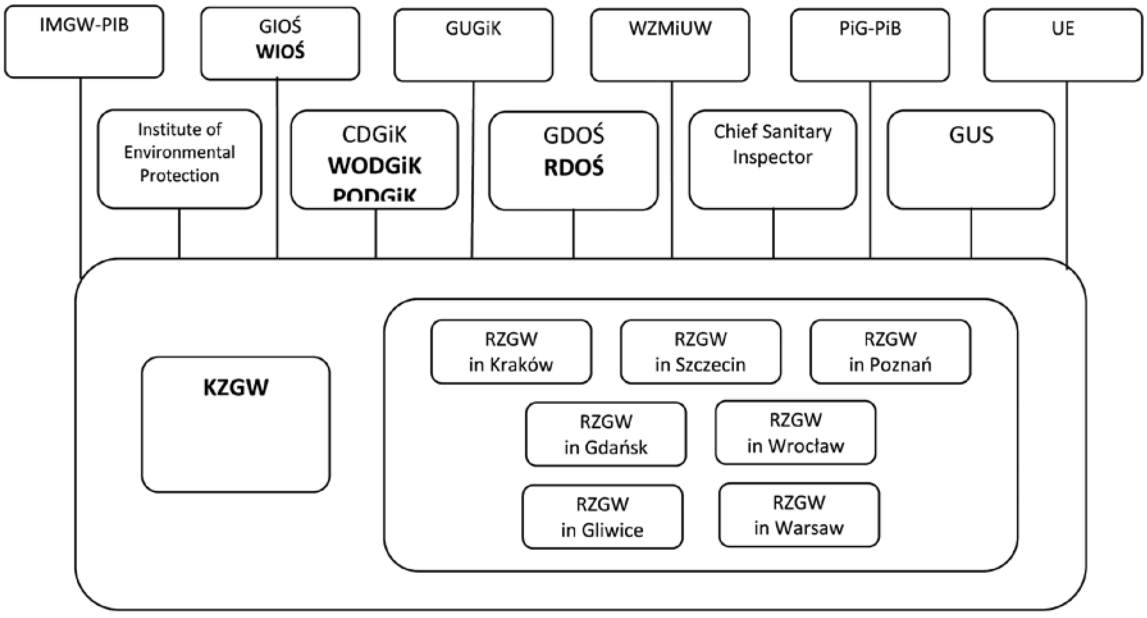
Public authorities, research institutes, as well as establishments and water facilities owners are obliged to free transfer of data needed to conduct the water cadastre. Cadastral water is made available for review free of charge.

The data source of water cadastre in the range of real estate is the real estate cadastre, referred to in the ACT OF 17 MAY 1989 - Geodetic and Cartographic Law (Journal of Laws of 2000 No. 100, item. 1086, as amended). Referring to studies BIEDA & PARZYCH (2012) water cadastre should be effectively integrated with the real estate cadastre.

## Water management information system – development trends

In Krakow Meeting with INSPIRE, Krakow, 16-17 May 2013 National Board of Water Management presented the concept of Water Management Information System (SIGW – System Informatyczny Gospodarki Wodnej), which will be the instrument supporting water management within the meaning of the Water Act. SIGW will be one of the main logic elements of ISOK (Computer System of Country Protection). Other features of the system include the following:

- Processing, integration and sharing of data in the field of water resources management and planning,
- SIGW will be built and deployed in the structures KZGW and seven Regional Board (terminal ends),
- Data processing will be done in a centralized environment,
- SIGW logical architecture assumes the use of a standardized data model RZGW,
- Integration with industry systems (e.g. IT-GIS OKI - IT system supporting the work of the Coordination and Information Centers of Flood Protection RZGW, SIKPOŚK - System supporting the implementation of the National Program for Municipal Wastewater Treatment).




Caption: **IMGW-PIB** (Instytut Meteorologii i Gospodarki Wodnej – Państwowy Instytut Badawczy) – Institute of Meteorology and Water Management - National Research Institute; **GIOŚ/WIOŚ** (Głowny/Wojewódzki Inspektorat Ochrony Środowiska) – Chief/Regional Inspectorate for Environmental Protection, **GUGiK** (Główny Urząd Geodezyjny i Kartograficzny) – Central Office of Geodesy and Cartography; *WZMiUW* – (Wojewódzki Zarząd Melioracji i Urządzeń Wodnych) – Regional Board of Land Reclamation and Water Facilities; *PiG-PiB* (Państwowy Instytut Geologiczny - Państwowy Instytut Badawczy) – Polish Geological Institute - National Research Institute; **CDGiK/WODGiK/PODGiK** (Centralny/Wojewódzki/Powiatowy Ośrodek Dokumentacji Geodezyjnej i Kartograficznej) – Central / Regional / District Documentation Centre of Geodesy and Cartography; **GDOŚ/RDOŚ** (Generalna/Regionalna Dyrekcja Ochrony Środowiska) – General / Regional Directorate for Environmental Protection; **GUS** (Główny Urząd Statystyczny) – Central Statistical Office; **KZGW/RGZW** (Krajowy/Regionalny Zarząd Gospodarki Wodnej) – National / Regional Board of Water Management

*Fig. 6. Data sources for Water Management Information System. Source: own study*

Water Management Information System will support the following groups of business processes such as: establishing public acts, administrative proceedings, conducting of water cadastre, maintenance of water, flood protection, the management of fisheries, wealth management treasury, reporting and others.

The study by the authors of the Water Cadastre quality allowed to draw the following conclusions:

1. The main scope of data is collected by the Regional Board of Water Menagement,
2. Due to the local nature each RZGW collects, processes and organizes the data in a different way,
3. The independent development of various applications supporting the functionality of water cadastres,
4. Different levels of technical sophistication from standard GIS (ArcGIS, Geomedia, QuantumGIS, MapInfo) to specialist dedicated solutions (Wisma, Aquarius),
5. Different standards for data storage (Excel, Access, Oracle, Shapefile, geodatabases)
6. Each Regional Board has one main data repository cadastre and runs various additional database and records.

Development of water cadastre will move towards integration SIGW with ePUAP system (Electronic Platform of Public Administration Services) - providing services to the people / businesses. Integration of SIGW with ePUAP enables the following.:

- Use the communications boxes of ePUAP platform,
- Verification of signatures submitted by a trusted profile ePUAP,
- Making payments via Electronic Credentials

Fees (EPO - Elektroniczne Poświadczenie Opłat),

- Providing information in accordance with the formulas published in a central repository writings ePUAP,
- Sending the signed electronic documents to recipients by identifying their electronic mailbox (ESP - Elektroniczna Skrzynka Podawcza) of ePUAP,
- Publishing and delivery decisions for cases reported by ePUAP.

A preliminary list of issues provided for the operation through ePUAP includes: issuing water permits or authorizations integrated, issuing a decision exempting from the prohibitions provided for special flood hazard areas, providing information to the water cadastre, registration, update and deletion of Water Companies, Trade Companies and Trade Associations for Flood Embankments, sharing information from water cadastre, issue a certificate of water cadastre, the processing of applications for compensation.

SIGW component will be Hydroportal, a web portal for external users whose goal is to share data for the whole country, and their metadata.

There are far-reaching plans of the Ministry of Infrastructure in the direction of integration SIGW with the Integrated Real Estate Information System (ZSiN – Zintegrowany System Informacji o Nieruchomościach). The plan is to create "system of systems" in the form of a "mega-system" integrating all spatial information. Exchange of information between multiple entities of public administration significantly reduce the time and efforts to create and maintain data records, will reduce a significant portion of the costs, but will also enable the maintenance of current and uniform spatial information.

The idea of integrated spatial information system based on the institutional databases and information systems operated by different entities, available on-line via the Internet and the creation of a common database of metadata from these systems can help easily find out the potential recipient in the type and characteristics of data resources provided by individual institutions.

## The concept of integrated real estate information system - integration of water and marine cadastre data

Polish Land Administration System will work in the near future as an Integrated Real Estate Information System (Zintegrowany System Informacji o Nieruchomościach – ZSIN). ZSIN will functionally integrate the Real Estate Cadastre, New Land and Mortgage Register (Nowe Księgi Wieczyste – NKW), Tax system, Register of Economic Entities (Rejestr Gospodarki Narodowej – REGON), Population Register (Powszechny Elektroniczny System Ewidencji Ludności – PESEL),Water Cadastre as well as other public (institutional) records through the functional specification of Integrating Electronic Platform (IPE) which will allow the viewing and data transferring between a number of public registers (DAWIDOWICZ, 2013, DAWIDOWICZ *et al.* 2012a). Diagram of IPE and ZSIN system operations is presented in Figure 7.

Marine cadastre data included in the ZSIN will come from: institutional spatial data resources, studies and the concept of expert, remote sensing of spatial data sources, geodetic and cartographic resources (both cartography land and sea), information systems of international and European institutions in monitoring the development (including the indicators), global database e.g. the World Database on Marine Protected Areas, European systems and databases for the Baltic Sea catchment area, data resources and concepts emerging from the multilateral, international European projects, databases containing information materials, scientific and practical planning in marine areas (e.g. Marine Protected Area Planning Resources).

ZSIN will be based on the following functional assumptions shown in the diagram (Fig. 8), which expanded to sub-module for analysis the real estate market:

1) exchange of data between the real estate cadastre and other public records in electronic form,
2) the software enabling automatically generate notifications of changes to the cadastre, the automatic generation of data update,

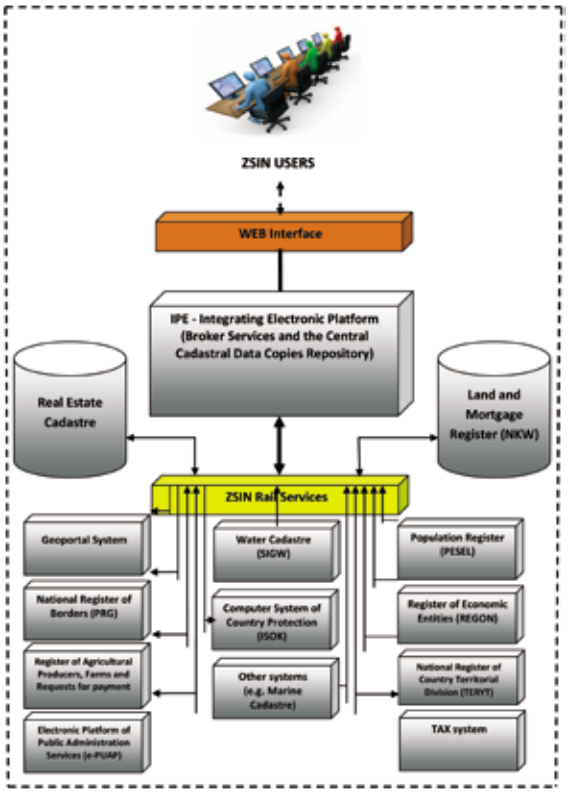



*Fig. 7. Logical architecture of ZSIN. Source: own study on Council of Ministers Regulation of 17 January 2013*

3) access to cadastral data will take place over the Internet,
4) procedures for data conversion and cadastral database updates will be implemented by a set of applications,
5) data integration will be carried out by Integrating Electronic Platform (IPE),
6) data network will consist of LAN and WAN,
7) for the transformation of the source database of real estate cadastre in modern cadastral database should be installed application that will integrate the descriptive part and mapping (DAWIDOWICZ & ŹROBEK, 2012b).

## Evaluation of the Polish water-marine cadastre development strategy

TOWS/SWOT analysis is a method that has developed following the combination of a SWOT analysis. Allows determining the strategic options of the unit.

It is expressed by the statement "reinforcing strengths, using the opportunities, while eliminating weaknesses and avoiding threats." In addition to such a statement it offers four normative action strategies (OBŁÓJ, 2001):

- the aggressive strategy (maxi - maxi) - involves maximizing synergies present between organization strengths and opportunities generated by the environment,
- the conservative strategy (maxi - mini) - is to minimize the negative environment impact by the maximum active use the organization potential,
- the competitive strategy (mini - maxi) - is to eliminate the organization's weaknesses and building its competitive strength by maximum use of existing opportunities conducive to the development,
- the defensive strategy (mini - mini) - is to ensure survival by minimizing the impact, both from inside the weaknesses and risks from the environment.

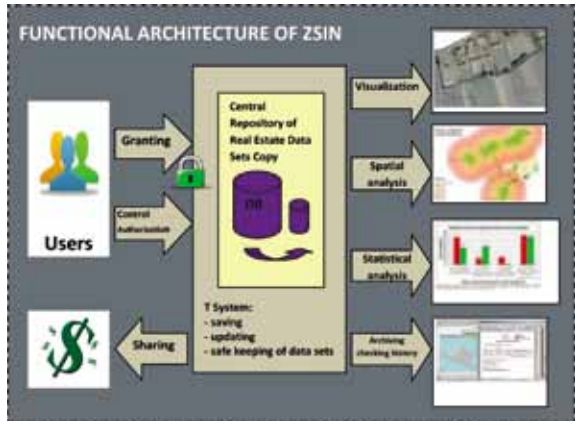



*Fig. 7. Diagram of ZSIN functional architecture with sub module for spatial land market analysis. Source: own study on the basis SOKOLIK. & ZAJĄC (2010)*

For purposes of this study uses the following algorithm steps the simplification of a method TOWS / SWOT:

STEP 1. Defined a list of opportunities, threats, strengths and weaknesses of water-marine cadastre based on the analysis of literature.

STEP 2. Assigned to individual opportunities, threats, strong and weak sides the rank determining their significance from the point of view of their impact on the possibility of converting water cadastre system in the desired water-marine cadastre (based on a questionnaire

surveys conducted in a group of 8 experts).

STEP 3. Were examined in parallel relations between strengths and weaknesses and the opportunities and threats, "outside-in" and "inside out", as follows:

a) in the analysis TOWS ('outside-in') were used the following questions:
> Do the threats weaken the force?
> Do the chances magnify the forces?
> Will the threats magnify existing weaknesses?
> Will the chances overcome existing weaknesses?
b) in the analysis SWOT ('inside out ') were used the following questions:
> Will strengths allow exploit opportunities that may arise?
> Won't weakness allow the exploitation of opportunities that may arise?
> Will strength enable to overcome possible threats?
> Will weakness strengthen the impact of possible threats?

To analysis by TOWS / SWOT separated 10 aspects of the strengths of the Polish marine cadastre concept, 11 aspects of weaknesses, 12 aspects of opportunities and 9 aspects of the possible threats to the system development. Typing of various aspects in the four categories was due to an in-depth analysis of the literature and questionnaire surveys conducted in October 2013.

According to the above described procedure achieved the rank each factor on the basis of indications of the 18 experts (among others regional directors of water management) on a previously prepared survey form.

The experts evaluated the validity of a given factor using a five-point Tilgner scale (BABBIE, 2008):

1 point. – lack of impact factor on the system,
2 points – low impact factor on the system,
3 points – average impact factor in the system,
4 points – significant impact factor on the system,
5 points – maximum impact factor on the system.

To analyze TOWS / SWOT finally accepted the five most important factors in each category, in order to obtain reliable results associated with further statistics. Ranks were determined by the transformation of the results obtained from the questionnaires (mean values) using the following formula:

$$W_c = \frac{\dot{p}}{\sum_{i=n}^{1} p} \text{ x } 100\% \qquad (1)$$

where:

n – number of factors,

$W_c$ – rank of the i-th factor,

pi – arithmetic average the scored points i-th factor from a set of 18 expert answers,

$$\sum_{i=n}^{1} p$$

- sum of points obtained from factors within the same category.

## RESULTS AND DISCUSSION

The ranking results are shown in Table 2, which is the basic matrix for further study relations between strengths and weaknesses and the opportunities and threats.

Comparison of the factors listed in Table 2 performed in eight detailed matrices according to the principle: in the case of relation between the factors at the intersection of a row and column inscribed "1", in the absence of the relation "0", and so for each matrix.

As a result of comparison the water-marine cadastral system characteristics each with each in two directions: "from the outside to the inside" and "from the inside out" obtained the specific synergies values between factors as the strength of these relations interaction listed in Table 3.

Based on the analysis summarized in Table 3 (combination of factors) the highest score obtained for the situation SO (strengths-opportunities) - the so-called. strategy maxi-maxi (expansive, "aggressive"). The result shows the situation in which the strengths dominate the weaknesses, and in the environment outweigh the opportunities than threats. The advantage

*Table 2. Ranks of external and internal factors affecting the water-marine cadastre. Source: own study*

| Lp. | External factors | Rank | Lp. | Internal factors | Rank |
|---|---|---|---|---|---|
| **OPPORTUNITIES** | | | **THREATS** | | |
| 1 | The establishment of regulations open to continuous technological, structural and organizational development of the system. | **0,2** | 1 | The system has multiple functions (spatial planning, resource protection, economic planning) | **0,2** |
| 2 | Functional integration of water cadastre data and data from GIS databases for the Baltic Sea in the ZSIN. | **0,3** | 2 | Access to the GIS data for the Baltic Sea via the Internet. | **0,2** |
| 3 | Processes automation of supply, review, updating and archiving databases. | **0,2** | 3 | The proposed spatial database for the Baltic Sea are with possibility of analysis. | **0,2** |
| 4 | Draw up the standards for data harmonization. | **0,2** | 4 | Well-trained staff. | **0,1** |
| 5 | Access to all of system data through the Internet. | **0,1** | 5 | Water Cadastre is part of the infrastructure for spatial information. | **0,3** |
| **Sum** | | **1,0** | **Sum** | | **1,0** |
| **STRENGTHS** | | | **WEAKNESSES** | | |
| 1 | Lack of funding sources to data planned integration. | **0,3** | 1 | Lack of integration between the water cadastre and GIS databases for territorial Baltic Sea | **0,4** |
| 2 | Unfavorable political-branch-social conditions to support the structural and organizational changes of water cadastre. | **0,3** | 2 | Varied range of data. | **0,2** |
| 3 | Few staff to work. | **0,2** | 3 | Distributed access to all data. | **0,2** |
| 4 | Legal restrictions | **0,1** | 4 | Non-optimal way to enter and store data. | **0,1** |
| 5 | The slow pace of missing data and metadata completions according to Annexes of the INSPIRE Directive. | **0,1** | 5 | Incomplete data sets. | **0,1** |
| **Sum** | | **1,0** | **Sum** | | **1,0** |

## CONCLUSIONS

of the Polish water cadastre strengths and using opportunities to create a marine cadastre is a positive phenomenon for the further integrated system development. Therefore, it is justified continuation of the planned activities related to the extension of the internal waters cadastre system to water-marine cadastre.

Cooperation in the field of resource management and development ceased to be a local domain, but has become a space of interregional and international cooperation (and sometimes competition). Both the Polish entry to the European Union and the desire for closer economic cooperation whether scientific in the Baltic Sea area for the past several years, has created the need to develop mechanisms linking institu-

*Table 3. A summary of analysis TOWS / SWOT. Source: own study*

| | **OPPORTUNITIES** | **THREATS** |
|---|---|---|
| **STRENGTHS** | **TOWS**<br>Number of interactions: **40**<br>Value of interaction: **7,9**<br><br>**TOWS/SWOT**<br>Number of interactions: **78**<br>Value of interaction: **16,1**<br><br>**SWOT**<br>Number of interactions:**38**<br>Value of interaction: **8,2** | **TOWS**<br>Number of interactions: **24**<br>Value of interaction: **4,8**<br><br>**TOWS/SWOT**<br>Number of interactions: **37**<br>Value of interaction: **7,6**<br><br>**SWOT**<br>Number of interactions:**13**<br>Value of interaction: **2,8** |
| **WEAKNESSES** | **TOWS**<br>Number of interactions: **34**<br>Value of interaction: **7,3**<br><br>**TOWS/SWOT**<br>Number of interactions: **52**<br>Value of interaction: **11,1**<br><br>**SWOT**<br>Number of interactions: **18**<br>Value of interaction: **3,8** | **TOWS**<br>Number of interactions: **24**<br>Value of interaction: **5**<br><br>**TOWS/SWOT**<br>Number of interactions: **38**<br>Value of interaction: **7,9**<br><br>**SWOT**<br>Number of interactions: **14**<br>Value of interaction: **2,9** |

tional measures and allow for the formulation of the principles of cooperation, policies, plans and programs for the development of this area. An integral component of these activities is to operate information and interest is geographical space. The efficiency of this cooperation is a derivative of the institution organizational efficiency and specificity of functional tools used in management. Using GIS, modern systems and information sources has become a necessity. Economic and social development of countries, regions and local authorities in many cases depend on the neighborhood of maritime. On the other hand, both the natural resources of marine areas, as well as the space are subjects of growing interest and use. As a result, there is the imperative of cooperation and integration of information and activities of many entities operating in marine and coastal areas.

Strategic analysis allowed to draw the following conclusions:

1. Water Cadastre is closely related to the real estate cadastre.
2. Integration is possible taking into account the concept of ZSiN and platform Geoportal.
3. Lack of detailed concepts of the territorial sea and internal waters data integration in ZSiN
4. There is a need for cooperation of the scientific community and the government to identify needs for data and the means of financing them.
5. The multipurpose nature of the marine cadastre is supported by the development of spatial data infrastructures (SDI).

The development of information systems based on GIS and integration of data resources of administrative and research institutions involved in the marine areas should be treated as a priority. In the regional, interregional and international cooperation the primary issue conditioning the spatial information exchange efficiency and its optimal use is the integration of data resources.

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# Poljski višenamjenski katastar za vode i more - pravci razvoja

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## SAŽETAK

Za potrebe upravljanja površinskim i podzemnim kopnenim vodama u Poljskoj postoje baze podataka katastra voda već više od 20 godina. Ove baze podataka stalno se ažuriraju i moderniziraju.

Unutarnje to jest nacionalne potrebe za dobrim upravljanjem teritorijalnim resursima Baltičkog mora i međunarodne potrebe glede oblikovanja prostora i upravljanja morskim resursima potiču stvaranje morskog katastra u Poljskoj. Treba spomenuti brojne važne aktivnosti u određivanju novih pravaca razvoja pomorske politike, a to su: „Europska vizija za oceane i mora" usvojena 2006. godine pod nazivom Zelene knjige (Europska komisija, 2006); zatim okvirni dokument kreiran 2005. godine, a odobren u 2007.godini „Integrirana pomorska politika za Europsku uniju" pod nazivom Plava knjiga (Europska komisija, 2007) ili „Strategije EU za baltičku regiju". Pretpostavke pomorske politike pokazuju da važnu ulogu u oblikovanju i upravljanju obalnim područjima ima pristup relevantnim informacijama.

Integracija podataka iz različitih sustava i izvora će biti ključan projekt za stvaranje multi-funkcionalnog i potpunog vodno-morskog katastra, što je važan preduvjet za uspjeh u trans-sektorskoj i prekograničnoj suradnji. Još uvijek je način ove integracije otvorena tema, no međutim nastojanja Europske komisije za realizacijom izgradnje cjelovitog prostornog informacijskog sustava (na temelju smjernica INSPIRE Direktive 2007) i podrška za razne GIS sustave, ukazuju na put kojim se namjerava organizirati razmjenu informacija na europskoj razini.

Shodno tome u Poljskoj, pod pokroviteljstvom Ministarstva infrastrukture, su u tijeku konceptualni radovi za organiziranje upravljanja morskim područjima; uključenje Poljske u Europsku dimenziju pomorske politike; izrada pravne dokumentacije i organizacija sustava pristupa i razmjene informacija.

**Ključne riječi:** katastar voda, katastar mora, sustav za upravljanje vodama, integrirani sustav prostornih informacija, integrirani informacijski sustav za nekretnine (ZSIN)