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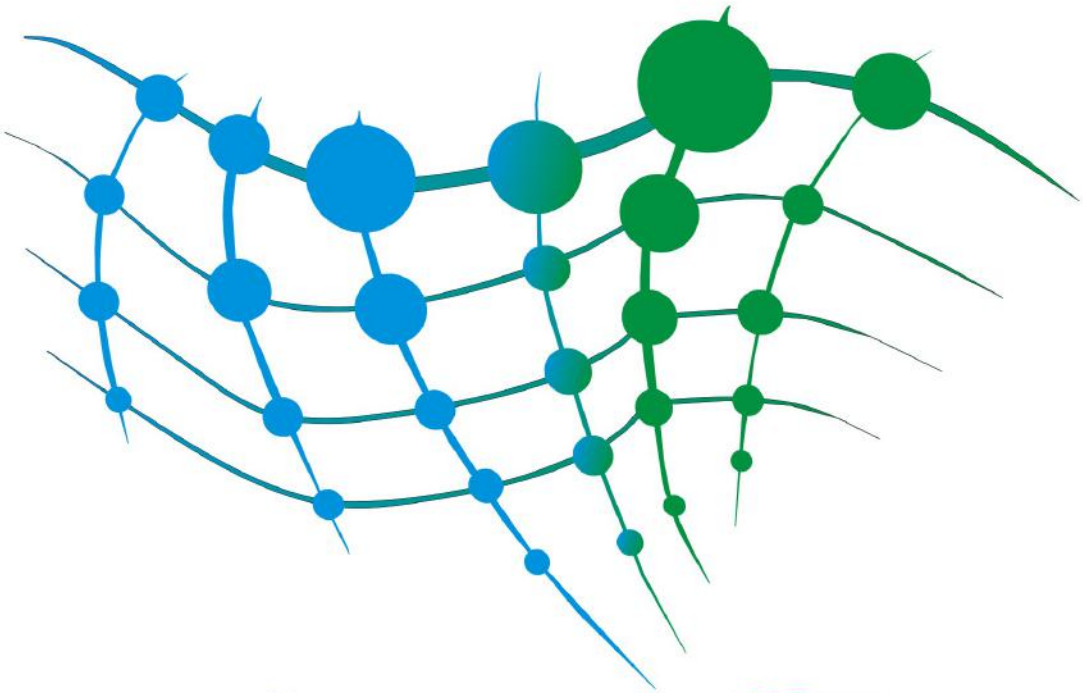

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METHODS, TECHNIQUES AND TOOLS FOR IDENTIFYING AND VALUING GIS ASSETS FOR MEASURING SECURITY, QUALITY AND RISK

Abstract: This paper attempts to develop and characterize instruments and approaches to the problem of identification, protection and quality of information processed in GIS class systems. One of the issues that causes most problems in the process of identifying and valuing GIS resources for measuring security, quality and risk is the proper selection of methods, techniques and tools for collecting and compiling various types of data in relation to these resources. In the process of identifying and valuing GIS resources, there is no list of test methods and techniques "reserved" for GIS only. It uses all – quantitative, qualitative and mixed – approaches and methods used in various studies. When designing an appropriate set of methods, techniques and tools in the process of identifying and valuing GIS resources, it is also important to remember to collect only those data that are really necessary. Proposed methods, techniques and tools take into account all the features, characteristics and determinants of GIS resources necessary to measure their security, quality and risk. A set of GIS resource identification instruments has been proposed, the implementation of which will significantly contribute to an increase in the level of security, reliability and quality of these resources. The proposed elements of a set, which are theoretically justified, may be improved and the set may be extended to other elements of the security policy. Far-reaching flexibility is called for in the choice of methods, techniques and tools used to identify and value GIS resources.

Keywords: GIS, risk, information resource, security, quality

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Introduction

The expanding range and functionality of GIS class systems, the diversity and scope of services and the increasing requirements and expectations of their users have led to the search for new solutions for collecting and transmitting various types of information resources, e.g. data, spatial information, knowledge, etc. At a time of the information society, efforts are being made to obtain both an efficient and efficient flow of these information resources. The market driven economy requires constant adaptation to customer needs, thus improving the internal infrastructure of GIS class systems. The quality, security, risk and temporal and spatial aspects of the services offered by these systems have become an extremely important factor. Therefore, along with technological developments, the position of the IT infrastructure of the GIS class systems in supporting the information society has been strengthened. Gradually, new solutions were introduced, ranging from automatic identification and communication technology to integrated quality, security and risk management.

There are a number of methods, techniques and tools for identifying GIS assets for measuring security, quality and risk, with some being less and others more versatile. In order to identify and classify these instruments (methods, techniques and tools), a bibliometric analysis was carried out, on the basis of which the dynamics of interest in this subject, manifested in the number of publications in the analysed period, was assessed. The publication was reviewed in the Scopus database. The database was selected due to its size and availability. The phrase included in the titles, abstracts and keywords, on the basis of which the database lookups were conducted, was "Methods and techniques of data identification in the field of information security". The lookup area has been limited to publications concerning the Information and IT security area. The last 10 years were analysed (2010–2020). During this period, approximately 1000 (exactly 988) studies registered in the database were created, the largest part of which were Papers 679 (70%), conference releases 211 (21.1%) and reviews 48 (4.8%).

During the analysed period (2010–2020), an increasing trend can be observed in the context of the number of studies on methods, techniques and tools for the identification of GIS resources for the measurement of security, quality and risk, related to this topic. A clear interest in the subject matter is evident throughout the time period covered by the survey. Such a large number of studies indicate that the emphasis on continuous improvement of security and the need to deepen awareness of these issues is constantly increasing.

This study analyses and presents those methods, techniques and tools for the identification and identification of GIS resources for the purpose of measuring security, quality and risk, which are most often and widely used in practice. The selection of the methods, techniques and tools presented has been made on the basis of their frequency in publications and they are of the nature of good practices or standards.

It should also be noted that a well-selected identification system should meet, inter alia, the following criteria:

- should provide a cheap, reliable and ready for automatic recognition way to label products,
- should enable access to the necessary data at each stage of manufacture and distribution of products,
- should enable the transmission of data in a structured and comprehensible manner for all concerned.

Process for identifying GIS assets for measuring security, quality and risk

A schematic illustration of the GIS resource identification process for measuring security, quality and risk and its environment is shown in Figure 1.

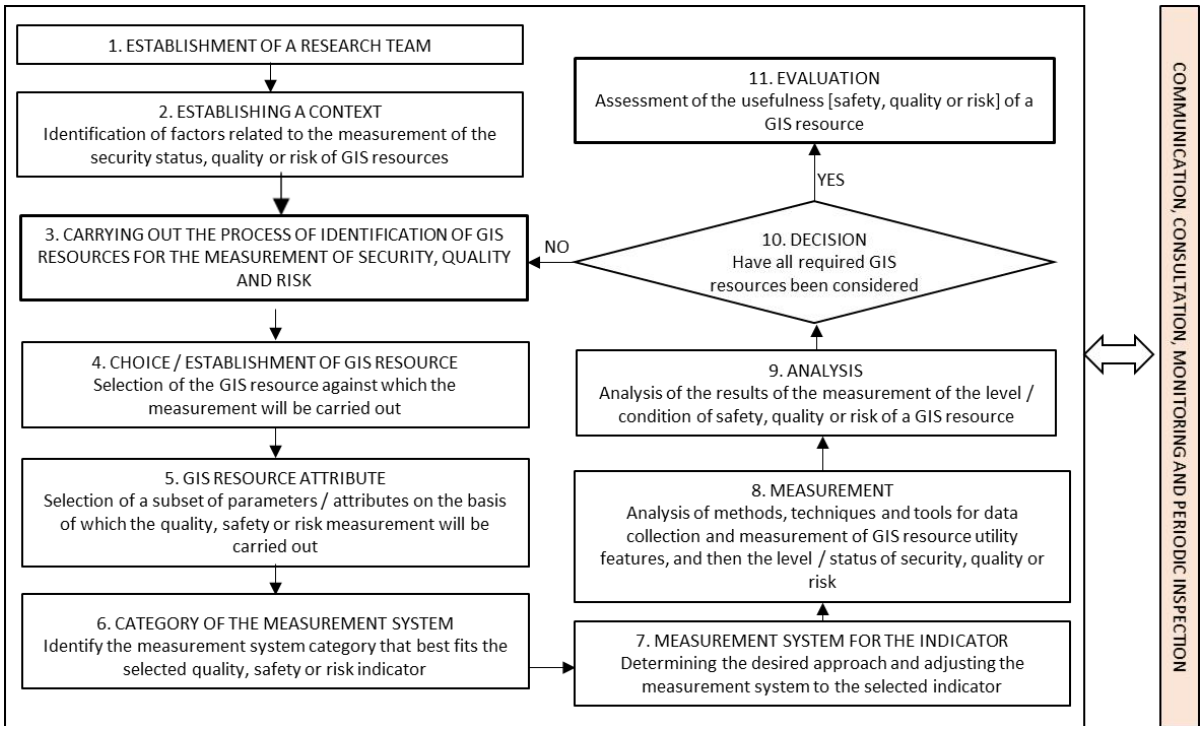

Fig. 1. Illustration of the process of identifying and valuing GIS resources for measuring security, quality and risk
Source: Own study

In this figure, four (colour-coded) important groups of elements are distinguished, comprising:

1. The GIS class system and its perspectives;
2. The process of identifying and valuing GIS resources for measuring security, quality and risk;
3. Risk analysis process for measuring the security or quality of GIS assets;
4. System for protecting/securing GIS sensitive resources.

The first step in the process of identifying and valuing GIS assets for measuring security, quality and risk is to establish the context. The second stage focuses on the identification of sets of information packets/resources residing on various information media, e.g.: paper, electronics, human brain, and consists of two specific steps:

1. Automatic identification aimed at automatically collecting, storing or entering descriptions of GIS information resources into the database of the computer system, i.e. referring to automatic identification. In literature, terms such as AI (Automatic Identification), Auto - ID (Automatic Identification) or ADC (Automatic Data Capture) may be met. The diversity of names used in this case results from the continuous development of IT technology and thus improvements and modifications aimed at improving and classifying the methods used (Jedynak & Bąk, 2917; Stanik & Kiedrowicz, 2018; Kwaśniowski & Zając, 2004; Lejuez et al, 2002).
2. Traditional identification aimed at determining the actual status of sets of information packets residing on electronic media at a given moment, verifying their usefulness, valuing and comparing them with records, settling and clarifying differences, settling persons materially responsible for sets of information packages, and finally adjusting records to reflect an actual state.

The third step, after identification, is the acquisition, collection, archiving, analysis and presentation of data. It may be disaggregated into the following phases:

- obtaining spatial data,
- collecting data in an automatic way,
- archiving information assets,
- analysing, presenting or visualizing data.

The next step, once the asset identification has been carried out, is to agree on a scale and criteria for assigning all assets a specific place on the scale, based on asset valuation. Given the variety of assets operating in GIS, it is likely that some assets can be assigned a specific value expressed in money, while for others a range of values can be indicated only, for example, from “very low” to “very high”. The decision to use a quantitative or qualitative scale depends on the organization’s preferences, but it is recommended to refer to assets. Both types of valuations can be used for the same assets.

Typical terms used for the qualitative valuation of assets are: negligible, very low, low, medium, high, very high and critical. The choice and scope of terms suitable for GIS depends to a large extent on needs for the security, quality and size of GIS and other factors specific to a given GIS class.

The fifth stage focuses on the protection of GIS information packages residing on various information media, in particular on electronic information carriers, and the following processes/areas can be distinguished:

- protection of sets of information packets sent in the GIS computer network,
- protection of access to sets (resources) of information packets.

The entire process of identifying GIS assets for security, quality and risk measurement is iterative and is supported by communication, consultation, monitoring and periodic review (Allen et al, 2018; Suchecka & Nieszporska, 2015). Sets of methods and techniques for identifying GIS resources, for measuring security, quality and risk, are presented in Table 1.

Table 1. Methods and techniques for identifying GIS resources, for measuring security, quality and risk

Name of process step	Groups/types of methods, techniques and tools	Identification	Valuation	Characteristics of the method/technique/tool
E1. Establishing the context.	E1.1. A systems or process approach. E1.2. An iterative approach.	–	–	Depending on the scope and purpose of the GIS, different approaches may be used. The approach may also be different for any iteration. It is recommended to select or develop an appropriate approach to security, quality or risk management relating to basic criteria such as risk assessment criteria, security and quality assessment criteria, consequence criteria, risk acceptance criteria.
E2. Identification of GIS resources	E2.1. Inventory of information packets	–	–	List by nature of the number of sets of information packets, valuation of those quantities, comparison of the values received with reference data or electronic repositories, including databases or data warehouses, and explanation and settlement of possible differences.
	E2.2. Global EAN UCC identification system	+	++	A consistent approach to identification and communication, thus aiming to create and develop a common language for the wider business. The EAN UCC system includes identification data that can be applied to various facilities, including information resources, following their coding in specific bar codes.
	E2.3. Automatic Data Capture (ADC) and storage or Automatic Identification (Auto ID) systems.	++	++	They enable the processing of information in electronic form, which helps to manage available resources more efficiently, including collections of information packets transferred on electronic media. With regard to sets of information packets residing on electronic information media, automatic identification can be performed with using (Robinson, 2016): - Bar code, - Radio Frequency Identification – RFID, - Magnetic strip, - Optical Character Recognition – OCR, - Visio system, - voice solutions.
	E2.4. RFID technology	++	+	It is among the fastest growing automatic identification techniques. Its development results both from the continuous improvement of the efficiency of the technology itself and from the reduction of the costs of its implementation and the introduction of global standards. However, it is perceived as threatening civil liberties.
	E2.5. Radio Frequency Identification System RFID – Electronic Product Code (EPC) – RFID identification standard - EPC global – Image recognition systems – Biometric technologies	+	+	Radio Frequency Identification (RFID) technology has greater capabilities than bar codes and enables their disadvantages to be eliminated. By using radio waves and electronic labels, it is possible to detect and identify objects from a long distance, regardless of the position and visibility of the label with the reader. The RFID identification system consists of transponders (tags) and readers together with control devices and data transfer devices. Transponders can be designed as Read Only devices (Read Only – writing is done during production - limitations similar to bar codes), as Write Once Read Many times (WORM) devices, or as devices that are able to write and read data repeatedly.

E3. Data collection, archiving, analysis and presentation	E3.1. Automatic data collection methods (Robinson, 2016):			Automatic identification is a complex concept, applies both to recognition, verification and identification processes. This complexity is due to the situation and the relationship between the identifier, the automatic reader, the database and the executive device. These relationships are determined by the choice of a specific automatic identification technique, which, if properly selected for a given GIS, enables to increase the efficiency of the business activities undertaken.
	– optical	+	–	They enable recognition of the presented image and optical recognition of graphic characters, letters, print, writing or coded structures. These include methods such as: OMR (Optical Mark Reading), OCR (Optical Character Reading), ICR (Intelligent Mark Reading), VS Image Recognition Systems (Vision Systems) and bar code techniques.
	– magnetic	+	–	They are based on the recognition of information recorded in the form of magnetic dots and dashes on a magnetic track. With the help of a magnetic reader, a reading is made which is possible even if the characters are blurred or crossed out. Magnetic methods are used for identification and authorization control, which is carried out on the basis of various types of magnetic cards.
	– electromagnetic	+	–	They are based on radio frequency identification with using an RFID system. These are wireless methods, reading is done in a non-contact manner. They enable identification and transmission of data over long distances, as well as remote saving and modification of information. By means of an antenna, a transmitter (receiver with a decoder) and a transponder (radiolocation device), the radio pulse is received and processed together with the information stored in it.
	– biometric	++	–	They allow identification of identity, based on fixed physical or behavioural characteristics (behavioural identification). The digitally encoded profile of the person is stored in the database or is on the personal card. The characteristics shall be written by means of a magnetic stripe or a two-dimensional bar code. 8 Identification may be based on physical characteristics such as fingerprint pattern, shape, proportions and dimensions of hands or fingers, pattern of blood vessels on the retina or characteristic points of the iris, facial features including the eye area, thermal image of the face and voice
	– tactile	–	–	Devices also known as contact devices, enable data to be read and entered by using a special probe. These are micro-devices in the form of stainless steel containers with an internal electronic memory chip. The upper part of the device is connected to one end of the electronic circuit, while the lower part, along with the sides, acts as an electrical mass. The whole circuit is closed by a probe.
	– smart cards	–	–	They belong to cards equipped with memory and a microprocessor. It is used to control, read and record information and manages the card memory by indicating its specific areas for recording selected data. Microprocessor cards have Read Only Memory, in which the operating system is stored. The operating system enables the microprocessor to function. There are many different models of smart cards. Some have their own battery power supply, e.g. Active Cards, others, equipped with a keyboard and display, are self-sufficient systems, e.g. Super Smart Cards. Smart cards include cryptographic cards (with embedded encryption accelerator, thus increasing data protection effectiveness), hybrid cards (using various technologies combining magnetic or optical cards with an electronic system) and cards with a dual interface (communication is possible through a radio interface or connector).

	E3.2. Systems for data archiving, analysis and presentation (Robinson, 2016):			These systems are an intermediate element between the GIS hardware layer and the business layer. It may include a geo-database responsible for efficient real-time archiving of often large amounts of data and various types of tools for processing and analysing this data, often based on artificial intelligence methods.
	- Historian industrial databases	+	–	Plant-wide Historian databases have an architecture aimed at collecting and presenting data being processed. They have a variety of built-in capabilities to collect processed data from multiple sensors and systems that operate in real time, producing huge data sets. Typically, the Historian system elements responsible for collecting various types of data are built as so-called collectors, ready for use immediately after installation. Data sources can be the industrial-standard OPC servers, but it is also possible to download data from other sources such as HMI/SCADA software from various manufacturers.
	- MES systems	+	–	MES systems are responsible for analysing and presenting spatial data collected in the Historian database and other sources. In order to enable them to function properly, it is necessary to build a correct data model taking into account the links existing therein.
E4. Valuation of resources	E4.1 Generalized method	++	++	The valuation of GIS resources is carried out in two (or more) iterations. The first one is an overall valuation carried out to identify potentially sensitive resources that open up the possibility of further valuation. The next iteration includes further, more detailed considerations on potentially high losses disclosed in the initial iteration. If it does not provide sufficient information to estimate the level of security, a further detailed analysis shall be carried out, presumably for a part of the overall scope, and possibly by using another method.
	E4.2. Detailed methods	++	++	The methods for the detailed valuation of resources in the GIS information security include the in-depth identification and valuation of GIS assets, the estimation of threats to these assets and the estimation of vulnerabilities. The results of these activities are then used to estimate the risks and then to measure the level of security or quality status. To evaluate assets/information resources by using the detailed method, functionals are used, described by the following formulations: $$F^a : AB \times KA \longrightarrow S^J \ , \ F^a(b_i, k_j) = f^a_{i,j} \in S^J$$ where: A – a set of assets, AB – set of basic security attributes, KA – a set of financial and non-financial criteria for assets, S^J – a scale of possible values of an asset

E5. Protection of GIS information packets	E5.1. Protection of sets of information packets transmitted over a GIS data communication network,	+	–	As regards the protection of information transmitted over the GIS network, it is essential to prevent the flow of unauthorized data and to define very strictly which data can be accessed and for what purposes, and which data are necessarily open and which are restricted. The protection of sets of information packets in open systems consists in/is implemented with using the following services (Stanik et al, 2014): – access control/controlling an access – protects resources against unauthorized users – confidentiality of data – a service designed to protect information or data against unauthorized persons – data integrity – data protection against data modification / erasure, i.e. it is cohesion security – authentication – control / security, identity of parties or data – non-repudiation – this is a control regarding the sending of information as well as the receiving of information – encryption – this involves making information secret, two encryption algorithms are distinguished: symmetric (with secret keys) asymmetric (with secret keys and public keys) – a digital signature – for which signing and verification procedures are defined; the former uses the input of information that is unique and confidential to the signatory, the latter uses information that is publicly available – access control – has been established in order to define and respect access rights – ensuring data integrity – the most common domain referred to as cryptography, i.e. control sums, is used in this case – authentication exchange – this is important for party authentication Three parameters are used here: challenges, time stamps, subsequent numbers – filling in with traffic – it hides information about the activity of a given source
	E5.2. Protection of access to sets (resources) of information packets.			In this respect, the following methods may be used: methods based on the control of the number of a responses set, methods based on the transformation (distortion) of responses or values of attributes of the information packets, methods based on making sets of information packets secret.

E5. Protection of GIS information packets	a) The method based on the control of the number of a responses set	+	–	This method is extremely simple, very easy to implement, and places a negligible burden on the time of usage (GIS information packet analysis) of a set of packets, and does not allow them to be accessed if they have been analysed on a smaller set of responses than it results from the time of access policy established for this set.
	b) Method based on transformation (distortion) of response	+	–	This method is among the most interesting because of its simplicity and at the same time high efficiency, especially when intrusives have additional external knowledge. To the greatest extent, it counteracts attacks with the use of spools.
	c) Cryptographic method - a method of making sets of information packets secret.	+	–	In cryptographic protection, a system is considered correct only if each attempt to "break" it forces to scan the entire space of contained keys, or if the time and complexity of such a scanning is equal to the time of such a review. It can therefore be said that the system becomes secure when it is correct and when a successful attack takes more time than the required period of classification of encrypted information.
	Techniques to protect sets of information packets collected in databases.	+	–	This is a problem that takes a great deal of attention and a variety of solutions, often very complicated, depending on protection requirements, are being taken in this regard. Despite the passage of several decades, the Denning's proposed division of data protection mechanisms in GIS databases into control mechanisms, such as the below mentioned ones, is still valid: - access control mechanism, - flow control mechanism, - control mechanism for data encryption and data inference (Denning, 1982; Denning, 1992). By limiting the scope of considerations, it can be noted that encryption, as the oldest technique for data confidentiality protection, has been developed outside IT, mainly by mathematics and communication specialists. From the point of view of IT systems, including database systems, it is primarily a technical problem consisting in the search for efficient implementation of theoretically recognized encryption methods. It is also worth noting that this technique prevents or significantly impedes the disclosure of the content of the information, but does not prevent any distortion or destruction of the data at all and can therefore only be used in databases as a complementary technique.

Legend: ++ – definitely applicable, + – applicable; – – not applicable

Source: Own study

The above groups of methods, techniques and tools for identifying GIS resources for the purposes of measuring security, quality and risk are only a reference point for those responsible for the management and administration of GIS resources. There is no algorithm advice on how to conduct the security, quality or risk measurement process for GIS resources. A more methodological approach to the problem is presented by (Fedulova & Lanovska, 2018). The authors use a mix of "top-down" and "bottom-up" strategies as complementary actions. Fedulova and Lanovska (2018) propose a list of questions useful to identify the symptoms and causes of the risk, risk factors, the risk situation and its consequences. In addition, the proposed list of questions concerns the method for detecting a specific source of risk. However, this approach is very general. Another methodological approach to risk identification is proposed by (Dzięcioł, 2018). This proposal is called the multidimensional risk analysis in the company. Despite the methodical level of the above-mentioned proposals, the methods do not answer

the question of how to perform comprehensive risk identification throughout the enterprise. One may wonder, in the context of the literature, this process should be characterized not only by "methodology" (Jedynak & Bąk, 20017), but also by multi- and inter-disciplinarily (Zawiła-Niedźwiecki, 2018).

Research methodology

The research presented in this paper is conceptual. This determines the lack of a research hypothesis. Nevertheless, this paper assumes that the process of identifying and valuing GIS assets for the purpose of measuring security, quality and risk will be successful (accurate) provided that GIS assets/resources are correctly disaggregated into basic ones and support ones and provided that values of possible damages/losses in case of loss of the security or quality attributes assigned to them, are correctly assigned/calculated to them. The basic research process led first to the development of a security, quality or information resource risk measurement model and then to the development of a methodology for measuring the security status of the GIS system or its information resources. The methodology takes into account groups of GIS resources and their attributes which, in the opinion of the members of the problematic/research team, allow a relatively objective and accurate assessment of the level of security, quality or risk of information resources. Due to the fact that individual factors or features of GIS resource usability within the distinguished areas of: quality, security and business continuity, belong to different sets of values, it is necessary to introduce a function ξ or a set of functions $\xi \epsilon \Xi$ unambiguously mapping these components to a uniform range of values.

The normalization function is referred to as the family of the functions $\xi \epsilon \Xi$ (Stanik & Kiedrowicz, 2018):

$$\xi : X \longrightarrow [1, 2, \ldots, N] \tag{1}$$

The form of the normalization function of the family Ξ should be defined in such a way as to represent their values in the range [1,..., N] and to maintain appropriate proportions of their impact on the overall usefulness of the GIS resource, taking into account the set X all specified utility factors. The set X should be decomposed into subsets X^B, X^J, X^C representing distinct areas/ /aspects.

The critical step in the GIS usefulness measurement process or a GIS security status is to determine:

- what is to be measured? (e.g. people, processes, activities, threats, policies, procedures, documentation, technical resources or other elements of the Armed Forces of Poland);
- what attributes, properties or utility features will be taken into account? (e.g. security, business continuity, etc.);
- how will the data be collected?;
- what data collection techniques will be used? (e.g. testing, research, interviews, observations, instruments, combined methods);

- what type of measures are best suited to selected elements and usefulness attributes? (i.e. binary measures, categories, structured measurements, measurements of factors, interval measurements);
- what category of measurement system is best suited to a given measurement situation? (e.g. descriptive, threshold or trend category);
- what measurement system and/or measure is the best to be used? (e.g. Likert's scale, binary measure, quotient measure, interval measure).

Having defined and determined a generalized GIS utility level based on a function F^{GIS} (a general GIS utility function determined on a set $\{A\}$ - the set of GIS utility parameters) we can finally introduce a definition of a partial GIS utility, e.g. F^B „ which represents the security aspect, and determine the GIS security level. Partial usability is related to a specific usability attribute and reflects its "contribution" to the total usability of the GIS system. The partial usability or usefulness of an attribute A_i is called a number $R_i \in$ R equal to the length of the vector.

Research findings

Model to measure security, quality or risk of information resource. In the literature of the subject matter and in available sources, in particular online resources (Laskowski, 2011; Bastien, 2009; Au et al, 2008; Fitzpatrick, 1998; Kuziak, 2006) several risk measurement models of any object can be found, ranging from simple models to developed and finishing on the most complex ones. These models have been presented in different ways, namely as:

- numerical models written by using mathematical formulae (Zikmund & Scott, 1977),
- graphic models written in the form of drawings, diagrams or constructed on the basis of Question aggregates (lists), or constructed on the basis of matrices, tables, maps,
- integrated models (combined, mixed) – resulting from a combination of numerical models or graphic models.

In this paper, the model for measuring the security, quality or risk of a GIS resource has been defined by the following formulation (Stanik & Kiedrowicz, 2018):

$$\text{MPBJR} =< Z, \{I\}, \{A\}, \text{F}^{GIS}, \{F^B, F^J, F^R\}, \text{MP} > \quad (2)$$

where:

Z – a set of key elements/information resources of GIS that are subject to identification and are the basis for determining their security, quality or risk status

$\{I\}$ – set of GIS resource identification instruments (it is a set of methods, techniques and tools necessary to identify GIS information resources)

$\{A\}$ – a set of GIS utility parameters (it is a set of basic GIS usefulness features disaggregated into three subsets $A^B \subset A, A^J \subset A, A^R \subset A$ of attributes, each of which reflects a subset of parameters enabling the measurement of quality, security or risk in relation to the established GIS resource)

F^{GIS} – the general GIS usability function determined on the set $\{A\}$

$\{F^B, F^J, F^R\}$ – detailed functions of usefulness of the information resource, properly determined on the subsets $A^B \subset A, A^J \subset A, A^R \subset A$

MP – methodology for measuring GIS usability or its components such as: quality, security, risk

Methodology for measuring the security, quality or risk status of the GIS information resource. Analysing the different approaches to measuring and handling the security, quality or risk status of a GIS information resource, the question arises whether it is possible to create a complete and coherent methodology taking into account the various internal and external factors relevant to the basic characteristics of GIS usability and linking them in a way that allows the level/status of security or quality to be determined as fully and unambiguously as possible, while maintaining the practical utility of the approach proposed.

This chapter is an attempt to answer such a question by presenting a description of the methodology for measuring the security, quality or risk status of the information resource, which, in the opinion of the authors, is a complete and consistent methodology (Figure 2).

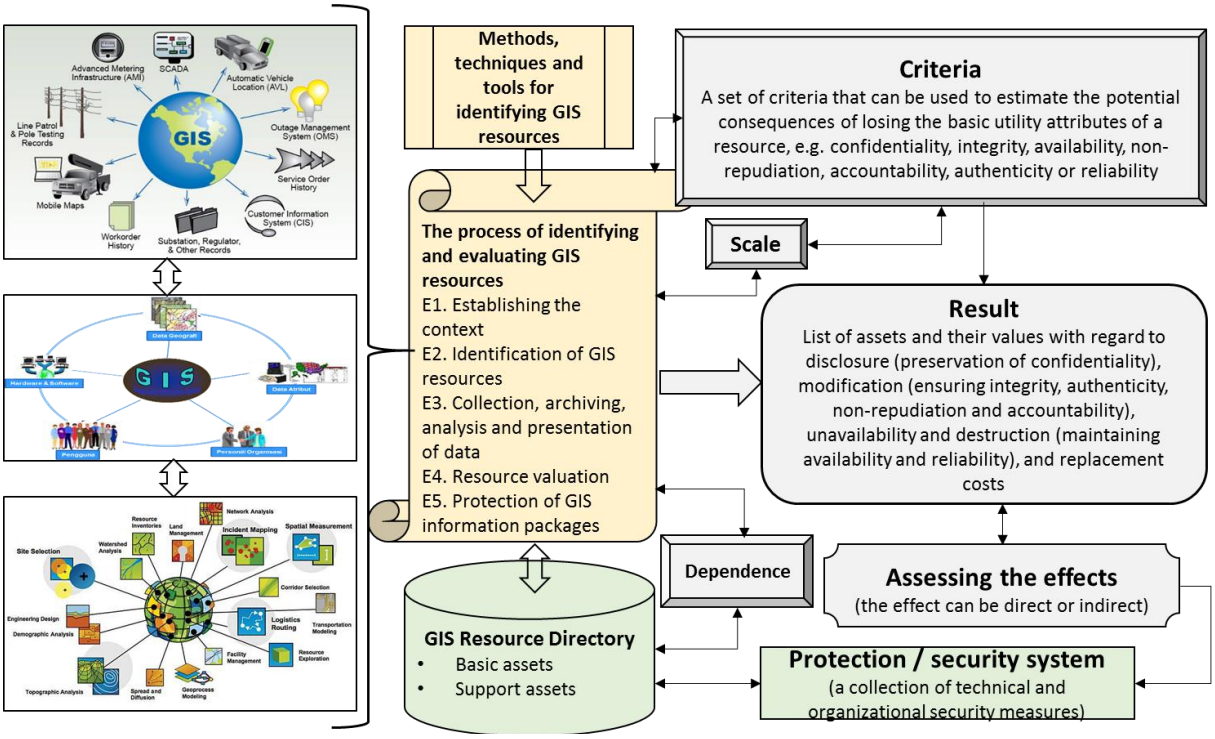

Fig. 2. Illustration of methodology for measuring the security, quality or risk status of the GIS information resource

Source: Own study

The basic elements of the methodology proposed in this paper are:

- A set of activities, conceived as stages or steps in a procedure and the links between them;
- A set of key GIS elements/resources that are measurable and form the basis for determining security, quality or risk status;
- A set of methods, techniques and tools for identifying GIS resources for measuring security, quality and risk;
- Set of attributes/properties of GIS usability, e.g. security, quality, risk;
- A set of indicators used to measure the characteristics of GIS resources and attributes of its resources, e.g. confidentiality, availability, integrity, reliability, accountability;
- A set of categories of measurement systems used to quantify security, quality or risk status;
- A set of types of measures used to express security, quality or risk status, e.g. binary measure, Likert scale;
- A set of data collection techniques, e.g. observations.

The starting point for establishing a methodology for measuring the security, quality or risk status of a GIS information resource is to select a leader or leaders to initiate the work, promote and coordinate the introduction of the programme, ensure effective communication and generally oversee the implementation of the programme. This function may be performed by one person or group of persons, depending on the size and complexity of the GIS or organization and the availability of personal resources. The team leader/team manager should plan the composition and structure of the measurement team. The structure of the team should be supplemented with roles (usually persons, groups of persons) which will represent all stakeholders. The respective roles will be assigned appropriate responsibilities appropriate to the tasks performed.

The determination of measurement systems and measures of the security, quality or risk status of a GIS information resource should start with establishing the context for a GIS operation in order to:

a) become acquainted with issues directly related to the structure and status of the GIS use environment and the elements/objects to be analysed and assessed in terms of security and quality,
b) identify internal and external factors related to GIS usability attributes,
c) lay down the basic criteria needed for measuring the security, quality or risk status of the GIS information resource:
   - criteria for selecting a set of indicators,
   - criteria for the selection of categories of measurement systems used to quantify the security, quality or risk status of the GIS information resource, criteria for the selection of data collection techniques,
   - criteria for selecting types of measures,
d) define the sets of key GIS resources,

e) define a set of attributes describing the usability of GIS,
f) define sets of measurement systems for established indicators to measure the security, quality or risk status of the GIS information resource, establish data collection techniques,
g) define categories of measurement levels – a set of measures.

Conclusions

One of the issues that causes most problems in the process of identifying and valuing GIS resources for measuring security, quality and risk is the proper selection of methods, techniques and tools for collecting and compiling various types of data in relation to various types of GIS assets. In the process of identifying GIS resources, there is no list of research techniques, tools and methods "reserved" only for it. The main contribution of these studies is to fill the research gap associated with the absence of proposal, of a methodological, comprehensive approach to the implementation of this phase throughout the security, quality or risk management process. An additional value of this paper is the development of a model and a method for measuring GIS usability that can enrich the risk management process (make it more accurate). This is reflected in the methodology presented. The methodology proposed in this paper has theoretical background but is aimed at practitioners. The methodology is universal and can be used in all types of GIS systems as part of a risk, quality or security management process. However, it is important that the choice of specific methods, techniques and tools to support the identification process at individual stages depends on the situation (e.g. nature, destination or size) and the capacity to analysing GIS and the range of needs.

The methods proposed in this paper for identifying and valuing GIS resources are quantitative, qualitative and mixed methods and can be applied to a variety of studies. The article also does not present a ready-made "canon" of methods and techniques that work in every situation with regard to the exploitation of GIS resources. It is often recommended to use, where possible, rather simple, "respondent-friendly" techniques and tools that do not require labour-intensive statistical analyses when developing the results collected. When designing an appropriate set of methods, techniques and tools in the process of identifying and valuing GIS resources, it is also important to remember to collect only those data that are really necessary. This paper attempts to develop and characterize instruments and approaches to the problem of identification, protection and quality of information processed in GIS class systems. Proposed methods, techniques and tools take into account all the features, characteristics and determinants of GIS resources necessary to measure their security, quality and risk. A set of GIS resource identification instruments has been proposed, the implementation of which will significantly contribute to an increase in the level of security, reliability and quality of these resources. The proposed elements of a set, which are theoretically justified, may be improved and the set may be extended to other elements of the security policy. Far-reaching flexibility is called for in the choice of methods, techniques and tools used to identify GIS resources. In the context of the studies carried out, it can be concluded that:

- The process of identifying and valuing GIS assets for measuring security, quality and risk resembles a research process, which is opened by a problem-solving team responsible for its progress, based on substantive and methodological knowledge (which such knowledge is often interdisciplinary). On the other hand, however, this fact sets out a duty of care and a high level of self-awareness of its "researcher".
- Identification of risk factors for the entire GIS from several different perspectives may reveal more sources of risk or challenges, and consequently the cognitive gap (the area of risk omitted) is limited to the minimum.

The most important limitation of the model and methodology for measuring the security, quality or risk status of a GIS information resource is the theoretical nature of their foundations. Further empirical research (e.g. case studies) is therefore recommended, as well as a theoretical critique of the model and methodology.

References

Allen B.J., Loyear R., Noakes-Fry K. (2018). Enterprise Security Risk Management: Concepts and Applications. Connecticut, Publisher: Rothstein.

Au F., Baker S., Warren I., Dobbie G., (2008). Automated usability testing framework. In: Proceedings of the Ninth Conference on Australasian User Interface, AUIC 2008, vol. 76, pp. 55–64.

Bastien J. (2009). Usability testing: a review of some methodological and technical aspects of the method. International Journal of Medical Informatics, no. 79(4), pp. 18–23.

Denning D. (1982). Cryptography and Data Security. USA, Addison-Wesley.

Denning D. (1992). Kryptografia i ochrona danych (*Cryptography and Data Security*). Warsaw, Publisher: Wydawnictwo Naukowo-Techniczne.

Dzięcioł P. (2018). Proces wielowymiarowej analizy ryzyka w przedsiębiorstwie (*The process of multidimensional risk analysis in an enterprise*). In: Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, no. 541, pp. 19–38.

Fedulova I., Lanovska H. (2018). Identyfikacja ryzyka: Esencja i metody wykrywania (*Risk identification: Essence and detection methods*). In: Scientific articles Mykolo Romerio universitetas, no. 21, pp. 40–53.

Fitzpatrick R. (1998). Strategies for Evaluating Software Usability. Methods, vol. 353, no. 1, Publisher: Technological University Dublin.

Jedynak P., Bąk S. (2017). Przegląd standardów zarządzania ryzykiem (*Review of risk management standards*). In: E. Skrzypek, A. Piasecka, S. Sagan (ed.), Nowa jakość a zadowolenie interesariuszy (*New quality and stakeholder satisfaction*), pp. 49–68. Lublin, Publisher: Katedra Zarządzania Jakością i Wiedzą, Wydział Ekonomiczny UMCS w Lublinie.

Kuziak K. (2006). Metody analizy ryzyka operacyjnego (*Methods of operational risk analysis*). Prace Naukowe Akademii Ekonomicznej we Wrocławiu, no. 1133, pp. 254–265.

Kwaśniowski S., Zając P. (2004). Automatyczna identyfikacja w systemach logistycznych (*Automatic identification in logistic systems*). Publishing House of the Wrocław University of Technology, Wrocław.

Laskowski M. (2011). Czynniki zwiększające jakość użytkową interfejsów aplikacji internetowych (*Factors increasing the usability of web application interfaces*). Logistyka, vol. 6, pp. 2191–2199.

Lejuez C.W., Read J.P., Kahler C.W., Richards J.B., Ramsey S.E., Stuart G.L., Strong D.R., Brown R.A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). Journal of Experimental Psychology: Applied, no. 8(2), pp. 75–84.

Robinson A. (2016). More advanced technology trends in logistics in 2016, http://cerasis.com/ [access: 28.08.2021].

Stanik J., Kiedrowicz M. (2018). An Information System Risk Model for the Risk Management System of an Organisation Processing Sensitive Data. Journal of Management and Finance, vol. 16, no. 3/1, pp. 207–227.

Stanik J., Protasowicki T., Kiedrowicz M. (2014). Wybrane aspekty standaryzacji w ochronie publicznych zasobów informacyjnych i świadczonych usług w kontekście społeczeństwa informacyjnego (*Selected aspects of standardization in the protection of public information resources and provided services in the context of the information society*). Zeszyty Naukowe Uniwersytetu Szczecińskiego – Ekonomiczne Problemy Usług, Szczecin, vol. 113, pp. 113–130.

Suchecka J., Nieszporska S. (2015). Koncepcja ryzyka w kontekście funkcji użyteczności (*The concept of risk in the context of the utility function*). Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie. Częstochowa, no. 19, pp. 103–115.

Zawiła-Niedźwiecki J. (2018). Od zarządzania ryzykiem operacyjnym do publicznego zarządzania kryzysowego. Wyzwania badawcze (*From operational risk management to public crisis management. Research challenges*). Kraków, Publisher: eduLibris.

Zikmund W.G., Scott J.E. (1977). An Investigation of the Role of Product Characteristics in Risk Perception. Review of Business and Economic Research, New Orleans, La, vol. 13(1), pp. 19–34.

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Katarzyna Roszewska[1]

GEOGRAPHIC INFORMATION SYSTEMS AND ACCESSIBILITY FOR PERSONS WITH DISABILITIES

Abstract: Disability is a natural part of the human experience across the world and an integral part of the human condition. However, people with disabilities are often seen as different from "the norm" of human being and as a result their needs are marginalized in their societies. The access to many aspects of social life is limited for them. Initially, disability was recognized in the medical and social context as a dysfunction requiring medical treatment, "special" schools, workplaces or social benefits due to incapacity for work. Over time, the influence of the environment on the functioning of a person with a disability became the subject of interest. The importance of shaping space for people with disabilities is developed in disciplines dealing with urban planning, spatial planning and architecture. Even the concept of "geography of disability" lately came into existence. Geographic information systems offer analytical methods and tools to explore various spatial concepts and their impact on the functioning of people with disabilities. Their application is growing and strengthening GIS in disability research can contribute to greater autonomy of people with disabilities and promote their integration into society. One of the impulses for the development of GIS in this area are undoubtedly regulations guaranteeing people with disabilities access to the physical environment, transport and other facilities, information and communication as well as services intended for use by the general public, and obliging not only public entities, but more and more often private entities to ensure accessibility. The aim of the article is to indicate what new challenges were created by the legal systems and what expectations can be addressed to GIS.

Keywords: geography of disability, accessible space, GIS applications in disability studies, GIS tools, the right to access

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Introduction

Human activity has a strong spatial context. It is natural for humans to live in space and influence it at the same time. Therefore, the surrounding space needs to be shaped to meet human needs. However, for many centuries the environment surrounding even the most developed societies has been shaped from the perspective of able-bodied people and intended for able-bodied people. It was overlooked that disability is not only a constant, but also a natural experience that has been present across all human societies. Historically, the perception of human corporeality was an important starting point for shaping the natural surroundings and creating social spaces (Gleeson, 1998). Persons with disabilities were treated as different from the human "norm." The participation of persons with disabilities in social life was thus marginalised, and, under the guise of providing assistance, it was subjected to strong social control and monopolised by medicine over time. Social assistance and medicalisation were the key tools of exercising social control over persons with disabilities (Barnes & Mercer, 2008). Disability was viewed as a dysfunction that requires medical treatment and secure income, the provision of "special" education, and assistance in finding "special" employment. Even the removal of barriers initially involved the provision of "special" solutions intended only for persons with disabilities.

Spaces adapted for the needs of society thus reflect a specific social structure and cultural patterns. As a result, they represent social artefacts, shaped through the mutual interaction of structures, institutions and people in successive historical periods. From this perspective, disability represents a socio-spatial experience emerging from essential social relations (Gleeson, 1998). At the same time, the resulting environment also influences society and individuals, their ideas about social needs as well as their attitudes. It does not help to see how unfriendly, inaccessible and excluding it can be for persons with disabilities. In turn, the specific features of the surroundings determine access to places, essential public goods and services, it may foster a person's self-actualisation or constrain their educational, professional, economic opportunities or even natural social interactions and, as a result, the quality of life. In other words, poorly designed space can exclude people and can be analysed in terms of lack of equal access to public places, goods and services.

Disability not only manifests itself but also reproduces itself in socio-spatial ways. The existing disabling socio-spatial patterns and relations are maintained by dominant power relations. Only when they begin to trigger resistance will they result, over time, in the renegotiation and change of those patterns and relations (Gleeson, 1998).

The disability rights movement was inspired by the struggle for equal racial rights. The problem of inaccessibility in many areas of life, the isolating approach that adds to the existing impairments was strongly highlighted in the *1976 Fundamental Principles of Disability of The Union of the Physically Impaired against Segregation and the Disability Alliance.* A concept emerged to reject disability as a characteristic of the person and it was proposed instead to see it as a social construct defined through discrimination and exclusion by the surroundings. A strong emphasis was placed on environmental

barriers. The creator of the theoretical concept of the social model of disability was M. Oliver, who recognised the growing sense of discrimination and social oppression among persons with disabilities and the emergence of a new paradigm of disability, which placed disability in society rather than within individuals, and called for a shift from a focus on the physical limitations of individuals towards the way in which physical and social environments impose constraints on specific groups and categories of people (Oliver, 1983). In this way, the impact of the environment on the functioning of persons with disabilities evolved into a topic of systemic interest.

The concept of accessible space

The conceptualisation of disability has expanded significantly since the 1980s. The idea of barrier-free design was born, followed by universal design, also called inclusive design or design-for-all (Ostroff, 2001). The role of assessing collective needs, co-deciding about their choice for implementation fell not only on the shoulders of urban planners, but also environmentalists, people representing health care and social policy, as well as local activists (Parnell, 2016). Ensuring accessibility (especially physical) of public spaces and facilities, incorporating the idea of universal design, also makes them more accessible for people who may not be disabled (e.g. families with baby prams, people with large luggage).

The influence of environmental and social factors on the participation of persons with disabilities in society became a researched topic. Accessibility, especially when measuring physical access, can be assessed in various ways. Measurement in absolute terms helps to assess whether or not a person with a specific disability has access or not. In order to measure accessibility more accurately, it is necessary to use other measures of access (such as accessibility to the nearest facility, "gross" accessibility as the sum of all measures and types of accessibility, accessibility with probabilistic choice, also called choice-based accessibility). For example, a ramp at the back of a building may provide absolute access, but may force its users to take a detour and take more time to get down and return to the main route (Church & Marston, 2016). Accessibility was also separately ensured in places specifically designated for persons with disabilities. Over time, it began to focus not only on access to specific places, transport and physical access, but also on broader access to urban features, public goods such as spaces open for the general public, and to public services (Waters, 2016).

Architectural accessibility was the first area where the need to provide equal access for persons with disabilities was noticed. This type of accessibility is indicated as a fundamental feature of the built environment. It enables people to participate in all the activities for which the built environment is designed. For most people, the modern environment is built accessibly. They can use it independently and naturally without being aware of accessibility as an essential feature of the environment. However, if accessibility criteria are benchmarked against the characteristics of the "average" person, this does not mean that the facilities built are automatically equally accessible to all (Wijk, 1996).

Finally, providing spaces without architectural barriers did not mean that public spaces, transport, other public services and goods were accessible to the entire community of persons with disabilities. Environmental disability may depend on the specific type of disability (Keysor, 2006). Less commonly realised but equally important was the availability of information, the accessibility of communication for deaf persons, blind persons, persons with intellectual disabilities, and persons who communicate using AAC. Technological progress, in turn, forced the need to ensure accessibility of information technology.

A separate issue is the question about the environmental factors that should be taken into account and ways of measuring their impact on the provision of accessibility. It is therefore important to recognise the real role of environmental factors in the disability process, and researchers need to develop an underlying theory to help explain when barriers actually mean that participation does not occur, without neglecting the fact that participation is also strongly related to quality of life (Whiteneck, 2006).

Finally, the interaction between the person with disability and the environment is not limited to the physical environment but also incorporates the social, cultural and economic environment (Enders & Brandt, 2007).

Development of GIS applications in disability studies

The meaning of space and place for persons with disabilities is a research area in geography, urban planning, spatial planning and architecture. Even a term such as "geography of disability" has been coined and it was first used by R. Golledge (1993, see also Zajadacz, 2011). Geography of disability is considered to be a subdiscipline of geography, focused on studying the experience of persons with disabilities in the context of the relationship between space (geographical environment) and human beings. Geographers propose to see disability as a result of the relationship between the person with disability and the geographical environment. Studies focus on this relationship, taking into account natural, political, cultural and social factors, but also degrees and types of disability. This refers to the experience of persons with disabilities in different spatial areas: from urban to rural, from the micro scale (mobility in the place of residence) to accessibility of transport (as a network connecting cities and countries) (Jacobson, 2012).

Geographic information systems (GIS) are a key tool to support geography of disability in public space planning. They connect geography, space and technology and are used for digital acquisition, mapping, collection, analysis, processing, including visualisation, of spatial data (Burrough & McDonnell, 1998). Those systems enable data comparisons over time (data on a map referring to different periods). The data may refer to physical, natural, political, social, ethnic and cultural elements and may derive from various sources. GIS enable spatial coordination of resources from distinct systems (Enders & Brandt, 2007). GIS are faster and more accurate to use than paper maps and data can be shared online. If different data are overlaid, this reveals not only the problem, but also its source and cause.

GIS offer methods and analytical tools to analyse different spatial concepts and their impact on the everyday life of persons with disabilities. However, it is still only a set of analytical tools and methods that produce results as accurate as the data processed, and are only as intelligent as their users.

GIS tools quickly made it to health services, enabling the tracking of the incidence and spread of diseases and medical conditions. It is worth mentioning that historically mapping had already been used during the cholera epidemic in 19th-century London, when a local doctor, John Snow, used his map to determine that the problem originated from a specific water pump that delivered contaminated water from the Thames. Transport has become another important area of application of GIS for persons with disabilities. GIS have been widely used to obtain information on the accessibility of public transport, the possibility of using personal transport, the conditions of individual mobility and spatial orientation, currently also inside built-up facilities (Zimmermann-Janschitz, 2018).

As geospatial technologies grew more widespread, social needs analysis has become even more attainable. New applications of GIS have expanded to include the study of how interactions between geographic phenomena and social structures affect individuals and society (Kocaman & Ozdemir, 2020), and how the environment can condition the impact on specific social groups and individuals. GIS can serve as a tool for assessing community needs and resources, setting or influencing policy, planning an initiative or intervention, as well as evaluating and redirecting work. The example of environment and population mapping in disasters has shown how the perception of persons with disabilities can change from those with “special needs” to those who contribute to progress in the community. GIS technologies are also an opportunity to be seen as part of the solution, not just part of the problem (Enders & Brandt, 2007).

Geospatial tools and methods can detect structural injustices that each person with disability experiences differently. Depending on the kind of disability, factors might hinder access to the environment but they can also support the development of solutions (Kocoman & Ozdemir, 2020). The digitalisation that is taking place in social life enables the implementation of new concepts, creative approaches to the services offered in a new institutional setting, institutional reconstruction, stimulation of processes that could meet citizens ever new needs (Grewiński & Karwacki, 2015; as regards social innovation in various European countries: Grewiński, 2018).

Among the limitations and barriers of GIS, authors point out, however, to the idea of targeting solutions to specific disabilities. Different groups identify barriers individually (Zimmermann-Janschitz, 2018). A systematic approach to the use of geospatial technologies in order to improve the rights and lives of persons with disabilities must include the structuring of the problem by identifying the basic requirements, designing the system in a proactive and evolving way so that it can be updated with new technologies and user input data (Kocoman & Ozdemir, 2020).

Accessibility in the legal system

The development of accessibility was not only associated with the spread of universal design, reasonable adjustments or social pressure to remove existing barriers. Environmental barriers were accompanied by social policy restrictions as well as formal and structural barriers. The impact of disability rights movements translated into the emergence of accessibility standards. In the USA, accessibility became mandatory for all federal facilities as early as 1978. Further, in 1990, the U.S. Congress passed *The Americans with Disabilities Act* (ADA), a comprehensive law that covers most accessibility issues for persons with disabilities in the United States. ADA applies to all state and municipal government offices and facilities, as well as all public facilities: buildings and other spaces accessible to the general public. ADA guarantees both physical accessibility and non-discrimination in employment and in the provision of goods, services, programmes and education. Similar legislation has been introduced by the United Kingdom (*The Disability Discrimination Act 1995*, called the DDA) and Japan (*The Heartful Building Law*, in 1994).

In contrast to the "complaints-based" human rights system, regulations establishing accessibility standards were seen as a complementary tool to help reduce discrimination on the basis of disability and promote a society that is more open to persons with disabilities (Jacobs, 2016). The UN Standard Rules on the Equalization of Opportunities for Persons with Disabilities (1993) included a principle devoted to accessibility (Principle 5: Accessibility). The Rules referred to accessibility in all spheres of life, not only within the physical environment but also in terms of information and communication. They pointed out that the process by which every aspect of the organisation of society is accessible is a fundamental goal of socio-economic progress and development (Preamble). In recognition of the important role of the environment in human functioning, environmental factors were included by WHO in the International Classification of Functioning, Disability and Health (ICF). These factors range from physical (such as climate, terrain or building design) to social (such as attitudes, institutions and regulations).

A breakthrough came with the adoption of the Convention on the Rights of Persons with Disabilities (CRPD). The concept of accessibility has become part of the human rights canon. Accessibility is one of the pillars underlying the Convention. CRPD defines accessibility as one of the general principles. It views persons with disabilities as rights holders rather than targets of charity or clients of welfare services. States are now obliged to take adequate measures to enable persons with disabilities to participate fully in all aspects of life and live independently. Under the obligation to provide access, CRPD mentions the physical environment, means of transport, information and communication (information and communication technologies and systems) and all other facilities and services generally available or provided to the public, in both urban and rural areas (Article 9(1)). States Parties should promote access for persons with disabilities to new information and communication technologies and systems (Article 9(2)(g)), provide persons with disabilities with accessible information on mobility aids,

devices and assistive technologies, including new technologies, as well as other forms of assistance, support services and facilities (Article 4(1)(h)).

Year 2019 saw the adoption of Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services (OJ L 151, 7.6.2019), which aims to approximate the legislations of Member States with regard to accessibility requirements for certain products and services, in particular by eliminating and preventing the emergence of barriers to the free movement of certain accessible products and services that result from divergent accessibility requirements in different Member States. The obligations set out in that Directive should apply equally to economic operators from the public and private sectors (Recital 57). However, this is not the first piece of EU legislation on accessibility. Their list can be found in the appendix to Annex II of the Council Decision of 26 November 2009 concerning the conclusion, by the European Community, of the United Nations Convention on the Rights of Persons with Disabilities (2010/48/EC).

In Poland, new challenges arose from the Act of 19 July 2019 on ensuring accessibility to persons with special needs. Its enactment was preceded/heralded by the 2018–2025 Accessibility Plus government programme (Resolution No. 102/2018) adopted a year earlier. Among other things, the Act imposes an obligation to continuously monitor the provision of accessibility by public entities. As in EU law, certain obligations of public and sometimes non-public entities regarding accessibility also arise from many other previous regulations in the field of construction, telecommunications, postal services, information technologies, media, etc.

Conclusions

Geoinformation technologies can serve to improve and enhance the effectiveness of the rights of persons with disabilities. Inadequate spatial planning means that the rights of persons with disabilities are not exercised despite being declared in the law. This leads to structural injustice (Kocoman, Ozdemir, 2020). However, GIS can provide inputs for planning and implementation decisions and to justify them to funders and policy makers, and then evaluate the implementation. In this way, GIS enable the implementation of evidence-based public policies (Kocoman & Ozdemir, 2020).

The use of GIS is growing ever more widespread, and their strengthened role in disability studies can enhance the autonomy of persons with disabilities and foster their integration into society. One of the impulses for the development of GIS in this area undoubtedly comes from the regulations that guarantee access to the physical environment, transport, other facilities, information and communication and public services. Regulations also oblige not only public entities but increasingly also private ones to ensure accessibility.

References

Act of 19 July 2019 on ensuring accessibility to persons with special needs. Its enactment was preceded/heralded by the 2018–2025 Accessibility Plus government

programme, Resolution No. 102/2018 of Poland's Council of Ministers on the establishment of the Accessibility Plus Government Programme https://www.funduszeeuropejskie.gov.pl/strony/o-funduszach/fundusze-europejskie-bez-barier/dostepnosc-plus/ [access: 03.08.2021).

Annex II 2010/48/EC of the Council Decision of 26 November 2009 concerning the conclusion, by the European Community, of the United Nations Convention on the Rights of Persons with Disabilities (OJ EU L 23, p27.01.2010, 35–36).

Barnes C., Mercer G. (2008). Niepełnosprawność (*Disability*), translated by P. Morawski, Warszawa.

Burrough P., McDonnell R. (1998). Principles of Geographical Information Systems, Oxford University Press, Oxford.

Church R.L., Marston J.R. (2010). Measuring Accessibility for People with a Disability. Geographical Analysis, Wiley Online Library.

Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services, (OJ L 151, 7.6.2019), pp. 70–115.

Enders A., Brandt Z. (2007). Using Geographic Information System Technology to Improve Emergency Management and Disaster Response for People with Disabilities, Journal of Disability Policy Studies, vol. 17, no. 4, p. 223–229.

Gleeson B. (1998). Geographies of Disability, Routledge, London.

Fundamental Principles of Disability of The Union of the Physically Impaired against Segregation and the Disability Alliance. https://disability-studies.leeds.ac.uk/wp-content/uploads/sites/40/library/UPIAS-fundamental-principles.pdf [access: 30.10.2021].

Golledge R.G. (1993). Geography and the disabled: A survey with special reference to vision impaired and blind populations. Transactions of the Institute of British Geographers, no. 18, pp. 63–85.

Grewiński M., Karwacki A. (2015). Wprowadzenie – Innowacyjność jako próba dynamizacji myśli o polityce społecznej (*Introduction – Innovativeness as an attempt to dynamize thinking on social policy*). In: M. Grewiński, A. Karwacki (ed.), Innowacyjna polityka społeczna (*Innovative social policy*), Warszawa, WSP im. J. Korczaka, pp. IX-XIX.

Grewiński M. (2018). Cyfryzacja i innowacje społeczne – perspektywy i zagrożenia dla społeczeństwa (*Digitalisation and social innovation: Perspectives and threats for society*). Kwartalnik Nauk o Przedsiębiorstwie, no. 1, pp. 19–29.

The International Classification of Functioning, Disability and Health, World Health Assembly on 22 May 2001, Resolution WHA 54.21.

Jacobson D. (2012). Geography of Disability. In: B. Warf (ed.), Oxford Bibliographies in Geography, New York: Oxford University Press, http://www.oxfordbibliographies.com [access: 28.10.2021].

Jacobs L. (2016). Humanizing Disability Law: Citizen Participation in the Development of Accessibility Regulations in Canada, Revue Internationale des Gouvernements

Ouverts, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2787422 [access: 30.10.2021], pp. 93–120.

Kocaman S., Ozdemir N. (2020). Improvement of Disability Rights via Geographic Information Science. Sustainability, no. 12, pp. 1–17.

Keysor J.J. (2006). How Does the Environment Influence Disability? Examining the Evidence. In: M.J. Field, A.M. Jette, L. Martin (ed.), Workshop on Disability in America: A New Look: Summary and Background Papers, Washington, pp. 88–100.

Oliver M. (1983). Social Work with Disabled People, Palgrave London.

Ostroff E. (2001). Universal Design: An evolving paradigm. In: W.E.F. Preiser, K.H. Smith, Universal Design, Handbook, ebook, para 1.3–2.1.

Parnell S. (2016). Fair cities: Imperatives in meeting global sustainable developmental aspirations. In: D. Simon (ed.), Rethinking sustainable cities. Accessible, green and fair, Bristol, pp. 107–144.

The UN Standard Rules on the Equalization of Opportunities for Persons with Disabilities on 20 December 1993, (A/RES/48/96), Resolution adopted by The General Assembly [on the report of the Third Committee (A/48/627)].

Waters J. (2016). Accessible cities: From urban density to multidimensional accessibility. In: D. Simon (ed.), Rethinking sustainable cities. Accessible, green and fair, Bristol, pp. 11–60.

Whiteneck G. (2006). Conceptual Models of Disability: Past, Present, and Future. In: M.J. Field, A.M. Jette, L. Martin (ed.), Workshop on Disability in America: A New Look: Summary and Background Papers, Washington D.C., pp. 50–66.

Wijk M. (1996). European concept for accessibility, The Netherlands.

World Health Assembly on 22 May 2001, Resolution WHA 54.21.

Zajadacz A. (2011). Badania geograficzne a niepełnosprawność. Warsztaty z geografii i turyzmu (*Geographical research and disability. Geography and Tourism Workshop*), no. 11, pp. 181–203.

Zimmermann-Janschitz S. (2018). Geographic Information Systems in the Context of Disabilities. Journal of Accessibility and Design for All, vol. 8, no. 2, pp. 11–30.

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Ewa Mackiewicz[1]

MANAGEMENT OF THE RENOVATION OF MONUMENTS TO OPTIMISE THE BUILDINGS UTILITY VALUES AND ENERGY EFFICIENCY (CASE STUDY RZUCHÓW, POLAND)

Abstract: Historic buildings are an essential component of the national heritage, constituting the fundamental determinants of the cultural identity of each society. The protection and conservation of monuments are a manifestation of care and evidence of their responsibility. The way owners deal with historic buildings has its specificity. Management, protection, and sharing should follow the conservation rules defined by law and good practices. After World War II, due to Poland's historical, political, and socio-economic transformations, some historic buildings gradually degraded and lost their original functions. Devastated monuments are often considered redundant by society. Effective use of them for new functions allows society to preserve unique elements of the landscape and develop the economic and social potential of the monument's surroundings. The renovation and adaptation of monuments to a new function should be preceded by a multi-level analysis allowing for the sustainable revitalisation of the building. The diversity of types of monuments, their state of preservation, location, and the form of ownership significantly affect the procedure. This article aims to present a holistic approach to the renovation of monuments and sustainable management of these objects. The concept is based on the results of questionnaire research and considers conservation guidelines, pro-environmental solutions, utility value and the socio-economic potential of the monument. The survey conducted with the owners of the monuments described in the article is the basis for determining the conditions for the sustainable revitalisation of monuments. The survey results will help develop a management model for this process. Sustainable revitalisation is shown on an example of an adaptation palace in Rzuchów for cultural and scientific purposes.

Keywords: monuments protection, management of heritage, sustainable revitalisation, retrofitting, pro-environmental solutions

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Introduction

The long-term and complex process of shaping culture and cultural heritage is one of the fundamental factors in building the identity of nations. Each community's moral and legal duty is to protect and care for the evidence of the past. This article focuses on preserving architectural monuments, which are an essential element of cultural heritage. Jan Pruszyński (2001) defines *heritage* as "(...) the stock of immovable and movable things along with related spiritual values, historical and moral phenomena considered as the basis for legal protection for the good of a specific society and its development, and their transfer to the next generations".

From the above definition, it can be concluded that only objects under legal protection are included in it. In a broader sense, heritage is also the resources of old architecture that are not entered in the register of monuments. A broad understanding of heritage is crucial for the renovation process of many public buildings that exhibit historical or architectural value and have not been legally protected.

The protection of cultural heritage is guaranteed by international and national law. The primary Polish normative document is the Act on the Protection and Guardianship of Monuments (Ustawa z dnia 23 lipca 2003 r. o ochronie i opiece nad zabytkami). The Act defines the subject, forms and scope of protection of cultural goods. It regulates the principles of shaping monument protection programs, conducting and financing conservation works, and the activities of conservation services. The juxtaposition of the cited Act with other legislation implies the need to harmonise the protection of monuments with other values, principles and standards (Lis, 2020). The protection of monuments should take into account environmental protection, resource efficiency and energy efficiency. Restrictive conservation guidelines oppose the utility and ecological standards of modern construction, in which the implementation of new pro-environmental technologies is typical. In newly built facilities, pro-environmental solutions are standard and can be implemented without any obstacles. In the case of historical objects, especially those entered in the Register of Monuments, these activities require an in-depth, multi-faceted analysis, e.g. architectural, construction, economic, and social. Due to the risk of disturbing the historic building fabric and the composed historical space, the Polish conservation services often oppose using modern technologies. They rarely allow any significant interference in the material structure of monuments.

The implementation of ecological solutions in historical buildings depends on the dominant conservation doctrine in a given country. This is evident in the examples of Sweden and Norway. Comparing the standards of the energy performance of historic residential buildings allows the analysis of the advantages and disadvantages of both systems. In Sweden, the restrained implementation of environmental solutions makes it challenging to achieve the climate policy goals. In Norway, priority is given to environmental recommendations, which may reduce the value of existing architectural monuments (Berg & Donarelli, 2019). Guidelines for improving the energy efficiency of historic buildings often take the form of government documents or guides for investors.

An example of regulations at the national level is the guidelines for the modernisation and improvement of the energy efficiency of historic buildings developed by the Italian Ministry of Culture published in 2015 (Buda & Pracchi, 2020), as well as the guidelines of the Croatian Ministry of Culture of 2019 (Zloušić Idjaković et al., 2019). A different approach can be observed in Canada, where conservation services have issued guides containing indications of good practice. The Canadian guidelines are not normative, even though conservation services developed them at the national and regional levels (Accroître la résilience, 2016).

The restrictive conservation guidelines often discourage Polish investors, affecting buildings' soft comfort of use, low energy efficiency, and high operating costs (Renovation of a monument: nobility obliges, 2021). It results in a significant number of abandoned or neglected historical buildings. A chance for their preservation is sustainable revitalisation taking into account conservation guidelines and contemporary utility and environmental standards (Battisti, 2020). Giving new functions to historic buildings is an opportunity for their reconstruction while maintaining all the requirements of the applicable conservation doctrine. Adaptation to new utility requires the improvement of the functional values of monuments to modern standards in terms of comfort of use, energy efficiency and operating costs. This undertaking should be preceded by a thorough analysis of the existing factors and the revitalisation potential. Conducting these analyses solely based on conservation guidelines may discourage investors from renovating and adapting monuments to new functions. It is necessary to consider modern solutions to increase utility value, monuments' energy efficiency, and reduce future operating costs. It follows from the above that it is necessary to search for a compromise that would allow the preservation of historical values while increasing the value in use (Broström & Svahnström, 2011).

The multitude of aspects that appear at the interface between monument protection, economic development and functional improvement forces a holistic approach to cultural heritage management. For this to happen, the owners and managers of the facilities need to show great determination due to the limitations and high formal requirements imposed by the conservation services. Therefore, it is necessary to develop a model of management solutions to improve the functioning of the owners of monuments. The concept outline is part of the project "Application of pro-environmental solutions and new ecological technologies in adapting buildings under conservation protection on the example of the historic park and palace complex in Rzuchów".

Conservation of monuments and sustainable revitalisation

Proper understanding of the subject of sustainable retrofit requires the definition of the concept of monument conservation at the outset. "Conservation is aimed at healing, consolidating and strengthening the physical substance of the monument and its structure using appropriate methods developed based on natural sciences. The form of the monument should remain intact" (Arszyński & Tajchman, 1971). This definition was

quoted in the guidelines for conservation services issued in October 2018 by the Polish Ministry of Culture and National Heritage.

Conservation services in Poland, when issuing permits for works on monuments, are obliged to comply with the basic principles of conservation, including:

1. primum non nocere rules,
2. the principle of maximum respect for the original substance of the monument and all its values (tangible and intangible),
3. the principle of minimum necessary interference (refraining from unnecessary actions),
4. the principle according to which it is necessary to delete (and only that) what is destructive to the original,
5. the principles of legibility and distinguishability of interference,
6. the principles of reversibility of methods and materials,
7. the rules of performing and documenting all works according to the best knowledge and at the highest level.

The essence of monument protection is the preservation of historically or architecturally valuable material heritage. Objects that are well-preserved, unique or of priority importance for a given region are subject to the most restrictive conservation restrictions in interfering with their structure, surroundings and functions. According to the data as of 16 July 2021, the Polish registry sitecontains 78 789 objects under conservation protection (Rejestr zabytków nieruchomych, 2021). The palaces and manors, the subject of the research described in this article, constitute a significant group. Residential monuments are a very diverse group of objects, among which there are well-preserved examples of top-class architecture, as well as buildings of medium historical value in deplorable technical condition. For the latter, the method of rescue is sustainable revitalisation through adaptation to new functions.

The palaces suffered significantly due to the war and the Polish political system of the 20th century. The communist system ordered the nationalisation of estates with the area over 50 ha, which was associated with the expropriation of the owners of mansions and palaces. The facilities fell into disrepair, were rebuilt or were given new functions that devastated their historical values (Smoke, 2020). It is particularly evident in the case of nationalised rural estates and thoughtlessly rebuilt former German residences. In the latter, elements indicating the German origin of the building were often destroyed (Kozak, 2008).

The perception of monuments as objects of limited use influences investors' decisions, who therefore give up renovation activities. The consequence of this approach is the growing percentage of neglected buildings of historical and landscape value. From the conservator's point of view, the fundamental issues are the historical and aesthetic values and the antiquity of the object. The utility function is of secondary importance, which, however, cannot be ignored. For most former residences, adaptation to new, socially valuable functions is necessary for their survival (Pawłowska & Swaryczewska, 2002). The individual characteristics of the building determine the historical, artistic and scientific value of a monument, and the public interest dictates its protection.

Monuments are a testimony to the past and an essential element of the modern economy (Lis, 2020). One opportunity to preserve and effectively protect decaying residences is to increase their adaptation potential through solutions increasing the utility value of the buildings. The critical aspects are improvement of energy efficiency, optimisation of running costs, and improvement of the comfort of use.

One of the crucial reasons for the modernisation of historic buildings is the climate policy. The European Green Deal aims to achieve climate neutrality by 2050. One of the areas of activity is building and renovating in energy and resource-saving ways (The European Green Deal, 2019). European Union law defines energy efficiency standards for new and existing buildings (Directive 2002/91/EC). The directive allows for a derogation from the guidelines for objects under conservation protection, which aims to protect historical values. The investors' need is functional and economic optimisation, which means increasing utility value, maximising user comfort and reducing running costs. These needs are related to improving energy efficiency and the use of blue-green infrastructure in water management. Adapting monuments to environmental standards and maximising energy and economic efficiency is in the investors best interest. However, it is not obligatory for them, as stated in Art. 4.3 of Directive 2002/91/EC. The Polish Act on the energy performance of buildings (Ustawa z dnia 29 sierpnia 2018 r. o charakterystyce energetycznej budynków) presents a similar position. It stipulates that owners of buildings under conservation protection are exempt from the obligation to prepare energy performance certificates.

The research subject is the sustainable management of palaces and manors, constituting 6.84% of objects under conservation protection in Poland. It is the fifth-largest group in terms of the original function of the building. The largest group (27.69%) are residential buildings that face similar problems.

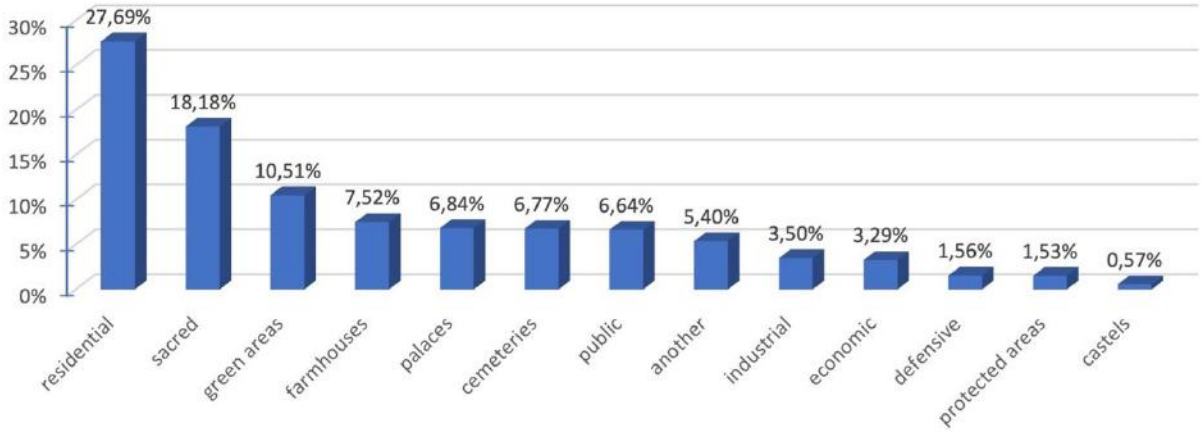

Fig. 1 Structure of the Register of immovable monuments in Poland according to the primary function
Source: work, based on Report on the conservation of immovable monuments in Poland, NID 2017

The sustainable revitalisation of historic buildings is a prerequisite for the adequate protection of monuments. For many of them, adaptation to new functions and raising the utility value by increasing energy efficiency and reducing running costs is the only chance for rescue. Due to the diversity of monuments and the complexity of the problems related to granting them new functions, there are no universal methods of monument revitalisation (Sowińska-Heim, 2018). Scientists, working with practitioners, analyse the renovation capacity of buildings in different areas. It is evidenced by the research projects undertaken, such as ENBAU "Energie und Baudenkmal" (Polo Lopez & Frontini, 2014), RIBuild – Robust Internal Thermal Insulation of Historic Buildings (Written…, 2020) and the Polish-Croatian project "Mitigation of climate change in historic buildings" (Mitygacja…, 2021).

Renovation management requires an individual approach and a thorough, multidimensional analysis. When planning the revitalisation or adaptation of a monument to a new function, the existing factors and the revitalisation potential of the building should be analysed. The method of assessing the revitalisation capacity of monuments developed by Terlikowski considers nearly 100 technical and non-technical sustainable factors. Technical factors, such as the structure of the building, necessary installations, energy demand, are compared with social, environmental, functional and economical aspects (Terlikowski, 2018). In-depth analysis allows for the application of solutions that do not adversely affect the aesthetic and historical values of the monument. A comprehensive, individualised diagnosis of the condition and potential of a building is necessary for the proper course of sustainable adaptation (Terlikowski, 2016). Therefore, revitalisation is a process in which it is necessary to verify the various conditions.

Material and methods

The analysis of the existing factors is the basis for determining the revitalisation potential. The basis for further activities is the determination of the future function and method of use. It enables to design solutions that raise the standard of building and optimise future operating costs. At this stage, the possibilities of implementing new technologies and pro-environmental solutions should be considered. In historic buildings, it depends on existing environmental and cultural factors that are the framework for sustainable revitalisation.

Among the issues to be acknowledged the following should be considered:

- historical conditions,
- state of preservation,
- the degree of conservation and the form of legal protection,
- the existing and potential functions of the facility,
- architectural values,
- natural features (topography, weather conditions, local climate, water conditions, potential and actual vegetation, forms of nature protection in the vicinity),

- landscape values, including scenic values (the physiognomy of the monument's surroundings).

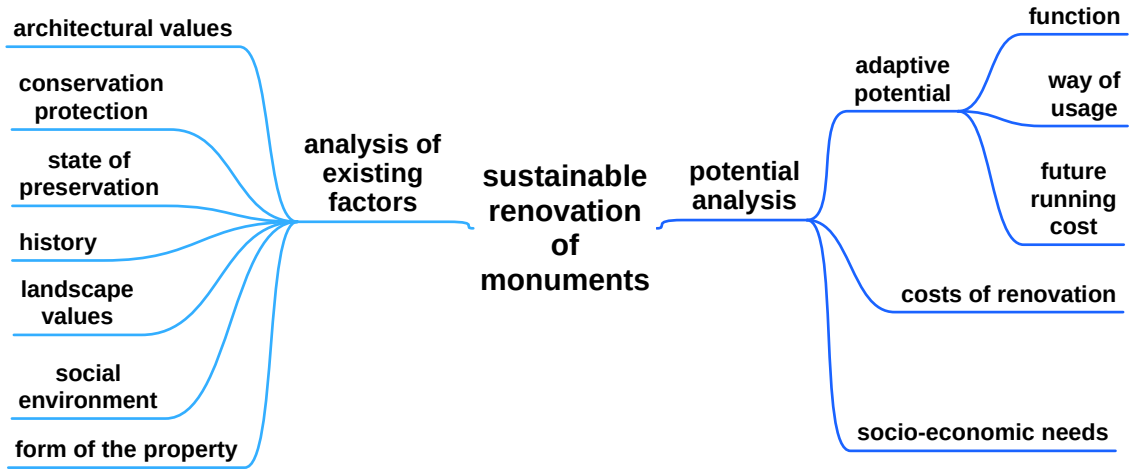

Fig. 2 The essential factors for sustainable revitalisation
Source: own work

The next stage of work is the analysis of available pro-environmental technologies that can be implemented in a given historic building, excluding unacceptable ones (Litti et al., 2013).

The overriding goal of monument conservation is to preserve its authenticity. This approach limits the catalogue of solutions that can be used in historic buildings. The activities authorised by the Polish conservation services are presented in a guide prepared by the employees of the Provincial Office for the Protection of Monuments in Olsztyn (Bakalarczyk & Szymański, 2018). The stage of designing the revitalisation of the facility, based on the catalogue of conditions, creates space for modern technologies. When planning work, should be taken into account:

- thermo-modernization,
- sources of electricity and heat,
- air exchange installations,
- water management.

The dynamic development of ecological technologies and new possibilities for the revitalisation of monuments encourage research on the degree of implementation of pro-environmental solutions in historic buildings. The results will allow the development of a revitalisation management model, taking into account conservation recommendations and environmental requirements.

The works undertaken by the author of this article include questionnaire research and the analysis of the obtained material in the context of conservation conditions. The conclusions of the study will enable the development of a model of sustainable revitalisation management. An extensive questionnaire was developed to examine the awareness and approach to sustainable retrofit of the owners of historic palaces and mansions for the research. In order to narrow down the research sample, a group of 300

residential monuments from all over Poland was selected. The questionnaire consists of 78 questions in six subject areas:

1. basic information and contact details,
2. the location of the monument and the characteristics of the surroundings,
3. state of preservation and technical condition,
4. building functionality – past, present and planned implementation of pro-environmental solutions,
5. relations with the social environment and local administration.

Results

The research discussed in the article is in progress, and its completion is scheduled for the third quarter of 2022. The expected research results will analyse the conditions favourable to implementing pro-environmental solutions and identify the most common barriers to using such technologies. They will also allow for the analysis of four aspects of the sustainable revitalisation of monuments formulated in the form:

1. analysis of conditions conducive to the use of pro-environmental solutions,
2. classification of problems related to the implementation of sustainable solutions,
3. statements of the benefits of using pro-environmental solutions,
4. analysis of the investor's relationship with conservation services, local authorities and the social environment.

The observations obtained during the survey will help develop guidelines for investors planning to adapt a historic building to a new function. The above aspects can be seen in the example of the palace in Rzuchów. The revitalisation of this facility is a case study of the comprehensive management of sustainable retrofit through the implementation of pro-environmental solutions in a historical building.

Defining market needs in pro-ecological technologies applicable in historical buildings allows for developing an innovative knowledge-based economy. The interest of the owners of historic buildings in improving the energy efficiency of the building and other pro-ecological solutions is the starting point for further considerations on the subject of sustainable revitalisation.

The palace in Rzuchów

The Palace in Rzuchów is a space for sustainable revitalisation. In this example, as part of the "Implementation doctorate" program, research is carried out on the application of pro-environmental solutions.

The residence in Rzuchów was constructed in 1888 by Heinrich Himml. The building was raised on a rectangular plan in an eclectic style. The façade was faced with yellow brick. Characteristic elements are the richly decorated windows frames topped with a semicircular pediment in the shape of a shell. There is a semicircular portal at the entrance supported by two columns, decorated with a cartouche with the monogram of the first owners. Decorated windows and dormers are placed in the mansard roof, covered with handmade copper tiles. The buildings usable area is approximately

1600 m^2, has four utility storeys: basements, representative level, residential level and attic.

The turbulent history of the palace led to far-reaching devastation. In 2010, the building was purchased by a private investor who established the Foundation for the Protection of Cultural Goods. Currently, the Foundation manages the building and conducts revitalisation activities, including renovation of the building and cultural and educational activities (Mackiewicz, 2019).


Photo 1-2. The Palac in Rzuchów 2018 vs. 2021
(Author: E. Mackiewicz)

Conservation works have been carried out since 2011, and their intensification took place in 2018–2021. Currently, the palace is undergoing a comprehensive retrofit aimed at its adaptation for scientific and cultural purposes. The basis of the adopted revitalisation program is an interdisciplinary analysis of architectural, historical, economic and environmental conditions. A bold and innovative approach will create an energy-independent building with high energy efficiency and comfortable conditions of use. The works started in 2011 took into account the use of pro-environmental solutions from the very beginning. The most important element is an innovative energy system based on photovoltaics and hydrogen energy.



Photo 3-5. Panoramic views of the palace, the roof containing a hidden terrace in the middle and the flat part intended for the photovoltaic panels, 2020
(Author: M. Giba)

Due to the poor technical condition of the roof structure, it had to be replaced entirely in 2012-2014. A decision was made to accommodate photovoltaic panels on the flat part of the mansard roof. Additionally, a recessed (hidden) terrace was prepared on the roof to hide the external ventilation and air conditioning elements. Thanks to this, modern technologies will not infringe the monument's historical, architectural, and scenic values. Renovation works are carried out not only to restore the splendour of the palace in Rzuchów but also to set a new direction of activities at the interface between the protection of monuments and environmental protection. The design of an energy-autonomous building characterised by zero emissions and ecological solutions in a historic facility indicate the synergy of environment and cultural heritage protection.

Discussion

For over ten years, the international community has recognised the need to integrate pro-environmental solutions with the renovation of monuments. It is evidenced by the topics discussed for years at international conferences such as the World Renewable Energy Congress (2011), Congreso Internacional Eficiencia Energetica y Edificacion Historica (2014). The protection of cultural heritage based on the principles of sustainable development is also reflected in the policies of the protection of monuments in individual countries. The examples of guidelines and guides cited above show different approaches to this topic.

An essential part of the research is the survey of positions presented by conservation services. At the turn of 2020/21, a letter to the Provincial Conservators of Monuments was sent. It was answered by 7 out of 16 respondents. The obtained answers emphasise the need for an individual approach and an in-depth analysis of the potential benefits and threats to the monument. Monika Bogdanowska of the Lesser Poland Provincial Conservator of Monuments presented an extensive position. She presented "a list of doubts and concerns regarding the threat to the historic – non-renewable – substance, the authenticity of which we are obliged to protect in the first place, because, according to the definition, it constitutes the basis for the value of the object". The use of the so-called pro-ecological solutions may lead to the destruction of monuments. "It is justified by a thorough observation contained in the letter of 4 January 2021, which concerns renovation and thermo-modernization activities of monuments in the Lesser Poland region. Using the example of applications submitted to the Office for the Protection of Monuments, Bogdanowska identified the primary areas of energy efficiency improvement:

- replacement of windows and doors,
- thermal modernisation of walls and horizontal partitions,
- assembly of new technical infrastructure (heating, ventilation, air conditioning,
- photovoltaics.

The long-term adverse effects of applying immediate thermal modernisation solutions, such as plastic windows and thermal insulation, are presented using the dry-light method, in which polystyrene or mineral wool are used. The service life of such

solutions is determined for 20–30 years, which from the conservator's point of view is an ineffective and harmful solution due to the necessity to dispose of the materials used. The issue of interfering with the structure of the monument through the use of technical infrastructure is also raised: "technical progress and constant changes in functions mean that technical innovations quickly turn out to be obsolete, another renovation and introduction of new devices are necessary".

The above restrictive approach softens the voice of Maria Fornal, the head of the delegation in Zamość, the Provincial Office for the Protection of Monuments in Lublin. Quoting the letter of 30 December 2020, "The Conservation Office accepts the use of renewable energy sources, blue-green infrastructure and information technologies in the process of adapting historic buildings to new functions, which will lead the monument to a good condition". She noticed that any interference and technology implementing "should be carried in a non-accidental and space-justified manner".

A positive attitude towards solutions that does not conflict with the principles of conservation protection is presented by Łukasz Konarzewski, the Silesian Provincial Conservator of Monuments. In the letter of 29 December 2020, he points out that solutions that "allow better use of monuments and the extension of their existence are not only acceptable but also recommended". A similar statement applies to the change in the way of use, which "contributes to the extension of the monument's life".

The Polish conservation services noticed that permissions for historical buildings retrofit should be carried out in the context of climate policy challenges and investors' needs. In 2020, two documents relevant to the sustainable revitalisation of monuments were developed. The General Conservator of Monuments has published guidelines for the protection of cultural heritage in the process of improving the energy performance of historic buildings (Guidelines ..., 2020). Assumptions have also been developed for the standardisation of conservation procedures, including the issuance of permits for photovoltaic installations in historic buildings, in the vicinity of a monument and protected areas (Marcinek et al., 2020). The document results from the National Program for the Protection of Monuments and the Preservation of Monuments for 2019–2022 (Monitor Polski 2019 item 808) postulate conservation standards and methods evaluation. One of the elements is the standardisation of conservation procedures in photovoltaic installations in historic buildings and their surroundings. In the light of the data provided by Bogdanowska, standardisation is necessary, as 80% of applications for the installation of photovoltaic installations in historic buildings are considered positively. The development of standards by the conservation services is a signal that applying pro-environmental solutions in historic buildings is gaining more and more importance in conservation practice.

The survey research cited in this article will make it possible to identify the needs of the owners of historic buildings in the scope of implementing pro-ecological solutions. The conclusions of the questionnaire will be an important voice in the discussion on effective and sustainable heritage protection. The position of owners and investors should be taken into account as an important factor in protecting monuments. Conservation services should consider the needs of administrators because the entry in

the Register of Monuments is a rigorous form of protection that interferes with the right to property (Lis, 2020).

The research results will enable the development of guidelines for investors who, by undertaking the renovation of monuments, plan to increase the utility values of buildings through the use of modern technologies. It will allow for improving communication between the investor and the conservation services, and at the same time, for more effective protection of the cultural and natural heritage.

Conclusions

Activities in the field of monument protection require intuition and specialist knowledge. In order to limit irreparable damage, the retrofit must be carried out according to conservation guidelines. In many cases, the investor's interest is limited by restrictive maintenance rules. The inability to increase utility values and reduce future running costs for many facilities means that the investor resigns from renovations activities, and in extreme cases, leads to the abandonment of the monument. Conservation services in Poland are beginning to notice the necessity to adjust the guidelines to the investors' needs while maintaining conservation standards and upholding the cultural heritage. The literature on the modernisation and implementation of pro-environmental solutions in historical buildings presents mainly an approach based on conservation guidelines. Moreover, many publications are devoted to technical aspects of thermal modernisation and pro-environmental technologies. The research undertaken aims to balance the conservation requirements with the needs of the owners and users of monuments. The analysis of the investor's needs as a foundation for revitalisation planning is the opposite of the current conservation approach.

The development of a revitalisation management model supports investors undertaking the renovation or adaptation of a historic building to new needs. It will be a tool that will facilitate the conscious analysis of the necessary factors and prepare consistent project documentation and effective work management.

Preparation of a guide containing tips and examples of good practices for investors/owners of monuments will optimise the renovation process. It will also contribute to an increase in the number of saved monuments, which, thanks to adaptation, will have received a new life. Thus, they become an essential harmonising element of the landscape.

Work on the management model is in the initial phase. The experience in the renovation of the palace in Rzuchów and the developed tools (database of residential monuments and research questionnaire) will enable a multi-faceted analysis of the conditions for the implementation of pro-environmental solutions in Polish cultural heritage sites.

References

Accroître la résilience: Lignes directrices pratiques pour la réhabilitation durable de bâtiments au Canada (2016). Canada's Federal, Provincial and Territorial Ministers of Culture and Heritage.

Arszyński M., Tajchman J. (1971). Wybrane zagadnienia słownictwa konserwatorskiego w dziedzinie zabytków architektury (*Selected issues of conservation vocabulary in the field of architectural monuments)*. Paper presented in the Section of the History of Architecture and Town Planning and Monument Protection of the Faculty of Technology of the Polish Academy of Sciences in Warsaw, typescript Toruń-Warsaw.

Bakalarczyk Sz., Szymański Ł. (2018). Termomodernizacja a zabytki. Czy faktycznie styropian to jedyna opcja? (*Thermo-modernization and monuments. Is polystyrene really the only option?*) http://wfosigw.olsztyn.pl/wp-content/uploads/2018/06/1-Termomodernizacja-a-zabytki.pdf [access: 20.10.2021].

Battisti A. (2020). Energy and Ecology Efficiency as a Chance for Cultural Heritage. In: A. Sayigh (ed.) Green Buildings and Renewable Energy, Springer, pp. 639–647.

Berg F., Donarelli A. (2019). Energy Performance Certificates and Historic Apartment Buildings: A Method to Encourage User Participation and Sustainability in the Refurbishment Process. The Historic Environment Policy & Practice.

Borowy M. (2021). Remont zabytku: szlachectwo zobowiązuje. (*Renovating a monument: nobility obliges*) https://ocieplamyzycie.pl/remont/remont-zabytku-szlachectwo-zobowiazuje [access: 29.10.2021].

Broström T., Svahnström K. (2011). Solar energy and cultural-heritage values. In: World Renewable Energy Congress – Sweden 2011.

Buda A., Pracchi V. (2020). Le Linee di Indirizzo per il miglioramento dell'efficienza energetica nel patrimonio culturale: indagine per la definizione di uno strumento guida adeguato alle esigenze della tutela. In: Restauro: Conoscenza, Progetto, Cantiere, Gestione coordinamento di Stefano Francesco Musso e Marco Pretelli sezione5.2 Tutela, pratica, codici e norme Casistiche e interpretazioni, pp. 772–781.

Directive 2002/91/EC of The European Parliament And of The Council of 16 December 2002 on the energy performance of buildings.

Kozak M. (2008). Dwory, pałace i zamki – kosztowne pamiątki czy zasób w rozwoju? (*Manors, palaces and castles – expensive souvenirs or a resource in development?*). Studia Regionalne i Lokalne nr 2(32), pp. 92–111.

Lis W. (2020). Miejscowy plan zagospodarowania przestrzennego jako prawna forma ochrony zabytków (*Local spatial development plan as a legal form of monument protection*). Wydawnictwo Katolickiego Uniwersytetu Lubelskiego, Lublin.

Litti G., Audenaert A., Braet J. (2013). Energy Retrofitting in Architectural Heritage, Possible Risks Due to the Missing of a Specific Legislative and Methodological Protocol. In: The European Conference on Sustainability, Energy and the Environment 2013 Official Conference Proceedings.

Mackiewicz E. (2019). Gdzie przeszłość staje się przyszłością. Historia i renowacja pałacu w Rzuchowie. (*Where the past becomes the future. History and renovation of*

the palace in Rzuchów) In: Zobacz, znaj, zachowaj. (*See/ know/ save*) Zamek Piastowski, Racibórz

Marcinek R., Myczkowski Z., Siwek A. (2020). Założenia dotyczące standaryzacji postępowań konserwatorskich, w tym wydawania pozwoleń na instalacje fotowoltaiczne w obiektach zabytkowych, w otoczeniu zabytku i w obszarach chronionych (*Assumptions for the standardisation of conservation procedures, including the issuance of permits for photovoltaic installations in historic buildings, in the vicinity of a monument and protected areas*), working study.

Mitygacja zmian klimatu w budynkach zabytkowych (*Climate change mitigation in historic buildings*). https://sendzimir.org.pl/projekty/mitygacja-zmian-klimatu-w-budynkach-zabytkowych/ [access: 30.10.2021].

Pawłowska K., Swaryczewska M. (2002). Ochrona dziedzictwa kulturowego. Zarządzanie i partycypacja społeczna (*Protection of cultural heritage. Management and social participation*). Kraków, Wydawnictwo Uniwersytetu Jagiellońskiego.

Polo López Ch.S., Frontini F. (2014). Energy efficiency and renewable solar energy integration in heritage historic buildings. Energy Procedia 48, pp. 1493–1502.

Pruszyński J. (2001). Dziedzictwo kultury Polski. Jego straty i ochrona prawna. Tom I (*Polish cultural heritage. His losses and legal protection. Vol. I*), Kraków.

Raport o stanie zachowania zabytków w Polsce (*Report on the state of preservation of monuments in Poland*) (2017), Narodowy Instytut Dziedzictwa.

Rejestr zabytków nieruchomych (*Register of immovable monuments*). https://dane.gov.pl/pl/dataset/1130,rejestr-zabytkow-nieruchomych [access:14.10.2021].

Smoke H. (2020). Cicha apokalipsa. Zrujnowane pałace Dolnego Śląska (*A Silent Apocalypse. Ruined palaces of Lower Silesia*). E-Bookowo.

Sowińska-Heim J. (2018). Transformacje i redefinicje. Adaptacja dziedzictwa architektonicznego do nowej funkcji, a zachowanie ciągłości historycznej miejsca (*Transformations and redefinitions. Adaptation of the architectural heritage to the new function and preservation of the historical continuity of the place*), Łódź, Wydawnictwo Uniwersytetu Łódzkiego.

Terlikowski W. (2016). Zrównoważona rewitalizacja budynków zabytkowych (*Sustainable revitalisation of historic buildings*). In: Journal of Civil Engineering, Environment and Architecture, XXXIII, 63 (4/16), pp. 531–538.

Terlikowski W. (2018). Evaluation of the revitalization capacity of the historic building as an example of interdisciplinary diagnostics, XXVII R-S-P Seminar 2018, Theoretical Foundation of Civil Engineering.

The European Grean Deal (2019), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640 [access: 14.10.2021].

Uchwała nr 82 Rady Ministrów z dnia 13 sierpnia 2019 r. w sprawie Krajowego programu ochrony zabytków i opieki nad zabytkami na lata 2019-2022 (*Resolution No. 82 of the Council of Ministers of 13 August 2019 on the National program for the protection and care of monuments for 2019-2022*). Monitor Polski 2019 item 808.

Ustawa z dnia 23 lipca 2003 r. o ochronie i opiece nad zabytkami, tekst jednolity (*Act of 23 July 2003 on the protection and care of monuments, uniform text*). Journal of Laws 2003 item 1568.

Ustawa z dnia 29 sierpnia 2018 r. o charakterystyce energetycznej budynków (*Act of 29 August 2018 on the energy performance of buildings*). Journal of Laws 2018 item, 1984.

Written guidelines for decision making concerning the possible use of internal insulation in historic buildings (2020). A. Blumberga, E.J. de Place Hansen (ed.) Robust Internal Thermal Insulation of Historic Buildings

Wytyczne generalnego konserwatora zabytków dotyczące ochrony wartości dziedzictwa kulturowego w procesie poprawy charakterystyki energetycznej budowli zabytkowych (*Guidelines of the General Conservator of Monuments regarding protecting the value of cultural heritage in improving the energy performance of historic buildings*) (28.02.2020).

Zloušić Idjaković K., Sudić I., Sabljak M., Radunić Z., Križaj L. (2019). Preporuke za primjenu mjera energetske učinkovitosti na graditeljskoj baštini (*Recommendations for the application of energy efficiency measures on architectural heritage).*

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SUSTAINABLE FOREST MANAGEMENT: CURRENT SITUATION AND CERTAIN CHALLENGES OF THE FOREST SECTOR OF MONGOLIA

Abstract: A goal of the article is to explore the theoretical understanding of sustainable forest management and empirical result of the Mongolian forest sector in regarding to institutional regulatory framework, and human resource capacity. Provides also a discussion of improvement possibilities of forest sector of Mongolia. In the framework of sustainable forest management planning, implementing and controlling procedure shall focus on social, environment and economic pillars tends to meet needs of present and future generations of the nations. Also, forest sector human resource shall tend to sustainability as well as in policy, employment and educational level.

A mixed research design that incorporated qualitative data and quantitative data was used in this study. Interviews and questionnaires were completed public officials, forest user groups' employees and private companies' employees which are responsible for forest planting, afforestation, restoration, nursery, thinning and cleaning. Goal and main focus of the state policy on forest sector of Mongolia, coherence of the public organizations in charge of forestry and forest management in Mongolia, success factors and shortcomings are determined in the discussion part. Human resource capacity shall be provided in all policy, employment and educational manners as well.

Keywords: state policy on forest sector, human resource capacity, institutional regulatory framework

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Introduction

Sustainable Forest Management (SFM) is the management of forest which aims to keep balance between social, environmental and economic pillars (Baumgartner, 2019). SFM consists of production of forest goods and services to meet the needs of present and future generations while preserving natural capitals. Globally, forest sector policy tends to protecting and producing. Key policy elements in forest sector tend to a more sustainable economy, a well-rounded forest ecological and relatively developed forestry industry system, in optimizing the forestry structure and promoting industrial development, and upgrading the industrial structure and strengthening the implementation of guidance and regulation on development of forestry industry.

A primary goal of the article is to explore the theoretical understanding of sustainable forest management and empirical result of the Mongolian forest sector in regarding to institutional regulatory framework, and human resource capacity. The article also provides a discussion of improvement possibilities of forest sector of Mongolia. A mixed research design that incorporated qualitative data and quantitative data was used in this study. Interviews and questionnaires were completed public officials, forest user groups' employees and private companies' employees which are responsible for forest planting, afforestation, restoration, nursery, thinning and cleaning. We reached to the following results: there is a weak understanding and configuration of sustainable forest management among stakeholders, there is a weak collaboration between public organizations in charge of forestry and forest management, and there is low capacity and high work load of human resources in all public organizations, forest sector units and private companies (forest user groups) in Mongolia.

The main focus of forestry objectives should be on the development of human resources. Unfortunately, forestry sector policy documents leave the integrated human resource policy unaddressed. Human resource preparation, training and capacity development is not taken care of. Also, whatever human resource policies there are, they are not interconnecting different government organizations, universities, research institutes, forest units and business organizations from the forestry sector. Real needs of the forest industry with regard to human resources are not defined. A clear policy on innovation, technology, professional equipment management and optimal investment is lacking.

Forestry and the 2030 Sustainable Development Goals (SDGs 2030)

Forests are among the world's most productive land based ecosystems and are essential to life on earth. The United Nations Strategic Plan for Forests 2017–2030 (UNSPF) provides a global framework for actions at all levels to sustainably manage all types of forests and trees outside forests and halt deforestation and forest degradation (UN, 2016). The importance of forests to people and the 2030 Agenda for Sustainable Development was emphasized as well in the UNSPF, including among others the amount of forest on the Earth's land area, one of the essential factors providing ecosystems. 25% of the global population depends on forests for subsistence; livelihood, employment and

income generation (see UNSPF p. 1). Although there is no specific Sustainable Development Goal (SDG) titled "Forests", the SDG 15 addresses forestry in a broad spectrum. The integration of forests into the SDG discussion requires all environmental, economic and social dimensions of forests and trees outside forests and their contributions to sustainable development to be recognized. SDG 15 aims to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" (UN, 2020). Therefore, the aspects concerning forests are relevant for many of the other SDGs, and the fulfillment of some will have an immediate or long-term impact on forests. However, the relevance of forests is regionally quite different, depending on their integration in the economy and the provision of ecosystem services. Also, the Open Working Group of United Nations Economic Commission for Europe (UNECE) made a proposal in July 2014 through which (i) sustainable forest management, (ii) terrestrial ecosystems' protection, restoration, and promotion, (iii) combating desertification, (iv) halting reverse land degradation, and (v) halting biodiversity loss are aimed (UN, 2015).

Sustainable Forest Management (SFM) is the management of forest which aims to keep balance between social, environmental and economic pillars. Essentially SFM is forest management for the long term: the production of forest goods and services to meet the needs of present and future generations while preserving natural capital (FAO, UN, 2016). Furthermore, related social and environmental problems can be solved by different stakeholders including citizens and individuals (Que et al., 2018). In regarding to the different interest of the stakeholders are different, roles and responsibilities are key indicator of the collaboration within them. Stakeholders are concerned on their past experiences through-out the collaboration (Smulders-Dane et al., 2016). In the framework of SFM, a sustained supply of goods and services shall be met through forest management planning. Between 1990 and 2015, the total amount of the area covered by forest management plans has increased over time and forest management plan has split evenly between production and conservation (FAO, UN, 2016).

Socio-economic benefits from forests are the basic human needs and improvements in quality of life (higher order needs) that are satisfied by the consumption of goods and services from forests and trees or are supported indirectly by income and employment in the forest sector (Domaracká et al., 2020). The socio-economic benefits from forests are mostly derived from the consumption of forest goods and services (FAO, UN, 2014).

Measuring the socio-economic benefits from forests, data collection must focus on people, not only trees. It can be measured by the number of people who use forest outputs to meet their needs for food, energy and shelter and also by the contribution of forestry to gross domestic product. According to the Global Forest Resources Assessment 2015, the amount of the area designated for production in the low income countries hold around 100 million ha which was the one sixth of that in the high income countries (FAO, UN, 2016).

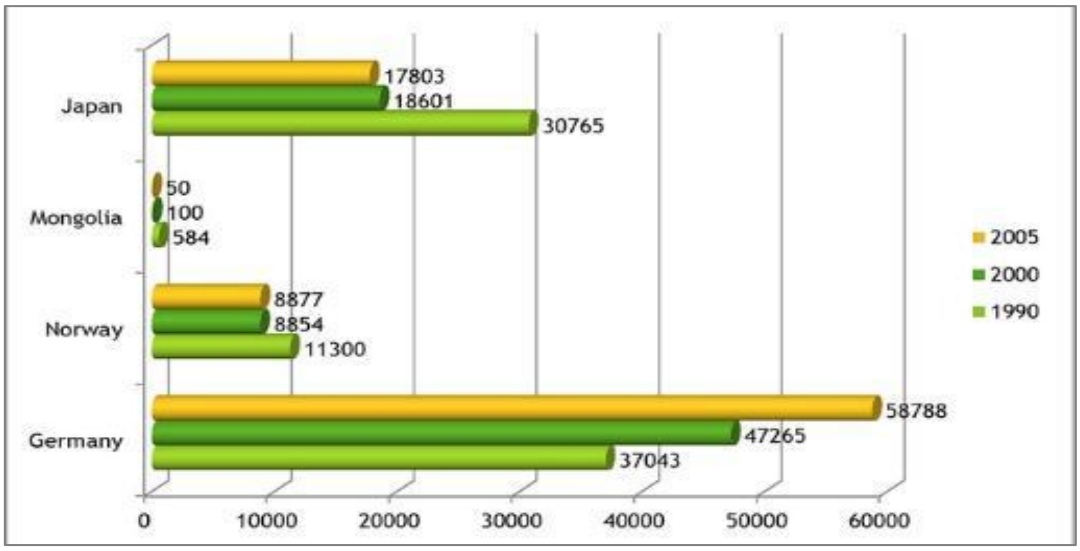

Fig. 1. Forest production (amount of timber harvesting) in Mongolia compared with other countries, in m3

Source: MNET and Forestry Policy and Coordination Department information, 2016

The Food and Agriculture Organization of the United Nations (FAO) organizes the World Forestry Congress (WFC) which is the largest and most significant meeting of the world forestry sector and has been organized every six years since 1926. In the conference, forest issues including international dialogue, socio-economic and institutional aspects, and forest policies are addressed among the international forest experts. The last IV Conference – "Forest and People: Investing in a Sustainable Future" – hold in 2015 in Durban, South Africa. The following vision of forest and forestry is suggested in the Durban Declaration (Word Forestry Congress XIV, 2015), namely, forestry is a way to achieve the 2030 SDGs and a sustainable future 2050 and beyond.

Globally, forest sector policy tends to PROTECTING AND PRODUCING. Key policy elements are that the forest sector has a key role to play in (i) the transition towards a more sustainable economy, (ii) a well-rounded forest ecological system and relatively developed forestry industry system, (iii) in optimizing the forestry structure, and promoting industrial development, and (iv) upgrading the industrial structure and strengthening the implementation of guidance and regulation on the development of forestry industry (UNECE, 2016).

Furthermore, forest sector regulations are standardized by the norms, guiding principles and standards. Those are listed below not including industrial and production standards:

- the 10 principles of the United Nations Global Compact,
- UN Guiding Principles on Business and Human Rights,
- the ILO Declaration on Fundamental Principles and Rights at work,
- IFC Environmental and Social Performance Standards and Guidance Notes,
- national parks and nature reserves, High conservation value forests,
- the UN Convention on Biological Diversity and the related Bonn Guidelines or Nagoya Protocol Forest Stewardship Council,

- program for the Endorsement of Forest Certification.

In order to achieving Sustainable Forest Management, forest sector human resource shall tend to sustainability as well in policy, employment and educational level. For all three factors, sustainability related aspects shall be intensively introduced and considered. The reality, however, is more complicated. According to the Global Forest Resources Assessment which includes 234 countries and territories, in 1990 the world had 4128 million ha of forest; which had decreased by 2015 to 3 999 million ha. This is a change from 31.6 percent of global land area in 1990 to 30.6 percent1 in 2015. At the same time, the report states that the attention paid to sustainable forest management (SFM) has never been higher: "More land is designated as permanent forest, more assessment, monitoring, reporting, planning and stakeholder involvement is taking place, and the legal frameworks for SFM are being widely adopted" (FAO, UN, 2016). In fact, forest area change can be described as a process of gain (forest expansion) and loss (deforestation). Natural forest area changes as an indicator of natural habitat and biodiversity dynamics shows a net loss of some 129 million ha of forest between 1990 and 2015, representing an annual net loss rate of 0.13 percent. The good news is that the rate of annual net loss of forest has slowed from 0.18 percent in the 1990s to 0.08 percent over the last five-year period. Between 2010 and 2015 there was an annual loss of 7.6 million ha and an annual gain of 4.3 million ha per year, resulting in a net annual decrease in forest area of 3.3 million ha.

Forestry employs 13.7 million formal workers, about one percent of the total world employment, and its commercial output represents about 0.4% of world GDP (International Labour Organization, 2011). Despite the relevance of these figures, the workforce is probably much larger as the sector is characterized by widespread informality, especially in developing countries. Forestry work is often characterized by high degrees of informality, land tenure issues, undervalued by markets, workers outside of traditional social protections, low wages, and hazardous working conditions. Debates over forests tend to dominate aspects related to biodiversity and ecological issues and neglect the human and labour dimensions, including the function of forests for society together with the role and conditions of forest professionals. However, renewed interest in the issue in light of the Sustainable Development Goals (SDGs) provides a unique opportunity to fill the gap in terms of the social dimension of forestry management for once and for all. Forests need to be socially beneficial to contribute to the objective of sustainable development, and in parallel, benefits derived from the existence and management of forests and accruing to people living in and around them may be a precondition for the conservation of forests.

Globally, the total amount of employment in forestry has declined in 2010. The amount of forest employment decreased in Asia, Europe, and North and Central America; whereas it increased in Africa and South America. 79% of total employees in the forest sector work in Asia, mainly India, Bangladesh and China. Based on data from 29 countries, there are some countries with high numbers of female employees such as Bangladesh, China and Mali (FAO, UN, 2016) in absolute numbers. Moreover, Mali,

Mongolia and Bangladesh had the biggest percentage of female employees in forest sector employment.

Usually, there is a lack of information about forestry sector employment. More specifically, harvesting and silvi-cultural operations, including wood-fuel and non-wood forest production collection is under-reported due to a lack of data, particularly for informal or part-time employment. Internationally, the discussion about employment related to the forest sector focusing on three overlapping categories of forest dependent populations (BWI Position Paper, January 2017):

1. Those engaged in subsistence actions for their livelihoods

There is considerable debate about the role of forests for those engaged in subsistence non-market actions for their livelihoods. Are forest resources a safety net or a poverty trap? Do forests provide protection, nourishment, and cultural advancement and or protection for forest dependent peoples? Are subsistence uses of forests emitters of carbon through the burning of fuel wood or are the carbon emissions of these populations proven to be sustainable over millenniums? Are indigenous cultures and societies end points of sustainable development? Or, are they gaps the development process of the larger culture overlooked or exploited?

2. Those engaged in commercial transactions through informal work for their livelihoods

As with those engaged in subsistence livelihoods there is some controversy regarding those engaged in informal work. Are those engaged in informal work, working to enjoy the flexibility and independence of informal work or are they engaged in survival mode eking out poverty level or below lifestyles? There is no doubt that a clear majority of those engaged in informal work live near or below the poverty level, especially within the forest workforce. Some of these workers are in work that is misclassified by national labor legislation.

3. Those engaged in an employer/employee relationship for their livelihoods.

Traditional development programs envision formal work as a goal in and of itself. There is an assumption that those engaged in formal work are inherently better off than those workers who are not. The real world appears to provide a different set of data. Workers forced into wage labor from many other categories frequently lose access to important safety net resources. Likewise, it is increasingly possible to be engaged in full time formal work and still remain below the poverty level.

As with the categories above the common element that determines whether any work status is overall positive or negative is the amount of control the worker has over their circumstances. Workers in formal employment in countries where it is a common practice to seize and hold their passports (for migrants), or where limits on hours worked, or safety regulations are either non-existent or not enforced may not be in a better position than those engaged in informal work. However, the question whether a person has the possibility to engage in formal employment does depend to a large degree on the availability of and access to a formal education and/ or training that would allow for the systematic build-up and improvement of available knowledge and skills, Also, in the forest sector education is critical.

Forest sector of Mongolia

Mongolia has a territory of 1.566.600 squire kilometers. Forest cover 8.5% of the total land area. Mongolia's forests are under-utilized, vulnerable and forest resources are largely mature forest. On average, forest resources per hectare are small and primarily based on natural regeneration. Mongolia's Sustainable Development Concept 2030 foresees that State Special Protected Areas increase from the current level of protection of 17,4% of total land space to 25% between the years 2016 to 2020, 25% from 2021 to 2025 and 30% from 2026 to 2030.

Fig. 2. The map of Mongolia
Source: Batkhuu et al., 2011

Mongolia will be a country with a steadily increasing per capita income and diversified and stable economic sectors, middle-class dominated, ecologically balanced and with a consistent democratic government.

Sustainable environmental development is the basis for efficient use of natural resources, preservation of the ecosystem, maximization of the benefits of long-term economic growth, sustainable development of society and the improvement of the quality of human life.

Principles for sustainable environmental development

- ensure community involvement and community participation in sustainable environmental development,
- efficient and sustainable use of natural resources,

- promote better technology, build low-waste, sustainable production and use,
- establish and maintain environmental rehabilitation at the international standard,
- developing environmentally friendly approaches and good practices.

Principles for sustainable economic development

- encouraging high productivity and advanced technology into every sector and promoting innovative products, production and services,
- promoting natural resource-saving, greenhouse gas EMISSIONS and low-waste industries,
- maintain an efficient and economical principle in all areas of economy and society.

Principles for sustainable social development

- the key development indicators are human development based on inclusive growth,
- civil and lifelong education systems are open, accessible and qualified,
- to ensure equal participation in the labor market and maintain a high level of proper employment,
- transfer the value of Mongolian labor to productivity-based compensation and incentives.

Mongolia's Sustainable Development Concept 2030 foresees that State Special Protected Areas increase from the current level of protection of 17,4% of total land space to 25% between the years 2016 to 2020, 25% from 2021 to 2025 and 30% from 2026 to 2030.

State policy documents that are being implemented in the forestry sector of Mongolia ("Concept of Sustainable Development of Mongolia 2030" Resolution No. 19 of 2016; "The State Policy on Forests" No. 49 of 2015; "Green Development Policy" No. 43 of 2014; "National Program of Special Protected Areas" No. 29 of 1998 and "National Biodiversity Program" No. 325 of 2015; "Combating Desertification Program" No. 90 of 2010; "National Green Belt Program" No. 44 of 2005; "National Forest Program" No. 248 of 2001).

The study (GIZ/INCOSAD, 2017) found that goods and services provided by Mongolia's boreal forests indicated the value of forests to be around 431.5 billion MNT or approximately 150 million EURO per year. However, the economic potential cannot be utilized as state funding for state forestry units is insufficient. This is related to the following reasons:

- there are too few people to run operations professionally and efficiently,
- there is not enough manpower to fulfill the mandatory obligations from relevant laws and regulations,
- persons working in the forest sector have very little motivation to improve their own performance or better their qualifications,
- forest units have not enough financial capacity for improving operations, for example through investments into technology or product development,
- there are no incentives to operate in a transparent manner based with high governance standards,
- there is very little pressure from monitoring and evaluation bodies to perform in the best possible way.

For example, through investments into technology or product development, there are no incentives to operate in a transparent manner based with high governance standards, there is very little pressure from monitoring and evaluation bodies to perform in the best possible way.

The forestry units in provinces and the capital city Ulaanbaatar manage forest according to their forestry management plan for sustainable use, restoration and afforestation forest management policy framework. According to Article No. 12.2 of the "Mongolian Law on Forest", the Resolution No. 255 from 2012, government can establish state owned and state financed legal entities to harvest timber from forests, build forest roads, and plant trees and seedlings for climate change adaptation purpose. Forestry departments in the provinces, forestry units of soums (administrative unit of Mongolia), inter-soum forestry units, private forest enterprises and forest user groups are main stakeholders in Mongolia.

The legal framework and organizational setup of the forestry sector in Mongolia

The base for the legal framework governing Mongolia's forestry sector is the constitution of Mongolia. It states that:

- Article 6.1: in Mongolia the land, its subsoil, forests, water, fauna and flora and other natural resources shall be subject to people's power and state protection,
- Article 6.2: the land, except that is given to the citizens of Mongolia for private ownership, as well as the subsoil with its resources, forests, water resources and wildlife shall be the property of the state,
- Article 17.2: it is a sacred duty for every citizen to work, protect his/her health, bring up and educate his/her children and to protect nature and the environment.

Other relevant legislation, parliament and government resolutions as well as orders issued by MET were added over the years. Since 2010, the Government has issued several resolutions, including:

- the approval of a procedure to incentivize citizens, cooperatives, enterprises and organizations in order to minimize harmful effect on forest and introduce advances methods and technologies,
- the approval of norms,
- procedures for forest management,
- the approval of forest clearance programs,
- the approval of procedures to earmark a portion of the revenues from the forestry sector for environmental protection and rehabilitation measures.

By definition, all forest resources in Mongolia are state property. The MET has primary oversight for forest development and conservation, while aimag and soum administrations are responsible for forest management at the local level. The Law on Forestry 2007 allows for the MET and local government authorities to contract management and use right to private forest enterprises (PFE) and community user groups (CUG). The MET also produced a number of regulations, for example regulations on afforestation, on planning, on organizational funding, the appraisal of cultivated

forests, the purchase of state forest reserves, the procedures to give ownership rights, forest harvesting certificates and certificates of origin and how they are being issued, requitements and operational calculation methods to estimate fees for harvesting wood and firewood from forests, forest registry's registration and reporting forms and procedures how to manage and proper use of non-timber forest resources and last not but least procedures about employing volunteer rangers.

The Law on Environmental Protection adopted in 1995 and the "Law on Forest" from May 17th 2007, are the principle guidelines for the forestry sector. Mongolian parliament, the State Great Khural, has a role to play as it shall define the state policy on forest protection, use, restoration and afforestation, establish the minimum and maximum amount of the forest and steppe fires (Mongolian Law on Forest, 2020) (State Policy of Forest of Mongolia, 2019). The Law on Forest deals with the regulatory framework for forest protection, rehabilitation, reproduction, possession, use and prevention of forest and steppe fires. It also regulates the different roles the Government, the MET, the National Emergency Management Agency, the General Agency for Specialized Inspection, the General Police Department, the Local Government Unit and its Agencies hold with regard to forestry management and oversight.

According to the Resolution No. 49 by the Parliament of Mongolia from May 14th, 2015, the Government's policy on forestry is defined as a "comprehensive economic, social, and environmental issue for Mongolia", in line with the green development policy and human well-being. The document defines the future goals and actions of forest protection, utilization and restoration and forest resources. The following purpose of forest policy was adopted:

- increase forest cover, by raising forest reforestation,
- preserve and protect forest biodiversity,
- increase forest health, vitality and productivity,
- increase forest ecological, economic and social importance.

Article 12 of the Mongolian "Law on Forest" provides for the Government's implementation arrangements, most importantly:

- implement state policy,
- approve the national forestry program,
- plan in annual budgets for expenditures for forest resource protection, restoration and afforestation, as well as road exploration studies,
- develop designs and construction of main roads within commercially used forest zones,
- approve norms and locations of the forestland coverage to be managed by forest units depending on state and reserve of forest and its utilization intensity,
- approve and ensure the enforcement of procedures to estimate damages and losses incurred by forest and steppe fires along with other related regulations including the development of norms for fire extinguishing equipment, taking into account specific conditions of administrative and territorial units. In addition, regulations related to forest fires shall be clearly defined.

According to the article No.13 "Law on Forest", MET is responsible for organizing the implementation of state policies and relevant legislation about the protection, sustainable use and restoration of forests, afforestation as well as to prevent forest and steppe fires and maintain an ecological equilibrium. In regarding to the "Law on Administrative and Territorial Units and Their Management" from December 2006 as well as the "Law on Forests", outline the rights and responsibilities of forestry subjects on capital city, aimags and soum level and outline the rights and responsibilities of District Citizens' Representative Khurals and governors. According to that, they are responsible and forest protection, its use, restoration and afforestation as well as forest and steppe fire prevention. Province and Capital City Environmental Departments shall organize the implementation of the forestry legislation in their area, and report the findings to the aimag and capital city governors and to the State Central Administrative Body. They shall provide professional management of their forestry units and monitor their activities. According to the law they shall submit proposals related to forest activities to the Citizens Representative Khural or to the Governor to find resolutions and submit those to the state central administrative body. Those laws, policy documents and resolutions clearly outline that it is important to establish a "Good Forestry Governance" which comprises of forestry policy, forestry legislation, structure, organization and operation of forestry organizations as well as the involvement of all relevant stakeholders. Also, it indicates that in terms of legal environment constant change occurs, reflecting the generally instable political environment of Mongolia with frequent changes of government. At the same time, the regulations and procedures developed by MET are mostly related to relatively simple operational requirements for daily activities and work instructions for forestry management and cultivation.

Human resource in the forestry sector in Mongolia

In this section current employment situation and education system for the forest sector of Mongolia in line with the relevant policies will be described. Available data for the employment situation in the forest sector are often unreliable and inconsistent. To compensate for the lack of statistical data, for example from the National Statistical Office or the Ministry of Labor, the Employment Office or other designated institutions, INCOSAD developed a questionnaire which was used for interviews with approximately 70 key persons related to the forest sector. Main findings from those interviews are:

As of January, 2018, in total 185 employees work at the different levels of forest administration in Mongolia.

INCOSAD 2017 survey showed (INCOSAD, 2017) that forest units are far low staffed which leads to partly unrealistic work overload.70% of all people interviewed about the human resource situation answered, that the current level of personnel was very inadequate. 55% of all respondents answered that it would need three to four more people in order to fulfill all task in a proper manner. 19% answered that it would need five to six people more, and 3% said it would need at least seven or more people. Two thirds of all respondents answered that it would need forest engineers and rangers. One

considerable factor influencing the work load is the daily tasks of employees: Human resource capacities are tied up by doing 50% of administrative work, 20% of inspection and control, 20% of advisory services for forest user Groups, which leaves only 10% for actual forest work (INCOSAD, 2017). Furthermore, forest sector employees want to refresh and improve their knowledge. For instance, 60% of all respondents answered that they would want to have a two-week short-term training; 38% of all respondents answered that they would need short term professional training where they could get professional certificate; and 55% of all respondents answered that they would need exchange experience with other forest units' employees.

Table 1. Number of personnel in forest administration

Type of forest organization	No. of entities	Total no. of employees
Ministry of Nature Environment and Tourism (121), Department of forest policy and coordination	1	10
Forest Office at province level	9	26
Forest Unit of Soums	2	6
Inter-soum Forest Units	34	143
Total		185

Source: Report of the Mongolian Environmental Situation 2015-2016, p.131 Forest Research and Development Center's Information, 2016; Interview with employees of Soums and Inter-soums' Forest Units

As of January 1st, 2018 there are over 1150 registered private forest companies with licenses for the following partial activities of forest management.

Table 2. Main operational areas of forest sector enterprises, 2018

Types of licenses	Number	Percent
Forest inventory and management planning	23	2%
Research and fight pest infestation and disease	36	3.1%
Forest thinning and cleaning	436	38%
Protection and use of non-timber forest products	125	10.9%
Afforestation and reforestation	467	40.5%
Commercial selective cutting	63	5.5%
Total	1150	100%

Source: Ministry of Nature Environment and Tourism of Mongolia, 2018

Altogether, they employ about 8000 persons. Around 2100 forest professionals work in the forest professional enterprises (FPE) in Mongolia. Out of those, 1.088 employees graduated from vocational education and training centers.

On the other hand, a total of 1281 forest user groups employ a total of 23.496 persons. On the local level, in Selenge Aimag, 3.180 persons work in forest user groups. From them, only 205 persons have a forest profession, which is only 6.4% of all persons. In summary, the work load of current employees in the forest sector, especially in forest units, is so intense that they would like to have extra staff. The operational types of forest sector enterprises are mostly concerned with tree nursery, afforestation, reforestation, and forest thinning and cleaning.

To define the forest sector-human resource situation in Mongolia, the employment status and educational training and skills situation shall be elaborated. The government's policy on forestry is reflected in the resolution No. 49 of 2015, mainly:

- support the creation of a unit, incubator center, small and medium-sized enterprises in the fields of reforestation, forest protection, wood processing, and processing technology at the universities and research institutes,
- build a foundation for strengthening the facilities and technical base of forest universities, colleges and vocational training centers, and providing full support and assistance in improving the capacity of teachers and establishing training system for forestry experts, professionals and workers.

Under the State Policy on Forestry, the following training institutions are operating. These are: training and production laboratories at National University of Mongolia (NUM), Mongolian University of Life Science (MULS), and Mongolian University of Technology and Sciences (MUST); dendrology laboratory, forest ecosystem monitoring laboratory, forest genetic and eco-physiological laboratories, Central Asian Regional Fire Management Center, training and research center at Batsumber, Tuv aimag, tree nursery training-research center at Bayanchandmani, Tuv aimag, tree nursery and forest mechanization center at Mandal, Selenge aimag.

In the national profession-reference booklet, the forest sector specialists that are being trained in the universities are being defined as forester, forest researcher, forest advisor, forestry engineer, and forest mechanics.

There are 11 universities that train forest specialists in Mongolia. Specifically, forest science, environmental science, ecology, environmental protection technology, forest production technology, forestry and forest management, forest planting and forest engineering, remote sensing study professionals are being trained at NUM and are tending to the field of forest research. In contrast, forest engineers and mechanics are being trained at MUST and forest students at MULS are more into ecological and environmental protection field. Other universities including International University of Ulaanbaatar, Mongolian National University (private institution), Khovd University, Eco-Asia Institute, Gazarchin Institute, Maral Institute train specialists for ecology, environmental protection, forestry, gardening, environmental studies and management in forest sector.

The number of specialists trained in these higher education institutions has been around 470 each year in the last 6 years. The ratio is nearly 50:50 male and female. For instance, in 2017 were 248 female and 221 male graduates out of 469 and almost 90% of them are graduating with Bachelor's degree. About 10% have a Master´s degree or a Ph.D.

The highest number of students are graduating from MULS, and then NUM and MUST in order. Unfortunately, the employment ratio shows that approximately 70% of the graduates are not finding work in the forest sector but work in different areas. For example, in between 2012 and 2014 the employment rate within the forest sector was about 25% – 29%, and from 2015 to 2017 it was only 12% – 17% (Statistical data, Ministry of Education, Culture, Science and Sports, 2018). This means that each year around 400 forest graduates are not finding employment in the forest sector. However, there are no statistical data and registrations of unemployed forest professionals on the labor market. Many of the graduates are being employed in other sectors like mining, however, the trace survey must be conducted annually.

Universities that train forestry specialists in Mongolia recruit according to the enrollment policy under quota which are approved by the Ministry of Education, Culture, Sciences and Sports of Mongolia (MECSS). According to the quota, approximately 450 – 500 people are being recruited annually.

The following are the reasons why the forestry sector's employment status is poor:

- remote workplace,
- low salary,
- availability of professional jobs is poor,
- forest industry competition is high,
- scope of the labor market is low.

Vocational education is professional knowledge and skills, and labor and communication culture formulation acquired by organized training to meet the needs of specific activities (Law on Vocation Educational and Training of Mongolia, 2021). According to the Vocational Education and Training Law of Mongolia, a vocational training center is the organization where people obtain vocational education and training. Technical education is organized training to meet the needs and management of technical and technological processes (Law on Vocation Educational and Training of Mongolia, 2021). This type of technical education training institution is a technical college and it can have a vocational training center in its structure.

The adults over 18 years old earn 1-2 professional ranks by studying one year in a vocational education center. In contrast, the graduators of 9th grade of a high school earn 3-4 professional ranks by studying 2.5 years in a Vocational Training Center. In the vocational training centers, students learn classes combined technique of theory and practice, specifically 30 – 35% theory and 65 – 70% practice of the program.

In Mongolia, there are 16 vocational training centers preparing forest mid-level skilled forest workers currently. They are: tree planter, forest thinning and logging worker, forestry worker, forest technician and forest user group employee. Overall, 13

vocational training centers participated in this research work except Khovd, Bayankhongor, and Orkhon VTCs.

On average, around 1 or 2 lecturers are teaching full time in the vocational training centers besides Khuvsgul VTC and Eco-Mongol Erdene VTC where 4 and 9 lectures work separately. To awake the interest of employees to work in Vocational Education and Training center continuously, an allowance equal to 10 months basic salary paid once in every five years by the employers (Law on Vocation Educational and Training of Mongolia, 2021).

Between 2013 and 2015, the number of VETC graduates slightly increased from 209 to 329 before it went down to 163 in 2017. Their gender ratio is 48% male and 52% female. To compare with university graduates, the VETC graduates have a high employment rate with 70% over the last five years.

The National Vocational Education and Training Council of Mongolia is a non-permanent organization which provides equal participation of the public and private sector in the implementation of state policy on vocational education and training gives guarantee on working in a stable environment (Law on Vocation Educational and Training of Mongolia, 2021). The Ministry of Labor and Social Protection of Mongolia heads the Council and representatives from both public and private sectors including Ministry of Finance of Mongolia, the Vocational Education and Training Centers' Association and Employers' Association of Mongolia sit on the council. Unfortunately, the MNET is not participating in the council. The council has the following duties (Law on Vocation Educational and Training of Mongolia, 2021):

- discussing and evaluating long, medium, short term of vocational education and training,
- coordinating the activities of vocational education and training centers and employers and administrative authorities,
- informing and presenting development of professional national system in the forest sector, implementation of law and regulation of vocational education and training relation of Mongolia,
- discussing and evaluating national classification and description of occupation, professional standards, content of vocational education and training at national level.

Both, national classification and description of occupation and Ministry of Education, Culture, Sciences and Sports of Mongolia approved indexes through forest workers' preparation and training at VETCs. There are certain majors that are required under both classifications including forest technicians, forestry worker, Forest thinning and logging worker, mechanics, technicians and operator of wood processing equipment. In contrast, some professions like lumberman and log-man are prepared just under National classification and description of occupation. In practice, there is a trend that the majors required under both classifications are trained more often.

In the academic year of 2015 – 2016, totally 20.961 students had enrolled into VETCs and it decreased to 18.967 in 2016 – 2017 (General Agency of Labor and Welfare

Services, 2018). Reason of declining numbers of people studying at vocational education and training centers are:

- there are less obstacles to university entry,
- grant for the VETC students was shut down,
- lack of interest due to lower reputation of forest employees,
- less encouragement on VETCs staff,
- slight coherence between Ministry of education, culture, sciences and sports of Mongolia, Ministry of Labor and Social Protection of Mongolia, and MNET, and
- lack of exchanging the experience between the VETCs.

In 2015/ 2016, the Ministry of Nature, Environment and Tourism (MNET) conducted knowledge based short-term trainings in promoting sustainable development, green development concepts and fundamental principles. These trainings incorporated recommendations from international organizations and their programs and over 190 training sessions were organized for around 7.800 people. Trainings included experts from the environment and tourism sector, representatives from government organizations, media workers, civil society organizations and local communities. Also, 96 trainers were trained, as a result. In the case of Selenge aimag, trainings were organized by the Ministry of Nature, Environment and Tourism, University of Life Science, the Aimag Governors' Office, the Aimag Nature, Environment and Tourism Department, Local Property and Statistic Offices. These government agencies had trainings for aimag's forest office, forest units, forest user groups and forestry companies. These trainings were conducted from 1 day to 1 month and 2 – 11 times a year.

The other training providers are NGOs. The trainings were directed to provide knowledge about environmental protection technology, sustainable tourism in Mongolia and inclusive economy, national assembly of eco-schools, and local partnerships for gender equality. Mostly the aimag's forest office employees participated in these trainings.

Trainings were also provided by universities: the National University of Mongolia, Mongolian University of Science and Technology, University of Life Science and International University of Ulaanbaatar. The trainings were wood cutting, rangers, gardening, forestry, ecology, forest fire, pests control, tree nursery, afforestation, forest conservation and protection. These trainings are organized by requisitions of government, non-government organizations, private sectors and individuals.

Short-term trainings for Mongolian forest sector employees are organized by MNET, Aimag Governor's Office, Aimag Nature, Environment and Tourism Department, NGOs and international organizations. Short term trainings are provided by professional organizations, however, most of them are (about 80%) dedicated to forest units, which means by the fact that the forest workers' involvement is insufficient. On average, 25 – 30 trainings are conducted per year in one aimag. In addition, universities provide short-term training based on their need, according to our survey. In terms of frequency, they offer short-term training 1 – 2 times per year.

At present, the leading universities of Mongolia are preparing forest specialists as professionals, including the National University of Mongolia, Mongolian University of Life science, and Mongolian University of Science and Technology. However, the educational tendencies are in different directions. Specifically, NUM works more on forest research, whereas Mongolian University of Life Science is into the conservation and ecological protection. The Mongolian University of Science and Technology leans towards forest engineering. The environmental, ecological and rehabilitation specialists are being prepared at some other private institutions. To make the practical forest training more effective, the above mentioned universities could do it in cooperation with professional forest units or forest companies. With this approach, a theoretical and practical complementarity could be achieved. By 2020, in addition to the current forest programs, it is possible to add interdisciplinary courses such as forestry policy and planning specialist, business related forestry courses or to expand them as new classes. Also, courses like forest animal biology and forest pest protection can be trained in developed countries, exemplifying Germany, Japan, and Canada.

By 2025, as the forest sector expands, it would be advisable to open up some new forestry related subjects/ classes as for example forest law, forest IT, forest equipment engineer, and forestry economist. Some courses such as agro-forestry and forest renewable energy specialists could be educated externally in highly developed countries. Also, the continuous improvement of the quality of existing curricula should be undertaken in an orderly manner including the accreditation process at the national level. The goal should be the internationally accepted accreditation of higher forest education by 2030.

By sustainable development education goals from 2020 to 2025, current professional programs should be enhanced further and courses such as equipment technologist, forest and landscape management, natural resource conservation, urban forestry and forest production management should be added or expanded.

To achieve the goal, current skill sets of existing employees are necessary to be assessed and extra training and re-training are required. Meanwhile, the forest officials can increase the number of skilled workers, intensify their professional skills and competitiveness, and open more opportunities for students to acquire dual occupations, therefore, the achievement will be internationally recognized by 2030.

The short-term forestry training can be divided into two main sections: the training for the policy makers and the training for the implementers. The reason is that the decision makers are usually appointed politically, meaning, they are mostly not the professional ones. To comprehend the fundamental significance of forestry, they should take specific trainings, essentially, forest law and legislations, long and med-term forest development policies, strategies, and implementations. The further training should include international and national level of forest standards, international market and competitiveness, coordination between sectors and subsectors, forestry human resource policy, forest technology, innovation and investment. If you see Mongolian present situation, we would say that the officials should take an active training on political responsibility and ethics.

Secondly, the implementers (forest units and forest user groups) must have training according to international standards, forest related laws and legislations, labor safety, in addition to development of business plans and the development of small and medium enterprises.

The most important implementers are the forest companies and they must be provided with targeted training because they should enroll their forest workers short term advanced trainings regularly. These include: up to date methods and techniques for forestry operations, handling of work tools and equipment's, first aid, and labor safety.

Sustainable use, restoration, and afforestation of forest sector are regulated by state policy on forest sector of Mongolia is the main success factor. However certain shortcoming elements has been revealed in Mongolian forest sector. Those are:

- weak legal regulatory framework for addressing frequent changes in forest sector of Mongolia that contains norms and standards,
- weak organizational structure of forestry units / they interfaces with other state institutions such as local province administrations or the Central State Administrative Body/,
- there is low capacity of public sector human resources at the local administrative level, and
- educational and vocational system are not able to train required employees in forest sector of Mongolia.

To conclude, the sustainable development concept of Mongolia stipulates the sustainable use of natural resources, preserving ecosystem balances and aiming at long-term benefits, which would in turn enable inclusive economic growth, foundation of sustainable development of the society and create the basis for improving the quality of human life. Also, sustainable forest management shall contain protection, restoration, and promotion, (iii) combating desertification, (iv) halting reverse land degradation, and (v) halting biodiversity loss are aimed efficient use of natural resources.

Main focus of the state policy on forest sector of Mongolia, coherence of the public organizations in charge of forestry and forest management in Mongolia, success factors and shortcomings are determined in the discussion part. Those are among others:

- state policy on Forest management and coherence of the laws and regulation in forest sector,
- role and responsibilities of the main stakeholders in forest sector of Mongolia,
- revenues and revenue distribution in the forestry sector,
- staffing and human resource capacity and their work load,
- required skills and knowledge of the forest sector employees.

Based on those discussion points certain recommendation are given in considering on success factors and shortcomings of forest sector of Mongolia.

Furthermore, human resource development must be addressed in the framework state policy of forest sector by defining needs of forest sector employees, being in line with public institutions, universities, research institute, forest units, private enterprise and forestry organizations, and by penetrating innovation, technology, equipment and

optimal investment policy. Most importantly, proactive and broad training on all levels constitutes the precondition for ensuring sustainable forest management in Mongolia.

The Sustainable Development Concept of Mongolia stipulates the sustainable use of natural resources, preserving ecosystem balances and aiming at long-term benefits, which would in turn enable inclusive economic growth, foundation of sustainable development of the society and create the basis for improving the quality of human life. The forest sector goals and objectives are well reflected at the level of policy programs and documents of Mongolia such as the "Sustainable Development Concept", "State Policy on Forests" and "Green Development Policy". The purpose, objectives and principles of state policies are in line with the goals and objectives of international sustainable development, but they don´t systematically address the implementation. Implementation policies, planning, results and control issues are inadequate. If there will be no real policy addressing implementation issues, it is likely that goals and objectives will only remain on paper.

Currently, the educational and vocational systems are not able to train marketable experts who could work inter-sectoral. In this case, it will be extremely hard to achieve the goals and objectives of the sustainable development policy. Graduates of forestry related education will work in government organizations, non-governmental organizations, the private sector, universities, research institutions, international organizations, projects and programs. However, the results of the survey conducted by INCOSAD on aimag and Capital City level found that the HR capacities of forest services and forest units are rarely used for actual forestry work. Only 10% of total capacities go into that area, 50% are absorbed by administrative work, 20% for inspection and control work and 20% for advisory services for forest user groups.

Existing capacities in forest companies should be further evaluated in order to determine required trainings and re-qualifications on the basis of their daily work and anticipated HR needs. Considering the topics of training organized for forestry workers the survey found that 80% of respondents answered that they have the need for specialized training based on new technologies.

The MNET provides permission for logging of around 1 million m^3 annually for the last 8 years (Ministry of Environment and Tourism, 2013-2014; 2015-2016). But this volume has not been reached fully since 2011. In average, only around 65 – 70% has been used for the last 5 years. One major reason is the inadequate situation with regard to human resources, i.e., the people working in the sector. In order to promote and encourage high productivity and advanced technologies, innovative new products, production and services, and ensure that they are efficient and economical, it needs a clear focus on quality education and training of forest sector employment.

In Mongolia, the potential maximum for harvesting could be 6 million m3 per year, which would require a total of 6150 professionals working in the forest sector. Compared to today´s number, this would mean an additional 5060 persons. In order to increase the number of skilled workers in the forest sector, it is best to make a policy to provide systematic training to forest workers and students in the field of vocational skills and specialization. As a result of these measures, it will increase the

competitiveness of the forestry sector, enhance the competitiveness of professional and technical qualifications, and develop a national accreditation certificate to match the salary level. It is imperative to implement a policy to improve the value of professional workers in Mongolia.

It is also necessary to implement a reward policy and professional payroll policy that create a system of employee engagement. It is possible to transform the value of Mongolian labor into productivity and to create internationally recognized competitive forestry professionals. The INCOSAD research study came across some criticism that too often non-specialists are being employed by political appointment. Therefore, it is strongly recommended that relevant government agencies and decision-makers take strong measures against civil servants who do not comply with the law or are obviously under-qualified.

As of January 2018, there are 57 academics in Mongolia who hold Ph.D. degrees related to forestry. Since 2012, only 3 scientists have received a doctoral degree on forestry. Therefore, it is time to focus on scientific research. In addition, only 30% of university graduates in forestry and approximately 70% of the graduates of vocational schools have gone into professional occupations in the forest sector. That means the Mongolian forestry sector needs a general human resource policy. There is no integrated database of human resources in the forestry sector. Human resource policy planning is unclear.

MNET, MECS, Ministry of Social Welfare and Labor, and General Department of Labor and Social Welfare Services (Labor Exchange) are weak in coordinating between sectors which has a negative impact on human resources planning and training of the professionals. This includes:

- the real human needs of the forest industry are not defined,
- human resource policies are not in line with public institutions, universities, research institute, forest units, private enterprise and forestry organizations,
- there is no innovation, technology, equipment and optimal investment policy,
- statistics on unemployed people with forestry background are not available to forest sector staff,
- there are very students recruited from forest companies and other business establishments since the training is not in line with market demand.

Barriers for university graduates to enter the forestry sector are an underdeveloped labor market, a lack of professional status, remote work locations, low salaries and poor working conditions. This creates a need to provide a reliable source of guaranteed funding for training and re-training consistent with the basic needs and existing capacities of forestry workers. This will create a strong interest in forest education, empowering people, promoting a salary system, and providing employment opportunities for skilled workers in the forestry sector.

Special attention should be paid to the competitiveness of forest units and professional forestry organizations. To do this, it is necessary to pay attention to the government policy level regarding quantity and quality of forestry professionals. It is desirable to have a professional forest organizational policy to develop, support and

finance competitiveness in the fields of innovation or production, product type and quality, and to compete in free market environment. It is advisable to introduce international quality standards to forest products and forest operations in the forest sector enterprises.

Universities and institutes providing forestry programs need to make sure that the quality of the current programs are in conformity with international standards. New education programs can be developed, with new forestry science programs and modified learning styles. Adopting a students' enrollment and graduation quota would meet the needs of the "Manufacturing-Business-Labor Market" within the policy framework that aligns universities to free market competition. With regard to the framework of coordination between theory and practice in university programs the following should be considered:

- implementation of science-based innovation policies based on University-Business-Manufacturing collaboration, and enabling policy to attract investment from technological companies,
- in order to build a knowledge and innovation network in the forestry sector master's and Ph.D. degree programs based on business needs in biotechnology, finance, and management should be promoted,
- forest universities research results should be prepared in a marketable way to attract investment,
- encourage financing from small and medium-sized enterprises.

Additionally, for subjects such as forest pest protection, forest information, software and agro forestry which cannot be taught in Mongolia, the education of professionals in foreign schools should be made available. The qualification of vocational education and training centers should be strengthened. Firstly, competition should be strengthened and systematically enhanced through better teaching resources, training materials, technology and curricula accredited by national accreditation agencies. Economic incentives for the new students through the granting of scholarships on the level of the minimum wage amount would help to attract new people.

The Mongolian National Council for Vocational Education and Training should make sure, that all relevant actors and stakeholders are heard with regard to professional education, training institutions, employers and ministries. The Council should:

- integrate the professional indexes the Ministry of Education, Culture and Science and Ministry of Population Development and Social Protection,
- assess the capacity of teaching staff at Vocational Training Center, focus on quantity, quality and capacity,
- support the vocational education and training funds and vocational training center funding from state and local budgets and foreign projects, as well as support policy that small and medium-sized enterprises financing,
- provide industrial internships at vocational education and training center and colleges which has the provision of practical training base for internships,
- organize competence training in highly skilled professionals within international organizations and projects,

- improve vocational and professional qualifications of Vocational Education and Training Center's graduates,
- provide combined professional and technical education, and
- develop realistic ability and capacity of professional staff to compete at national and international levels.

The INCOSAD survey clearly revealed that both the requirement and training profiles will have to undergo a continuous process of adaptation. This continuous process of adaptation to changing societal, economic and ecological conditions and requirements constitutes a permanent task for the relevant training and research institutions. Tried and tested basic forestry training must be guaranteed, however, increasing specialization in various fields must also be facilitated at the same time.

Proactive and broad training on all levels constitutes the precondition for ensuring sustainable forest management. The knowledge and skills required for this are imparted in the corresponding training institutions. Cooperation, knowledge transfer and innovation force are success factors for future-oriented, economically and socially relevant forestry trainings in Mongolia.

Conclusions

The main focus of any goals and objectives should also consider the development of human resources. Unfortunately, forestry sector policy documents leave the integrated human resource policy in forestry unaddressed, human resource preparation, training and capacity development is not taken care of. Also, whatever human resource policies there are, they are not interconnecting different government organizations, universities, research institute, forest unit and business organizations from the forestry sector. The real needs of the forest industry with regard to human resources are not defined. A clear policy on innovation, technology, professional equipment management and optimal investment is lacking.

The human resource policy should be prioritized in order to improve cross-sectoral coordination and the legal environment and legal arrangements of the forest sector in Mongolia. An assessment of the capacities of human resources needs evaluation of the forest units, professional organizations, forest user groups and the vocational training centers conducted by independent entities in order take a step-by-step measure to improve capacities. Creating real economic incentives to support the forestry sector is essential to the optimal forestry. Proper structural change is needed for forest sector as such as well as the forest units in order to operate profitably. It is advisable to focus on the training for highly motivated professionals, who are enhanced by employee activation systems and performance rewards. Mongolia should develop a "National Program for Human Resource Development in the Forest Sector". An integrated human resource database of the forest sector is essential to this program. The database should contain the following information:

- demand for the forestry sector,
- marketability of forest sector staff,

- inter-sectoral movements of forestry workers,
- realistic workplace statistical information,
- whether registered at the General Agency for Labor and Welfare Services,
- information working in other sectors, and
- gender indicators.

All this information would well facilitate the policy of providing the labor market with skilled labor for the forest sector.

In view of the many challenges faced by the forestry training institutions and the people working in the forestry sector in Mongolia, international cooperation and the formation of a wood cluster including the area of knowledge creation must find greater prominence. Increased cooperation between the training institutions and the private sector are also in demand. Partnerships with forestry operations and companies and with other organizations working on the ground should be promoted. With regard to the potential expansion of the Mongolian forestry industry, a further increase in the requirements relating to the qualifications held by experts is mandatory. The required skills may be expert-technical, organizational-methodical or social in nature. In addition to the corresponding systematic further development of training programs, more measures in the area of further and continuing training are also in demand. Other aspects comprise of the updating of the skills of teachers and trainers to reflect latest developments, guaranteeing the attractiveness of the teaching profession and provision of possibilities for the exchange of knowledge and experience. Training courses offered should be adapted, a target -group-specific marketing needs to be developed. Through an adequate communication strategy, the attractiveness of forestry professions could be improved.

References

Baumgartner R.J. (2019). Sustainable Development Goals and the Forest sector – A Complex Relationship. Forest no. 2.

Batkhuu N.O., Lee D.K., Tsogtbaatar J. (2011). Forest and Forestry Research and Education in Mongolia. Journal of Sustainable Forestry, vol. 30, no. 6, pp. 600-617.

BWI Position Paper (2017). Development of a global core set of forest indicators to support the implementation of the 2030 Agenda on Sustainable Development and the IAF Strategic Plan: Identifying economic and social core indicators for the forest.

Domaracká L., Tausova M., Pavolová H., Bakálar T. (2020). Interdependence of mining industry and industrial sectors in Slovakia. Acta Montanistica Slovaca, vol. 25, no. 4, pp. 494-503.

FAO, UN (2014). State of the World‘s Forests Enhancing the socioeconomic benefits from forests.

FAO, UN (2016). Global Forest Resources Assessment 2015 – How are the world’s forests changing? Rome.

GIZ/INCOSAD. (2017). Current Situation of Mongolia's Forestry Operations and Options for their Improvement.

INCOSAD (2017). Current situation of Mongolia´s forestry operations and options for their improvement.

International Labour Organization (2011). International Year of Forests 2011: What about the labour aspects of forestry? Geneva.

Law on Vocation Educational and Training of Mongolia. (2009). https://legalinfo.mn/ [access: 30.10.2021].

Ministry of Environment and Tourism. (2013–2014; 2015–2016). Report of the Mongolian Environmental Situation.

Mongolian Law on Forest. (2012). https://legalinfo.mn/ [access: 30.10.2021].

Que S., Wang L., Awuah-Offei K., Chen Y., Yang W. (2018). The Status of the Local Community in Mining Sustainable Development beyond the Triple Bottom Line. Sustainability, vol. 10, no. 6, pp. 1-11.

Šimunović N., Hesser F., Stern T. (2018). Frame Analysis of ENGO Conceptualization of Sustainable Forest Management: Environmental Justice and Neoliberalism at the Core of Sustainability. Sustainability 10(9).

Smulders-Dane S., Smits T., Fielding G., Chang Y., Kuipers K. (2016). Learning from Regional Sustainable Development in The Netherlands: Explorations from a Learning History. Sustainability, vol. 8, no. 6, pp. 1–17.

State Policy of Forest of Mongolia (2015). https://legalinfo.mn/ [access: 30.10.2021].

Statistical data, Ministry of Education, Culture, Science and Sports (2018).

UN (2015). Sustainable Development Goals and Forest: A Summary of UNECE engagement and perspective.

UN (2016). United Nations Strategic Plan for Forest 2017-2030. Retrieved from http://www.un.org/esa/forests/wp-content/uploads/ 2016/ 12/UNSPF AdvUnedited.pdf [access: 30.10.2021].

UN (2020). Sustainable Development Knowledge Platform. Retrieved from https://sustainabledevelopment.un.org/topics/forests [access: 30.10.2021].

UNECE (2016). Committee on Forests and the Forest Industry Statement.

Word Forestry Congress XIV (2015). Durban Declaration: 2050 vision for forests and forestry. Durban.

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PASSENGER NAME RECORD (PNR) – REVIEW OF REGULATIONS

Abstract: The flows of personal data to and from countries outside the Union are essential to the development of international trade and cooperation. The increase in such flows has raised new challenges and concerns with respect to the protection of personal data, which the EU Data Protection Reform was intended to counteract. Since May 2018, the transfer of data to third countries can only take place in full compliance with the General Data Protection Regulation. However, in addition to this EU regulation, a number of regulations relating to the processing of passenger name record have been developed in the European Union. The aim of this article is to present these regulations and to show the impact of GDPR on them.

Keywords: General Data Protection Regulation, Safe Harbor, Privacy Shield, Advance Passenger Information, binding corporate rules

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Introduction

In the era of digitization and constant development of new technologies, the need for data transfer is constantly growing. At the same time it is becoming increasingly difficult to maintain the information autonomy of European Union (EU) citizens. According to Rojszczak (2019), "information autonomy will not be complete if an individual is deprived of control over the circulation of information about him or her" (Ratajczak, 2019). Cross-border transfer of personal data, which involves the use of multiple devices by multiple parties, raises questions about legal protection instruments. In particular, there is a question how the EU regulations protect the rights of persons whose data are transferred to third countries.

For the transfer of flight passenger data PNR to third countries analyzed in this article, two events are relevant, i.e. the Edward Snowden case, which contributed to changes in EU data protection regulation, and then the judgment of the Court of Justice of the European Union (CJEU) in Maximilian Schrems v. Data Protection Commissioner Data Protection Commissioner and Facebook Ireland Ltd, which had a significant impact on the interpretation of the provisions of Chapter V General Data Protection Regulation (Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC).

As a reminder, in mid-2013. Edward Snowden, a former employee of the U.S. National Security Agency (NSA), published secret U.S. intelligence service documents revealing the service's practices of accessing personal data processed on the Internet through the services of leading providers such as Google, Microsoft, Yahoo!, Facebook, Apple, and LinkedIn. In the second case, Maximilian Schrems argued that US law and practice did not provide effective protection for personal data transferred to the US from the EU, including in particular the protection of Facebook users. He claimed that data from the service were transferred by an Irish company (Facebook Ireland Ltd) to servers on US territory belonging to Facebook Inc. US law allowed the collection of personal data of EU citizens who did not have effective legal protection.

Pre-GDPR regulations for PNR data

In 2000, a European Commission Decision was adopted on 26 July under Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the Safe Harbor Privacy Principles. Thus, the European Union recognized that U.S. companies that join the Safe Harbour program would be treated as providing an adequate level of protection for personal data. Companies or other entities only had to declare that they followed certain rules and report to the U.S. Department of Commerce (Commission Decision, 2008; Szpor, 2012).

Council Directive 2004/82/EC on the obligation of carriers to communicate passenger data was adopted on 29 April 2004. It regulates the transfer of Advance Passenger Information (API) by air carriers to the competent national authorities in order to improve border controls and to combat illegal immigration. The Directive, also

known as the "API Directive", was implemented by Poland by the Act of 3 July 2002 – Aviation Law (Act, 2002).

On 6 November 2007, the European Commission presented a proposal for a Council Framework Decision on the use of Passenger Name Record (PNR) data for law enforcement purposes (Council Directive 2004/82/EC of 29 April 2004 on the obligation of carriers to communicate passenger data, OJ 261,6.8.2004, p. 24). In this regard, the Opinion of the European Data Protection Supervisor on the draft Proposal for a Council Framework Decision on the use of Passenger Name Record data for law enforcement purposes has also been prepared (Opinion of the European Data Protection Supervisor, 2008). The EDPS pointed out that the proposal concerns the processing of PNR data within the EU, and is closely related to other systems of collection and use of passenger data, in particular the July 2007 agreement between the EU and the US. The proposal aimed to harmonise Member States' provisions on obligations for air carriers operating flights to or from the territory of at least one Member State to transmit PNR data to the competent authorities for the purpose of preventing and fighting terrorist offences and transnational organised crime. Within the EU, the proposal was intended to complement Council Directive 2004/82/EC on the obligation of carriers to communicate passenger data, known as API data, in order to combat illegal immigration and improve border controls. The directive was to be transposed into the national legislation of the Member States by 5 September 2006 at the latest. However, the European Commission's proposal became obsolete because the Council had not adopted it by 1 December 2009, the date of the entry into force of the Lisbon Treaty (The Treaty entered into force on 1 December 2009, whereas in the hierarchy of sources of law of the legal order of the Republic of Poland it is binding upon its announcement in the Journal of Laws, which took place on 2 December 2009 (Act, 2009).

Then, on 4 May 2010, the "Stockholm Programme – An open and secure Europe serving and protecting citizens" (The Stockholm Programme – An open and secure Europe serving and protecting the citizens, 2010/C 115/01) called on the Commission to present a proposal for the use of PNR data to prevent, detect, investigate and prosecute terrorism and serious crime.

In the Communication of 21 September 2010. on "The global approach to transfers of Passenger Name Record (PNR) data to third countries", the Commission presented the main elements of EU policy in this area. The Communication characterised the trends in the use of PNR data within the EU and in the world. The Commission considered it necessary for the EU to review its global approach on PNR (Communication from the Commission, 2010). In addition, the objective of the European Commission communicating the principles was to bring about greater convergence between the various PNR agreements and respect for the fundamental rights to respect for private life and to protection of personal data. At the same time, the Commission pledged to remain flexible in taking into account the specific security concerns of individual third countries and their national legal orders.

For example, on 29 September 2011, the Agreement between the European Union and Australia on the processing and transfer of Passenger Name Record data by air

carriers to the Australian Customs and Border Protection Service was concluded in Brussels (Agreement EU-Australia, 2012). Subsequently, on 14 December 2011, an agreement was concluded in Brussels between the European Union and the United States of America on the use and transfer of Passenger Name Records to the United States Department of Homeland Security (Agreement EU-USA, 2012).

The breakthrough came after the CJEU's Schrems ruling on October 6, 2015 (Judgment, C-362/14), in which the Court of Justice of the EU invalidated the European Commission's Decision 2000/520/EC of July 26, 2000 on the adequacy of the protection provided by the Safe Harbor Privacy Principles and the related Frequently Asked Questions issued by the U.S. Department of Commerce. The Court assessed the data protection rules under the Safe Harbor program against the standards that resulted from Directive 95/46/EC and the Charter of Fundamental Rights. It concluded that the US law allows public authorities almost unlimited and uncontrolled access to Europeans' data and thus undermines the very essence of the right to privacy. The decision approving the Safe Harbor program specifically alleged that: "the Principles apply (...) only to self-certified U.S. organizations that receive personal data from the Union, with no requirement that U.S. public authorities be required to respect the Principles" (Judgment, C-362/14). The impact of the ruling was also important for the negotiations of the TTIP agreement – the Transatlantic Trade and Investment Partnership. Completely different standards of privacy protection prevailing on both sides of the Atlantic were perceived by American companies as a barrier to unfettered economic development. The agreement has not been concluded so far.

The literature indicates that the interpretation of the Court of Justice has left its mark on the final form of Chapter V of the GDPR. It raised expectations for third countries, replacing the requirement of "adequate" protection with a standard of "substantial equivalence" (Grusza, 2020).

The principles of data transfer between Europe and the US were therefore called into question at the end of 2015, and data controllers had to look for other rationales to legalize data transfers while waiting for another agreement on data transfers between the two continents. On 12 July 2016, European Commission Implementing Decision (EU) 2016/1250 was adopted under Directive 95/46/EC of the European Parliament and of the Council, on the adequacy of the protection provided by the EU-US Privacy Shield, which concluded that the United States provides an adequate level of protection for the personal data of Europeans. Privacy Shield became the system that supports data flows between the European Union and the United States, replacing the Safe Harbor program. It should be mentioned that the Article 29 Data Protection Working Party, when giving its opinion on the draft Commission Decision 2016/2295 on the adequacy of the protection of personal data by certain countries, indicated that a detailed analysis of the conditions under which services from third countries can access the transmitted data should be made before taking a decision on adequacy (Opinion 01/2016 on the EU – U.S. Privacy Shield draft adequacy decision).

The shield guaranteed a number of benefits, such as the right to receive information about the transfer of data and the right to access the data. The program also allowed control over whether a company was certified. In addition, U.S. companies wishing to self-certify and enjoy the benefits of program membership had to meet a number of requirements, such as being subject to the "investigatory and enforcement powers" of the Federal Trade Commission, the U.S. Department of Transportation, or "other statutory authority that effectively ensures compliance" (C(2016) 4176). The Shield required the organization to publish its privacy policy (Karwala, 2018).

Additionally, in 2016, Directive (EU) 2016/681 of the European Parliament and of the Council of 27 April 2016 on the use of Passenger Name Record (PNR) data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime was adopted by Member States, which was implemented into the Polish legal order by the Act of 14 May 2018 on the Processing of Passenger Name Record Data (Act, 2018).

After GDPR regulations for PNR data

Even before the entry into force of the GDPR provisions, i.e. before 25 May 2018, the terms and conditions for the transfer of passenger flight data by air carriers and the processing of such data for the purposes of detecting, combating, preventing and prosecuting terrorist offences and other crimes or fiscal offences, as well as the entities competent in these matters, were regulated by the Law of 14 May 2018. In the explanatory memorandum to the draft law, it was pointed out that the provisions in force before May 2018 did not regulate matters concerning the processing of PNR data for the purpose of combating crime, but only regulated the transfer by air carriers, at the request of the commander of the relevant Border Guard post, of information concerning passengers on board an aircraft (API data) landing on the territory of the Republic of Poland. In the justification it was indicated that the solutions in this area constituting the transposition of Council Directive 2004/82/EC of 29 April 2004 on the obligation of carriers to communicate passenger data were implemented into Polish law by the Act of 3 July 2002 – Aviation Law (Article 202a-202d and Article 209u, OJ 2016, item 605).

For the rest, the obligation of air carriers to transfer the PNR data they collect is governed by international agreements concluded between the European Union and third countries.

To this extent, the provisions of Chapter V of GDPR, which address the issue of transfer of data to third countries or international organizations, are applicable. As a rule, the Regulation provides for a prohibition of transfer of personal data to third countries and international organizations, which is not in fact expressed directly, but may be inferred from the overall regulation. However, the ban may only be lifted after it has been established that the third country ensures an adequate level of data protection. One of the ways indicated in Article 45 GDPR is that a transfer of data is permitted on the basis of a decision of the European Commission stating that the third country, a territory or a specific sector within that third country, or an international organization

ensures an adequate level (degree) of protection. On the other hand, in the absence of an implementing decision of the European Commission, the data exporter should proceed to the application of the appropriate measures provided for in the GDPR to compensate for the lack of protection (Fischer, 2018). The first group of safeguards legalizing the transfer does not require the consent of the supervisory authority and consists of the choice made by the transferring party from among: (1) binding corporate rules i.e. personal data protection policies which are adhered to by a controller or processor established on the territory of a Member State for transfers or a set of transfers of personal data to a controller or processor in one or more third countries within a group of undertakings, or group of enterprises engaged in a joint economic activity, (2) standard data protection clauses adopted by the European Commission; (3) standard data protection clauses adopted by a supervisory authority and approved by the European Commission in accordance with the examination procedure referred to in Article 93(2) of the GDPR; (4) approved codes of conduct, which should be understood to mean accepted specific principles and practices for the processing of personal data; (5) approved certification mechanisms if they are linked to binding and legally enforceable obligations on the controller or processor in a third country (i.e. by contract or through other legally binding instruments) to apply appropriate safeguards, including with respect to the rights of data subjects; 6) a legally binding and enforceable instrument between bodies or entities belonging to the public law sphere, whereby the GDPR provides no indication as to the legal nature of such an instrument.

The group of safeguards that require authorisation by the supervisory authority includes: 1) contracts concluded between a controller or processor and a controller, processor or recipient of personal data in a third country or international organization (ad hoc contracts); 2) provisions of administrative arrangements between public authorities or entities, which will provide for enforceable and effective rights of data subjects.

In the context of considering the grounds for processing PNR data, it should be noted that after the enactment of the GDPR, the European Commission Decision 2010/87/EU of 5 February 2010 on standard contractual clauses for the transfer of personal data to processors established in third countries under Directive 95/46/EC of the European Parliament and of the Council, which, in conjunction with Article 46 of the GDPR, remained in force.

Also, many Commission decisions under the former Directive 95/46/EC, where the mechanism of country-by-country assessment was similar, remained in force until amended, replaced or repealed. The EC issued the following decisions concluding on the level of security of personal data in the following third countries (Table 1).

Table 1. European Commission Decisions concluding on the level of security of personal data in the following third countries

State	Commission Decision
Switzerland	Commission Decision of 20 December 2001 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data provided by the Canadian Personal Information Protection and Electronic Documents Act
Canada	Commission Decision of 20 December 2001 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data provided by the Canadian Personal Information Protection and Electronic Documents Act
Argentina	Commission Decision of 30 June 2003 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Argentina
The County of Guernsey	Commission Decision of 21 November 2003 on the adequate protection of personal data in Guernsey.
Isle of Man	Commission Decision of 28 April 2004 on the adequate protection of personal data in the Isle of Man
Jersey	Commission Decision of 8 May 2008 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Jersey
The Faeroe Islands	Commission Decision of 5 March 2010 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection provided by the Faeroese Act on processing of personal data
Andorra	Commission Decision of 19 October 2010 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Andorra
Israel	Commission Decision of 31 January 2011 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by the State of Israel with regard to automated processing of personal data
Eastern Republic of Uruguay	Commission Implementing Decision of 21 August 2012 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by the Eastern Republic of Uruguay with regard to automated processing of personal data
New Zealand	Commission Implementing Decision of 19 December 2012 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by New Zealand

Source: own study

In the context of this dispute between the Data Protection Commissioner and Facebook Ireland Ltd and Maximillian Schrems, a reference for a preliminary ruling was made to the Court of Justice on 9 May 2018. It seeks to interpret and examine the validity of Commission Decision 2010/87/EU and Commission Implementing Decision (EU) 2016/1250 on the adequacy of the protection afforded by the EU-US Privacy Shield.

In a judgment dated July 16, 2020, the Court of Justice of the EU challenged the Commission's finding that the United States provides a degree of protection substantively equivalent to that guaranteed in the European Union by the GDPR. Additionally, the Privacy Shield decision was annulled, so the program can no longer be the basis for data transfers to the U.S., and companies and others should either find another basis for the transfer or stop the transfer altogether.

Also, the entry into force on 27 June 2021 of European Commission Decision (EU) 2021/914 on standard contractual clauses for the transfer of personal data to third countries, replacing Commission Decision 2010/87/EU, does not change the status quo, especially since the existing standard clauses are to remain in force until 27 December 2022.

It is clear from the GDPR regulations that entities should not transfer data to a country that does not provide an adequate level of data protection. It is incumbent upon a controller who is established in the European Union to verify, prior to the transfer of data, whether the level of data protection in the country in question is equivalent to that required by Union law. An in-depth analysis of the law of the third country must therefore be carried out by the controller, including a reference to the access of public authorities to the transferred data. A thorough analysis of the judgment leads to the conclusion that the transfer of data to the US should not be based on the standard contractual clauses and that therefore the applicability of Commission Decision (EU) 2021/914 remains questionable.

Christopher Kruner points out that in a world marked by constitutional diversity and legal pluralism, it is an illusion to expect a legal order to be able to protect individuals on a global scale by persuading other states to adopt its own standards; rather, what is needed are creative solutions that take into account the differences of other legal systems and, ultimately, international treaty solutions (Kruner, 2014) and it is hard to disagree with him.

Entities, including those from third countries, that process personal data, including flight passenger data, operate within a legal framework. Therefore, it is difficult to expect that, in the case of a conflict of standards, an entity will ignore the provisions of its national law in favor of conflicting European regulations arising from contractual obligations. This demonstrates the weakness of the GDPR and Privacy Shield model of data protection for third country processors and the lack of legal means to oblige them to apply EU law. The Regulation, which aims to approximate legal solutions for data controllers in individual Member States, allowed the use of model clauses and Binding Corporate Rules. It also introduced new data protection guarantees in the form of approved codes of conduct and approved certification mechanisms. Systemically, however, the principles of data transfer to a third country have not fundamentally

changed. The judgment of the Court of Justice annulling the Privacy Shield Decision, which indicates that the United States does not provide a substantively equivalent level of protection to that guaranteed in the European Union, creates the need to seek another legal basis for the transfer of personal data, including flight passenger data, or forces the suspension of transfers. The above affects legal uncertainty, which is further burdened by the awareness of severe penalties for non-compliance.

Again, there is currently no systemic solution to legalize data transfers to the US. With regard to the transfer of personal data from the EU to third countries, including the U.S., the application of standard contractual clauses developed by the European Commission requires an EU entity to examine whether the legal system of the recipient country provides adequate protection of personal data. New solutions are therefore needed, with the existing contractual clauses still in force needing to be modified accordingly on the basis of the new ones introduced by Commission Decision (EU) 2021/914, and by 27 December 2022.

Conclusions

Christopher Kruner points out that in a world marked by constitutional diversity and legal pluralism, it is an illusion to expect a legal order to be able to protect individuals on a global scale by persuading other states to adopt its own standards; rather, what is needed are creative solutions that take into account the differences of other legal systems and, ultimately, international treaty solutions (Kruner, 2014) and it is hard to disagree with him.

Entities, including those from third countries, that process personal data, including flight passenger data, operate within a legal framework. Therefore, it is difficult to expect that, in the case of a conflict of standards, an entity will ignore the provisions of its national law in favor of conflicting European regulations arising from contractual obligations.

This demonstrates the weakness of the GDPR and Privacy Shield model of data protection for third country processors and the lack of legal means to oblige them to apply EU law. The Regulation, which aims to approximate legal solutions for data controllers in individual Member States, allowed the use of model clauses and Binding Corporate Rules. It also introduced new data protection guarantees in the form of approved codes of conduct and approved certification mechanisms.

Systemically, however, the principles of data transfer to a third country have not fundamentally changed. The judgment of the Court of Justice annulling the Privacy Shield Decision, which indicates that the United States does not provide a substantively equivalent level of protection to that guaranteed in the European Union, creates the need to seek another legal basis for the transfer of personal data, including flight passenger data, or forces the suspension of transfers. The above affects legal uncertainty, which is further burdened by the awareness of severe penalties for non-compliance. Therefore, work should be urgently undertaken to develop legal regulations guaranteeing safe data transfer to third countries, including the United States

Summary

There is currently no systemic solution to legalize data transfers to the United States. With regard to the transfer of personal data from the EU to third countries, including the United States., the application of standard contractual clauses developed by the European Commission requires an EU entity to examine whether the legal system of the recipient country provides adequate protection of personal data. New solutions are therefore needed, with the existing contractual clauses still in force needing to be modified accordingly on the basis of the new ones introduced by Commission Decision (EU) 2021/914, and by 27 December 2022.

References

Agreement between the European Union and Australia on the processing and transfer of Passenger Name Record (PNR) data by air carriers to the Australian Customs and Border Protection Service, OJ L 186, 14.7.2012, pp. 4–16.

Agreement between the United States of America and the European Union on the use and transfer of passenger name records to the United States Department of Homeland Security, OJ L 2015, 11.8.2012, pp. 5–14.

Commission Decision of 26 July 2000 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the safe harbour privacy principles and related frequently asked questions issued by the US Department of Commerce, OJ L 2015, 25.8.2000, pp. 7–47.

Commission Decision of 26 July 2000 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data provided in Switzerland, notified under document number C(2000) 2304, OJ L 215, 25.8.2000, pp. 1–3.

Commission Decision of 20 December 2001 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data provided by the Canadian Personal Information Protection and Electronic Documents Act, notified under document number C(2001) 4539, OJ L 2, 4.1.2002, pp. 13–16.

Commission Decision of 30 June 2003 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Argentina, OJ L 168, 5.7.2003, pp. 19–22.

Commission Decision of 21 November 2003 on the adequate protection of personal data in Guernsey, notified under document number C(2003) 4309, OJ L 308, 25.11.2003, pp. 27–28.

Commission Decision of 28 April 2004 on the adequate protection of personal data in the Isle of Man, OJ L 151, 30.4.2004, pp. 48–51.

Commission Decision of 8 May 2008 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Jersey, notified under document number C(2008) 1746, OJ L 138, 28.5.2008, pp. 21–23.

Commission Decision of 5 March 2010 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection provided by the Faeroese Act on processing of personal data, notified under document C(2010) 1130, OJ L 58, 9.3.2010, pp. 17–19.

Commission Decision of 19 October 2010 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data in Andorra (notified under document C(2010) 7084, OJ L 277, 21.10.2010, pp. 27–29.

Commission Decision 2010/87/EU of 5 February 2010 on standard contractual clauses for the transfer of personal data to processors established in third countries under Directive 95/46/EC of the European Parliament and of the Council, notified under document C(2010) 593, OJ L 39, 12.2.2010, pp. 5–18.

Commission Decision of 31 January 2011 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by the State of Israel with regard to automated processing of personal data, notified under document C(2011) 332, OJ L 27, 1.2.2011, pp. 39–42.

Commission Implementing Decision of 21 August 2012 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by the Eastern Republic of Uruguay with regard to automated processing of personal data, notified under document C(2012) 5704, OJ L 227, 23.08.2012, pp. 11–15.

Commission Implementing Decision of 19 December 2012 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequate protection of personal data by New Zealand, notified under document C(2012) 9557, OJ L 28, 30.1.2013, pp. 12–14.

Commission Implementing Decision (EU) 2016/1250 of 12 July 2016 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the EU-U.S. Privacy Shield, notified under document C(2016) 4176, OJ L 207, 1.8.2016, pp. 1–112.

Commission Implementing Decision (EU) 2021/914 of 4 June 2021 on standard contractual clauses for the transfer of personal data to third countries pursuant to Regulation (EU) 2016/679 of the European Parliament and of the Council, OJ L 199, 7.6.2021, pp. 31–61.

Communication from the Commission on the global approach to transfers of Passenger Name Record (PNR) data to third countries, COM/2010/0492.

Council Directive 2004/82/EC of 29 April 2004 on the obligation of carriers to communicate passenger data, OJ 216, 6.8.2004, p. 4.

Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data , OJ L 281, 23.11.1995, pp. 31–50.

Directive (EU) 2016/681 of the European Parliament and of the Council of 27 April 2016 on the use of Passenger Name Record (PNR) data for the prevention, detection,

investigation and prosecution of terrorist offences and serious crime, (OJ UE L 132, 4.5.2016, p. 119.

Fischer B. (2018). Art 46 Transfers subject to appropriate safeguards. In: M. Sakowska-Baryła (ed.), General Data Protection Regulation. Commentary, Warszawa, C.H. Beck, p. 472.

Grusza M. (2020). New rules for transferring personal data from the European Union to third countries (selected issues). Legal Review, no. 2, p. 15.

Judgment of the Court in case C-362,14, 6.10.2015, ECLI: EU:C:2015:650, no. 82

Karwala D. (2018). Commercial transfers of personal data to third countries. Warsaw, p. 437.

Kuner C. (2014). Safe Harbor before the EU Court of Justice. Cambridge Journal of International and Comparative Law, 13.4.2014, Safe Harbor before the EU Court of Justice – Cambridge International Law Journal (cilj.co.uk) [access: 21.11.2021].

Opinion of the European Data Protection Supervisor on the Communication from the Commission on the global approach to transfers of Passenger Name Record (PNR) data to third countries, COM/2010/0492, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0492:FIN:EN:PDF [access: 21.11.2021].

Opinion 01/2016 on the EU – U.S. Privacy Shield draft adequacy decision, Article 29 Data Protection Working Party, https://ec.europa.eu/justice/article-29/documentation/opinion-recommendation/files/2016/wp238_en.pdf [access: 21.11.2021].

Rojszczak M. (2019). Protecting privacy in cyberspace, taking into account the threats posed by new information processing techniques. Warsaw, Wolters Kluwer, p. 335.

Szpor G. (2012). Administrative and legal problems associated with the expansion of the Internet. In: G. Szpor, W. Wiewiórowski (ed.). Internet. Problems of Net, Portals and e-Services. Warsaw, C.H. Beck, pp. 71–80.

The Act of 3 July 2002 – Aviation Law, OJ 2017, item 959 and 1089.

The Act of 14 May 2018 on the Processing of Passenger Name Record Data, OJ 2018, item 894.

The Stockholm Programme – An open and secure Europe serving and protecting the citizens, 2010/C 115/01.

Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, done at Lisbon on 13 December 2007, OJ 2009, No. 203, item 1569.

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USE OF GIS INHEALTHCARE

Abstract: The use of spatial data allows implementation improvement of the public entities tasks in the field of health care. Both government and territorial self-government administration, within the scope of their competence, can process such information resources. The aim of this article is to present the role of spatial data in healthcare management processes. Local self-government units, in order to ensure equal access to health care services, develop, implement and evaluate the effects of health policy programmes, as well as take other actions resulting from the identified health needs and health condition of the inhabitants. These tasks of the local government may be carried out more effectively through the use of spatial information systems, facilitating data analysis, which may be fully or partially automated. In the Polish legal system, regional maps of health needs are created by voivodes, while the Nationwide Map of Health Needs is developed, established and updated by the Minister of Health. Spatial information systems can be a useful tool to support the implementation of tasks by the above-mentioned competent bodies and verification of the achieved results, provided that appropriate quality of collected data and interoperability of used solutions is ensured at the organisational, semantic and technical level.

Keywords: spatial data, INSPIRE, Map of Health Needs, information system in healthcare, interoperability

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Introduction

Spatial data processing concerns various areas of public administration and economy. The use of these information resources makes it possible to represent objects and phenomena by indicating their relationships and the extent to which they influence the environment and the shaping of space. Article 3 point 1 of the INSPIRE Directive 2007/2/EC defines spatial data as any data with a direct or indirect reference to a specific location or geographical area (OJ UE L 108/1). These resources consist of two basic elements:

- location in the field of a specific object according to geographical coordinates,
- object description indicating its properties, features and functions (Białousz, 2013).

Spatial data can be used to analyse and formulate conclusions about a specific area and its components. These observations also apply to the health sector, where spatial data can facilitate a comprehensive analysis of the actual state of existing processes or the planning of strategies and new policies. The use of spatial information systems allows for the improvement of resource management and implementation of statutory tasks in the public sector.

The first part of the article presents the position of spatial information systems in the national information infrastructure, which is an introduction to consider the role of spatial data in the processes of health management.

Spatial information systems and the national information infrastructure

Spatial information systems include methods and techniques related to the processing of data related to the location and characteristics of specific objects in space. The primary purposes of this technology are data collection, as well as support for decision-making, research, education, and the dissemination of information about land. The elements of spatial information systems include: data – together with its processing and collections, hardware, software, technologies or users (Fig. 1).

Sources of spatial resources for such solutions are: topographic and thematic maps, satellite images, aerial photographs, results of geodetic and specialist measurements, registers and databases and other information systems, signals of GPS and GLONASS satellites as well as Galileo (Baranowski, 2012). Spatial information systems are multi-module structures that allow for extensive data analysis. On their basis, it is possible to draw conclusions to support decision-making on selected issues.

At the national level in Poland there is a spatial information geoportal available at https://www.geoportal.gov.pl/. The legal basis for its operation and processing of certain categories of data is Art. 13 of the Act of 4 March 2010 on spatial information infrastructure (OJ DzU 214/2021). The Chief Geodesist of Poland (pol. Główny Geodeta Kraju) creates and maintains this geoportal as the central access point to spatial data services, making it possible to search (Catalog Service for the Web), view (Web Map Service), download (Web Feature Service for vector graphic, Web Coverage Service for raster graphic) and transform (Web Processing Service) spatial data.

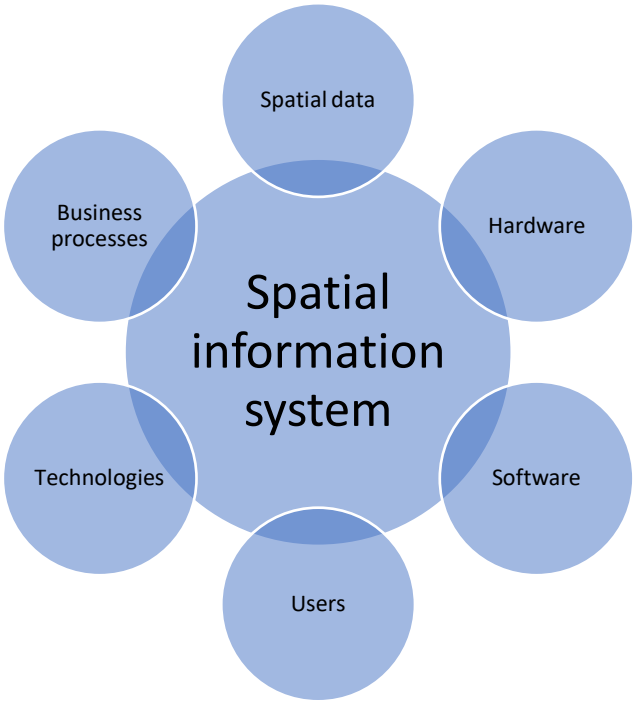

Fig. 1. Spatial information systems structure
Source: Own elaboration

At the regional level, there are also specialized provincial spatial information systems:

- Pomorski (https://pomorskie.e-mapa.net/),
- Kujawsko-Pomorski (https://kujawskopomorskie.e-mapa.net/),
- Warmińsko-Mazurski (https://warminskomazurskie.e-mapa.net/),
- Lubuski (https://lubuskie.e-mapa.net/),
- Wielkopolski (https://wielkopolskie.e-mapa.net/),
- Mazowiecki (https://geodezja.mazovia.pl/msip.html),
- Podlaski (https://podlaskie.e-mapa.net/),
- Łódzki (https://rsip.lodzkie.pl/),
- Dolnośląski (https://dolnoslaskie.e-mapa.net/),
- Świętkorzyski (http://sip.e-swietokrzyskie.pl/),
- Lubelski (https://lubelskie.e-mapa.net/),
- Podkarpacki (https://https://podkarpackie.e-mapa.net/),
- Małopolski (https://miip.geomalopolska.pl/imap/),
- Śląski (http://www.orsip.pl/geoportal),
- Opolski (https://mapy.opolskie.pl/).

Considering the data processed in these systems, one can find among resources layers associating with various areas of competence of local government, including those relating to the shaping of processes in healthcare sector.

Both the national geoportal and regional geoportals are part of the national information infrastructure. This concept refers to the global, European and national scale. Information infrastructure is a complex of institutions, organizational units,

resources and information systems, as well as information and communication technologies, whose appropriate shape and mutually ordered relationships determine the proper functioning of certain social, economic and political systems (Oleński, 2006). In the general theory of systems, the notion of system is defined as a set of elements that remain in mutual relations (von Bertalanffy, 1984). The information system is considered as a set of elements that cooperate with each other in order to collect, process, store and provide information to support decision-making processes and processes of coordination, control, data analysis in organizations (Laudon, 2011). This concept also has legal definitions. Pursuant to Article 2 point 14 of the Act of 5 July 2018 on the National Cyber Security System, an information system includes an ICT system (the content of Article 3 point 3 of the Act of 17 February 2005 on Informatisation of the Activities of Entities Performing Public Tasks indicates that it is a set of cooperating IT devices and software ensuring processing, storage, as well as sending and receiving data via telecommunication networks by means of a telecommunication end device appropriate for a given type of network – OJ DzU 2070/2021), together with data processed in it in electronic form (OJ DzU 1369/2020). In art. 2 point 13 of the Act of 29 June 1995 on public statistics the scope of the legal concept of public administration information systems covers systems for collecting, storing and processing information by public administration bodies, the Social Insurance Institution, the National Health Fund, the Financial Supervision Authority, registration bodies, other national or local government legal persons and other entities keeping official registers (OJ DzU 955/2021). Public spatial information systems are part of the national's information infrastructure.

In EU law the term infrastructure for spatial information has its legal definition in Article 3 point 3 of the INSPIRE Directive 2007/2/EC. It consists of metadata, spatial data sets and spatial data services; network services and technologies (OJ UE L 108/1). Infrastructure for spatial information also includes agreements on sharing, access and use, as well as coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with this Act. The Polish implementation of this definition in Article 3 point 2 of the Act on Spatial Information Infrastructure supplements the elements mentioned above by additionally including administrative bodies and third parties contributing to the infrastructure (OJ DzU 214/2021).

Information infrastructure is therefore a complex of institutions, systems and resources reducing uncertainty, in which public resources and entities implementing public tasks are important (Szpor, 1998). Such solutions make it possible to organise the information sphere of the functioning of the state and its institutions. In relation to health care, safe, effective and comprehensive exchange of data and the possibility of their extensive analysis makes it possible to actually realise the postulate of realisation of knowledge-based medicine and management of this sector based on complete and up-to-date information. Transformation of the information model through the introduction of comprehensive legal solutions and implementation of modern IT tools in the health care sector should ensure its uniform, integrated and flexible structure, which will be

beneficial both for patients – their health and information security, as well as from the point of view of optimization of processes operating in the health care system (Wdowiak et al., 2009). An effectively functioning national information infrastructure is an important component of modern information societies and knowledge-based economies.

Spatial data in healthcare

Among the themes of spatial data specified in the INSPIRE Directive 2007/2/EC and its Annex No. 3, the following data is of particular importance in the context of the subject of this presentation:

- human health and safety – these resources are referred to geographical distribution of dominance of pathologies, information indicating the effect on health or well-being of humans;
- utility and governmental services – includes utility facilities such as administrative and social governmental services such as civil protection sites and hospitals.

In an analogous way, these thematic areas are provided for in the Annex to the Act on Spatial Information Infrastructure. In section 5 of chapter 3 issues related to health and safety of the population can be found. Moreover, section 6 refers to public services including social services and hospitals (OJ UE L 108/1). Spatial data analyses results allow the observation on a time line of the relationship of health events with the space and the objects located in it, e.g. hospitals, emergency stations (Khashoggi et al., 2020). This allows dependencies and variability between such elements to be identified (Fig. 2).

Fig. 2. Spatial objects in the geoportal related to healthcare infrastructure
Source: Own elaboration

Detailed competences related directly or indirectly to the processing of spatial data for the needs of health care management can be found in the regulations related to the functioning of local government and government administration. Content of Art. 7, 8 and 9 of the Act of 27 August 2004 on health care services financed from public funds outlining the tasks of local government (of municipalities, districts and voivodeships) in ensuring equal access to health care services refer to the following areas:

- development, implementation and evaluation of health policy programmes and
- monitoring actions of the local self-government community in the area of health, as well as
- undertaking other activities resulting from identified health needs (OJ DzU 1285/2021).

These tasks of the local government can be carried out more effectively through the use of spatial information systems, by facilitating data analysis, which can be fully or partially automated.

An important problem of the Polish health care system is the uneven distribution of resources – including medical staff –which results in the needs of local communities not being adequately met. This causes the migration of patients to satisfy health needs, which translates into the increase of indebtedness of medical entities, and in the further consequence, the limitation of quality and accessibility of services in connection with decapitalisation of system resources. The objective of rationalisation of the functioning health care system in Poland was the introduction of maps of health needs, which is – in its assumption – one of the tools stimulating the development of regional and national infrastructure, in accordance with the health needs of the society.

At the government level according to art. 95a Act on health care services financed from public funds The Minister of Health as the competent authority shall develop, establish and update the Nationwide Map of Health Needs (OJ DzU 1285/2021). The basis for the creation of the Nationwide Map of Health Needs are regional (voivodeship) maps. The authority competent to draw up the regional map of health needs is the voivode (pol. wojewoda), who passes this act to the marshal of the voivodeship (pol. marszałek województwa), the convention of districts (pol. powiaty) of the given voivodeship, the voivodeship consultants in health care, the President of the National Health Fund and the voivodeship council for social dialogue for an opinion. Regional map of health needs and the Nationwide Map of Health Needs consist of the following parts:

- health needs and challenges of health system organisation requiring action,
- actions that need to be coordinated,
- planned period for implementing the actions,
- entities responsible for implementing the actions,
- estimated costs of actions,
- expected outcomes of actions,
- performance indicators for the various actions mentioned above.

The maps were supposed to be the basis for determining the level of future health care needs and to indicate the key actions that should be implemented first by the

voivodeship branches of the National Health Fund, which would result in optimal provision of health care services. In the process of creating this document, the role of the Fund's representatives and voivodeship consultants is crucial (Sikorski, 2021).

The source of information for developing the Maps of Health Needs may be the Medical Information System, domain information systems (pol. dziedzinowe systemy teleinformatyczne) or medical registers regulated in the Act of 28 April 2011 on the information system in health care (OJ DzU 666/2021). These collections have significant potential from the point of view of their use in the processes of planning and evaluation of public policies implemented in Poland in the area of health care.

It should be noted that the effective use of data for the up-to-date management of health care still faces significant problems that require finding effective methods to solve them at technical, organisational and legal levels. In the course of the audit carried out in 2018 by the Supreme Chamber of Control, it was established that the previously published maps of health needs contained a lot of unreliable data, including in particular epidemiological phenomena and health system resources. The reason was the outdatedness and incompleteness of data contained in some registers. In addition, analyses were developed on the basis of information, often even historical, from 2012 and 2013 (Information on the results of the audit Creating Maps of Health Needs, Najwyższa Izba Kontroli, No. 191/2017/P/17/059/KZD).

The second significant – related to the first problem - is the interoperability of IT systems operating in the healthcare system. Article 3 point 18 of the Act of 17 February 2005 on Informatisation of the Activities of Entities Performing Public Tasks defines the concept of interoperability as the ability of different entities and the ICT systems and public registers used by them to work together to achieve mutually beneficial and agreed objectives, taking into account the sharing of information and knowledge by the business processes supported by them, implemented by means of data exchange through the ICT systems used by these entities (OJ DzU 2070/2021). A similar understanding of the concept of interoperability can be found in the EU legal system, in particular in the area of soft law relating to the management of electronic public services (European Interoperability Framework – Implementation Strategy (COM (2017) 134).

Interoperability is considered at three basic levels:

- organisational – it implies the unification of management standards, organisational structures, policies and business processes related to information processing,
- semantic – establishing agreed, consistent and unambiguous data structures at all stages of information processing,
- technical – ensuring compatibility of technical solutions (e.g. communication protocols) and software used for information processing (e.g. by formulating minimum requirements for such solutions in legal regulations or indicating the relevant technical standards that should be followed to ensure effective data exchange).

In addition, the processing of data in European public services should comply with the following set of principles:

- subsidiarity and proportionality,
- openness,
- transparency,
- reusability,
- technological neutrality and data portability,
- user-centricity,
- inclusion and accessibility,
- security and privacy,
- multilingualism,
- administrative simplification,
- preservation of information,
- assessment of effectiveness and efficiency.

Compliance with them are relevant to the process of establishing interoperable european public services infrastructure. With regard to cooperation between the Member States and the EU institutions, there is also a legal level of gradual harmonisation of the regulations relating to data exchange within the European single market.

The components of the infrastructure for spatial information should maintain interoperability as defined in Art. 3 point 7 of the INSPIRE Directive 2007/2/EC as the possibility for spatial data sets to be combined, and for services to interact, without repetitive manual intervention, in such a way that the result is coherent and the added value of the data sets and services is enhanced (OJ UE L 108/1). In doctrine, interoperability is considered as the ability of components or systems to distribute information to each other, to understand it in a uniform way, and to use it effectively to achieve the intended results of their actions. It draws attention to such important related issues as precisely the compatibility and cooperation of distributed autonomous IT solutions (Świtała, 2018). Achieving interoperability between individual information systems and their coherence with the organisational and legal layer allows improving the management of processes occurring in health care through efficient access to complete and reliable data on the functioning of this sector.

Conclusion

Spatial data related to the functioning of health care allow for a graphical representation of past, present and projected objects and phenomena concerning this sector. This facilitates conducting analyses aimed at formulating conclusions supporting decision-making processes related to the constant management of processes of ensuring medical safety of the population. Thanks to the processing of such resources, it is possible to evaluate the implemented health policies more effectively by verifying their effects. Spatial information systems also facilitate the forecasting of new phenomena related to public health and the selection of impact methods relating to them.

References

Baranowski M. (2012). Zarys problematyki systemów informacji przestrzennej w kontekście infrastruktur geoinformacyjnych (*Outline of the issues of spatial information systems in the context of geoinformation infrastructures*). In: S. Białousz, E. Bielecka (ed.), INSPIRE i krajowa infrastruktura informacji przestrzennej, Warszawa 2012, pp. 39–40.

Białousz S. (2013). Rozważania metodyczne o informacji przestrzennej (*Methodological considerations about spatial information*). In: S. Białousz (ed.), Informacja przestrzenna dla samorządów terytorialnych, Warszawa, p. 3.

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, European Interoperability Framework – Implementation Strategy (COM(2017) 134).

Directive 2007/2/EC of The European Parliament and of The Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (OJ UE L 108/1).

Information on the results of the audit Creating Maps of Health Needs, Najwyższa Izba Kontroli, No. 191/2017/P/17/059/KZD.

Khashoggi B., Abdulkader Murad A. (2020). Issues of Healthcare Planning and GIS: A Review. International Journal of Geo-Information, no. 9, pp. 19–20.

Laudon K.C, Laudon J.P. (2011). Essentials of Management Information Systems. New Jersey, p. 13.

Oleński J. (2006). Infrastruktura informacyjna państwa w globalnej gospodarce(*State information infrastructure in the global economy*), Warszawa, pp. 270–271.

Sikorski S. (2021), Administracja ochrony zdrowia w Polsce – między świadczeniem a reglamentacją(*Healthcare administration in Poland – between service and regulation*), Warsaw, pp. 444-459.

Szpor G. (1998). Informacja w zagospodarowaniu przestrzennym. Zagadnienia administracyjnoprawne (*Information in spatial development. Administrative and legal issues*), Katowice, p. 25.

Świtała K. (2018). System informacji w ochronie zdrowia a problematyka planowania i ewaluacji polityk zdrowotnych w Polsce (*The information system in health care and the issues of planning and evaluation of health policy in Poland*).Roczniki, Kolegium Analiz Ekonomicznych SGH, vol 52, pp.112–113.

The Act of 17 February 2005 on Informatisation of the Activities of Entities Performing Public Tasks (OJ DzU 2070/2021).

The Act of 27 August 2004 on health care services financed from public funds (OJ DzU 1285/2021).

The Act of 28 April 2011 on the information system in health care (OJ DzU 666/2021).

The Act of 29 June 1995 on public statistics (OJ DzU 955/2021).

The Act of 4 March 2010 on spatial information infrastructure (OJ DzU 214/2021).

The Act of 5 July 2018 on the National Cyber Security System (OJ DzU 1369/2020).

von Bertalanffy L. (1984). General Systems Theory, Warsaw, p. 85.

Wdowiak L., Kamiński Z., Horoch A., Bojar I. (2009). Systemy informatyczne w ochronie zdrowia. Część 2 – doświadczenia krajowe (*Systemy informatyczne w ochronie zdrowia. Część 2 – doświadczenia krajowe*). Zdrowie Publiczne –Public Health, no. 119(1), p. 80.

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SPATIAL ASPECTS OF ECOMMERCE IN THE EUROPEAN UNION: PROHIBITIONS TO GEO-BLOCK OR TO DISCRIMINATE BASED ON GEOGRAPHIC LOCATION

Abstract: Geo-blocking are practices undertaken by sellers using technological means or otherwise, the result of which is to prevent, limit or differentiate the conditions of access to goods and services depending on the country or region of the customer's origin. The Geo-blocking Regulation prohibits unjustified geo-blocking and other forms of discriminating practices based on the customers' nationality, place of residence or place of establishment within the internal market. The Regulation covers three main types of practices: a) blocking or limiting access or automatically redirecting the user to another version of an online interface, b) applying different conditions of sale for the goods or services, and c) applying different payment conditions, based on the buyer's location or nationality. The Regulation is to be applied in the Member States, and they took different approach to it . This paper aims to present the current legal framework as well as required changes to ensure it effectiveness and increase its impact on the internal market.

Keywords: geo-blocking, e-commerce, audio-visual services, geographical discrimination

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Introduction

Geo-blocking is understood to include practices undertaken by sellers using technological means or otherwise, the result of which is to prevent, limit or differentiate the conditions of access to goods and services depending on the country or region the customer's origin. Along with the expansion of the e-commerce industry, online sellers began to massively block or limit access to their websites for customers from outside a specific country or region to which they directed their products or services, or to automatically redirect their customers to a language version of the store designed for the country or region of the consumer's residence. That actions usually consisted in presenting the customer with a different offer, usually less favourable in terms of product or price. A well-known example of geo-blocking was the sale of admission tickets by Disneyland. The Paris amusement park redirected customers from Germany or Italy to, respectively, the German or Italian version of the website, where the prices of the admission tickets were even as much as 15% higher than the prices of the same tickets offered to the French or Belgians (Disneyland Paris faces pricing probe, BBC News, 2015). In other situations, access to the online stores' website was not blocked or limited, but other discriminatory practices were applied. For example, online retailers used different payment terms, which often made it impossible for foreign customers to effectively place and process an order (Mystery shopping survey on territorial restrictions and geo-blocking, 2016).

Following surveys, open consultations and debates, the EU legislator has deemed geo-blocking practices as a threat to the possibility to fully benefit from the potential of the EU internal market (Analysis of part of the public consultation on geo-blocking, 2016) and decided to adopt Regulation (EU) 2018/302 of the European Parliament and of the Council of 28 February 2018 on addressing unjustified geo-blocking and other forms of discrimination based on customers' nationality, place of residence or place of establishment within the internal market ("the Geo-blocking Regulation"). The Geo-blocking Regulation applies from 3 December 2018 (Article 11(1)).

The scope of the geo-blocking practices was assessed in the surveys commissioned by the European Commission (Mystery shopping survey on territorial restrictions and geo-blocking, 2016 and Mystery Shopping Survey on territorial restrictions and geo-blocking, 2020). The prevalence of geo-blocking was measured on the basis of the indicator which was the success of purchase meaning that no geo-blocking practices prevented the mysterious shopper from purchasing the good or service. The initial survey carried out before the adoption of the Geo-blocking Regulation (in December 2015) showed that 64,9 % of the purchases on average were unsuccessful due to retailers using geo-blocking practices, whereas the most affected sectors were electrical household appliances, electronics and computer hardware, computer games and software. The results of the survey carried out in 2019 do not differ significantly from the initial ones: 64,4% of all purchase attempts did not end up successfully. That time, the three most affected sectors included electrical household appliances, electronic equipment and computer hardware as well as clothes and sports goods. The survey of

2019 did not cover computer games and software. The results of both surveys show that there is still a lot of room for improvement. The results of the surveys are presented in the table below.

Table 1. The success of purchase in different sectors

Year	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7
2015	62,3%	65,1%	37,5%	32,2%	33,7%	23,2%	13,8%
2019	67,5%	60,9%	38%	36,7%	31,2%	21,3%	15,5%
Change	↑	↓	↑	↑	↓	↓	↑

Sector 1: online reservations of offline leisure; Sector 2: travel services; Sector 3: books, magazines and newspapers; Sector 4: cosmetics and healthcare products; Sector 5: clothes and sports goods, Sector 6: electronic equipment and computer hardware; Sector 7: Electrical household appliances.
Source: Mystery Shopping Survey on territorial restrictions and geo-blocking, 2020

This paper discusses the current legal framework of the Geo-blocking Regulation, enforcement of the Regulation in chosen European countries (Poland and Germany), as well as recent developments relating to fighting geo-blocking practices and some changes to the Geo-blocking Regulation aimed at making it more effective.

Requirements of the Geo-blocking Regulation

With the entry into force of the provisions on the prohibition of geo-blocking, every customer in the European Economic Area (European Union, Norway, Iceland and Liechtenstein) has the right to expect that they will make purchases from any seller (called "trader" in the Geo-blocking Regulation) operating in the EEA under the same commercial conditions as local customer, located in the country of the trader's seat (Article 4(1) of the Geo-blocking Regulation). However, the prohibition against geo-blocking or discrimination on the basis of the customers' nationality, place of residence or place of establishment does not mean that the trader must deliver the goods to a country where it does not operate (Article 4(1)(a) of the Geo-blocking Regulation). Further, it does not mean that a trader is under an obligation to comply with non-contractual national legal requirements relating to the respective goods and services, as applicable in the customer's Member State, or to inform customers about such requirements (Article 4(3) of the Geo-blocking Regulation). Similarly, it does not mean that the trader, on the grounds of following the prohibitions alone, will be considered to be directing activities to the consumer's Member State, which is important for the determination of jurisdiction over consumer contracts (Article 1(6) of the Geo-blocking Regulation). Those explicit provisions dispel many doubts which rise among traders, and fall into a lawyer's day-to-day practice. The traders seeking legal advice, often express their concerns that they are not able to have their terms and conditions

analyzed under the consumer protection requirements of all EU countries and they want to know if the failure to do so involves a risk.

The obligation for the traders to apply non-discriminatory access conditions to goods and services means in practice that they cannot use technological solutions that would deny or limit access to their websites to users from another EU country (Article 3(1) of the Geo-blocking Regulation). Technological solutions that prevent access to websites or mobile applications interface may, in particular, include determining the customer's physical location and monitoring the same using the IP address or coordinates obtained via the global satellite navigation system (Geo-blocking Regulation, Recital 18 of the Preamble).

Also, traders may not automatically redirect their visitors to a version of their website different from the one the visitors were originally trying to access, unless the visitor, or customer, expressly consents to such a redirection. Even if the customers have consented to being redirected, the version of the trader's web interface that the customer initially tried to access must remain readily available to them (Article 3(2) of the Geo-blocking Regulation).

The prohibition on the application of different terms and conditions also concerns the terms of payment transactions made by customers from other Member States, provided that (a) the payment transaction is made through an electronic transaction by credit transfer, direct debit or a card-based payment instrument within the same payment brand and category; (b) authentication requirements are fulfilled; and (c) the payment transactions are in a currency that the trader accepts (Article 5(1) of the Geo-Blocking Regulation). The prohibition, however, does not prevent the trader from requesting charges for the use of a card-based payment instrument, provided that such charges have been introduced in the law of the Member State to which the trader's operation is subject, and the charges do not exceed the direct costs borne by the trader for the use of the payment instrument (Article 5(3) of the Geo-blocking Regulation).

The prohibition to geo-block is not absolute. It does not apply to justified practices but the Geo-blocking Regulation does not clearly define when geo-blocking practices may be justified which raises concerns described later while discussing the areas for the improvement. Furter, the Regulation contains exceptions with respect to the goods and services covered by it, as it does not apply to services related to copyright protected content or works in an intangible form (e.g. streaming music or e-books) (Article 4(1)(b)), or to services indicated in Article(2)(2) of Directive 2001/29/EC i.e. financial, audio-visual, transport, health and social services (Article 1(3) of the Geo-blocking Regulation) which is also often a source of controversy.

Enforcement of the Geo-blocking Regulation in Poland and Germany, recent developments on the EU-level

The above-described requirements of the Geo-blocking Regulation are directly applicable in all EU Member States, without the need to implement them. However, in accordance with the Geo-blocking Directive, Member States must take actions to ensure

an effective enforcement of the provisions of the Geo-blocking Regulation. Pursuant to Article 7, Member States have to designate a body or bodies responsible for an adequate and effective enforcement of the Regulation, and to lay down and implement the rules setting out measures triggered upon infringement of provisions of the Regulation. Further, Member States have to designate a body or bodies responsible for providing practical assistance to consumers in the case of a dispute between a consumer and a trader arising from the application of the Regulation (Article 8 of the Geo-blocking Regulation).

In Poland, the effective enforcement of the Geo-blocking Regulation is ensured by provisions added to the Act of 16 February 2008 on Competition and Consumer Protection, which entered into force on 17 September 2019. Pursuant to Article 29 sec. 2a thereof, the President of the Office for Competition and Consumer Protection is responsible for the enforcement of the Geo-blocking Regulation. The infringement of the prohibition against geo-blocking or discrimination based on a geographical location may constitute an infringement of collective consumer interests within the meaning of Article 24 of the Act on Competition and Consumer Protection. In case of infringement of collective consumer interests, the Office may initiate proceedings and impose financial penalties of up to 10% of the company's previous year's turnover. The infringement of the aforementioned prohibitions may also restrict competition, and a such become subject to the anti-trust proceedings, which may in turn result in the President of the Office imposing the same financial penalty. The contact point for the out-of-court resolution of consumer disputes and the online consumer dispute resolution system operating at the President of the Office also performs the tasks referred to in Article 8 of Regulation 2018/302 (Article 32a sec. 2a of the Act). No decisions of the President of the Office concerning geo-blocking were found in the search engine available on the Website of the Office for Competition and Consumer Protection, and there is no public information concerning such decisions, either.

Unlike in Poland, the German enforcement body, within the meaning of Article 7 of the Geo-blocking Regulation, is Bundesnetzagentur (Federal Network Agency), a regulatory authority in the field of telecommunications, digitalization, electricity and gas, post and rail (Website of Federal Network Agency, § 116 of the German Telecommunications Law). The Telecommunications Law provides that the Federal Network Agency may impose a financial penalty of up to EUR 300,000 on traders infringing the prohibitions laid down in the Geo-blocking Regulation (§ 149 sec. 1d and sec. 2(3) of the German Telecommunications Law), which in many cases will be significantly lower than the maximum penalty provided for under Polish law (up to 10% of the company's previous year's turnover). In accordance with the information of the President of the Federal Network Agency of 3 February 2020, many complaints about geo-blocking received by the Federal Network Agency involved orders for electrical appliances, clothing, and e-books. However, consumers also encounter difficulties with cross-border orders in other areas, for example in the automotive trade, sports equipment trade, cosmetics, tobacco products, food, amusement parks or web hosting. A good half of the complaints came from German customers, approximately a third came

from other EU customers, with the rest being lodged by customers outside of the EU. Eight of those cases required administrative assistance from a foreign geo-blocking authority. Two thirds of the justified complaints has already been closed. Numerous cases have been resolved in cooperation with the providers and a legally compliant solution was often promptly found without the Federal Network Agency having to take further measures (Federal Network Agency supports consumers with cross-border purchases within the EU, 2020). No publicly available information has been found regarding Federal Network Agency decisions imposing financial penalties.

In January 2021, the European Commission fined Valve, owner of the online PC gaming platform "Steam", and five publishers: Bandai Namco, Capcom, Focus Home, Koch Media and ZeniMax with EUR 7.8 million for geo-blocking practices. Within the anti-trust proceedings, it was found that Valve and the publishers restricted cross-border sales of certain PC video games based on geographical location of users within the European Economic Area. The geo-blocking practices took form of agreements and/or concerted practices between Valve and each of the five PC video game publishers which prevented some of the video games from being activated outside certain EU countries (including Poland), as well as licensing or distribution agreements concluded bilaterally between some video game publishers and some of their respective PC video games distributors in the EEA (other than Valve), the agreements containing clauses which restricted cross-border (passive) sales of some PC video games within some EEA countries (Antitrust: Commission fines Valve and five publishers of PC video games, 2021). All the decisions were issued as part of antitrust proceedings held pursuant to Article 101 of the Treaty on the Functioning of the European Union, and Article 53 of the Agreement on the European Economic Area prohibits agreements between companies that prevent, restrict or distort competition within the European Single Market. No actions against the platform owner and publishers could have been taken on the basis of the Geo-blocking Regulation, as the provisions of the Regulation do not affect the rules applicable in the field of copyright and neighbouring rights.

Some areas for the improvement of the Geo-blocking Regulation

The Geo-blocking Regulation provides for a review of the provisions of the Regulation by 23 March 2020 and every five years thereafter, which should help adjusting the provisions to the current shape of and situation on the e-commerce market. While reviewing the Regulation, the European Commission takes into account the overall impact of the Regulation on the internal market and cross-border e-commerce, including but not limited to the potential additional administrative and financial burden for traders that could stem from the existence of different applicable regulatory consumer contract law regimes. That report may be a starting point for a proposal for an amendment of the Regulation (Article 9 of the Geo-blocking Regulation).

In its first report published on 30 November 2020, the Commission identified positive aspects of the implementation, such as a decrease in the number of cases of

blocking access to or re-routing customers to other websites, as well as good consumer awareness and certain initial positive effects. On the other hand, there have been significant delays in the empowerment of enforcement bodies by most Member States. The Commission dedicated an extensive section of its report to broadening the scope of the Geo-blocking Regulation over copyright-protected content online (Report on the First Short-Term Review of the Geo-blocking Regulation, 2020). Currently, the Geo-blocking Regulation excludes from its scope two main categories of content purchased online: audio-visual content, such as access to broadcasts of sports events provided on the basis of exclusive territorial licenses, and any copyright protected content. The above exclusions from the scope of application of the Geo-blocking Regulation significantly decrease its impact on the internal market. However, in its Report of 30 November 2020, the Commission points out that the extension of the Regulation in the above scope may result in a rise in prices, and that therefore the decision on the extension should be preceded by the assessment of implications for the overall ecosystem and welfare of the sector. Such assessment should take into account the significant impact of Covid-19 pandemic, including the common transition to cyberspace and opportunities the pandemic created for the traders (Gryszczynska & Szpor, 2020). The next assessment round to be held in the form of dialogue with the stakeholders has been planned for 2022 (Report on the First Short-Term Review of the Geo-blocking Regulation, 2020).

Other areas for improvement of the Geo-blocking Regulation could include specifying the justified cases of geo-blocking, as well as unifying the rules of enforcement of the Geo-blocking Regulation by the Member States. It is essential for the application of the Regulation to define the difference between legitimate and unjustified geo-blocking. Unjustified geo-blocking means that customers are differentiated based on their location in a discriminatory manner. The Geo-blocking Regulation prohibits unjustified geo-blocking practices as treatment of customers should only be based on objective and justified reasons. While the reasons why geo-blocking should be considered unjustified are clearly set out in Articles 3, 4 and 5 of the Geo-blocking Regulation, the situation is more opaque with regard to justified geo-blocking, as the Geo-blocking Regulation does not contain a catalogue of all exceptions that can be considered legitimate reasons for the use of geo-blocking. There are some hints in the preamble to the Geo-blocking Regulation. Admittedly, Recital 2 of the Preamble thereto provides a few examples of the reasons why microenterprises and small and medium-sized enterprises may have different general conditions of access, e.g. divergent regulatory environment, legal uncertainty, risks related to the consumer protection or labelling rules, taxation and fiscal issues, delivery costs or foreign language. Nevertheless, the hints are rather general in nature and they do not give much assistance in the construction of the provisions of the Geo-blocking Regulation (Zoboli, 2019). It seems that guidelines similar to those used in the area of competition law, such as the Commission's Guidelines on Vertical Restraints, would shed more light on situations where geo-blocking and other discriminatory actions could be justified.

Further, the Geo-blocking Regulation leaves it up to Member States to choose how to enforce it, i.e. by laying down rules to set out measures applicable to the infringements of the provisions of the Regulation and designating a body or bodies responsible for adequate and effective enforcement of the same (Art. 7 of the Geo-blocking Regulation). The current state of affairs resulted in Poland and Germany taking different approach to that enforcement and introducing completely different range of financial penalties for the infringement of prohibitions to geo-block or to discriminate (Rothermel & Schulz, 2019). It seems that this effect is to a large extent inconsistent with the internal market, the smooth functioning of which served as a driving force to adopt the Geo-blocking Regulation. The Commission noted the large variation of applicable fines across Member States and the considerable spectrum between the minimum and maximum fines has been in its Report of 30 November 2021, and identified that as requiring further evaluation.

Conclusions

The Geo-blocking Regulation was adopted as a result of many surveys, open consultations and debates. After three years, some positive aspects of the Geo-blocking Regulation have been identified but the decrease in geo-blocking practices is still not satisfactory. Therefore, the scope of the Geo-blocking Regulation should be reviewed and changed to ensure better effectiveness. While carrying out the required review of the Geo-blocking Regulation in 2020, the Commission took a cautious position, indicating, inter alia, the still unknown impact of the Covid-19 epidemic on the broadly understood e-commerce sector, and expressing the need for further assessment. It is possible that, as a result of the next review, the Geo-blocking Regulation will be amended to the extent discussed in this paper.

References

Act of 16 February 2008 on Competition and Consumers Protection. Dz. U. Journal of Laws of 2007, No. 50, item 331.

Agreement on the European Economic Area, OJ L 1, 3.1.1994, pp. 3–522.

Analysis of part of the public consultation on geo-blocking. Final report. A study prepared for the European Commission, DG Communications Networks, Content & Technology by the College of Europe. 2016. https://op.europa.eu/en/publication-detail/-/publication/26a252ad-36fc-11e7-a08e-01aa75ed71a1/language-en/format-PDF/source-240462342 [access: 6.11.2021].

Antitrust: Commission fines Valve and five publishers of PC video games € 7.8 million for “geo-blocking” practices, press release 20.01.2021. https://ec.europa.eu/commission/presscorner/detail/en/ip_21_170 [access: 6.11.2021].

Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society, OJ L 167, of 22.06.2001, pp. 10–19.

Disneyland Paris faces pricing probe, BBC News, 28.07.2015, https://www.bbc.com/news/business-33697945 [access: 5.11.2021]

Federal Network Agency supports consumers with cross-border purchases within the EU. 2020. https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2020/20200203_Geoblocking.html [access: 6.11.2021].

German Telecommunications Law of 22 June 2004, (BGBl. I S. 1190), https://www.gesetze-im-internet.de/tkg_2004/ [access: 6.11.2021].

Commission Notice. Guidelines on Vertical Restraints, SEC(2010) 411, https://ec.europa.eu/competition/antitrust/legislation/guidelines_vertical_en.pdf [access: 6.11.2021].

Commission staff working document. Geo-blocking practices in e-commerce. Issues paper presenting initial findings of the e-commerce sector inquiry conducted by the Directorate-General for Competition. 18.3.2016 SWD(2016) 70 final. https://ec.europa.eu/competition/antitrust/ecommerce_swd_en.pdf. [access: 6.11.2021].

Gryszczyńska A., Szpor G. (2020). Internet, Cyberpandemia, Cyberpandemic, C.H. Beck, Warsaw.

Mystery shopping survey on territorial restrictions and geo-blocking in the European Digital Single Market. Final Report, 2016. https://op.europa.eu/en/publication-detail/-/publication/2f45c29f-c35b-11e6-a6db-01aa75ed71a1/language-en/format-PDF/source-search [access: 5.11.2021].

Mystery Shopping Survey on territorial restrictions and geo-blocking in the European Digital Single Market. Final Report, June 2020, https://op.europa.eu/en/publication-detail/-/publication/878458a4-2308-11eb-b57e-01aa75ed71a1/language-en [access: 5.11.2021].

Regulation (EU) 2017/1128 of the European Parliament and of the Council of 14 June 2017 on cross-border portability of online content services in the internal market, OJ L 168, 30.6.2017, pp. 1–11.

Regulation (EU) 2018/302 of the European Parliament and of the Council of 28 February 2018 on addressing unjustified geo-blocking and other forms of discrimination based on customers' nationality, place of residence or place of establishment within the internal market and amending Regulations (EC) No 2006/2004 and (EU) 2017/2394 and Directive 2009/22/EC, OJ L 60l of 2.03.2018, pp. 1–15.

Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the first short-term review of the Geo-blocking Regulation of 30.11.2020, COM(2020) 766 final. https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2020/0766/COM_COM(2020)0766_EN.pdf [access: 06.11.2021].

Rothermel M., Schulz W. (2019), One Year After – Geoblocking-Verordnung: Fragen und Schnittstellen (One Year After – Geoblocking Regulation: Questions and Interfaces), Kommunikation und Recht, June 2019, pp. 361–432.

Treaty on the Functioning of the European Union (TFEU), OJ C 326, 26.10.2012, pp. 47–390.

Website of Federal Network Agency. https://www.bundesnetzagentur.de/EN/Home/home_node.html;jsessionid=8360204F66B4CD29DC0A025F45A62648 [access: 6.11.2021].

Website of the Office for Competition and Consumer Protection. https://decyzje.uokik.gov.pl/bp/dec_prez.nsf [access: 6.11.2021].

Zoboli L. (2019). Unijne rozporządzenie w sprawie blokowania geograficznego – wiele hałasu o nic? (*EU Geo-blocking Regulation – Much Ado About Nothing?*). Internetowy Kwartalnik Antymonopolowy i Regulacyjny, no. 2(8), www.ikar.wz.uw.edu.pl, DOI: 10.7172/2299-5749.IKAR.2.8.1, pp. 8–18 [access: 6.11.2021].

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'THE SKY IS NOT THE LIMIT' – GIS ANALYSIS OF SENTINEL-2 IMAGERY FOR HERITAGE PROTECTION AND MANAGEMENT

Abstract: This article aims to demonstrate the potential of Sentinel-2 and GIS for heritage monitoring, protection and management. Applications of remote sensing in heritage strategies have been explored for decades. However, new possibilities were opened up with the launch of the European Union's Earth Observation Programme Copernicus. Systematic and frequent global coverage of land surface offered by one of its products – Sentinel-2, provides an almost instant insight into sudden events and long-term processes that affect heritage around the world. Following new developments in remote sensing, GIS provides tools to integrate data for their effective processing, analysis, interpretation and dissemination of results. We will explore the potential and limitations of those datasets and tools using UNESCO World Heritage sites from Sudan as case studies. In particular, we will tackle issues related to interpretation of changes around heritage sites, attempt to estimate their recent conditions and identify existing and/ or potential threats.

Keywords: GIS, archaeological heritage protection, satellite imagery, Sentinel-2, UNESCO sites

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Introduction

There can be little doubt that archaeological heritage is undergoing dynamic processes that can be observed in different parts of the world. Natural hazards and cultural phenomena pose serious threats to the preservation and integrity of that heritage. Moreover, the rapidity of those changes requires frequent observations to monitor negative tendencies and develop effective strategies for their protection. Remote sensing has been long recognised as a powerful tool in heritage protection and management (e.g. Beck et al., 2007; Lasaponara & Masini, 2008; Cowley, 2011). Its growing importance in the last decade is reflected in publications by leading specialists in archaeological remote sensing that demonstrate broad ranges of applications and also open up new directions (Tapete, 2018a; Verhoeven et al., 2021). Among many factors, its increasing role is attributed to the technological development of sensors for data capture and the accessibility of new remote sensing and Earth Observation data (Tapete, 2018b). The European Union's programme Copernicus is one of a number of recent advances in the field of Earth Observation Programmes. According to the European Space Agency (ESA), it aims to provide timely and quality information, ensuring autonomous and independent access to reliable information around the globe (Martimort et al., 2007). Moreover, the high frequency of image acquisition from Sentinel missions offers an almost instant insight into sudden events: their development, extent, effects and aftermath. Therefore, it seems a ready-made solution to challenges in heritage strategies that are posed by global changes. However, its potential has not yet been adequately explored. As noted elsewhere, there is a noticeable preference for very high resolution (VHR) optical imagery that are mainly obtained from commercial providers (Tapete, 2018b). Applications of Copernicus products in archaeological studies still seem to be rare (see Tapete & Cigna, 2018; Abate et al., 2020). We will attempt to address this gap by exploring the potential of the optical dataset provided by Sentinel-2.

In pursuit of an autonomous heritage monitoring system

Initially, the idea behind the assessment of Sentinel-2 for heritage monitoring was relatively straightforward. We attempted to select a few well-documented archaeological sites that were recently reported as being affected either by natural or cultural threats. Using established methods of satellite data processing or an approach to available data characterized as “beg, borrow and steal” to use a phrase from Cowley et al. (2021), we aimed to estimate the impact of such events on archaeological structures. We assumed that starting from known, well-recognized and documented cases will help establish potential and limitations of Sentinel-2 dataset. Obvious candidates for such analysis are UNESCO World Heritage sites. According to UNESCO policy, party States are obliged to regularly report on the state of conservation of World Heritage properties which allows to assess the conditions of those sites. Thousands of reports and decisions taken by the World Heritage Committee since 1979 have been published as a part of the State of Conservation (SOC) Information System, which is, according to UNESCO, “one of

the most comprehensive monitoring systems of any international convention" (https://whc.unesco.org/en/soc/). Those reports were also used in statistical analysis of the state of conservation of World Heritage properties between 1979-2013 which is to date probably the most comprehensive overview of factors affecting cultural and natural heritage around the world (Veillon, 2014).

However, while browsing through statistical analysis at the SOC, one cannot overlook an interesting gap in the number of properties examined and reported each year. There are no reports for 2020 although in 2019 and 2021 a considerable number of properties was examined (166 and 255 respectively) (Fig. 1).

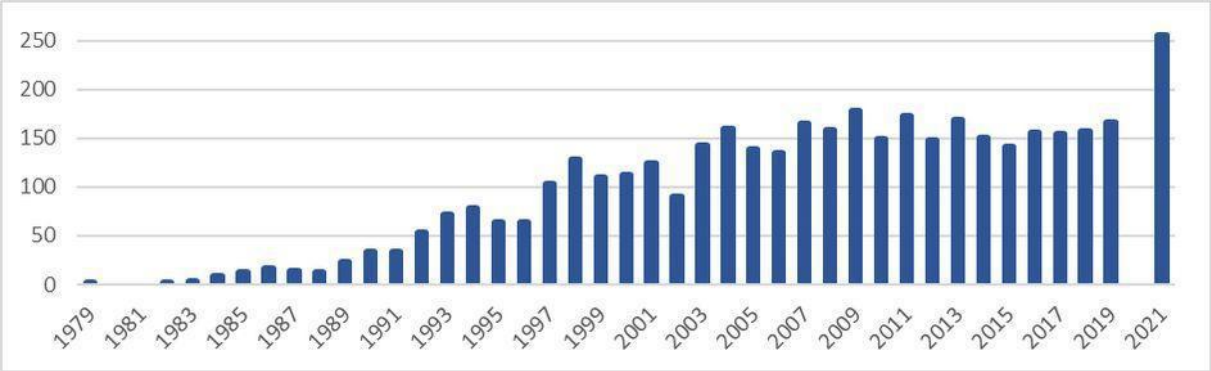

Fig. 1. Graph showing the number of UNESCO properties examined each year to assess the conditions at the sites
Source: State of Conservation System

Bearing in mind the present global situation, it is impossible to assume that 2020 was unusually heritage-friendly. On the contrary, recurring threats at numerous UNESCO sites were reported in various media. UNESCO also expressed its concern about their effect on World Heritage (see below). We can only conclude that the COVID-19 epidemic also affected heritage management. Whether it disrupted the monitoring system at its core or just reports publication and availability in SOC is another question which goes beyond the scope of this paper. In general terms, we face the situation where reliable reports from official bodies responsible for heritage management are unavailable, no other information exist and/ or alarming news about damage to heritage sites are circulated via newspapers or social media. Thus, this apparent reporting breakdown provides an interesting opportunity to test ESA'a mission claims to 'ensure autonomous, independent and reliable information' also for those well-monitored sites, despite current on-ground restrictions.

Materials and methods

Criteria. Sentinel-2 routinely generates information that is used to support a range of services such as risk management (e.g. floods and forest fires), natural hazards and global climate change monitoring, urban mapping, evaluation of land use/ land cover state and land use change (Martimort et al., 2007; Drusch et al., 2012). In UNESCO classifications those occurrences are categorized as the following threats to heritage:

buildings and development, climate change and severe weather events, transportation infrastructure, etc. (Veillon, 2014). We were also seeking categories of threats that would allow us to explore Sentinel-2's spatial, temporal and spectral resolution. These three basic characteristics are regarded as its major advantage, especially in comparison with other Earth Observation Programmes. Specifically Sentinel-2 is identified as providing "an unprecedented combination of systematic global coverage of land surfaces, a high revisit of five days (…), and a wide field of view for multispectral observations from 13 bands in the visible, near infra-red and short wave infra-red part of the electromagnetic spectrum" (Drusch et al., 2012) (Fig. 2).

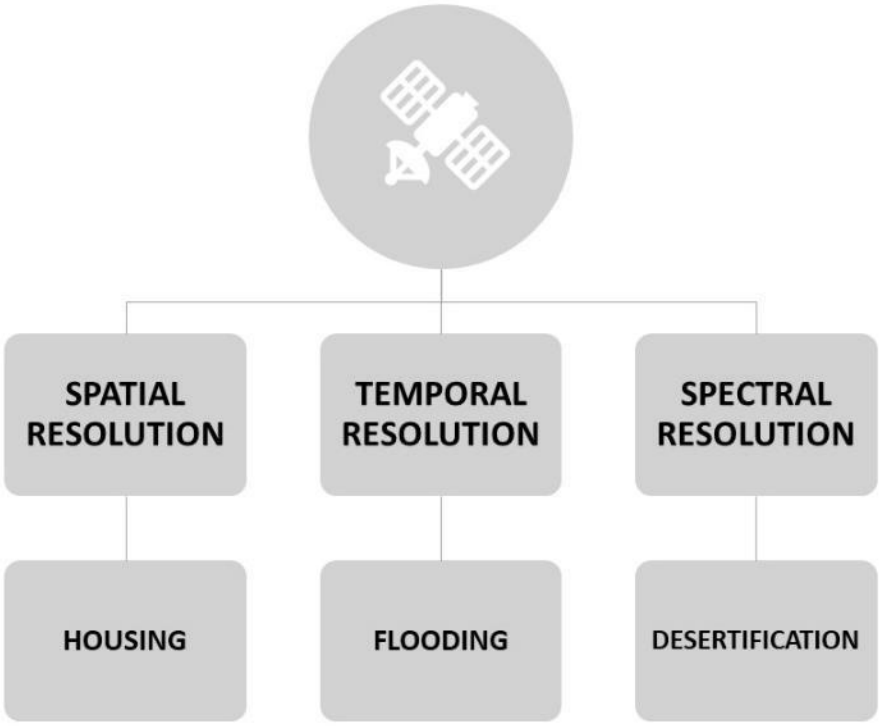

Fig. 2. The main characteristics of Sentinel-2 data and the specific threats they were applied to in our case studies
Source: own work

Case studies. Based on the above criteria, two World Heritage Sites were selected: Gebel Barkal and the Sites of the Napatan Region (inscribed in 2003) and Archaeological Sites of the Island of Meroe (inscribed in 2011). Both sites are located in Sudan, Northern states, province of Meroe (Fig. 3).

Gebel Barkal and the Sites of the Napatan Region is a complex of five sites. Gebel Barkal, Kurru, Nuri, Sanam and Zuma extend over more than 60 km on both sides of the Nile in an arid area considered part of Nubia (https://whc.unesco.org/en/list/1073/). Archaeological Sites of the Island of Meroe consists of three sites, comprising Meroe (which includes the town and cemetery site), which is situated in a riverine landscape, and two associated settlements and religious centres at Musawwarat es-Sufra and Naqa, which are located in a semi-desert landscape between the Nile and Atbara rivers (https://whc.unesco.org/en/list/1336/).

Fig. 3. Location of Gebel Barkal and the Sites of the Napatan Region and Archaeological Sites of the Island of Meroe (image ©Microsoft Corporation)
Source: own work

In the last decade the Gebel Barkal complex has been repeatedly, albeit inconsistently, reported as exposed to multiple threats. SOC contains eight reports published between 2010-2021 (https://whc.unesco.org/en/soc/4074) that indicate eight different factors that fall within four threat categories defined by UNESCO (Veillon, 2014). Contrary to this, no reports could be found for Meroe. However, in September 2020 a devastating flood that was threatening this site was reported in the media (Reuters Staff, 2020). Accordingly, UNESCO expressed its concern about the latest floods in Sudan (UNESCO, 2020) (Fig. 4).

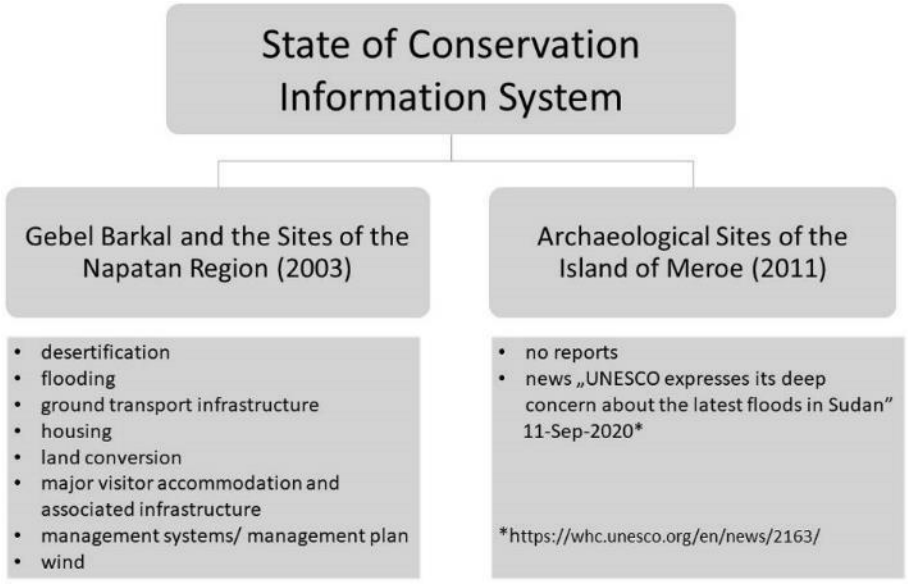

Fig. 4. SOC-based analysis of threats reported to Gebel Barkal and Meroe complexes
Source: own work based on State of Conservation Information System

Methods. The overall approach to developing a remote monitoring method is composed of following steps: a) data preparation; b) classification and map production; c) analysis; d) interpretation of the results. Only the first step of preparing archaeological information for further work in GIS environment and acquisition of relevant Sentinel dataset was identical for all three cases. Maps showing property boundaries for individual sites were downloaded from the UNESCO website, georeferenced and polygonised using ArcGIS Pro software. Sentinel-2 L1C satellite imagery was downloaded from the Copernicus Open Access Hub (https://scihub.copernicus.eu) using the "Semi-Automatic Classification Plugin" (SCP) in QGIS. All images were clipped to the study area using the QGIS raster tool "Clip raster by mask layer". QGIS and ArcGIS Pro were used for further data processing and analysis. No comparison between the efficiency of these two GIS software packages was attempted although a preference was given to QGIS as it is open source. At later stages different methods were applied for data processing and analysis and will be presented for each case individually.

Spatial resolution. Only visual comparison of RGB composites for Landsat-8 and Sentinel-2 was carried out in this small study area.

Temporal resolution. Flooding analysis was carried out for images obtained between 5th August 2020 to 29th October 2020. Only cloud-free scenes over the study area were selected. At the first stage Normalised Difference Vegetation Index (NDVI) was used to identify flooded areas. It was calculated for each image using near-infrared and red band by the given equation:

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

where NIR represents near infrared band (B8) of Sentinel-2 image and RED represents red band (B4).

NDVI values range from -1 to +1 where negative values or close to 0 (0-0,2) correspond to water or soil, whereas higher values (>0,2) correspond to vegetation (Abate et al., 2020).

Resulting images were combined into an animation which shows flood dynamics in the observed period against the location of major structures that were reported as threatened by high water level.

To verify observations based on the flood animation, a flood risk map was prepared using slope, hydrology and land cover factors for the observed area. The map was prepared in ArcGIS Pro software following workflow that is presented in Fig. 5.

Hydrology was derived from a Digital Elevation Model (DEM) provided by the United States Geological Survey (USGS) and calculated using the "Euclidean Distance" tool. Slope was derived from the DEM using the "Slope" tool. Land Cover and land use data can be accessed freely from ESRI using their application which provides access to the full 10-meter resolution GeoTIFF scenes for all land masses on the planet (Esri, 2020). The "Reclassify" tool was used to reclassify each layer used in analysis into five classes of flood risk from very low to very high. Finally, the "Weighted overlay" tool was

used to create a final product of the flood risk map for the observed area (Fig. 13). In a "Weighted overlay analysis" values allocated to each of the factors in order of relevance were as follows: slope: 30; hydrology: 40; and land cover: 30.

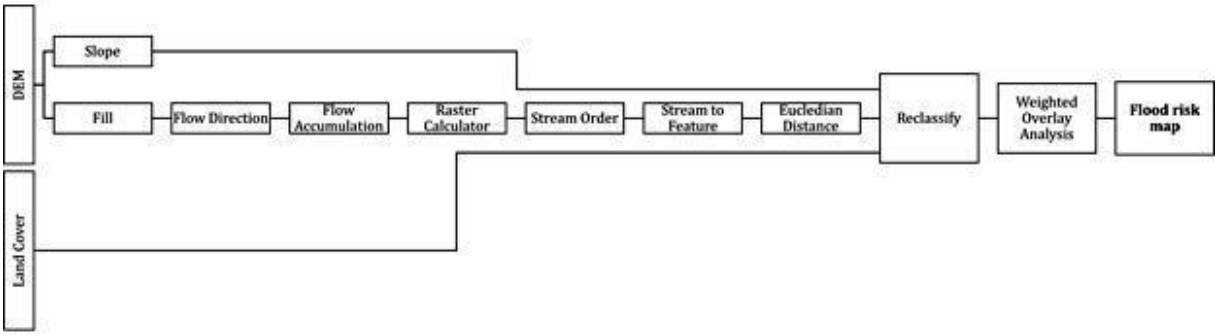

Fig. 5. Workflow for flood risk map
Source: own work

Spectral resolution. Remote sensing data were used for monitoring and assessment of desertification during the past three decades and several different analytical methods have been developed. Ground-truthing of those methods demonstrated that a "simple, robust, powerful, and easy to use for the (…) fragile arid and semiarid lands" method provided an overall accuracy around 93% (Lamqadem et al., 2018). Our choice of method was determined by a combination of four factors: relevance for semiarid areas; high accuracy of results; methodology developed specifically for Sentinel-2 imagery; and simplicity of proposed tools. Initially, the approach proposed by Lamqadem et al. (2018) was adopted. However, in due course some modifications of the original method were also proposed.

Following the original workflow, cloud-free scenes in summer (July) were selected. According to Lamqadem et al. (2018), desertification is most accurately assessed during the period when natural and annual vegetation is minimal. This approach avoids confusion with seasonal vegetation. Using the "Semi-Automatic Classification Plugin" (SCP) in QGIS3, all 13 bands of Sentinel-2 L1C data was downloaded, followed by preprocessing for atmospheric correction. At the next stage Tasselled Cap Transformation (TCT) was performed using QGIS 3's Raster Calculator.

TCT tool is used for landscaping, environmental threat mapping, estimating biomass, agricultural studies and identifying areas that exhibit desertification. It is an orthogonal transformation for the reduction of interpretability of the multispectral image to return three thematic indices: (1) brightness (TCB), which is sensitive to soil backgrounds and bright soils; (2) greenness (TCG), which is used to discriminate vegetation coverage; and (3) wetness (TCW), which provides information about water and soil moisture and vegetation conditions (Lamqadem et al., 2018).

Performing TCT requires 1) an input satellite image and 2) a set of transformation coefficients specific to the sensor that acquired the image. Transformation coefficients can be defined to work with either radiance or reflectance, and it is important to know which the transformation coefficients have been defined for (and which your image is

using) (Tasseled-cap Transformation). Coefficients of transformation used in this study for the multispectral Sentinel-2 MSI to perform the TCT are given by Abate et al. (2020) and are shown in the following equations:

$$TCTb1 = 0.3037 * B2 + 0.2793 * B3 + 0.4743 * B4 + 0.5585 * B8 + 0.5082 * B10 + 0.1863 * B12$$

$$TCTw1 = 0.1509 * B2 + 0.1973 * B3 + 0.3279 * B4 + 0.3406 * B8 - 0.7112 * B11 - 0.4572 * B12$$

where B2, B3, B4, B8, B10, B11 and B12 represent different Sentinel-2 bands respectively: Blue, Green, Red, Near Infrared (NIR), Short Wave Infrared (SWIR) - Cirrus, SWIR and SWIR.

After obtaining TCB and TCW, the next step required their normalization. This was achieved using equations given by Lamqadem et al. (2018):

$$TCWnormalized = 100 * \frac{TCW - TCWmin}{TCWmin + TCWmax}$$

$$TCBnormalized = 100 * \frac{TCB - TCBmin}{TCBmin + TCBmax}$$

According to Lamqadem et al., the linear correlation aims to select the best combination that presents a highly negative correlation and good visualization of different land cover types. As they note "analysis showed a strong negative correlation between TCW and TCB (r = −0.812). TCW is highly correlated to the soil moisture and texture, which can give more information about the different types of soil. This result indicates that TCW decreases gradually with the increase in the desertification process, whereas TCB increases" (Lamqadem et al., 2018) (Fig. 6).

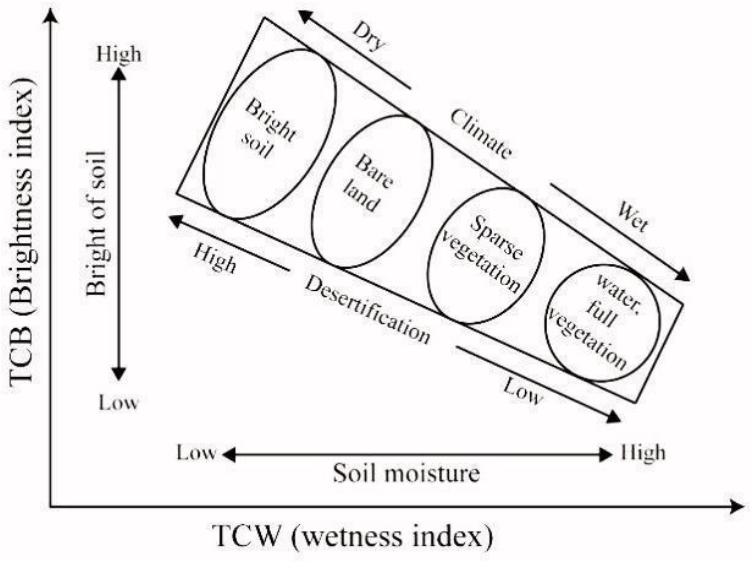

Fig. 6. TCW and TCB correlation
Source: Lamqadem et al., 2018

Using "r.regression.line" tool in QGIS3 parameters of regression equation between TCW and TCB were obtained, based on following equation: $TCB = a + b * TCW$ (Lamqadem et al., 2018). At the last stage, a Desertification Degree Index (DDI) was calculated using equation given by Lamqadem et al. (2018):

$$DDI = b \times TCWnorm - TCBnorm$$

Classification was also based on Lamqadem et al. (2018) (Table 1):

Table 1. The DDI values of different desertification classes

Desertification Class	DDI value
Non-desertification	> 64.95
Low	29.71 – 64.94
Moderate	3.79 – 29.70
Severe	-17.98 – 3.78
Extreme	< -17.99

Source: Lamqadem et al., 2018

Results and discussion

Housing. The spatial resolution of Sentinel-2 (10m GSD) provides greater detail than other Earth Observation satellites, such as Landsat (30m GSD). In some cases Landsat spatial resolution has proved adequate for documenting the changing extent of urbanization as demonstrated by comparative analysis of 2002 Landsat imagery and 1972 Corona images in the Middle Egypt which showed a 200 percent increase in urban extent in some areas (Parcack, 2009). This has led to irreversible landscape changes but the question remains, to what extent has urban sprawl also affected preservation of archaeological structures? An essential requirement for effective protection of World Heritage Sites is the delineation of boundaries which preserve the integrity of the property. Therefore, identification of general trends in urban development may be insufficient to estimate threats and/ or damage to sites. More detailed analysis should help identify instances of disturnbance with boundaries. One such instance is the Sanam site in the Gebel Barkal complex. At some point between 2003 and 2006, images in Google Earth (GE) show that the property's area was built over in north-east part and also cut by a road. We attempted to identify any further changes in Landsat and Sentinel images obtained in July 2021 (Fig. 7).

The Landsat image was sufficient to show general tendencies in urban development, including urban expansion into the north-east corner and a high density of buildings in western, southern and eastern areas adjacent to the property's boundary. However, its 30m spatial resolution, does not allow confident interpretation of the presence/absence of buildings within the area. On the other hand, the 10 m spatial resolution Sentinel provides sufficient detail to allow the identification of single house plots. It shows relationships between buildings and the site's boundary with sufficient precision to

eliminate false alarms – although buildings still seem to be pressing on the boundary. Despite apparent higher building density in the immediate vicinity of the site, no further sprawl into its area was noted.

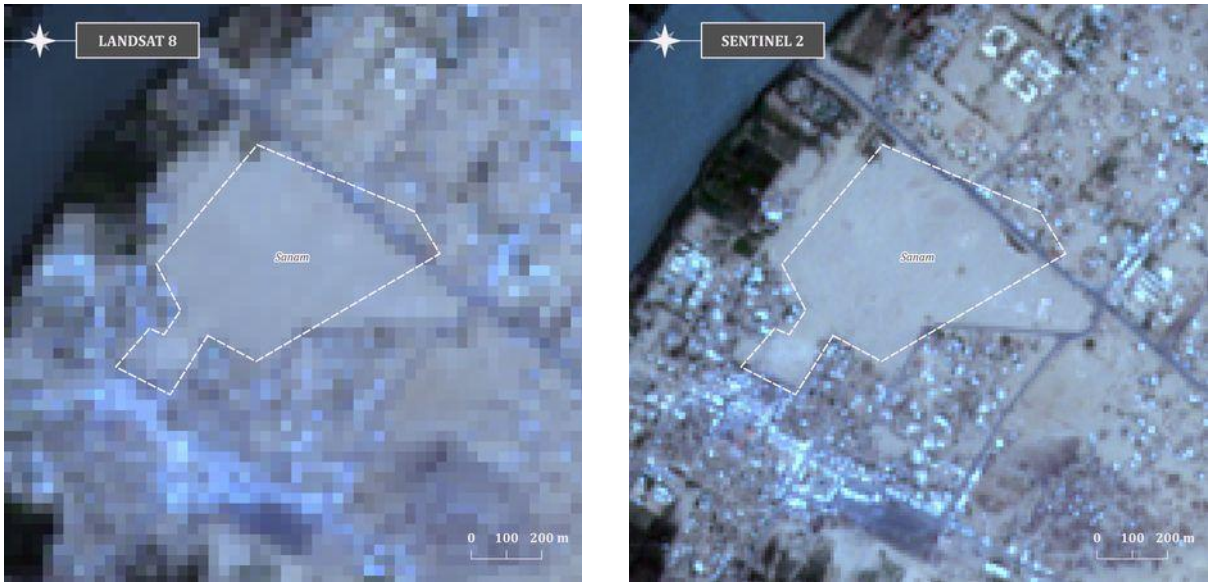

Fig. 7. A comparative analysis of Landsat-8 (left) and Sentinel-2 (right) spatial resolution for Sanam (image ©USGS, ESA, image acquisition: 19th July 2021)
Source: own work

However, Sentinel allowed us to identify the only instance of land cover change within the designated area. As early as 2017 some changes could be observed in the northern corner. A comparison with VHR images in GE demonstrated it to be developing vegetation (Fig. 8).

Fig. 8. A comparison of vegetation development into the designated area on Sentinel-2 images between 20th July 2017 and 19th July 2021 (image ©ESA)
Source: own work

Flooding. Two satellites of the Sentinel-2 constellation record the same area at frequent intervals and enable short-term changes to be observed. On 8th September 2020 Reuters published an article with the alarming headline of "Record floods threaten pyramid sites in Sudan" (Reuters Staff, 2020). Three days later a similar news item was released on the UNESCO website (UNESCO 2020). Both articles were reporting on the situations at the Meroe complex (Fig. 9) and at Nuri in the Gebel Barkal complex.

Fig. 9. Property boundaries of the Meroe complex and location of principal structures that were mentioned in press releases (image ©ESRI)
Source: own work

Some discrepancies between and within articles, concerning in particular parts of sites which were under immediate threat, were interesting enough to attempt flood development analysis and estimation of flood risk level for the Meroe complex. Nuri, where the threat was due to a rise in groundwater related to tombs which were buried 7-10 metres under pyramids (Reuters Staff 2020), was excluded from further analysis due to immense complexity of the case.

The Nile river flooding is a natural event that takes place every year from June to October (https://www.britannica.com/place/Nile-River/Climate-and-hydrology). However, floods in 2020 were reported as unusually severe and threatening archaeological structures on an unprecedent scale. We assumed that the crucial criterion for imagery selection was for temporal resolution that would permit the observation of changes at short intervals. We also aimed to obtain imagery within the date ranges of the news items from Reuters and UNESCO. Undoubtedly, with five days returns Sentinel has a considerable advantage over other Earth Observation datasets.

This approach provided images over the period from 20th August to 29th September 2020 when water was at its highest level and encroaching on the site's area (Fig. 10 – Fig. 12).

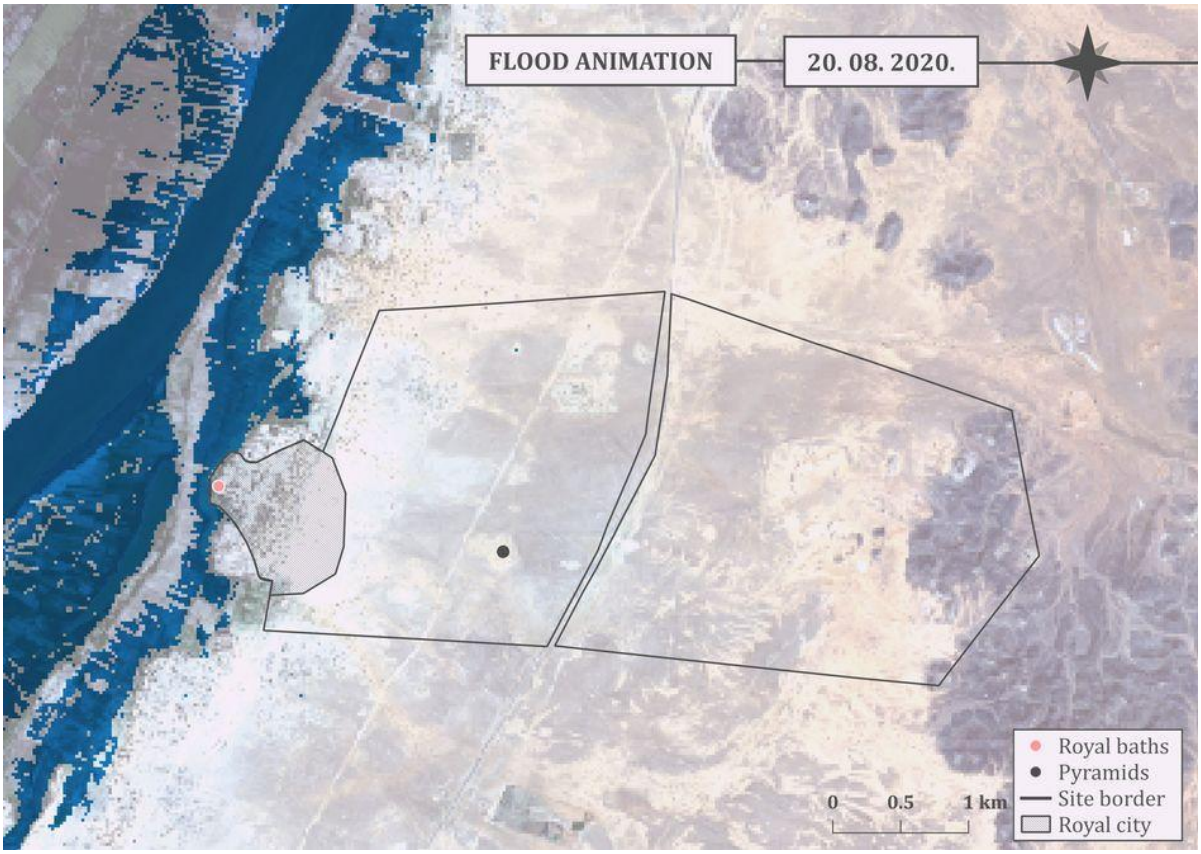

Fig. 10. NDVI analysis showing water level (blue) on 20th August 2020 (image ©ESA)
Source: own work

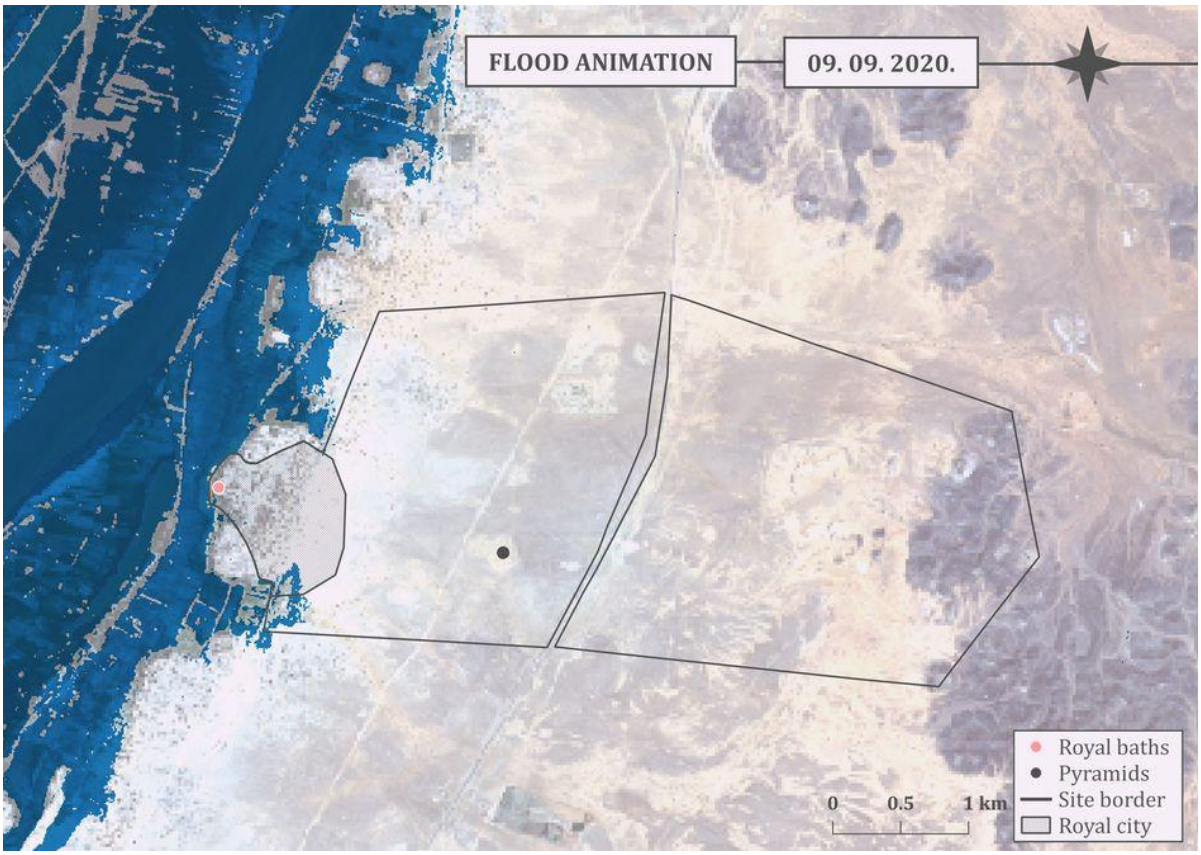

Fig. 11. NDVI analysis showing water level (blue) on 9th September 2020 (image ©ESA)
Source: own work

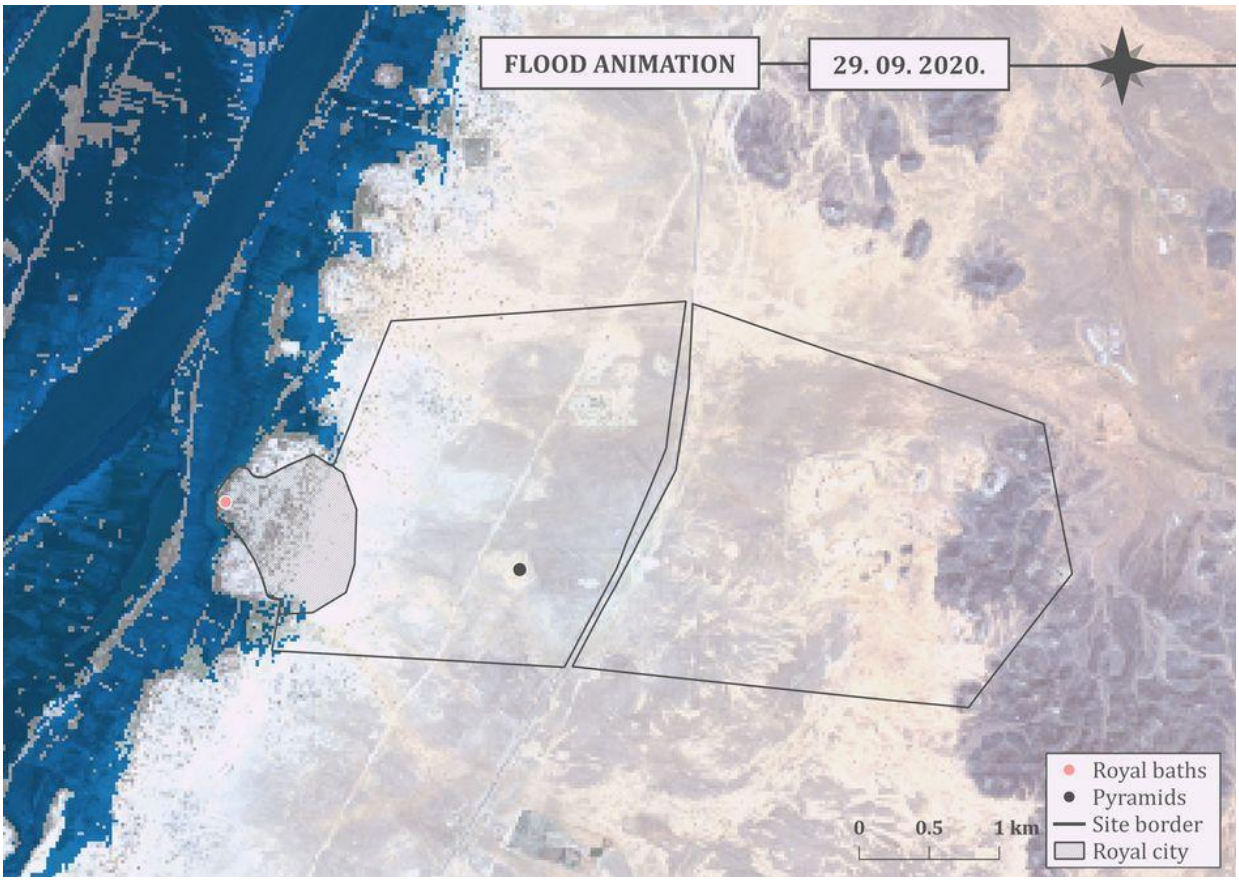

Fig. 12. NDVI analysis showing water level (blue) on 29th September 2020 (image ©ESA)
Source: own work

Two points from this analysis require emphasis. Firstly, observation of flood dynamics in areas that are regularly threatened gives useful early warnings for likely imminent flooding. The first flooding peak can be observed in the Sntinel-2 imagery in August (Fig. 10), though news was released by Reuters and UNESCO three weeks later (Reuters Staff 2020). Mere observation of flood development may give the advantage of early notification and offer more time for reaction. Secondly, it is worth noting that the southern part of the royal city was indeed flooded during this period (Fig. 11, Fig. 12). The royal baths that were reported at risk from being swamped, seem to be bordering on flooded area although they were not directly covered by water. However, the pyramids had not been at any danger from high water level.

The second point requires further consideration due to some confusion that was caused by imprecise description of endangered structures in the Reuters news. Therefore, this observation was verified against a flood risk map (Fig. 13).

A comparison of the flood risk map with the images showing the extent of the flooding between 20th August and 29th September 2020 (Fig 10 – 12) demonstrates that during the record floods in 2020 only zones of very high and high risk were flooded. Based on our analysis, nearly the entire site is under high or medium flood risk. However, different archaeological structures can be affected to various degrees by high water levels. The royal baths that were reported at risk from flooding, seem to be situated on land that is mostly medium risk and next to high flood risk area.

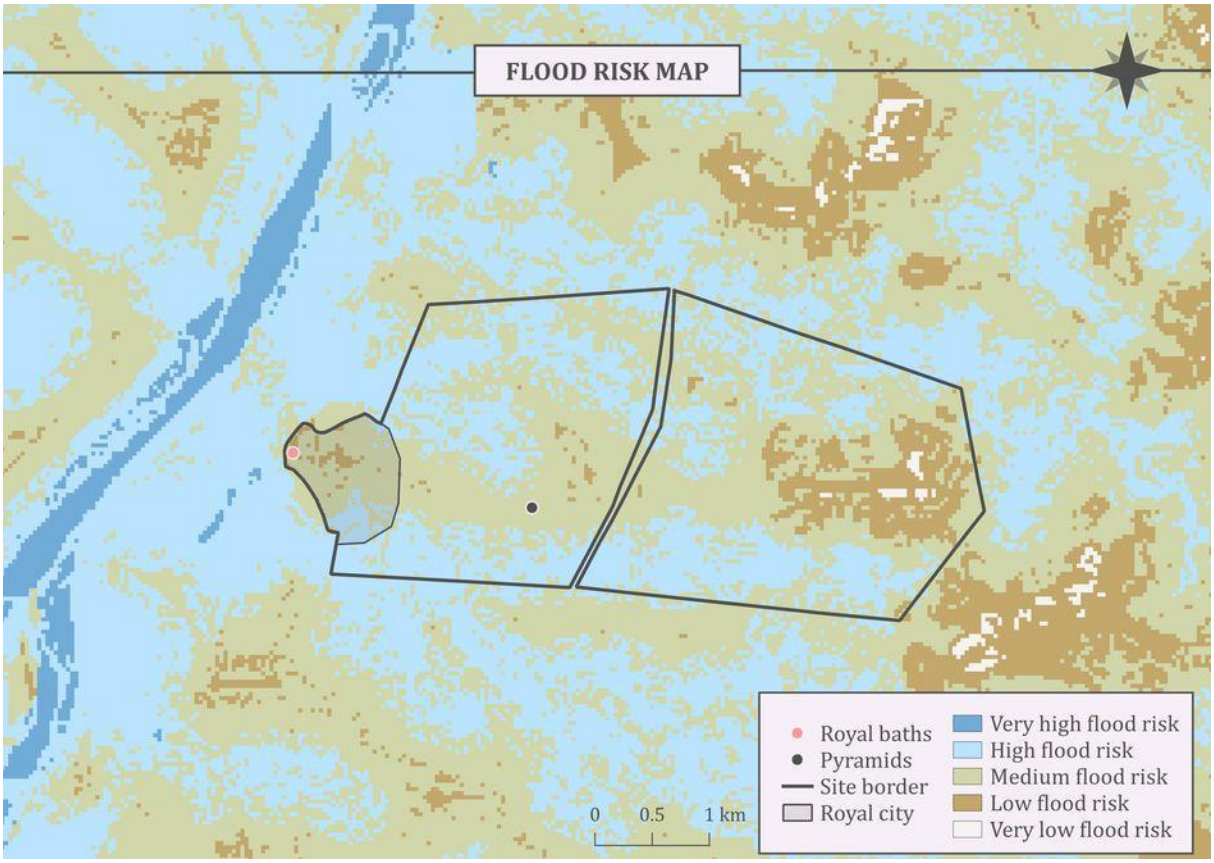

Fig. 13. Flood risk map for the Meroe complex (data ©USGS, ESRI)
Source: own work

The pyramids are situated in an area of medium flood risk which was not reached by water even at the flood peak. If this unusually severe flood could be used as a reference point to estimate the extent of the flooding threat to the Meroe complex then we can safely assume that pyramids are not under immediate threat. Probably more detailed studies are required (preferably with high-resolution DEM) to better understand the situation at the royal baths. Nonetheless, analysis of this type can help pinpoint areas that need closer monitoring and further actions to secure archaeological structures from recurring floods.

Desertification. The higher resolution of Sentinel-2's spectral bands may have a greater precision in the detection of edges of change than is possible at coarser resolution and so highlight slow-moving threats such as desertification. Generally speaking, desertification is defined as a form of land degradation in arid, semiarid and dry sub-humid regions caused by a combination of various factors, such as climatic variations and human activities (United Nations Convention to Combat Desertification 1994, after: Lamqadem et al., 2018). It is not the most frequently reported threat among World Heritage properties, with concerns noted at less than 30 sites (Veillon, 2014) (Fig. 14). Moreover, desertification has been reported as a threat mainly to cultural sites. This observation may be slightly surprising as desertification has been recognized in environmental sciences as a worldwide problem (Lamqadem et al., 2018). However, this threat has been regularly reported for the Gebel Barkal complex (Fig. 15) and it poses

a few interesting problems regarding correlation of results obtained by on-ground observations and remote sensing analysis.

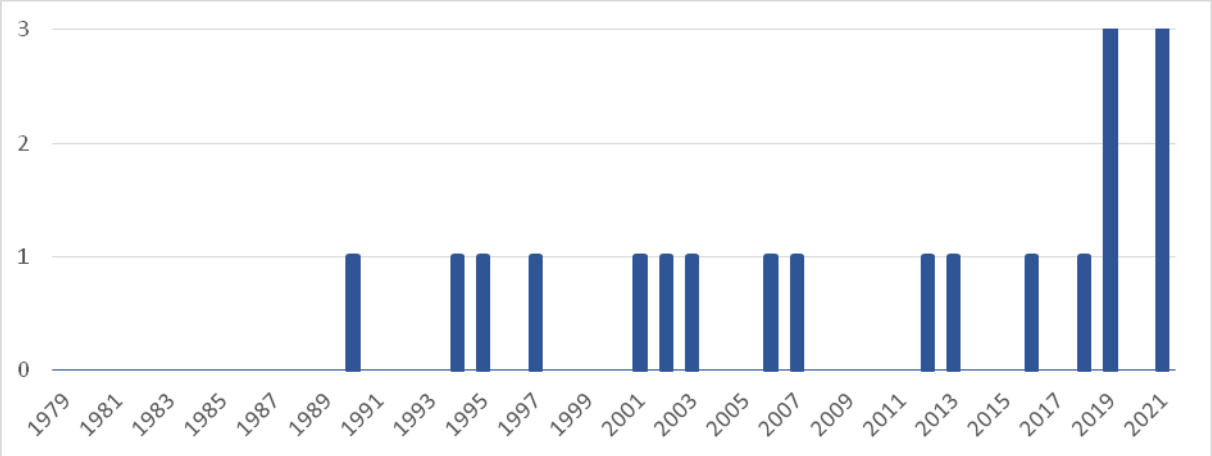

Fig. 14. Number of properties reported for desertification
Source: UNESCO, https://whc.unesco.org/en/soc/?action=list&id_threats=129

Fig. 15. Location and boundaries of five sites belonging to Gebel Barkal and the Sites of the Napatan Region (image ©ESRI)
Source: own work

Analysis of Desertification Degree Index (DDI) for the Gebel Barkal complex in 2018 (Fig. 16) and 2019 (Fig. 17) when this threat was reported showed extreme values in considerable areas in 2018 but in 2019 the situation seemed to improve.

The DDI was also calculated for 2020 when ground-based reports were not available (Fig. 18) and 2021 when they started to appear again (Fig. 19). Interestingly

enough, in 2020 the threat from desertification as shown by DDI was even lower than in the previous years, falling into the 'low' range for most sites, and moderate to low range for Gebel Barkal. In 2021 the situation seems to revert to the extreme values noted for 2018.

At the most general level, this analysis helped estimate the desertification threats for individual sites. The Gebel Barkal complex is reported collectively for all five sites. However, as this analysis demonstrated, even in the most extreme year 2018, only one site (Gebel Barkal) fell into the severe to extreme desertification class. Three sites (Zuma, El-Kurru and Sanam) range between moderate and low while Nuri remained at a low desertification class.

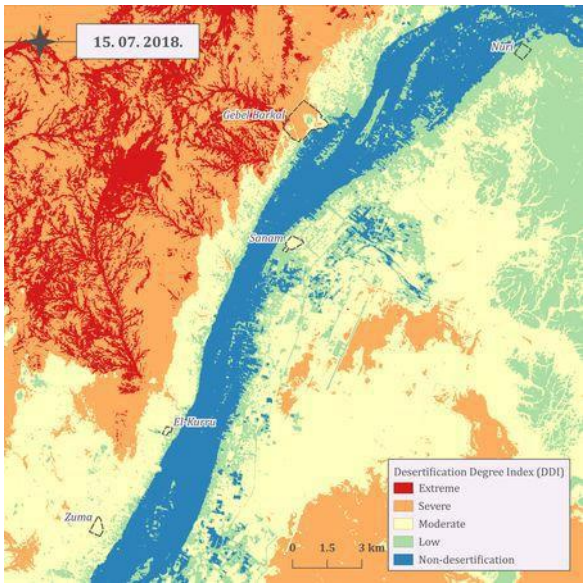

Fig. 16. DDI for 2018 (image ©ESA)
Source: own work

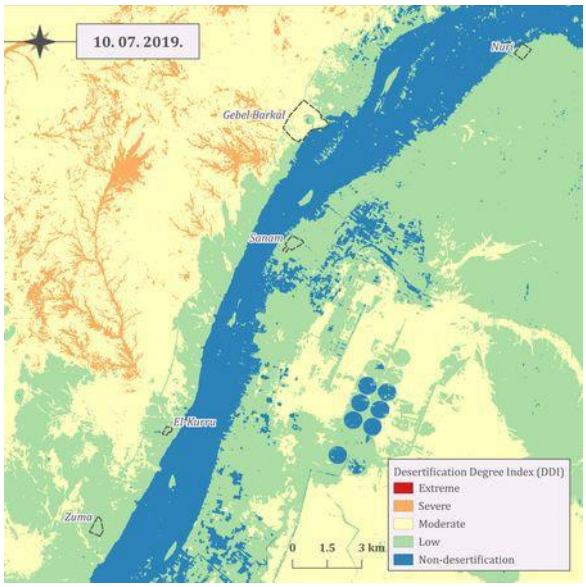

Fig. 17. DDI for 2019 (image ©ESA)
Source: own work

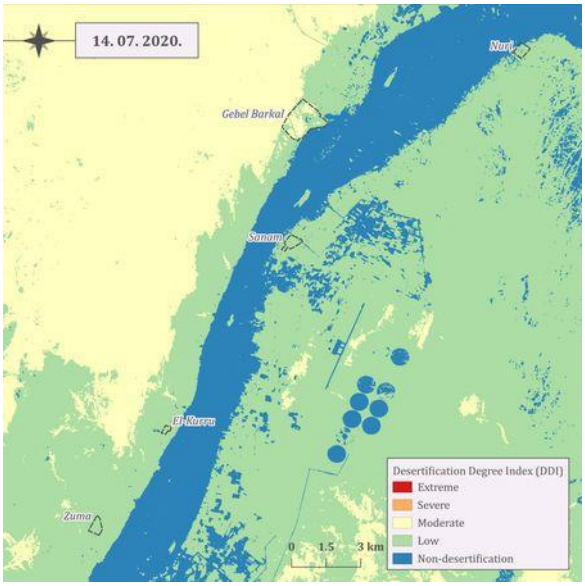

Fig. 18. DDI for 2020 (image ©ESA)
Source: own work

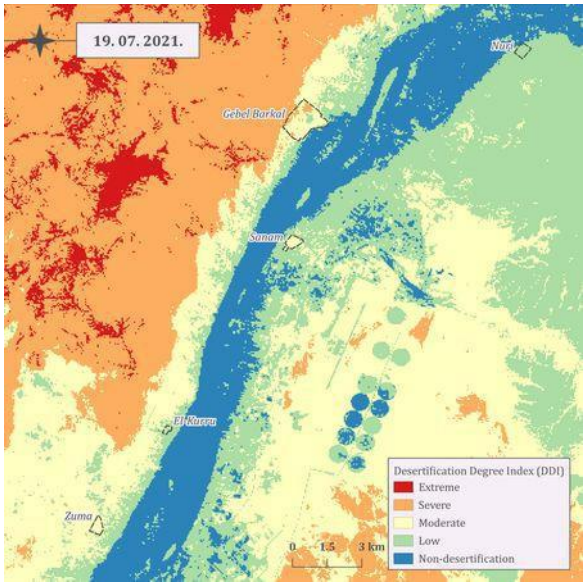

Fig. 19. DDI for 2021 (image ©ESA)
Source: own work

However, interpretation of tendencies that were observed in a four-year time span and their effect on archaeological structures that was noted in ground observation is yet another issue. The following graph shows DDI changing trends between 2018 and 2021 for Gebel Barkal (Fig. 20). It starts at severe desertification class (15th July 2018), drops to moderate a year later (10th July 2019), goes down to low (14th July 2020) and back again to moderate in the current year (19th July 2021). Therefore, we can note changing trends in DDI but no further support is offered to help understand those results in terms of desertification processes. Lamqadem et al. aimed to develop desertification degree index and elaborate desertification grades using a single image obtained in 2017 and a series of ground control points that were measured in the same year (Lamqadem et al., 2018). Whether repeated analysis in subsequent years would show similar fluctuations and how it would be interpreted remains unknown as no such work has been found.

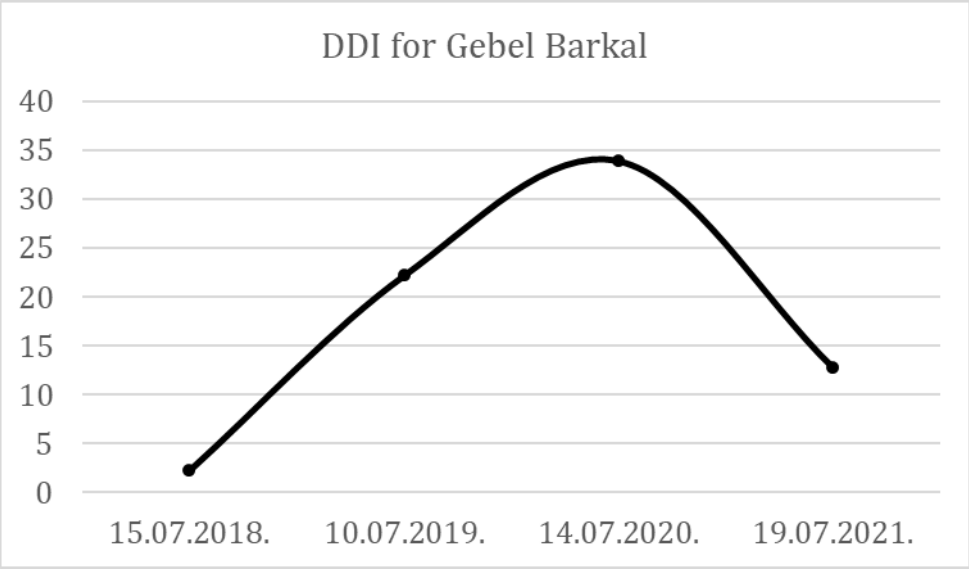

Fig. 20. DDI trend between 2018 and 2021 for Gebel Barkal
Source: own work

Even more difficult to understand is the effect of such changes on archaeological structures. Unlike for Lamqadem et al., no ground control measurements are available for the Gebel Barkal complex. Moreover, criteria to estimate the effect of desertification on archaeological structures that were used in the UNESCO reports have not been yet identified by authors. Perhaps due to low frequency of threat reporting, UNESCO analysis proved rather unhelpful in understanding this threat for cultural heritage. Only sand encroachment has been explicitly identified as a threat (Veillon, 2014). In case of shifting dunes, encroaching sand covers the surface of the sites and then slowly moves forward with wind action (Zaina, 2019) – a process that has been recorded on spectacular photographs of the Meroe pyramids (Reuters Staff, 2020). In itself it was described as not damaging archaeological structures but making them inaccessible for an undetermined period. Whether this threat or some other threat related to desertification is present at Gebel Barkal remains to be determined. Doubts have arisen about the reliability of this method and the results in this section are open to discussion.

Conclusions

In the 2020 response to the World Heritage Committee's concern over the overall condition of Gebel Barkal and the Sites of the Napatan Region, the National Corporation of Antiquities and Museums of Sudan (NCAM) emphasized that its actions were greatly complicated by the April 2019 revolution in Sudan, the appointment of a new transitional government in September 2019, and efforts to reform policies and procedures (NCAM, 2020). In addition, the current coronavirus pandemic has further affected regular monitoring of cultural heritage by putting serious limitations on visiting sites on the ground. However, easily accessible information that is provided by Sentinel-2 missions and open source GIS systems may help overcome at least some of the restrictions that are imposed by the changing world.

However, to use this potential certain changes are required.

1. *In-depth studies of Sentinel-2 potential (and other Copernicus products) preceded by changes in remote sensing agenda for heritage strategies.*

As noted by Zaina (2019) both academic researchers and the global media have focused mainly on threats caused by violent events such as war destruction and looting. This is reflected in preferences for VHR satellite imagery that allows easier identification of such occurrences. Less prominence is given to other equally destructive threats related to land use changes and environmental processes for which the Copernicus mission was designed.

2. *Further developments in methods of data processing.*

Several methods and techniques can be applied to map and assess a given process. Applications based on Copernicus products are probably the most dynamic due to the relative novelty of the programme. However, as our analysis also demonstrated, these methods need further development and adjustment to suit various contexts. The same category of threat may require applications of different sets of analytical tools due to varying characteristics and dynamics in different parts of the world.

3. *One step further: from analysis towards interpretation.*

Methodologically explicit analysis is crucial to reproducibility and testing if it is to reliably identify ongoing processes such as flooding or desertification. However, their effect on cultural heritage is likely to be complex and nuanced and needs to be explained (interpreted) from those results. There is certainly a need to translate indices and threshold values from remote sensing analysis into terms that are meaningful as degrees of threats to cultural heritage. However, this work requires input from heritage management and remote sensing, especially in case of threats that have been seriously underrepresented or neglected.

A value of Sentinel-2 is the combination of spatial, temporal and spectral resolution that can highlight small and local changes. By themselves these processes may be fairly insignificant but cumulatively can threaten archaeological heritage. Use of Sentinel-2 in ways that have been demonstrated in this paper may guide future mitigation strategies.

Acknowledgements

We would like to thank dr Mariusz Drzewiecki for drawing our attention to the Meroe and Gebel Barkal complexes and problems in heritage management arising from the latest developments in Sudan.

References

Archaeological Sites of the Island of Meroe, https://whc.unesco.org/en/list/1336/ [access: 20.12.2021].

Abate N., Elfadaly A., Masini N., Lasaponara R. (2020). Multitemporal 2016-2018 Sentinel-2 data enhancement for landscape archaeology: The case study of the Foggia province, Southern Italy. Remote Sensing, 12(8), 1309.

Beck A., Philip G., Abdulkarim M., Donoghue D. (2007). Evaluation of Corona and Ikonos high resolution satellite imagery for archaeological prospection in western Syria. Antiquity, 81(311), pp. 161–175.

Cowley D., Traviglia A., Verhoeven G. (ed.) (2021). Archaeological Remote Sensing in the 21st Century: (Re)Defining Practice and Theory, Remote Sensing, MDPI, Barcelona, pp. 1–4.

Cowley D. (ed.) (2011). Remote Sensing for Archaeological Heritage Management. EAC, Brussels.

Drusch M., Del Bello U., Carlier A., Colin O., Fernandez V., Gascon F., Hoersch B., Isola C., Laberinti P., Martimort P., Meygret A., Spoto F., Sy O., Marchese F., Bargellini P. (2012). Sentinel-2: ESA's Optical High-Resolution Mission for GMES Operational Services. Remote Sensing of Environment 120, pp. 25–36.

Esri 2020 Land Cover Downloader, https://www.arcgis.com/apps/instant/media/index.html?appid=fc92d38533d440078f17678ebc20e8e2 [access: 20.12.2021].

Gebel Barkal and the Sites of the Naptan Region, https://whc.unesco.org/en/list/1073/ [access: 20.12.2021].

Lamqadem A.A., Saber H., Pradhan B. (2018). Quantitative assessment of desertification in an arid oasis using remote sensing data and spectral index techniques. Remote Sensing, 10(12), 1862.

Lasaponara R., Masini N. (2008). Advances on Remote Sensing for Archaeology and Cultural Heritage Management, Aracne, Rome.

Martimort P., Berger M., Carnicero B., Del Bello U., Fernandez V., Gascon F., Silvestrin P., Spoto F., Sy O. (2007). Sentinel-2 The Optical High-Resolution Mission for GMES Operational Servics, ESA Bulletin 131 (August), pp. 18–23.

NCAM 2020, https://whc.unesco.org/en/list/1073/documents/ [access: 20.12.2021].

Nile River. Climate and hydrology, https://www.britannica.com/place/Nile-River/Climate-and-hydrology [access: 20.12.2021].

Parcak S.H. (2009), Satellite Remote Sensing for Archaeology, Routledge, Abingdon.

QGIS 3, https://www.qgis.org/en/site/about/index.html [access: 05.08.2021].

Reuters Staff 2020 Recent floods threaten pyramid sites in Sudan, https://www.reuters.com/article/uk-sudan-floods-idUKKBN25Z266 [access: 20.12.2021].

Tapete D. (ed.) (2018a). Remote Sensing and Geosciences for Archaeology, MDPI, Barcelona.

Tapete D. (2018b). Remote Sensing and Geosciences for Archaeology. In: D. Tapete, Remote Sensing and Geosciences for Archaeology, MDPI, Barcelona, pp. 1–10.

Tapete D., Cigna F. (2018). Appraisal of Opportunities and Perspectives for the Systematic Condition Assessment of Heritage Sites with Copernicus Sentinel-2 High-Resolution Multispectral Imagery, Remote Sensing, 10(4), 561.

SOC Gebel Barkal and the Sites of the Naptan Region https://whc.unesco.org/en/soc/4074 [access: 20.12.2021].

State of Conservation Information System (SOC), https://whc.unesco.org/en/soc/ [access: 20.12.2021].

Tasseled-cap Transformation, https://wiki.landscapetoolbox.org/doku.php/remote_sensing_methods:tasseled-cap_transformation [access: 20.12.2021].

UNESCO 2020, UNESCO expresses its deep concern about the latest floods in Sudanhttps://whc.unesco.org/en/news/2163/ [access: 20.12.2021].

Veillon R. (2014). State of Conservation of World Heritage Properties. A statistical analysis (1979-2013), https://whc.unesco.org/en/documents/134872 [access: 21.12.2021].

Zaina F. (2019). A Risk Assessment for Cultural Heritage in Southern Iraq: Framing Drivers, Threats and Actions Affecting Archaeological Sites, Conservation and Management of Archaeological Sites, 21:3, 184–206, https://doi.org/10.1080/13505033.2019.1662653 [access: 21.12.2021].

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SCHENGEN INFORMATION SYSTEM (SIS)

Abstract: The article discusses the principles of functioning of one of the largest databases in the world – the Schengen Information System (SIS). The article describes the history of the creation of the system, its genesis, and the goals it is supposed to achieve. The system's evolution was described, particularly the development of the second-generation system (SIS II). The article presents the basic functionalities of the system and its role in ensuring security and public order. The article presents the definition issues related to information and IT systems.

Keywords: information system, data, identification, border protection

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The genesis of the SIS

The Schengen Information System (SIS) was created in 1995 as a compensatory measure for abolishing border controls within the European Union. Previous control measures applied at the borders of EU countries monitored the movement of citizens of other countries, eliminated the movement of criminal groups or allowed surveillance of the activity of their citizens. Border controls also ensured the surveillance of goods entering a country (Wagner, 2021). It sought to eliminate the movement of prohibited goods, including those that directly threaten the safety of citizens and the environment. The idea of introducing the free movement of European Union citizens, embodied in the Schengen Agreement signed on 14 June 1985 by five Member States of the European Union, entailed a high risk of breaching the security of European Union Member States through the uncontrolled movement of both persons and goods. The Schengen Information System was intended to compensate for the abolition of border controls using possible data checks on EU citizens and certain goods (O.JL2000.239.13) (Schengen Agreement done by Five Mebers – Belgium, Holland, Luxmbourg, Germany and France). According to Article 92 of the Convention implementing the Schengen Agreement of 14 June 1985, the purpose of the Schengen Information System was to enable the authorities designated by the parties to the Convention, through an automated search procedure, to have access to alerts on persons and property for border checks and other police and customs checks carried out within the country under national law and, in specific cases, to issue visas, residence permits and the administration of legislation on aliens in the context of the application of the provisions of the Convention relating to the movement of persons.

Information system

It is worth noting that the system's designers have chosen to use the word "information" in the system's name (THE SCHENGEN INFORMATION SYSTEM). The literature points out that information systems collect, assemble and process information (Szpor, 2016). The Act on Informatisation of Activities of Entities Executing Public Tasks defines an ICT system as a set of cooperating IT devices and software ensuring processing, storing, sending and receiving data through telecommunication networks with the use of a telecommunication end device appropriate for a given type of network, within the meaning of the Act of 16 July 2004 – Telecommunications Law (Szpor, 2010). It should be recognised that the term information system is a broader term than ICT system because it also emphasises hardware and software (hardware and software). It also highlights the importance of content. Szpor considers the translation of "information system" as an IT system in the implemented acts of EU law to be incorrect (an example of incorrect transposition is the NIS Directive). It is worth noting here that this mistake was not made in the case of the system in question, and the SIS is translated correctly as the Schengen Information System. The legislator has deliberately emphasised, not only in its purpose but also in its name, the importance of the content of

the SIS in ensuring the security of the countries of the European Union which are party to the Schengen Implementing Convention.

Design of the SIS

The SIS operating schedule was defined in Article 92 of the implementing Convention. According to this provision, the system was common to all Contracting States. The system consisted of a central unit and national modules, which were the same in all the Member States. Data from each Member State were available to other States to carry out automated searches (Frießem, 1995).

The SIS allowed for verifying two types of items – persons and objects. The catalogue of things that may be entered in the SIS is defined in Article 100 of the Implementing Convention. It includes objects such as vehicles, trailers and semi-trailers which have been stolen, misappropriated or lost, firearms which have been stolen, misappropriated or lost, blank official documents which have been stolen, misappropriated or lost, issued identity papers that have been stolen, misappropriated or lost and suspect banknotes.

In the case of persons for whom an alert has been issued, the issuing State should include, among other things, the surname and given names and possible aliases, any specific physical characteristics not subject to change, date and place of birth, sex, nationality, information on potential weapons and aggressiveness of the person. Furthermore, the reason for the alert and the proposed course of action should be given if the person is found. There are many reasons for putting data of a person to the SIS. It could be a person wanted for extradition detention, a missing person; a person sought to be summoned to appear before the judicial authorities, aliens who have been refused entry on the grounds of reasonable threat to public policy, public security or national security. In addition, the system records persons who should be subject to secret surveillance or special checks. Under Article 99 of the CISA, such an alert may be issued for persons in respect of whom there is clear evidence that the person intends to commit a criminal offence or where an overall assessment of the person concerned made, inter alia, based on past criminal offences, gives reason to suppose that that person will commit a particularly serious criminal offence in the future.

The second generation Schengen Information System (SIS II)

The benefits of the Schengen Information System, including the opportunity to make the vision of free movement within the countries integrated into the system more tangible, meant that more and more countries wanted to join the SIS. Initially, the Schengen area consisted of five countries (France, Germany, Belgium, the Netherlands and Luxembourg). On 26 March 1995, Spain and Portugal also joined the system. Although not a member of the European Union, Monaco has its borders with France removed. Later on, Italy (26 October 1997) and Austria (1 December 1997) joined the Schengen Information System. On 16 October 1997, Vatican City and San Marino, which, although not a member of the EU, have abolished their borders with Italy, became

members of the Schengen Agreement. Greece joined the SIS on 26 March 2000, followed by Finland, Denmark, Sweden on 25 March 2001. Finland, Denmark, Sweden. Subsequently Norway and Iceland, which are not members of the European Union, also joined the SIS. The great interest in the system meant that its outdated infrastructure was no longer sufficient. There were an increasing number of interruptions in the system's operation, which made it extremely difficult to carry out checks and controls in the system properly. The European Union authorities created a new system, the so-called SIS II Generation (Tomaszewski & Girdwoyń, 2018). The new system was to be five times more efficient than the previous system, would allow 30 countries to be connected and would have twice the data coverage of the first-generation SIS (Dragan, 2015).

Legal basis of SIS II

The legal basis for the operation of the second generation Schengen Information System is Regulation (EC) No 1987/2006 of the European Parliament and of the Council of 20 December 2006 on the establishment, operation and use of the second generation Schengen Information System (SIS II) (OJ EU L.381.4) and Council Decision 2007/533/JHA of 12 June 2007 on the establishment, operation and use of the second generation Schengen Information System (SIS II) (OJ EU L.205.63 of 2007.08.06). In addition, detailed rules on the operation of SIS II are described in Regulation (EU) 2018/1860 of the European Parliament and of the Council of 28 November 2018 on the use of the Schengen Information System for the return of illegally staying third-country nationals (OJ EU 312, of 7.12.2018, pp. 1–13), Regulation (EU) 2018/1861 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of border checks, amending the Convention Implementing the Schengen Agreement and amending and repealing Regulation (EC) No 1987/2006 (Dz. EU OJ L 312, 7.12.2018, pp. 14–55) and Regulation (EU) 2018/1862 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of police cooperation and judicial cooperation in criminal matters, amending and repealing Council Decision 2007/533/JHA and repealing Regulation (EC) No 1986/2006 of the European Parliament and of the Council and Commission Decision 2010/261/EU (EU OJ L 312, 7.12.2018, pp. 56–106).

The purpose of SIS II was to ensure a high level of security within the area of freedom, security and justice of the European Union, including the maintenance of public security and public policy and the safeguarding of security in the territories of the Member States, and to apply the provisions of Title IV of Part Three of the Treaty relating to the movement of persons in their territories, using information communicated via this system.

Poland joined the Schengen Information System on 21 December 2007. Poland was joined by Hungary, Slovenia, Slovakia, Latvia, Malta, Lithuania and Estonia, and a year later by Switzerland, which is not a member of the European Union. The last country to

join the Schengen Information System was Liechtenstein, which joined on 19 December 2001 (Huybreghts, 2015).

The legal basis for Poland's participation in the system was the Act of 24 August 2007 on the participation of the Republic of Poland in the Schengen Information System and the Visa Information System. The legal basis for Poland's participation in the system was the Act of 24 August 2007 on the participation of the Republic of Poland in the Schengen Information System and the Visa Information System.

Data processed in the SIS II

Similar to the first generation of SIS, the technical architecture of SIS II comprised a central system (consisting of a database, a support function, the SIS II database and a uniform national interface), a national system (N.SIS.II) and an encrypted communication infrastructure between the central and the national systems (Bufon, 2015). The central system is located in Strasbourg, France, with a central backup system in Sankt Johann im Pongau, Austria, to take over a central unit failure fully (Dragan, 2015). The national systems are built, operated and maintained with national resources. Each Member State was obliged to designate an authority responsible for running its national system (N.SIS II). The role of the designated authority was the smooth operation and security of the national component. In addition, each country was to establish a so-called SIRENE Bureau to ensure the exchange of all information into the system. A very important aspect of developing the second generation of SIS was the interoperability of the national components. According to Article 9 of Regulation (EC) No 1987/2006 of the European Parliament and of the Council of 20 December 2006 on the establishment, operation, and use of the second generation Schengen Information System (SIS II), each Member State establishing its N. SIS II was to comply with protocols and technical procedures established at the central level. Compliance with these protocols was to ensure the compatibility of N. SIS II with the central system.

Member States were also obliged to ensure data security (Czaplicki, 2018), including among others ensuring physical protection of data by drawing up contingency plans for the protection of critical infrastructure, prevent unauthorised access to data-processing facilities used for processing personal data (infrastructure access control), prevent unauthorised reading, copying, modification or removal of data media (data media control, prevent unauthorised input of data and unauthorised inspection, modification or deletion of stored personal data (storage control) prevent the use of automated data-processing systems by unauthorised persons using data communication equipment (user control), ensure that persons authorised to use an automated data-processing system have access only to the data covered by their access authorisation, by means of individual and unique user identities and confidential access modes only (data access control); ensure that all authorities with a right of access to SIS II or to the data processing facilities create profiles describing the functions and responsibilities of persons who are authorised to access, enter, update, delete and search the data and make these profiles available to the national supervisory authorities without delay,

ensure that it is possible to verify and establish to which bodies personal data may be transmitted using data communication equipment (communication control), ensure that it is subsequently possible to verify and establish which personal data have been input into automated data processing systems and when by whom and for what purpose the data were input (input control), prevent the unauthorised reading, copying, modification or deletion of personal data during transfers of personal data or during transportation of data media, in particular by means of appropriate encryption techniques (transport control), monitor the effectiveness of the security measures referred to in this paragraph and take the necessary organisational measures related to internal monitoring to ensure compliance with this Regulation (self-auditing).

In the second generation system, the scope of data processing has been significantly extended. With regard to persons, these are surnames and forenames, name at birth, previously used forenames and surnames, any specific objective physical characteristics not subject to change, place and date of birth, sex, photographs, fingerprints, nationality, whether the person is armed, violent or a fugitive, reason for the alert, the authority issuing the alert, reference to the decision giving rise to the attention, type of offence, action to be taken following disclosure of the person concerned.

According to the Act on the participation of the Republic of Poland in the Schengen Information System and the Visa Information System, access to the data collected in the SIS II is available to courts, the prosecutor's office, the Head of the Office for Foreigners, the Police, the Customs and Fiscal Service, the Internal Security Agency, the Military Police, the Central Anti-Corruption Bureau, the Border Guard, the Foreign Intelligence Agency, the Military Counterintelligence Service and the Military Intelligence Service, the director of the maritime office. The Polish authority responsible for the national system N. SIS II is the central technical body of the National IT System KSI. The supervision over the operation of the national component is exercised by the Minister competent for internal affairs. Additionally, the President of the Office for Personal Data Protection shall be entitled to direct access to the National IT System to control the compliance of the processing of personal data in the system with the binding provisions.

The SIS II will collect data on, e.i., persons wanted for arrest for surrender purposes based on a European Arrest Warrant (Velicogna, 2014); persons wanted for arrest for extradition purposes; missing persons to be placed under protection or whose whereabouts need to be ascertained (Sołtyszewski & Solodov, 2021); persons whose presence is required for proceedings, including witnesses, persons summoned or sought to be summoned to appear before the judicial authorities in connection with criminal proceedings to account for acts for which they are being prosecuted; persons who are to be served with a criminal judgment or other documents in connection with criminal proceedings to account for acts for which they are being prosecuted; persons who are to be served with a summons to report to serve a penalty involving deprivation of liberty. The SIS II also contains data on aliens who have been refused entry into the territory of a Member State.

Summary

The SIS II database is of great importance for the security of the Schengen area. Every citizen of the European Union has the right to move freely without going through a long and complicated border control procedure. However, this freedom has not caused States to lose full control over the security of their territories. Anyone who enters the Schengen area can be checked, and their details are contained in the SIS II system. The exchange of information between individual states reflects the integration of the Schengen area and contributes to even greater cooperation between the associated countries.

References

Act of 24 August 2007 on the participation of the Republic of Poland in the Schengen Information System and the Visa Information System (Dz.U. 2021 item 1041).

Act on Informatisation of Activities of Entities Executing Public Tasks of 17 February 2005 (Dz.U. 2021 item 2070).

Bufon M. (2011). Engineering Borders and Border Landscapes: The Schengen Regime and the EU's New Internal and External Boundaries in Central-Eastern Europe. In: S. Brunn (ed.). Engineering Earth. Springer, Dordrecht, pp. 2067–2087, https://doi.org/10.1007/978-90-481-9920-4_114 [access: 09.12.2021].

Council Decision 2007/533/JHA of 12 June 2007 on the establishment, operation and use of the second generation Schengen Information System (SIS II) (OJ EU L.205.63 of 2007.08.06).

Czaplicki K. (2018). Security of Geographical Information system – How to ensure their Confidentiality, Integrity, Availability and Resilience? In: Geographic Information System Conference and Exhibition "GIS ODYSSEY", Italy, pp. 142–145.

Dragan A. (2015). System Informacyjny Schengen drugiej generacji jako nowoczesne rozwiązanie informatyczne (*The second generation Schengen Information System as a modern IT solution*). Annales Universitatis Mariae Curie-Skłodowska, Lublin, Sectio G. Ius, vol. 62, no. 1, pp. 35.

Frießem P. (1995). Global Management for a Real European Information System taking the Schengen Information System (SIS) as an example. In: F. Huber-Wäschle, H. Schauer, P. Widmayer (ed.), GISI 95. Informatik aktuell. Springer, Berlin, Heidelberg, pp. 110–117, https://doi.org/10.1007/978-3-642-79958-7_14 [access: 09.12.2021].

Huybreghts G. (2015). The Schengen Convention and the Schengen *acquis*: 25 years of evolution. ERA Forum 16, pp. 379–426, https://doi.org/10.1007/s12027-015-0402-3 [access: 09.12.2021].

Regulation (EC) No 1987/2006 of the European Parliament and of the Council of 20 December 2006 on the establishment, operation and use of the second generation Schengen Information System (SIS II) (OJ EU L.381.4).

Regulation (EU) 2018/1860 of the European Parliament and of the Council of 28 November 2018 on the use of the Schengen Information System for the return of illegally staying third-country nationals (OJ EU 312, of 7.12.2018, pp. 1-13).

Regulation (EU) 2018/1861 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of border checks, amending the Convention Implementing the Schengen Agreement and amending and repealing Regulation (EC) No 1987/2006 (Dz. EU OJ L 312, 7.12.2018, pp. 14–55).

Regulation (EU) 2018/1862 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of police cooperation and judicial cooperation in criminal matters, amending and repealing Council Decision 2007/533/JHA and repealing Regulation (EC) No 1986/2006 of the European Parliament and of the Council and Commission Decision 2010/261/EU (EU OJ L 312, 7.12.2018, pp. 56–106).

Sołtyszewski I., Solodov D. (2021), Międzynarodowa współpraca Policji w obszarze poszukiwań osób zaginionych (*International Police cooperation in the field of searching for missing persons*). In: E. Gruza, I. Sołtyszewski (ed.), Poszukiwania osób zaginionych (*Search for missing persons*), Warszawa, pp. 260–262.

Szpor G. (2010). The Electronic Platform of the Public Administration Services. In: D. Kereković (ed.), Space, Heritage & Future. Croatian Information Technology Association – GIS Forum, Uniwersity of Silesia, Zagreb, pp. 274–281.

Szpor G. (2016). Jawność i jej ograniczenia. Tom I. Idee i pojęcia (*Disclosure and its limitations. Volume I. Ideas and concepts*), C.H. Beck, Warszawa, pp. 120–125.

Tomaszewski T., Girdwoyń P., Europejska Przestrzeń Kryminalistyczna (*European Forensic Space*). In: Ł. Pisarczyk (ed.), Prawne problemy i wyzwania Unii Europejskiej (*Legal problems and challenges of the European Union*), Warszawa, pp. 257–274.

Velicogna M. (2014). The Making of Pan-European Infrastructure: From the Schengen Information System to the European Arrest Warrant. In: F. Contini, G. Lanzara (ed.), The Circulation of Agency in E-Justice. Law, Governance and Technology Series, vol. 13. Springer, Dordrecht, pp. 185–215, https://doi.org/10.1007/978-94-007-7525-1_8 [access: 09.12.2021].

Wagner J. (2021). Border Management in Europe. In: Border Management in Transformation. Advanced Sciences and Technologies for Security Applications. Springer, Cham, pp. 169–192, https://doi.org/10.1007/978-3-030-62728-7_7 [access: 09.12.2021].

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MODEL OF INFORMATION SYSTEM FOR SMART VILLAGE

Abstract: In this paper is proposed concept of an information model for development of smart villages in the Republic of Croatia in Slavonia region. An insight into the existing supply of structured knowledge and broadcasting of important information in areas relevant to 'smart villages' shows that there are hundreds of information emitters that provide information for use in development of local 'smart village' projects. Therefore, this project proposes: (a) introduction of a specific institution (mini consortium of several villages) *implementation unit*, which will identify information needs for the thematic group of belonging villages, and accordingly (b) construction of an appropriate information system. Based on the results of these analyses, the concept of the "Alberta Information System for the Development of Smart Villages", for Osijek Baranja County is proposed.

Keywords: implementation unit, rural services, rural-urban linkages, smart communities in rural areas

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Introduction

In our papers (Ivanović, 2005, 2005a, 2007, 2007a, 2008, 2018, 2021) we pointed out:

(a) The basic elements of the socialist transition in the field of agriculture and the elements in force; constitutional agrarian economy of the EU;
(b) The EU model of rural development as a new transition opportunity for the Slavonia region that must not be missed;
(c) The importance of organic agriculture for the development of Slavonian villages;
(d) A new model of looking at the overall development of local areas by balancing local human resources and traditions – which has not been the case so far;
(e) Transition processes regarding rural development and the need for broad education of Slavonian farmers to stop being subcontractors of large socialist combines but to become farmers – commodity producers of their products for the market;
(f) The social problems of introducing broadband access to rural areas and the economic interests of large telecommunications companies that do not take into account the needs of rural areas;
(g) Set up elements of the Alberta Smart Rural Information System – based on a broadband approach and thematic pre-selection of the information needed to develop specific rural areas.

In our papers (Ivanović et al., 2013; Ivanović et al., 2014; Ivanović & Ambroš, 2016; Job & Grgić, 2021; Lacković & Ivanović, 2020; Matić et al., 2016) we pointed out reasons why special information model for smart villages is needed and proposed implementation units (several villages that connect the same topics regarding agro production).

In this paper, we made an analysis of local Web portals in Slavonia, Baranja, regarding sharing of information and knowledge about agricultural production and smart village development. The aim of our research is to create regional model of knowledge and information dissemination for villages.

The Slavonia region

Basic data on the Slavonia region in the Republic of Croatia (Fig. 1) are shown in Table 1. It should be emphasized that Slavonia lost 86,000 inhabitants in period between the two censuses 1991-2001 due to destruction of the war, and next 85,000 in the next ten years (2001–2011) due to economic reasons – emigration to other regions and other countries (Ivanović, 2010) Estimates say that in the period 2011–2021 population also reduced due to emigration by about 70,000.

Slavonia region has tradition and excellent conditions for agricultural production, but due to poor policy towards the village and agriculture in the last 30 years villages are losing population and number of family farms is decreasing (Table 1 and 2).

Fig. 1. Five counties in the Slavonia Baranja region in the Republic of Croatia
Source: Ivanović, 2018

Table 1. Residents and settlements in the five counties of Slavonia region (2011 census)

County	Area km^2	Population	Number of cities	Number municipalities	Number settlements
Brod-Posavina	2,030	158,575	2	26	185
Osijek-Baranja	4,155	305,032	7	35	263
Požega-Slavonia	1,823	78,034	5	5	277
Virovitica-Podravina	2,024	84,836	3	13	188
Vukovar-Srijem	2,454	179,521	5	26	85
Region Slavonia	12,486	805,998	22	105	998
Republic of Croatia	56,594	4.284,889	127	429	6,756
% Slavonia in RC	22.1	18.8	17.3	24.5	14.8

Source: Statistical Yearbook of the Republic of Croatia 2018

Table 2. Number of settlements and family farms in the five counties of Slavonia region

County	Number of Agro households (2003)	Number family farms (2013)	Number family farms (2016)
Brod-Posavina	20,704	7,137	6,085
Osijek-Baranja	41,103	12,078	9,282
Požega-Slavonia	13,521	5,139	4,383
Virovitica-Podravina	19,062	7,080	5,718
Vukovar-Srijem	26,316	7,122	6,087
Region Slavonia	120,706	38,556	31,555
Republic of Croatia	448,532	154,400	130,264
% Slavonia in RC	26,9	25.0	24.2

Source: Croatian bureau of statistics. Agriculture – review by counties, 2017

As can be seen from Fig. 1, the area of Slavonia occupies 22.1% of the territory of the Republic of Croatia, and Table 1 shows the number of settlements and inhabitants according to the 2011 census. The region, therefore, has 805,998 inhabitants, 22 cities, 105 municipalities and 998 settlements. Table 2 shows that the number of agricultural households and agro-farms decreased from 38,556 in 2013 to 31,555 in 2016 and this decline continues (according to local media reports, because there are no statistical surveys).

Model of dissemination of knowledge and information for smart villages

State of dissemination of knowledge and information for smart villages

We have pointed out the insufficiently efficient agricultural policy in Croatia in our previous works (Ivanović, 2005, 2005a, 2007, 2007a, 2008) as well as the depopulation process (Ivanović, 2010). At a time of rapid doubling of scientific knowledge and technologies (Ivanović, 2009) – in Croatia, there are insufficient efforts to share new knowledge in agriculture and agricultural policy. True, there are public advisory services for farmers in Croatia, there are public calls for funding new productions and cooperation of agricultural faculties and institutes with the village, there are magazines and radio and TV shows for farmers – but it's not all connected in public space.

Thus, over the years – considering the issue of dissemination of new knowledge in the agricultural sector for farmers – there were contributions (elements) that are now integrated into the model "Alberta" information system.

Our analysis of local Web portals (municipalities and local action groups – LAG) regarding the sharing of new knowledge in agriculture and agrarian policy for smart villages – on a sample of 30 portals showed that – more or less all publish almost the same content – calls to farmers to co-finance the implementation of individual measures from the implementation of EU rural development projects or the proclamation of warnings for certain diseases (plants and livestock) or short-term weather conditions regarding crop production. to dozens of domestic Web portals. Given that the number of farmers who know foreign languages is negligible – the use of foreign Web portals e.i. (Smart Villages, 2019, 2019a) is also negligible (Ivanović et al., 2014; Ivanović & Ambroš, 2016; Ivanović, 2018; Job & Grgić, 2021; Lacković & Ivanović, 2020; Matić et al., 2016).

A model of knowledge and information dissemination for smart villages

Unlike thematically defined Web portals that offer a wide range of information about everything in the area – "Alberta" model is designed as a specialized source of information based on pre-selection of information needed to develop specific rural areas for certain regions (e.g. field regions), vegetable production regions, fruit and grape production regions, coastal regions, mountain regions and livestock, etc.

A model of collecting and disseminating knowledge needed for smart villages' development is presented in Fig. 1 and Fig. 2.

In order to effectively monitor the daily broadcasting of new organizational, economic, environmental, IT and agro-technological new knowledge and financial

information, it is proposed to establish expert groups on agro-production at the regional level (in Croatia – several counties); eg for the area of the Slavonia region (given the tradition and natural conditions) these are thematic groups:

1) Farming.
2) Livestock.
3) Vegetable growing.
4) Poultry.

In addition to agro-experts for related productions (agronomists etc.), the expert group also includes computer scientists, economists, lawyers, foreign translators, technologists and designers) and daily prepares texts with photos and diagrams that they publish on the appropriate Web portal (Fig. 2). Since villages and municipalities do not have enough experts for all the required areas – the expert team is filled by the necessary experts from neighboring cities. Of course – other regions (where traditions and natural conditions are different – e.g. regions with viticulture, fruit growing or Mediterranean regions) will have different structured thematic groups. In that way, centers would be created for collecting and disseminating the latest knowledge and information for development of smart villages. In the second stage of the development of information system for smart villages – according to the agreed rural development policy – all local media (newspapers, Web portals andradio and TV of municipalities, cities and LAGs) make available (access) to their readers. Thus, in our example (Slavonia), family farms and farmers will be able to consult and consume on a daily basis the latest knowledge and information needed for activities in the development of smart villages, i.e. agro-production that they are engaged in or interested for it (Fig. 3).

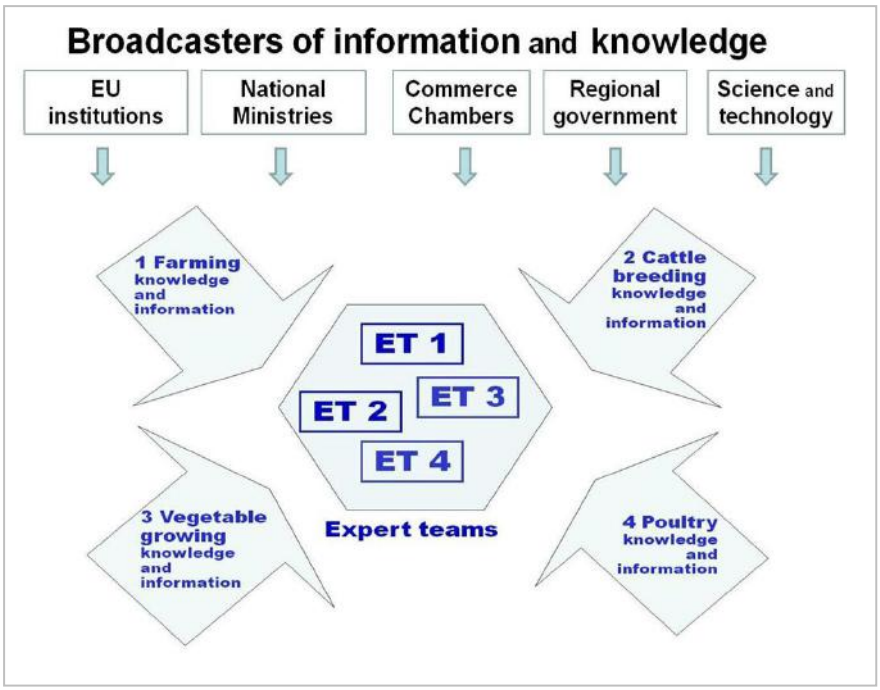

Fig. 2. Knowledge and information collection model for smart villages
Source: Author's work

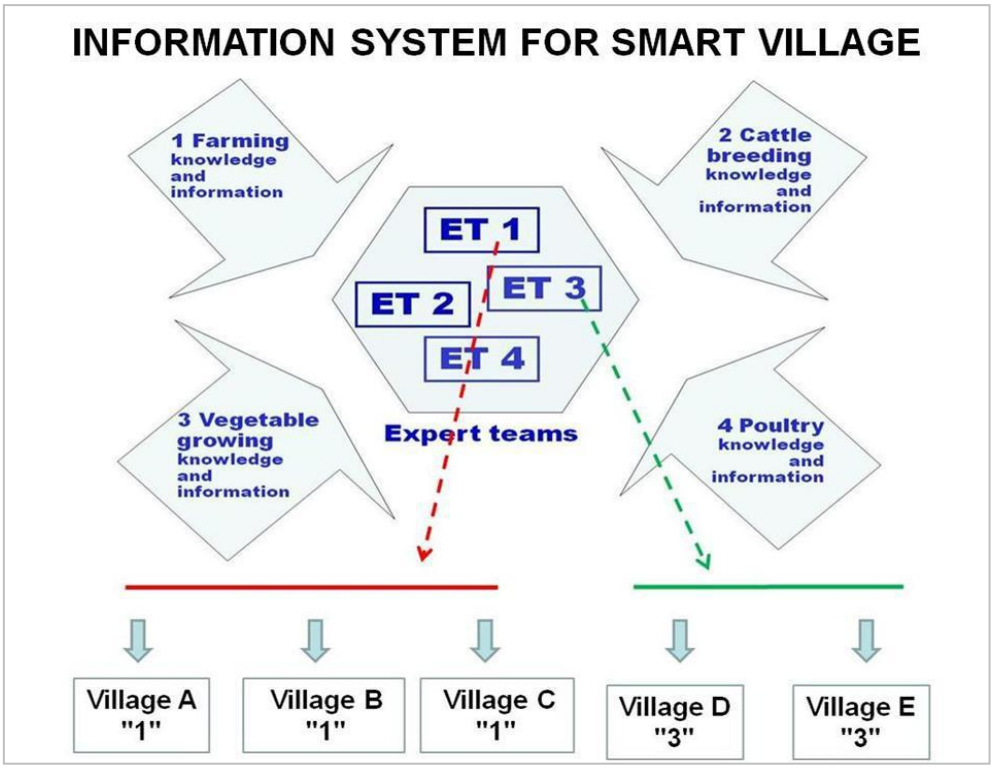

Fig. 3. Model of dissemination of knowledge and information for smart villages
Source: Author's work

Conclusion

Leaving the socialist planning model of agriculture in the Republic of Croatia during the post-socialist transition process, the need to educate agricultural producers to turn from subcontractors of socialist combines into farmers, i.e. producers of goods for the market, was not taken into account. This is especially important for the Slavonia region; so many years have been lost, villages are losing population and the number of agricultural households and agro-producers is declining.

In the current environment of rapid knowledge growth and information growth, the “Alberta” model of disseminating knowledge and information for rural development and smart villages has been proposed.

"Alberta" model is designed as a specialized source of information based on pre-selection of information needed to develop specific rural areas for certain regions; vegetable production regions, fruit and grape production regions, coastal regions, mountain regions and livestock, etc.

The villages do not have the necessary professional staff, so it is necessary to supplement the expert teams with experts from neighboring cities.

As social cohesion in Croatia (and Slavonia) is underdeveloped – the implementation of the "Alberta" model will require the coordination of county authorities – as we proposed in the project "Alberta Information System for Smart Village Development", a project for Osijek-Baranja County.

References

Croatian bureau of statistics (2017). Agriculture – Review by counties, Structure of agricultural holdings.

European Network for Rural Development (2019). Rural Connections – The European Rural Development Magazine, spring/summer.

Grgić K., Job. J. (2021). Tehnologija na selu – Tehnički i uslužni aspekti koncepta pametnog sela s mogućnostima primjene u ruralnim područjima Osječko-baranjske županije (*Rural technology – Technical and service aspects of the smart village concept with application possibilities in rural areas of Osijek-Baranja County*). Studija – Fakultet elektrotehnike, računarstva i informacijskih tehnologija Osijek, http://www.obz.hr/images/ruralni_razvoj_studije/studija_tehnologija_na_selu.pdf [access: 10.09.2021].

Ivanović M. (2005). Konstitucionalna ekonomija agrara EU (Constitutional economy of EU agriculture). In: B. Hebrang (ed.), Poljoprivreda u Europskoj uniji, Albert^{E}, Osijek, pp. I–III.

Ivanović M. (2005a). Ruralni razvitak – nova šansa koja se ne smije propustiti (*Rural development – a new opportunity not to be missed*). In: Okvir za ruralni razvitak, Slap, Osijek, pp 13–28.

Ivanović M. (2007). Ekološka poljoprivreda i razvitak sela (*Organic agriculture and rural development*). In: Vodič kroz organsku proizvodnju, Slap, Osijek, pp. 13–28.

Ivanović M. (2007a). Novi model sagledavanja ukupnog razvoja lokalnih područja (*A new model of perceiving the overall development of local areas*). In: A. Mašek, Program ukupnog razvoja Općine Erdut, Ekonomski fakultet, Osijek.

Ivanović M. (2008). Ruralni razvoj i procesi tranzicije – Slavonska poljoprivreda prema EU standardima (*Rural development and transition processes – Slavonian agriculture according to EU standards*), Albert^{E}, Osijek.

Ivanović M. (2009). Tri eseja o znanosti (*Three essays on science*). Elektrotehnički fakultet, Osijek.

Ivanović M. (2010). Ekonomski razvoj Slavonije i Baranje – prilozi za makro-ekonomsku analizu regionalnog razvoja u RH (*Economic development of Slavonia and Baranja – contributions to the macroeconomic analysis of regional development in the Republic of Croatia*), 2nd International Conference: Vallis Aurea: Focus on Regional Development, Požega, 3.09.2010. DAAAM International Viena i Veleučilište u Požegi, Procedings, pp. 475–486.

Ivanović M., Subašić R., Trischler R., Križanović K. (2013). Development of fruit and vegetable processing industry in Slavonia and Baranja, the paradigm is needed, 2nd International scientific conference: Economy of Easter Croatia, Osijek, May, 23–25, 2013, Proceedings, pp. 54–64.

Ivanović M., Ambroš L., Mesarić V. (2014). Establishing a Consortium – Way for Successful Implementation of Investment Projects – an Example of the Infrastructural Project Slavonian network, 3rd International scientific conference: Economy of Easter Croatia, Osijek, May, 23–24, 2014, Proceedings, pp. 16–22.

Ivanović M., Ambroš F. (2016). The Economic Impacts of Broadband Access Investment in The Croatia, 5th International scientific conference: Economy of Easter Croatia, Osijek, June, 1–3, 2016, Proceedings, pp. 49–60.

Ivanović M. (2018). Economic Interests and Social Problems in Realization of Broadband Network. In: A. Haidine, A. Aqqal (ed.), Broadband Communications Networks – Recent Advances and Lessons from Practice, Open Source – InTech, London.

Ivanović M. (2021). Informacijski sustav „Alberta" za razvoj pametnih sela – prijedlog projekta na natječaju za ideje o razvoju pametnih sela na području Osječko-baranjske županije (*"Alberta" information system for the development of smart villages – project proposal in the competition for ideas on the development of smart villages in the Osijek-Baranja County*) (17.7.2021).

Job J., Grgić K. (2021). Modeli digitalizacije sela (*Rural digitization models*). Konferencija: Pametna sela – EU koncept razvoja ruralne zajednice, Osijek, July, 09, 2021, Osijek Baranja County, http://www.obz.hr/index.php/pametna-sela/konferencija-pametna-sela [access: 10.09.2021].

Lacković K., Ivanović M. (2020). Smart and networked villages – information system for rural development, X International Conference Industrial Engineering and Environmental Protection, October 8–9, 2020, Zrenjanin, Serbia, Proceedings, pp. 128–135.

Matić T., Herceg M., Job J., Šneler, L. (2016). The receiver circuit for ultra wideband integral pulse frequency modulated wireless sensor. 2016 5th International Conference on Modern Circuits and Systems Technologies (MOCAST). Thessaloniki, IEEE, pp. 1–4, doi:10.1109/MOCAST.2016.7495136.

Smart Villages (2019). Pilot Project, Briefing note, Brussels, 21–22 February. https://enrd.ec.europa.eu/smart-and-competitive-rural-areas/smart-villages/smart villages-portal_en [access: 30 July 2021].

Smart Villages (2019a). Smart Villages in Finland: ideas for designing support in the future CAP Strategic Plans, European Network for Rural Development, https://enrd.ec.europa.eu/ [access: 30 July 2021].

Statistical Yearbook of the Republic of Croatia 2018.

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RESEARCH ON THE PHENOMENON OF SELF-AFFORESTATION OF AGRICULTURAL LANDS IN UKRAINE

Abstract: Extension of the forest area in Ukraine is one of the indicators confirming achievement of the goals of sustainable development. Therefore, the issue of protection, restoration and rational use of forest ecosystems is rather actual. The process of self-afforestation taking place on agricultural land, which are not used according to their intention because of their investment unattractiveness, due to lack of funds or other reasons, and thus, they are self-sown with forest plants, is one of the ways of the forest-covered area extension in Ukraine. There is no reliable information on the number of land plots with self-sown forests on agricultural land. Therefore, it is expedient to make inventory of them by using the tools of satellite remote sensing and field surveys. The author of the work suggests a conceptual model of planning the use of agricultural land with self-sown forests on the base of the inventory data. To make the best-possible decisions on the use of the land plots with self-sown forests, at the local level it is important to determine the rational direction of the self-sown forest use in the process of spatial planning on the base of the data of analysis of the soil and plant cover layer quality. Therefore, it is recommended to make zoning of the land by the kinds of land use (agricultural, forestry, recreational, nature protection). Basing on the zoning data and considering the potential ecosystem benefits from forests, it is necessary to develop measures on the self-sown forest use and protection.

Keywords: self-sown forest, agricultural land, ecosystem services, inventory, planning, zoning

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Introduction

The ecological policy of Ukraine aims to promote sustainable development of nature management, to halt biological and landscape diversity loss, to improve conditions of damaged ecosystems, to achieve a neutral level of land degradation, to expand the natural preserved area, etc. In that context, one of the research tasks is to develop a strategy of land use within the rural territories considering the sustainable development concept. That concept suggests balancing between the current human needs and protection of the future generation interests, particularly their needs for a safe and healthy environment (Sustainable Development Goals: Ukraine, 2017).

A particular attention is paid to sustainability of natural ecosystems, which determine stability of the whole biosphere. Protection of the artificially made systems' capacity to self-restoration and dynamic adaptation of those systems to any changes in the surrounding is of great concern (Ecosystem restoration for people, nature and climate, 2021). Ecosystem self-restoration is a process of the ecosystem self-recovery to the conditions of dynamic balance, which has been destroyed under the impact of negative external and internal factors. The capacity of ecological systems to self-restoration is reduced along with degradation of natural resources, environmental pollution, loss of biological and landscape diversity of territories (Grodzinsky, 1995).

In Ukraine, agricultural development of the territory accounts for 70%, plowing – above 50%, and therefore, it is very important to create conditions for protection and restoration of agroecosystem productivity. Agroecosystem is considered as an ecosystem subsystem, in which cultivated crops dominate on the treated soil. The structure and regime of such system is supported and regulated by people, whereas lack of control gradually causes loss of its functions, properties and productivity (Schiere & Grasman, 1997). To support or improve the ecological services in agroecosystems, it is necessary to broaden the diversity of vegetation within and around the agroecosystem (Altieri, 1989). For that purpose, forests are of great importance, as under smart management, they provide for a great number of ecosystem services, namely air purification, soil formation, regulation of climate and water streams, reduction of the risks of natural disasters, broadening of the territory biological diversity, improvement of human living standards, and raise of community stability (Cunningham et al., 2015).

However, the anthropogenic activities have caused a large-scale destruction of lands and maximum simplified ecosystems in the form of artificial agrocoenosis. Therefore, it is of urgent importance to make regeneration of forests. Regeneration (natural restoration) can be fulfilled by different ways, i.e., secondary forest, passive restoration, shrubs growing, etc. (Holl & Aide, 2011).

In the recent decades, Ukraine has experienced the process of self-afforestation of agricultural lands because of the land plots being not used according to their intended purpose (Unaccounted forests of Ukraine, 2020). Such situation is forced by some factors, including the land-owners' lack of funds to run agricultural activities, investment unattractiveness of the land because of low soil fertility, or poor state support for animal breeding development, etc. According to the data (Land directory of Ukraine, 2020), the

country cultivates 2.9 mln ha (7%) of agricultural land. Those processes have both positive and negative effects. On one hand, it results in creating forest ecosystems of both ecological and forestry value, on the other hand, the land plots with young forests belong to the category of agricultural lands, and legally cannot exist as forest lands of the forest fund of Ukraine, therefore they should be uprooted. In that context, there are some legal, social and economic, ecological and organizational problems, which require a complex approach to their solution.

The goal of the article is to substantiate the expediency of protecting forests on agricultural lands as an important constituent of sustainable development of the territory in Ukraine. The authors propose a conceptual model of planning the use of agricultural land with self-sown forests referring to the inventory data. Inventory of agricultural lands with the self-sown forests involves studying the natural and spatial conditions and analyzing the factors causing appearance of abandoned lands. The article describes the tools, which are necessary to implement the model of planning the use of agricultural land with self-sown forest.

Material and Methods

The methodological basis of the research is made by the concept of ecosystem services, which confirms the relationship between the human well-being and ecosystems stability. Reduction of the quality of ecosystem services causes significant economic losses and expenditures for healthcare (Millennium Ecosystem Assessment, 2005), whereas the ecosystem sustainability depends on the degree of its biological diversity, and in case of its loss, it negatively influences production of the essential vital services, provided by the ecosystem (Mehring et al., 2017).

In the research, forests are considered as social-ecological systems, which provide for a great variety of ecosystem services (Fig. 1). Therefore, one should concern fundamentals for the integrated ecosystem management (Izakovičová et al., 2018), which would integrate institutional norms, social practices, knowledge and technologies in the way to simplify the adaptive management and provides for sustainable use of ecosystem services by people (Hummel et al., 2011).

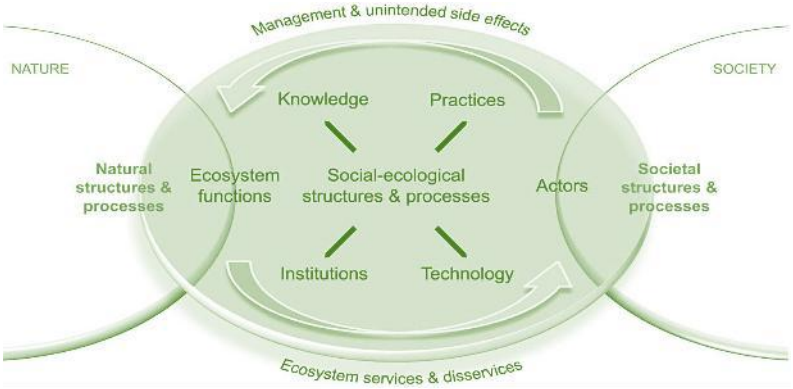


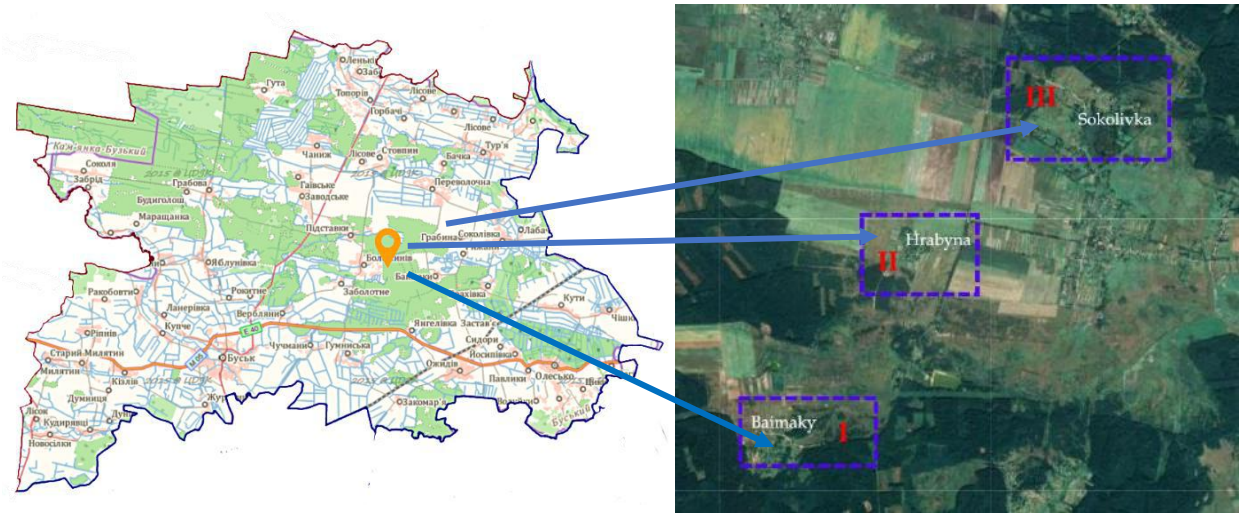
Fig. 1. Nature-society relations as a social-ecological system
Source: Hummel et al., 2011; Mehring et al., 2017

The research was conducted on the examples of land plots within the Busk territorial community in Lviv region (Western Ukraine) (Fig. 2). The territory belongs to the zone of Small Polissia, where a significant share of area is taken by the landscapes of Polissia type (sand plains, grasslands, deciduous and pine forests, swamps) (Geographical Encyclopedia of Ukraine, 1993).

a b c

Fig. 2. Location of the study area: (a) in Europe – Ukraine, (b) in Ukraine – Lviv region, (c) in Lviv region – Busk territorial community
Source: author compilation

On the community territory, three agricultural areas with self-sown plants were marked near Baimaky, Hrabyna, and Sokolivka villages (Fig. 3).



a b

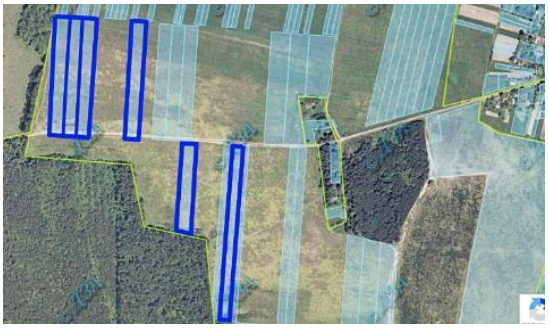
Fig. 3. Location of the study area: (a) Busk territorial community; (b) Research arrays –(I) near the village of Baimaky, (II) near the village of Hrabyna, (III) near the village of Sokolivka
Source: author compilation

Within the area, 15 land plots of private ownership were chosen to study the processes of self-afforestation (Fig. 4). Comparison of orthophotos of the Public Cadastral Map of Ukraine 2009 (Fig. 4 I a, II a, III a) and satellite photos of the social

GEO-information service “GISFILE” 2021 (Fig. 4 I b, II b, III b), confirm that 12 years ago, self-afforestation processes did not happen on the studied area.

I a

I b



II a

II b

III a

III b

Fig. 4. Location of land plots with self-sown forests: (I) near the village of Baimaky, (II) near the village of Hrabyna, (III) near the village of Sokolivka
Source: author compilation from the Public Cadastral Map of Ukraine 2009 (a), from social GEO-information service “GISFILE” 2021 (b)

The method of analysis was used to select, to make quantitative assessment, to determine the legal status, to describe the topographic characteristics of land plots with the self-sown forest. The information on the forest cover on agricultural land was obtained from the social GEO-information service “GISFILE” (GISFile) and geo-portal “Public cadastral map of Ukraine” (Public cadastral map of Ukraine). The cartographic method was used for visualization of the processes of self-afforestation on the studied territories. The system approach was used to study the self-afforested plots as an integral set of elements in the complex of relations and dependences. The abstract-logical method was applied for consolidation of the research results and conclusions making.

Results and Discussion

The initial phase of settling the situation with the self-sown forests on agricultural lands should involve inventory of lands, which aims to restore the quantitative and qualitative characteristics of land plots. Such information is required for the land cadaster, control for land use and protection, making managerial decisions by government and local authorities concerning the land use in the future. Inventory of land is conducted to determine the land plot location, its boundaries, size, legal status, kind of lands, use conditions, etc. (The order of land inventory, 2019). To obtain more information on the self-afforested agricultural lands, it is recommended to conduct soil and geobotanic observations (Mesquita et al., 2021). It will help assessing the ecosystem value of vegetation and soil suitability for agricultural use.

Referring to the inventory results and field surveys, the author of the research has got information about 15 land plots (Table 1). While choosing the land plots, the possibility to interview the owners was considered to get more detailed information on the use of self-afforested lands in the future.

All land plots are in private ownership. They include grasslands, which are intended for commercial agricultural production, e.g. cattle grazing.

The studied land plots are characterized by turf sand and clay-sand soils (Albeluvisols Umbric). Such soils are particular for Polissia zone and characterized by low fertility, weak humus horizon, small content of humus (0.6–0.9%), poor nutrition elements. However, under the adequate agricultural technologies, they provide for rather good yields of potato and winter rye (Soils and soil resources). The vegetation is represented by pine and grass that is also specific for Polissia zone. Pine is a dominating tree in local forests. The research confirms that open places of pine growing are the habitat for many animals and other kinds of plants, which are at risk of extinction (Nordman et al., 2021).

The interview results show that self-afforestation of agricultural lands has happened due to the following reasons, particularly 1) abandoned lands because of the land-owners' no interest to run any agricultural activity (cattle grazing, hay-making, cultivation of energy crops, etc.); 2) investment unattractiveness of land to be used for arable farming because of low soil fertility.

Therefore, legal aspects of the issue of self-sown forests on agricultural lands should be considered at the governmental level. The notion of "self-sown forest" should be legally approved and the procedure of transferring the agricultural land with self-sown forest to the category of the forest fund lands should be legislatively adopted.

Table 1. Results of the inventory of self-afforested land plots within the studied area

Land plot number	Area, ha	Soil/vegetation cover	Land use according to the cadaster	Afforest area
Area near the village of Baimaky				
1	0.7361	Turf sand and clay-sand / pine and grass	Grassland	0.3607
2	0.7022			0.3702
3	0.7021			0.3821
4	0.7167			0.4372
Area near the village of Hrabyna				
5	0.9823	Turf clay-sand / pine and grass	Grassland	0.7816
6	0.9823			0.7874
7	0.9823			0.8003
8	0.9823			0.6728
9	0.9448			0.8407
10	0.9455			0.7521
Area near the village of Sokolivka				
11	1.8615	Turf clay-sand / pine and grass	Grassland	1.4812
12	1.6009			0.9405
13	1.1137			0.8013
14	1.1337			0.5878
15	1.1275			0.8294

Source: author study from the Public Cadastral Map of Ukraine, field surveys and social GEO-information service “GISFILE”

Nevertheless, the final decision should be made at the local level while making spatial planning of the territorial communities. The authors of the research propose a conceptual model for planning the use of agricultural lands with self-sown forests (Fig. 6).

Referring to the inventory of lands, it is necessary to make managerial decisions concerning their future use, in particular, either change or not change their intended use, to include those land plots into the category of forest or environmental lands, or they should stay in the category of agricultural lands. According to the laws of Ukraine, the category of lands and their intended use are defined within the specific kind of the territory functional intention, identified in the complex plan of spatial development of the community area (On Amendments to Certain Legislative Acts of Ukraine Concerning Land Use Planning, 2020). It means the complex plan should include information about boundaries of the functional zones of the whole community area with the requirements to building and topographic organization. The territory functional zones should specify the permissible kinds of the land intended use with the list of restrictions.

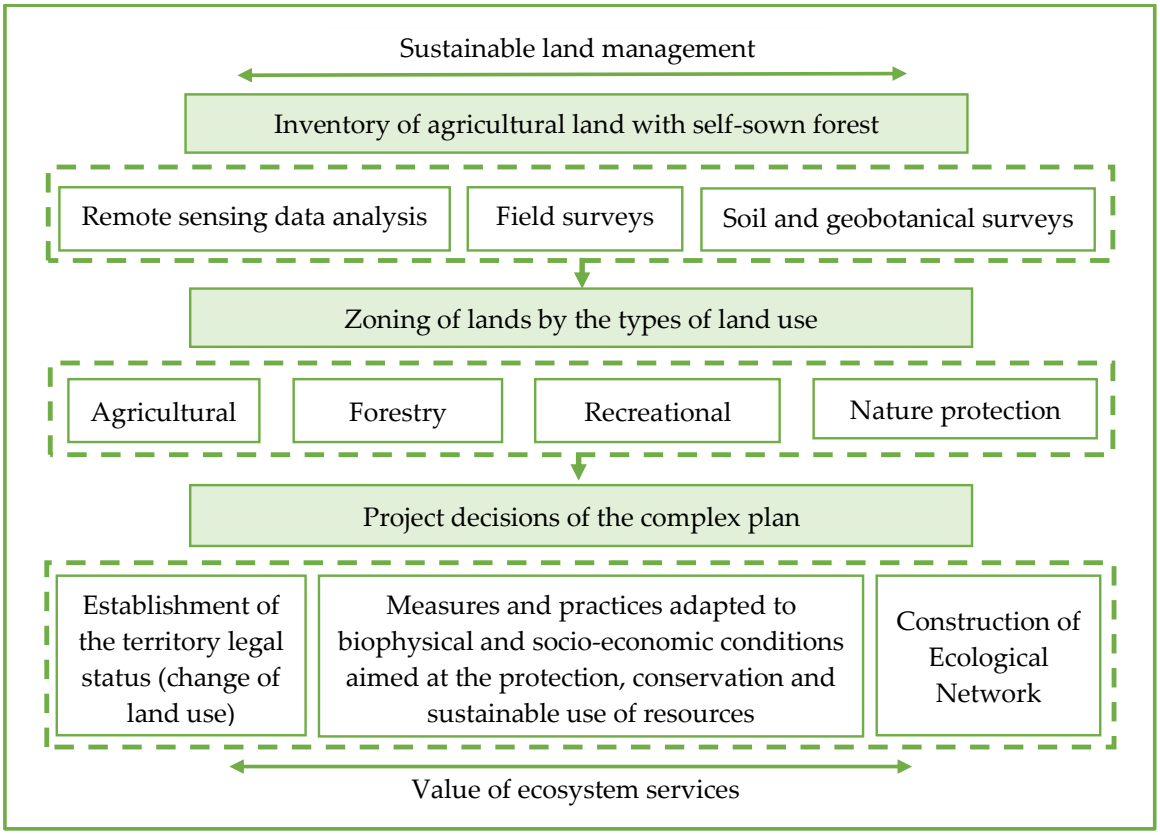


Fig. 6. Conceptual model of planning the use of agricultural land with self-sown forest
Source: author compilation

In that context, while planning the land use it is necessary to make the territory zoning along with grouping agricultural lands by the types of use with consideration of their quality, assessment of sensitivity to anthropogenic burden, modern use and determination of target functions of the future community development. It will determine the land use conditions and regulations within the corresponding types. It is recommended to distinguish four types of land use:

agricultural type – crops of different kinds of perennial fodder herbs for feeding animals with fresh green forage at pastures, or making hay and other green forage;

forest type – growing forest plants to satisfy needs of population and production for timber, technical, medical and other forest products; another important additional use of forests is related with obtaining non-timber products of forest, particularly collecting wild fruits, nuts, mushrooms, berries, medical plants, oleoresin, wood sap, placement of apiaries, etc.;

recreation type – lands of that type can be used for strolling, riding bikes and horses, camping, gathering berries, mushrooms, medical plants, photo hunting, resting by the river, fishing, etc.;

environmental type – any activity, interfering natural processes in the ecosystems or making harmful effects on the natural complexes and objects, is forbidden; a specific environmental regime is settled on the territory to restore the ecosystem natural conditions, to protect and improve its sustainability, capability to self-regulation,

ecological potential; in the future, such territories should be included in the ecological network.

Determining the direction of use of the agricultural lands with self-sown forests, it is required to assess the ecosystem benefits, which can be obtained from such lands. To regulate the land relations of environmental use and to motivate land owners, it is recommended to introduce a conservation easement (Murray et al., 2021).

The issue of self-sown forests on agricultural lands is disputable and needs further studying. However, the authors of the research consider, that self-sown forests perform as one of the tools to restore the natural ecosystems and to improve the biological diversity of territories. Therefore, management of self-afforested lands in favor of their protection should be an important constituent of the state policy, spatial planning and land resources management at the local level (at the level of territorial communities).

Obviously, self-sown forests need human support, treatment and protection from different negative impacts (e.g. fires, pests, invasion kinds, etc.). But, since self-sown of forest plants happens in a natural way (passive forest restoration), such forest ecosystems will be more resistant to different natural phenomena in the future and more valuable for increase of the territory biological diversity than man-cultivated forests (active forest restoration) (Birch et al., 2010).

Conclusions

1. It is important to protect self-sown forests in Polissia zone, where ecosystems have been important elements of the space, often dominating ones. The process of self-afforestation on agricultural lands should be considered as natural regeneration of forests, which provides for ecosystem benefits through restoration of natural ecosystems and increase of the territory biological diversity.

2. Inventory of agricultural lands with self-sown forests is an important constituent of sustainable management of lands and spatial planning, using the data of satellite remote sensing. A mandatory condition of the inventory of land plots with self-sown forests is to conduct soil and geobotanic observations of the land quality characteristics.

3. Solution of the problem of self-sown forests on agricultural lands needs a complex approach with consideration of legal, economic, social, and ecological aspects. However, the ecosystem value of forest ecosystems should be a primary criterion for determining the direction of use of the self-afforested agricultural lands.

4. Results of the research can be used for making a complex plan of spatial development of community territories in terms of topographic planning, as well as for project decisions concerning protection of land, water, forests, formation of ecological network, management of river basins, etc.

References

Altieri M.A. (1989). Agroecology: A new research and development paradigm for world agriculture. Agriculture, Ecosystems & Environment, vol. 27, no. 1–4, pp. 37–46, https://doi.org/10.1016/0167-8809(89)90070-4

Birch J.C., Newton A.C., Aquino C.A., Cantarello E., Echeverría C., Kitzberger T., Schiappacasse I., Garavito N.T. (2010). Cost-effectiveness of dryland forest restoration evaluated by spatial analysis of ecosystem services. PNAS, vol. 107, no. 50, pp. 21925–21930, https://doi.org/10.1073/pnas.1003369107

Cunningham S.C., Mac Nally R., Baker P.J., Cavagnaro T.R., Beringer J., Thomson J.R., Thompson R.M. (2015). Balancing the environmental benefits of reforestation in agricultural regions. Perspectives in Plant Ecology, Evolution and Systematics, vol. 17(4), pp. 301–317, https://doi.org/10.1016/j.ppees.2015.06.001

Ecosystem restoration for people, nature and climate (2021). United Nations Environment Programme. https://wedocs.unep.org/bitstream/handle/20.500.11822/36251/ERPNC.pdf [access: 15.12.2021].

Geographical Encyclopedia of Ukraine (1993). In 3 Volumes. K. Vol. 3: 480 p. ISBN 5-88500-020-4.

GISFile. https://gisfile.com/map/ [access: 17.12.2021].

Grodzinsky M.D. (1995). Resistance of geosystems to anthropogenic loads. K.: Likei, 233 p.

Holl K.D., Aide T.M. (2011). When and where to actively restore ecosystems? Forest Ecology and Management, vol. 261, no. 10, pp. 1558–1563, https://doi.org/10.1016/j.foreco.2010.07.004

Hummel D., Jahn T., Schramm E. (2011). Social-ecological analysis of climate induced changes in biodiversity – outline of a research concept. BiK-F Knowledge. Flow Paper 11, Frankfurt/Main.

Izakovičová Z., Špulerová J., Petrovič F. (2018). Integrated Approach to Sustainable Land Use Management. Environments. 5(3), 37, https://doi.org/10.3390/environments5030037

Land directory of Ukraine (2020), https://agropolit.com/storage/2020/Zemelniy_dovidnyk_2020.pdf?utm_source=mailchimp&utm_campaign=0300ccc2e1f0&utm_medium=page [access: 18.12.2021].

Mehring M., Bernard B., Hummel D., Liehr S., Lux A. (2017). Halting biodiversity loss: how social-ecological biodiversity research makes a difference. International Journal of Biodiversity Science, Ecosystem Services & Management, vol. 13, no. 1, pp. 172–180, https://doi.org/10.1080/21513732.2017.1289246

Mesquita S., Capelo J., Gama I., Marta-Pedroso C., Reis M., Domingos T. (2021). Using Geobotanical Tools to Operationalize Mapping and Assessment of Ecosystem Services (MAES) in Southern Portugal. In: F. Pedrotti, E.O. Box (ed.), Tools for Landscape-Scale Geobotany and Conservation. Geobotany Studies (Basics, Methods and Case Studies). Springer, Cham, https://doi.org/10.1007/978-3-030-74950-7_7

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-Being: Synthesis.

Murray H., Catanzaro P., Markowski-Lindsay M., Butler B.J., Eichman H. (2021). Economic Contributions from Conserved Forests: Four Case Studies of the USDA Forest Service Forest Legacy Program. Forest Science, vol. 67, no. 6, pp. 629–632, https://doi.org/10.1093/forsci/fxab039

Nordman C., Faber-Langendoen D., Baggs J. (2021). Rapid Ecological Integrity Assessment Metrics to Restore Wildlife Habitat and Biodiversity for Shortleaf Pine-Oak Ecosystems. Forests, 12(12): 1739, https://doi.org/10.3390/f12121739

On Amendments to Certain Legislative Acts of Ukraine Concerning Land Use Planning: Law of 17.06.2020 № 711-IX (Legislation of Ukraine: Database) https://zakon.rada.gov.ua/laws/show/711-20/card2#Card [access: 19.12.2021].

Public cadastral map of Ukraine, https://map.land.gov.ua/ [access: 17.12.2021].

Schiere, J.B., Grasman, J. (1997). Agro-ecosystem health: aggregation of systems in time and space. In: J. van Bruchem (ed.), Agro-ecosystem health. Proc. of Seminar, Wageningen 1996, NRLO-rapport 97/31, pp. 23–36.

Soils and soil resources. National Atlas of Ukraine. Online, http://wdc.org.ua/atlas/4100100.html [access: 17.12.2021].

Sustainable Development Goals: Ukraine. (2017). National report. file:///D:/Library/Owner/Downloads/SDGs_NationalReportUA_Web.pdf [access: 15.12.2021].

The order of land inventory: Resolution of the Cabinet of Ministers of Ukraine from 05.06.2019 № 476 (Legislation of Ukraine: Database), https://zakon.rada.gov.ua/laws/show/476-2019-%D0%BF/card2#Card [access: 16.12.2021].

Unaccounted forests of Ukraine, 2020, http://epl.org.ua/en/eco-analytics/neoblikovani-lisy-ukrayiny-analitychna-zapyska/ [access: 17.12.2021].