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ELECTRONIC SUPPORT OF CIVIL PROCEEDINGS AND THE NEED FOR DATA PROTECTION IN POLAND

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Abstract:

Computerization of the judiciary entails considerable risks connected with the disclosure of information about the participants of the proceedings. The availability of the judgments on the web is a recent innovation. Personal data should be anonymous, instead of the names of participants, shall be published only initials. Electronic support of judicial civil proceedings, inter alia the video record of the hearing, also planned possibility to communicate with the court via Internet, can lead to disclose the details of the trials, even if the case is remained confidential. Data relating to court cases, generated by the courts is stored on servers that require strong security, they may fall victim hacking attacks and be disclosed. It is necessary to ensure both the appropriate tools, such as proper education about the need for protection of personal data and the potential criminal liability for failure of protection standards.

Keywords:

civil proceedings, civil law, data protection, polish judiciary

Computerization of Polish judiciary

The process of computerization of Polish judiciary has been ongoing for several years, more and more information relating to the court proceedings is available on the Internet nowadays. On the other hand it is said, that new technologies support the civil proceedings.

It results first of all from the fact that application of the achievements of technology is visible in all areas of human life. The Polish legislator noticed the potential of new technologies and has been taking steps to use them, introducing them into the civil procedure.

The Polish civil procedure was construed on the basis of the established principles – trial procedures. So far, neither of them referred to the issue of securing data confidentiality. Along with dissemination of using new IT technologies, it is reasonable to start the activities by the legislator which introduce proper security for the data on court procedures. Previous lack of regulations results from the fact that the court procedures were pending and were serviced in a traditional manner, namely in paper form. The introduction of the electronic means of electronic

communication creates a potential risk of access to the data by the unauthorized persons who are not the participants of the procedure nor the workers of the court.

The computerization of the Polish judiciary takes place in multi-layer aspects. On one hand, the tools are introduced which support the service of the procedures such as electronic case list, portal of judgments, information portal, on the other hand there are instruments affecting the procedure such as electronic protocol, electronic court registers or electronic procedures (electronic reminding procedures). In September, another novelization of CCP enters into force and an electronic submission office will be introduced, which means a possibility to submit the letters to the court and collect the correspondence from court by electronic means.

Electronic case list

A case list is a list of court cases placed by order, in which they are to be considered on a given day [1]. It contains, i.e. names and surnames of the parties to the procedure and other persons summoned in connection with the subject of the cases, namely the personal data of the parties. As well as the names and surnames of the judges and lay judges, reference case numbers indicated for the session, times for which the cases were indicated and, in civil cases, the subject of the case is provided. The case list realizes the principle of openness in the aspect of access to basic data on the procedure, although it was not directly settled by the provisions of the code of civil procedure. The court case list in a paper form is hanged in front of the court room (more and more often it is substituted with an electronic display), whereas an electronic version is available on the website of the court. In fact, every person interested may search for basic information on the case, date for the trial, subject and participants of the procedure on the Internet.

In common courts, they were placed until recently in the form of paper printouts at the court rooms. For a few years the Information on the sessions, reference numbers, parties summoned judges have been displayed on a current basis on the displays. The displays are mounted in front of each room and collectively for a few rooms for each division or in the main hall for the whole court [2]. Apart from this, data from the case list is published on the websites of the court in e-wokanda tab.

The body conducting the procedure, solely for technical reasons in order to assure proper course of the procedure, gives the reference number to the procedure and discloses the parties to the procedure on the case list in order to make it possible for the entities to participate properly in the trial. Due to the openness of the trial, in accordance with art. 9 k.p.c., the information on the dispute pending between the parties may not be recognized as confidential [3].

The issue of placing the information about the underage participants in proceedings is particularly sensitive. President of Polish Personal Data Protection Office proposes to amend the Law. The reason for that is the lack of statutory regulation and the fact that too large volume of information is available.

The case list on the one hand pursues the principle of openness of proceedings, and on the other hand is a violation of the right to privacy.

Judiciary Information Portal

One of the best developing tools is the information portal [4]. It allows for the authorized or validated entities, by means of the data communication system, to have an access to the information on the pending case with their participation. Most often, it is used by advocates, although everyone interested may use it for their case. The user obtains the access to the data on the case covering, i.e. the present status of the procedure, activities performed by the court, marked dates, access to documents generated by the court in electronic form (judgments, decisions, justifications, electronic protocol) [5].

The portal allows to view the electronic version of the files of the cases and to print their copies. Using the portal is free of charge. The user obtains the information generated on the status of his account, changes made in the cases, incoming sessions and new cases which appeared on the list automatically.

Due to the possibility of online sharing of particular case files by the parties of the trial, the need of attendance by these parties during court hearings is eliminated. Hence, there is no need for the court officers to spend their time on the parties' service.

The information portal undoubtedly assures the realization of the access to the case files which may take place at any time and in any place if the person interested uses the devices connected to the Internet.

Judgement on the web (Judgement Portal)

For the past few years the Ministry of Justice has been implementing the project of the judgments' portal, namely the Internet website making available the texts of the judgments of common courts (regional, district and appellate courts) [6] for the users. The publication of the decisions of the common courts constitutes the source of knowledge for each citizen, is a tool allowing an effective social control of legality of the course of the procedure and reasonability of the judgments given [7]. The decisions are available for free and without the need of a prior registration of the user. Some appellate courts issue their own bulletins which are also available in electronic form (e.g. Appellate Court in Białystok, in Katowice, in Lublin, in Szczecin and in Wrocław).

The base of the decisions made available on the Internet fulfills, first of all, the informative and educational functions. It does not have the status of the official collection. To keep confidentiality of the personal data all decisions published in the base, are anonymous. It means that personal data which allow to identify the person to which they refer are not disclosed. The anonymization process takes place automatically by means of advanced algorithms of text analysis.

Anonymization involves the removal of the contents of the decision, all the personal data and other information identifying specific facts, entities and circumstances while maintaining the content of a document. However, in small towns it is still possible to identify the parties and the case. Before the publication of judgments all sensitive data for identifying the parties are deleted. With the publication therefore names, addresses and other information that would allow direct or

indirect identification of a person are provided. In addition, when anonymization decisions take into account the requirements of the protection of banking secrecy or trade secrets of entrepreneurs.

The account in the portal looks like the account in the social media; the user is automatically connected with cases, in which he is involved in. It's especially useful for attorneys.

In the portal of decisions in which one may search for the information by means of using key words, date of the decision, surnames of the judges, reference file numbers or by indicating the article of the act being the legal basis for the judgment.

The publication of the judgments creates a danger for disclosing the data either by means of access to data by unauthorized persons or by making available the documents collected from the portal.

In the light of the above considerations, one may bravely conclude that a broadly understood computerization of judiciary [8] may be favorable for guaranteeing and realizing the principle of openness of the civil procedure in all its aspects.

Record of the trial

On 1st of July, 2010 [9] a new manner of maintaining the course of the court procedure was introduced into the civil procedure, popularly called the electronic record or e-protocol which has a form of recording sound or image and sound. The definition however is not adequate, as the registration in the form of phony record or audiovisual one is not a new form of record of the course of the procedure, existing next to the previous one. As a result of novelization it was adopted that the form of the protocol is what is changed which will be only electronic. The distinguishing the electronic protocol as a separate institution in civil, procedural law, would introduce a terminology chaos and would disturb the uniformity of the construction of the procedural civil law systems [10]. In case of the protocol not the form of maintaining is important (written, phonic, audiovisual), as its role is brought down to playing the course of the procedure.

The change of the form of maintaining the course of the court session caused the wave of criticism in the judiciary circles [11]. It was pointed out, inter alia, that the protocol is to be played only for those events which are of significant importance for the case and as a result of the case. Recording the entire course of the case loses efficiency of communication and becomes an information noise which makes it difficult to separate significant events [12]. Somehow, in reply to the charges and reported applications the act was changed [13], as a result of which the scope of the previous text of the so called abbreviated protocol was extended and the changes were made in the scope of the possibility to make transcription.

E-protocol is connected first of all with the principle of the speed of the procedures, with procedure economics, etc. So far in the doctrine, not too much attention was paid to considering the institution in the context of the principle of openness of procedure. Usually it is considered that the main arguments in favor of the introduction of the electronic protocol include: a possibility to maintain completely the procedure activities in such a manner as they were in fact in reality, assuring better basis to assess the collected evidence in the case, allowing for the chairman to have full perception and for the witnesses and experts and the parties (participants of the procedure) to have the possibility of free utterance and for acceleration of the procedure [14].

In accordance with the provision of art. 9 KPC the parties have the right to view the files and obtain copies of them. In case of an electronic protocol, the parties may at their request, obtain the CD record with audio-video data. Such a solution may however lead to disclosing the details of the case including, if they were confidential, infringement of the right for privacy. The persons participating in the court session have no possibility to express the objection in the issue of maintaining their image. There is quite a large risk that the persons who will obtain the CDs may make them available for other persons.

Rehearsal on the distance

The participants of the procedure have the possibility to participate in the procedure activities and in particular those connected with conducting the evidence procedure. However, sometimes it happens that the principle of directedness is limited and some evidence may be conducted by means of legal aid by the court summoned. The legislator in order to give the priority for the principle of conducting the procedure before the adjudicating court introduced a possibility to conduct the evidence remotely. Therefore, in accordance with the provision of art. 235 kpc, if the nature of the evidence objects it, the adjudicating court may decide that it will be conducted with the use of the technical devices allowing to conduct the activity remotely. The adjudicating court conducts the evidence in the presence of the court summoned or the recording clerk in the court. The devices for conducting the evidence remotely between the adjudicating court and the summoned one are the technical digital or analogue devices which allow for conducting tele conference (transmission of sound in real time) or video conference (transmission of the synchronized image and sound in real time) between the participants to the procedural activity and which guarantee the integrity of the data communication transmission [15].

Due to the application of tele conference and video conference the participants to the procedure have a real possibility to take part in the activities of the evidence procedure, including in case of hearing the witness or the expert, they may ask them questions.

Electronic land register

For the past few years Polish land and mortgage registers have been incorporated within an IT system (art. 25¹ it. 1 of the act on land and mortgage registers [16]). The copies of the land and mortgage registers, extracts from the land and mortgage registers and certificates on closing the land and mortgage registers are issued by the Central Information Office by means of data communication system, having the force of documents issued by the court. In case of submitting by means of the data communication system the petition for obtaining the above documents, the persons interested have the possibility to print them independently. The printouts of the documents have the force of the documents given by the court if they have the features allowing for the review with the data contained in central base of land and mortgage registers. Despite the fact that the land and mortgage registers are conducted in IT system this is however necessary to control and review the data by the land and mortgage register court. In the situation of errors in IT system, preventing from making an entry consistent with the law, the Court cannot refuse to enter nor make an entry

which is inconsistent with the law and consistent with the IT program. The immediate change of the wrong program should be conducted and the entry should be made consistent with the law.

Electronic companies register

A similar solution has been applicable for many years with reference to the register of entrepreneurs. In accordance with the provision of art. 4 it. 3 of the act on National Court Register [17] Central Information of the National Court Register gives the copies, extracts and certificates and grants information from the register which have the force of official documents, if they were given in the paper and electronic form. Whereas, computer printouts collected independently of current information on the entities entered into the register have an equal force to the documents given by the Central Information Office, if they have the features allowing to review them with the data contained in the register (it. 4aa).

Electronic court

The Court, which is VIth Civil Division of the Lublin-West Regional Court – in Lublin, is better known as the electronic court (the e-court). It considers cases under electronic writ of payment proceedings (electronic order for payment proceedings [18]) introduced to The Civil Procedure Code in the Act of 9th January 2009 on the Amendment to the Civil Procedure Code and other Acts.

The jurisdiction of the e-court covers the whole territory of Poland regardless of the defendant's domicile or seat. The court is competent to examine civil pecuniary claims (including commercial and labour claims). The cases are considered under electronic writ of payment proceedings irrespective of the total amount of the dispute, which means that some of them would otherwise fall within the competence of District Courts. The Court lacks competence over non-pecuniary claims and family law claims.

It should be pointed out that bringing a case before the e-court is just an alternative to the traditional proceedings. In other words, the introduction of the e-court did not violet the citizens' right to the court.

The payment order (writ of payment) ends the proceedings. The defendant can submit a statement of opposition to it. The effective submission of the statement of opposition by the defendant cancels the payment order and results in the case being transferred for consideration to the competent court. If the defendant refrains from submitting the statement of opposition – the payment order (writ of payment) becomes final and the enforcement clause is issued in the electronic system by the court official. The resulting writ of execution, upon the claimant's motion, enables the court executive officer to start execution proceedings.

Data protection problem

Just because of new possibilities, new problems have been arising. It is especially important to ensure the security of legal actions. Recently in Poland a sad indicent has taken place. One of the

leading law firm was the victim of cyber-attack, which resulted in the leaked data [19]. Unfortunately the same can happen to the courts, which are not properly protected.

Undoubtedly, the introduction of new IT tools which support the justice and activity of the bodies of public administration creates on one hand a possibility of fast realization of access to information and on the other hand puts an obligation to assure security for the data stored and processed.

Not much attention has been paid so far to the issue of protection in particular for the personal data. The courts and the bodies are the administrators of the personal data both for the persons employed and those whose data is obtained in connection with the cases conducted as a result of which they are obliged to perform certain duties.

New technologies create a risk of disclosing too much information on people. The application of new technologies shall require proper regulations with reference to the personal data protection. Currently there are provisions missing which would directly settle the above issues and, at the same time, which would be the basis to store and process personal data in the manner consistent with the law and the requirements of the security of information.

The court is the administrator of personal data including both data of people employed there, as well as those whose data is obtained in connection with casework. As the result the court should fulfill certain obligations, like e.g. inform those people, whose data have been processed.

Openness of the court proceedings

One of the rules governing the civil procedure is the principle of openness. It constitutes the guarantee for the impartiality of the judge and reliable procedure, allowing for the parties interested to realize to right to be judged [20]. At the same time it is recognized as one of the fundamental legal values [21]. It is directly correlated with the right to be judged and the right for the information (the principle of openness) [22]. It also covers the right to familiarize with all arguments and charges which are used against the party to the procedure and the possibility to refer to them [23].

The issue of openness of the procedure is complicated. Due to the subjective criterion one may differentiate internal and external openness and on the basis of the subjective criterion – openness of the court sessions, openness of the access to court files to basic data on the process [24]. Internal quality refers to the parties of the parties and parties to procedure and external for the public namely the third persons, not interested directly in the result of the case [25].

The principle of openness states that general information about the case are available for everyone. That information consist of names of parties, subject of the case and the date of the hearing, and also the judgements can be presented to the public.

If an individual is making a request to find out information about his or her case, the request should be done without an unreasonable effort.

Conclusions

The realization of the principle of openness of the procedure, which is fully realized by the new institutions of law and tools supporting the procedure, may lead to infringement of the law, including the right to protect personal data.

New technologies create a risk to disclose too much information about citizens. The use of new technologies requires appropriate statutory regulations regarding the protection of personal data. However, such a modern means, that are used in civil proceedings, can be treated as a great achievement, not everybody can notice the lack of regulation of data protection. Too much data is revealed, and we don't have proper measures to protect the data. Fortunately, that issue is largely discussed at the moment at the conferences and among researchers.

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OUTSOURCING THEORIES

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Abstract:

Paper describes Outsourcing in theories. Outsourcing as a process which is fundamental part of many organization in the world is today very important for solutions in business developing. The paper contains definition of outsourcing, brief history, types and futures. Further the paper contains the collection of theories from 1990 to 2006 coming from many interesting authors. Main goal is to present and describe recognizable and valuable outsourcing theories. The paper is overview for following theories: Transaction Cost Economics, Relation View, Core Competences, Evolutionary Economics, Incomplete Contracts, Resourced-based view, Agency theory, Knowledge-based view, Neoclassical economic theory, Social exchange theory, Economics of information. As a summary overview for theories will be presented.

Keywords:

outsourcing, theories, outsourcing process, resource

Introduction

According to Perunović and Pedersen “the outsourcing phenomenon has been increasingly receiving attention both from academic and practitioners societies. The result of research has led towards the emergence of several frameworks depicting the phases of outsourcing process. At the same time, the phases were subjected to a flow of theoretical explanations. The studying of the outsourcing phenomenon has been grounded in many theories. Some of them are complementary, the other are contradictory. This creates confusion among the researchers of the outsourcing phenomenon [1]. The main aim of this paper is to present outsourcing theories, which has been studied through the time of outsourcing discoveries and explanations based on observations and analysis.

The paper is structured as follows. In first section outsourcing definition, brief history, types and features will be presented. In next section types of theories have been used in research and description will be presented. Last section will include conclusions and summary.

Outsourcing – definition, brief history, types and features

According to worldwide known Britannica portal "Outsourcing is work arrangement made by an employer who hires an outside contractor to perform work that could be done by company personnel. Outsourcing has been a frequent point of dispute for organized labour. If, for example, an employer has a labour contract with a union, and the outsourced work could be performed by union members, then the union will typically object to such a practice because it takes work away from the union's members. Management favours outsourcing, or subcontracting, often to nonunion providers, because these activities can often reduce costs. Outsourcing can also reduce the number of employees in a collective bargaining unit" [2].

In Management Encyclopedia "the term outsourcing is an English acronym for three words [3]:

- outside
- resource
- using" [3].

The same source says that "many scientific sources say that the term "outsourcing" was first used in 1979 and referred to the acquisition of German designs by the British automotive industry. Although outsourcing is widely regarded as an invention of the 20th century, its features can be found much earlier. A form of outsourcing can be considered, for example, entrusting the orders by the rulers of European countries with the educational structures. Napoleon certainly outsourced, who commissioned private companies to supply ammunition to the battlefields and collect the wounded" [3].

And going further Encyclopedia states "in Poland, outsourcing has been used since the 90s. Its beginnings, however, were not associated with this name. They were simply contracts for the servicing of auxiliary areas such as maintaining cleanliness or security. However, some characteristics of these contacts indicated that outsourcing cooperation may bring more benefits than just temporary savings, which were the first important reason for looking for external contractors" [3].

Stephanie Overby on CIO website shows "main features for outsourcing are benefits and costs. The business case for outsourcing varies by situation, but benefits of outsourcing often include one or more of the following [4]:

- lower costs (due to economies of scale or lower labor rates)
- increased efficiency
- variable capacity
- increased focus on strategy/core competencies
- access to skills or resources
- increased flexibility to meet changing business and commercial conditions
- accelerated time to market
- lower ongoing investment in internal infrastructure
- access to innovation, intellectual property, and thought leadership
- possible cash influx resulting from transfer of assets to the new provider" [4].

Main types of outsourcing can be distinguished as a main partition in all outsourced areas. According to Fronts Desk Helpers Co, 6 main types of outsourcing can be point out:

Business process outsourcing

The “business process outsourcing” describes a complex of secondary technological processes with constantly changing composition. Typically, this complex includes finance and accounting, labor, supply, payroll accounting and accounting, internal audit, tax calculation, customer service centers and a number of industry specific processes [5].

IT outsourcing

Currently, IT – outsourcing implies the passing of any IT processes execution to external companies. IT processes include the design, development, implementation, maintenance, and development of the company’s IT infrastructure. IT outsourcing became widespread due to the development of information technology in the late 20th century. Most business both small and large accept to entrust the IT support to specialized companies. It saves time and money. IT outsourcing is the most used type of outsourcing in the world due to the rapid pace of development and ever-growing market demand and high rates of computer technology development [5].

Production and housekeeping outsourcing

It is one of the most common types of outsourcing when all concerns related to administrative and lumper jobs like real estate operations, cleaning, cooking, company’s transport fleet management, goods inventory, and other service work fall on the outsourcing company’s shoulders [5].

Accounting outsourcing

It is one of the options for ensuring enterprise accounting. Types of cooperation are very different: ranging from the formation of “zero reporting” to regular cooperation on a daily basis. An accounting outsourcing company can fully perform all functions of an enterprise’s accounting including the bank payments execution and issuing primary documents to counterparties. However, this does not exclude the opportunity of building a fairly flexible business process using external companies and own employees to achieve maximum efficiency [5].

Marketing Outsourcing

I can be used when it’s more profitable for the company to receive services from third-party specialized in solving market issues. The choice of marketing development direction for outsourcing is unique for every company. It depends on the specifics of the company, presence in the company staff a sufficient number of its own marketers and their level of qualifications [5]”.

Tab. 1. Types of outsourcing – summary

Type of outsourcing	Summary
Business Process Outsourcing	finance and accounting, labor, supply, payroll accounting and accounting, internal audit, tax calculation, customer service centers and a number of industry specific processes
IT Outsourcing	design, development, implementation, maintenance, and development of the company's IT infrastructure
Production and housekeeping Outsourcing	real estate operations, cleaning, cooking, company's transport fleet management, goods inventory, and other service work
Accounting Outsourcing	all functions of an enterprise's accounting including the bank payments execution and issuing primary documents to counterparties
Marketing Outsourcing	from third-party specialized in solving market issues

Source: Own study based on <https://frontdeskhelpers.com/insights/outsourcing-definition-and-6-main-types-of-outsourcing/>, 18.10.2020

The website above provides empirical data base and states “United States Outsourcing Institute published information that 89% of US enterprises have delegated part of business of process to external providers. IT, call centers dispatching and accounting are leading services. Regarding to Europe, Eurostat says that 87% of enterprises use outsourcing in Germany, 88% France, 88%, 94% in Lichtenstein. The average of outsourcing in Europe is 83% [5]”.

Theories utilized in the research of outsourcing process

Both Perunović and Pendersen in his article from conference put down “the outsourcing process is a complex structure consisting of numerous activities and subactivities, carrying many managerial dilemmas. It is no wonder that many theories have been utilized to help the academics to understand the nature of those activities, and to help practitioners successfully manage the process. In order to depict the utilized theories we have conducted a literature study of the research papers in outsourcing from the 1990 up to 2006. Tab. 2 shows the papers and theories utilized. The abbreviations P, VS, T, MR, and R stand for the phases of the outsourcing process i.e., Preparation, Vendor(s) Selection, Transition, Managing relationship, and Reconsideration [1]”.

Tab. 2. Theories utilized in the research of the outsourcing process

Year	Authors	Theory	Method	Key Points	Applicability to outsourcing process
1995	Lacity and Willcocks	Transaction Costs Economics (TCE)	Case study	Experiences to the TCE framework of efficient governance structures resulted in anomalies	P, VS, MR, R
1995	Pinnington and Woolcock	Core competences	Case study	Growth of IT vendor industry is creating a new firm relationship for the IS function	P, R
1995	Willcocks and Choi	Relational view	Case study	Defining characteristics of total IT outsourcing strategic alliances and identifying problems of managing them	P, MR
1995	Willcocks et al.	Core competences	Conceptual framework	Conceptual framework	P

1996	Aubert et al.	TCE, Incomplete contract theory	Case study	TCE and Incomplete contract theory support the choice of activity to be outsourced and contract management between the outsourcer and its vendor	P, MR
1996	Ulset	TCE, Property rights theory	Survey	When substantial externalities are involved, like in the supply of R&D, TCE should be combined with property rights theory to explain the use of governance mechanisms	P, VS, MR
1997	Brandes et al.	TCE, Core competences	Case study	Outcomes are more successful if outsourcing decision is based on core competence and cost efficiency and if outsourced unit is able to develop strong resource base	P, MR, R
1999	Vining and Globerman	TCE	Conceptual framework	Framework for making the outsourcing decision	P
2000	Arnold	TCE, Core competences	Conceptual framework	Framework for making the outsourcing decision	P
2000	Baden-Fuller et al.	Core competences	Conceptual framework	Framework for making the outsourcing decision	P
2001	Lee	Knowledge-based view, Core competences	Survey	Knowledge sharing is positively related to outsourcing success	MR
2001	Mahnke	Evolutionary economics	Conceptual paper	Propositions regarding scope, speed and switching costs have been developed	P, T, MR, R
2001	Roy and Aubert	RBV	Case study	The best predictor of success and failure is the governance mode and the position of project in the value matrix	P
2001	Zviran et al.	Relational view	Case study	Factors determining success from outsourcer's and vendor's perspective – good project definition and specifications, good project management, trustworthiness, technical competence	P, VS, T, MR, R
2003	Barthélemy	Agency theory, Relational view	Case study	Managing outsourcing by contracts and trust	MR
2004	Aubert et al.	TCE, Incomplete contract theory	Survey	Uncertainty is major deterrent to outsourcing, while the level of technical skills is the most P important reason to outsource	P
2005	Barthélemy and Geyer	TCE	Survey	Determinants of outsourcing and quasi-outsourcing decisions	P
2005	Gottschalk and SolliSæther	11 theories	Case study	Core competences and stakeholder theory explain best critical success factors	P, MR, R
2005	Pati and Desai	Core competences	Conceptual framework	Framework for making the outsourcing decision	P
2006	Barthélemy and Quelin	TCE, Resource-based view	Survey	To restrict vendor's opportunism, contracts must contain incentives and penalties, as well as pricing and monitoring clauses	P, VS, MR, R

2006	Gottschalk and SolliSæther	Cumulative theory, TCE, Agency, Contracts, RBV, Core competences, Relational view, Social exchange	Conceptual model	Maturity model of IT outsourcing relationships	P, VS, T, MR, R
2006	Halldórsson and SkjøttLarsen	TCE, Agency theory, Contract theory, Relational view	Case study	Challenges TCE, agency, and contract theories and argues for relational view	P, VS, T, MR
2006	Miranda and Kim	TCE, Institutional theory	Survey	The logic of TCE decision maker is contingent on institutional context	P
2006	Mirani	Evolutionary economics	Conceptual framework	Stages of relationships are contracts, networks and hierarchies	MR
2006	Whitten and Wakefield	TCE, Social-exchange theory	Survey	A second-order switching costs model for specifying switching behaviour	R

Source: Z. Perunović, J.L. Pedersen, Outsourcing Process and Theories, POMS 18th Annual Conference Dallas, Texas, U.S.A. May 4 to May 7, 2007

The main outsourcing theories

As through all the years many papers and theories have been created and it shows how important and current topic outsourcing in many areas is. Due to the reason the following outsourcing theories have been published and worked out as per below:

- Transaction Cost Economics
- Relation View
- Core Competences
- Evolutionary Economics
- Incomplete Contracts
- Resourced-based view
- Agency theory
- Knowledge-based view
- Neoclassical economic theory
- Social exchange theory
- Economics of information [1].

Transaction Cost Economics

Transaction cost economics according to Suzanne Young from Springer Link website “is understood as alternative modes of organizing transactions (governance structures – such as markets, hybrids, firms, and bureaus) that minimize transaction costs (Williamson 1979). Transaction cost theory (Williamson 1979, 1986) posits that the optimum organizational structure is one that achieves economic efficiency by minimizing the costs of exchange. The theory suggests that each type of transaction produces coordination costs of monitoring, controlling, and managing transactions. Williamson has defined transaction costs broadly as the costs of running the economic

system of firms. He has argued that such costs are to be distinguished from production costs and that a decision-maker can make a choice to use a firm structure or source from the market by comparing transaction costs with internal production costs. Thus, cost is the primary determinant of such a decision” [6].

Douglas North states that “there are four factors that comprise transaction costs – “measurement”, “enforcement”, ideological attitudes and perceptions” and “the size of the market”. Measurement refers to the calculation of the value of all aspects of the good and service involved in the transaction. Enforcement can be defined as the need for an unbiased third party to ensure that neither party involved in the transaction reneges on their part of the deal. These first two factors appear in concept of ideological attitudes and perceptions, North third aspect of transaction costs. Ideological attitudes and perceptions encapsulates each individual's set of values, which influences their perceptions of the world. The final aspect of transaction costs, according to North, is market size, which affects the partiality or impartiality of transactions” [7].

According to Carl “transaction costs can be divided into three broad categories [8]:

- Search and information costs are costs such as in determining that the required good is available on the market, which has the lowest price, etc.
- Bargaining and decision costs are the costs required to come to an acceptable agreement with the other party to the transaction, drawing up an appropriate and so on. In game theory this is analyzed for instance in the game of chicken. On asset markets and in market microstructure, the transaction cost is some function of the distance between bid and ask.
- Policing and enforcement costs are the costs of making sure the other party sticks to the terms of the contract, and taking appropriate action (often through the legal system) if this turns out not to be the case” [8].

In Huascar paper is states “arguably, transactions costs reasoning became most widely known through Oliver E. Williamson’s Transaction Costs Economics. Today, transaction cost economics is used to explain a number of different behaviors. Often this involves considering as “transactions” not only the obvious cases of buying and selling, but also day-to-day emotional interactions, informal gift exchanges, etc. Oliver E. Williamson, one of the most cited social scientist at the turn of the century [9], was awarded the 2009 Nobel Memorial Prize in Economics” [10].

The determinants of transaction costs, according to Williamson are opportunistic behavior, uncertainty, frequency, limited rationality and specificity [11].

Relational View

In his paper from conference Perunović and Pederson describe Relational View which “develops and explains how firms gain and sustain competitive advantage within inter-organizational relationships (McIvor, 2005). Its key premise – the concept of relational rents has been explored to explain how firms choose their future outsourcing partners and preferred type of the relationship. It has been also utilized in studying the Transition, Managing relationship and Reconsideration phases. This makes the relational view to be the only theory that has been applied in the research of all the outsourcing process’ phases” [1].

Concept of Core Competences

Pederson and Perunović explain that “the concept of core competences has been developed on the basis of the resource-based theory. Prahalad and Hamel (1990) defined the core competencies as the collective learning in the organisation, especially how to coordinate diverse production skills and integrate multiple streams technologies. The application of concept of core competences in outsourcing became very popular among researchers. The concept has been predominantly use to develop and test various outsourcing decision frameworks arguing that the core activities shall remain in house. Learning and communication premises of the concept made it also applicable in the Managing relationship and Reconsideration phases” [1].

Resource-based view

Neves, Hamaher, Scavarda in his paper Outsourcing from the perspective of TCE and RBV point out, that “according to Peteraf (1993), Foss (1997) and Barney (1999), two authors, Richard Rumelt and Birger Wernerfelt, were instrumental in shaping the modern theory of resources. In Wernerfelt's (1984) analysis, the strategy of a firm should be viewed in terms of positioning its resources and not its products and markets, in contrast to Porter's (1980) analysis. The author defined resources as anything that can be perceived as a strength or weakness of a particular firm, including brands, existing internal technological expertise, trained employees, trade contracts, machinery, efficient procedures, and capital, among others. Wernerfelt (1984) was interested in defining strategies that would ensure a competitive advantage and suggested that firms should analyze the range of the current and future resources of the firm that would have an impact on their competitive advantage” [12].

The Trio mention further about Rumelt (1984), “who stated that firms, at the most primitive level, might simply differ in the relative efficiency with which they extract or process homogeneous goods. However, in the absence of perfect intermediate markets for these goods, firms would have incentives to integrate” [12].

Neves, Hamaher, Scavarda based on Teece (1986), who explained “if outsourcing exposes the firm to a leakage of proprietary information (i.e., knowledge that is not patentable), then the firm will take self-protective measures to reduce the loss of such knowledge. Goods and services can be contracted out in a regime in which proprietary knowledge is secure. Otherwise, they will be internally conducted within the firm. According to Liebeskind (1996), the internal mechanisms that protect the firms' knowledge are superior to those present when contracting between firms” [12].

Further the Trio explain “the question of which activities can be outsourced, based on RBV, has been systematized by Quinn and Hilmer (1994). For these authors, firms must focus their resources on a set of core competencies in which they have definite advantages over their competitors and offer unique value to their customers. In addition, the authors recommend the outsourcing of activities for which the firm has no critical strategic need or special skills” [12].

Evolutionary Economics

Again Perunović and Pedersen say “although mention for the first time in the 19th century, the evolutionary economics experienced revival after Nelson and Winter's work in 1982.

The theory develops from Darwinism and includes some assumptions transposed to the economic “species”. Both point out “these assumptions include (Andersen, 1994) [1]:

- The agents (individuals and organizations) can never be perfectly informed and they have to optimize locally rather than globally.
- The decision-making of agents is normally bound to rules, norms and institutions.
- Agents are to some extent able to imitate the rules of other agents, to learn for themselves and to create novelty.
- The processes of imitation and innovation are characterized by significant degrees of cumulativeness and path dependency but they may be interrupted by occasional discontinuities.
- The interaction between the agents are typically made in disequilibrium situations and the result is success and failures of commodity variants and method variants as well as agents.
- The processes of change occurring in a context described by the above assumptions and characteristics are non-deterministic, open-ended and irreversible” [1].

Agency Theory

According to professional website Risk Lane Solution which delivers advisory and control reports, “in general terms, the agency theory relates to all relationships between two parties in which one party is the principal and the other party is the agent who represents the principal in transactions with third parties. Agency relationships occur when the principals hire the agent to perform a service on the principals' behalf. Principals commonly delegate decision-making authority to the agents. Because contracts and decisions are made with third parties by the agent that affect the principal, agency problems can arise [13]”.

And further to this portal “In the situation outsourced activities to service organization by an user organization, the agency theory is relevant for all aspects described; information asymmetry, risk tolerance and resources committed. For example, a financial institution outsources IT services to a managed services provider. The managed service provider has no insight in the risk tolerance of the institution and might decide that a weekly backup is acceptable or that storage of data outside of the EU is acceptable. The service provider might not inform the organization of down-time of certain servers if this network outage is not identified by the financial institution. The service organization might also be inclined to minimize resources performing activities while trying to increase the fees received. A service organization might also have a different tolerance towards fraud or might be the committer of fraud itself. In the pension industry asset managers can make profits by front running transactions of pension funds. Resulting in the principal-agency problem described above” [13].

Knowledge-Based View

Zack and Singh in his work A knowledge-based view of outsourcing describes “the Knowledge-Based View (KBV) adds a valuable perspective to the theories we have discussed so far by accounting for knowledge and learning, while providing an additional point of view for considering the outsourcing decision. The outsourcing literature has significantly under-examined the KBV. For example, KBV was ignored in recent reviews of theories used to analyze outsourcing

decisions. Although the outsourcing literature acknowledges that knowledge plays a role, it has neither placed sufficient emphasis on the strategic value of knowledge and organizational learning nor investigated this directly. Where knowledge has been examined it has been treated simply as a resource to be contracted for per the RBV. Several studies identified knowledge erosion as an outsourcing risk, but none seriously considered the KBV in their analysis. Taking the KBV, a firm's products or services are the result of applying value-creating knowledge. Firms, then, are characterized not by their existing product array, but by the knowledge they apply to produce a variety of products. Thus the knowledge the firm possesses, develops, and enhances represents the basis for its ability to compete. Further, while traditional resources may confer a competitive advantage per the RBV, the knowledge an organization has about how to coordinate, combine and apply those resources (and the ability to acquire, integrate, apply and improve that knowledge) may be the most unique and inimitable resource. That is, knowledge is essentially a resource “trump card.” Knowing more than competitors can provide a strategic advantage, even if the organization's underlying tangible resources are not unique. And a strategic knowledge-based advantage can be sustained because knowledge is extremely difficult for competitors to imitate or even observe” [14].

Neoclassical Economy Theory

Pedersen and Perunović in his paper explain “the key characteristics of the neoclassical economic theory are (Hodgson, 1994):

- Assumption of rational, maximizing behavior by agents with given preference function.
- Focus on attained, or movement towards, equilibrium states.
- Absence of chronic information problem.

The neoclassical theory explains the initial motives for outsourcing demonstrated by some pioneering companies like Kodak. However, the theory has received a significant critique for not being able to explain contemporary business processes. Especially, the concepts of rationality and absence of chronic information problem have been criticized. However Gottschalk and Solli-Sæther (2005) showed that the neoclassical economic theory explains critical success factors of outsourcing that are being evaluated in the Reconsideration phase” [1].

Social Exchange Theory

In Chinese word press explanation of “Social Exchange Theory is based on Blau 1964, Emerson 1972 and Homans 1961. Early sociologists conceptualized social associations as exchanges of activities between two or more persons. Social exchange is defined as “voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do in fact bring from others”. Several attributes are important in an exchange. They are reciprocity, balance, cohesion, and power. The need to reciprocate the benefits received acts to reinforce the characteristics of the exchange. Balance refers to the balance of dependence of one actor in the exchange over the other and vice versa. Cohesion occurs when one or both actors in the exchange encounters conflict involving the exchange. Power is defined as the level of cost one actor can induce over the other. Trust is also an important construct in social exchange. The differences between TCE, AT and social exchange theory (SET) is that TCE and AT studies conditions leading to an inter-organizational relationship (IOR), while SET explains the process of IOR. When applied

to outsourcing research, social exchange has been studied as a dependent variable, for example, Ang and Slaughter (2001) used SET to study how work status can impact social exchange relationship” [15].

Economy of Information

Again duo of Petrović and Pedersen admit that “that the information is not perfect and new economical models emerged to explain situations where two parties possess unequal or none quantity of information. One of the first works in the area was development of the search theory (Stigler, 1961). The identification of sellers and the discovery of their prices are only one sample of the vast role of the search for information in economic. Another key concept of the economy of information is the concept of signalling developed by Spence (1973). His essay is about markets in which signalling takes place and in which the primary signallers are relatively numerous and in the market sufficiently infrequently that they are not expected to invest in acquiring signalling reputation. Application of the economy of information in outsourcing is associated to activities of searching, selecting, and contracting the vendor. However, the economics of information hasn’t been used explicitly in the studies of the outsourcing process” [1].

Interesting outsourcing theories and models partition present Žitkienė and Dudė in their paper The impact of outsourcing implementation on service companies. Duo shows on Fig 1. Theoretical concepts of outsourcing and divides them on 3 main groups: Economic activity decisions, Strategic decisions, Partnership and development decisions. Each group contains subgroups as the Fig. 1 shows.

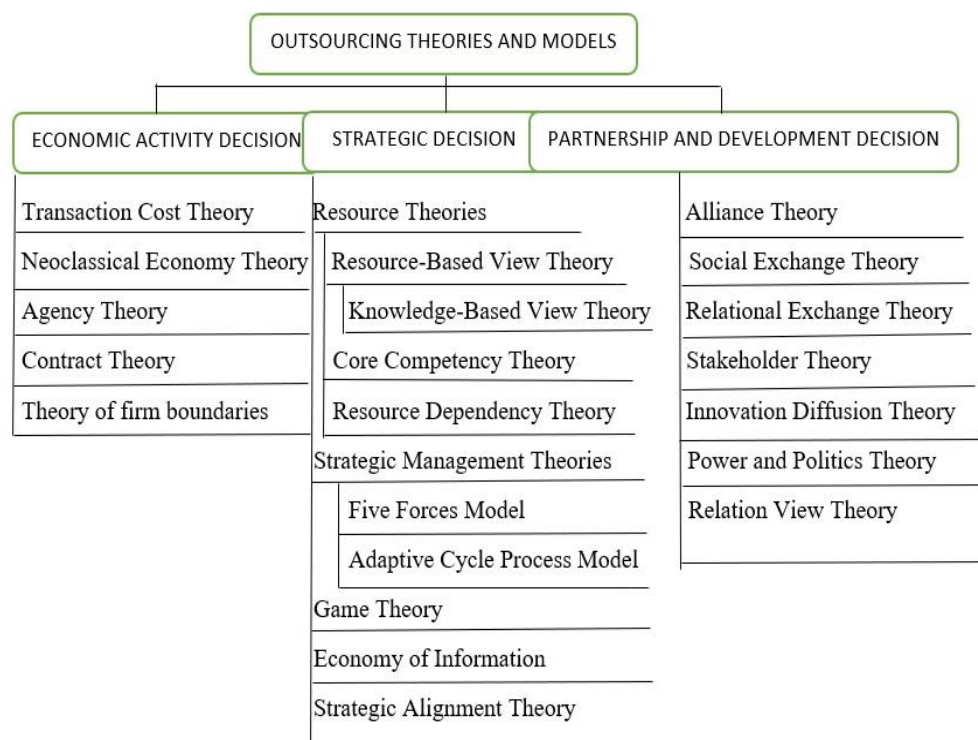


Fig. 1. Theoretical Concepts of Outsourcing

Source: Own based on R. Žitkienė, U. Dudė, The impact of outsourcing implementation on service companies, Entrepreneurship and Sustainability Issues, Entrepreneurship and Sustainability Center, 2018, 6 (1), pp.342-355.

Conclusion

Criticism of Neoclassical Economic Theory is for its impossibility to explain progressive business operations, but according to Gottshalk and Solli-Saether (2005) NET could be used to give an explanation the success factors in outsourcing process. Transaction Cost Theory is most used in researches and practice. Both NET and Resourced-Based View are taken as meaningful theories for giving an explanation of outsourcing success [16].

Practical and Theoretic researches are based on the subject of strategic management in the firms. The numbers show these theories are tightly associated with strategic decisions. Knowledge-Based View Theory shows knowledge combined with relationship and how the process of outsourcing management is maintained by outsourcing suppliers. Core Competency Theory came from Resourced-Based Theory and explains the key competencies and skills in managed organization. Prahalad and Hamel (1990) state that outsourcer competencies and management knowledge are main factors for the success of outsourcing contract. Game Theory shows the strategic player's behaviour in specific situation with the same conditions to gain the maximum of the profits reasonably and rationally to guess the actions of other player [16].

Partnership and development decisions are based on relationships and development of firms which are involved in outsourcing implementation. The oldest theory is Innovation Diffusion Theory which during the process is based on numbers of groups and factors which lead to decision-making. It is being used in many disciplines as for example in: criminal law, agriculture communication, science theories marketing and social work [16].

Going through knowledge about outsourcing and heading to outsourcing theories it is clearly visible how outsourcing important is. It is being observed outsourcing theories to be used both in research and in practice. They been created based on many observations during researches and to help improve outsourcing service for both parties.. Without outsourcing theories it would be not possible to find solutions in practical economic world. Outsourcing theories are still improving due to constant and fast changing world and business environmental.

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STUDIES OF THE PREPARATION OF THE MICROPOROUS CARBON MATERIALS FROM MOLASSES

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Abstract:

In this study, the raw material for the preparation of microporous carbon materials was a molasses solution with a sucrose concentration of 1 mol/dm³, placed in an autoclave for 12 h at 200 °C. After synthesis, the sample was removed from the autoclave, rinsed with deionized water until neutral, and dried at 110 °C. After drying, the spherical material obtained from hydrothermal synthesis was activated with a saturated KOH solution. The mass ratio of carbon to modifier was changed in the range of 1 to 2. The material was heated at 750 °C under nitrogen. Activation of carbon spheres with potassium hydroxide used contributed to obtaining carbon materials with a well-developed porous structure. It was found that the obtained parameters of the porous structure, such as the specific surface area or volume of micropores, were increased by using more KOH in the process of activation of carbon spheres.

Keywords:

carbon materials, activation, CO₂ adsorption, N₂ adsorption

Introduction

Carbon dioxide and methane are greenhouse gases, the emission of which is considered to be the most important cause of climate change on the Earth, manifested mainly in global warming [1]. Carbon dioxide plays the most crucial role in the greenhouse effect, as it remains much longer in the atmosphere than other gasses. Carbon dioxide emissions are mainly caused by burning fossil fuels, which are sources of electricity, car transport and heating households [2]. At present, energy demand is increasing, so reducing or eliminating the use of fossil fuels in the future is impossible. Therefore, new ways of using greenhouse gases as raw materials for the synthesis of useful products, such as methanol from carbon dioxide [3], methanol or formaldehyde from methane [4] or hydrogen from methane [5], are intensively sought after. Much research has been devoted to developing technologies, leading to the capture and storage of carbon dioxide, especially adsorption techniques, which are currently considered very promising. Various adsorbents have been described that could be used in the capture of carbon dioxide, e.g. carbon materials [6-8], zeolites [9], organometallic structures [10] and porous polymers [11].

Particularly noteworthy are carbon materials used in the planning and optimization of various industrial processes associated with the constant need to improve their properties. Thanks to the strongly developed specific surface area, an extensive pore volume, and unique physicochemical properties, carbon materials are widely used in almost every branch of modern industry as sorbents, catalysts, or electrodes in supercapacitors. In recent years, many researchers have turned their attention to very promising carbon spheres showing a full spectrum of applications [12-19]. Carbon spheres can be activated, for example, with KOH, NaOH, ZnCl_2 , so they can be used as sorbents.

So far, many methods of obtaining carbon spheres have been developed [19]. They were produced mainly by the Stöber method based on resorcinol reaction with formaldehyde in a water-alcohol-ammonia solution under conditions of hydrothermal synthesis at 100 °C [12]. The spheres were then carbonized at 400-800 °C under nitrogen. They activated under carbon dioxide at 850 °C. The highest carbon dioxide adsorption at 1 bar was: 8.05 mmol/g and 4.40 mmol/g at 0 °C and 25 °C, respectively. Marszewska and Jaroniec modified the Stöber method by adding tetraethoxysilane or colloidal silica to the reaction mixture. Thanks to which they obtained carbon nanospheres from which the templates were removed at 60 °C using a KOH solution with a concentration of 3 mol/dm³ [20]. The samples were activated in the same way as previously described [12]. At 1 bar pressure, the highest carbon dioxide adsorption at 0 °C was 7.8 mmol/g and 4.0 mmol/g at 25 °C. When using zinc chloride as the activating agent and drying the sample in an ammonia atmosphere, relatively low adsorption of carbon dioxide was observed at 0 °C and 1 bar pressure of 4.23 mmol/g [21]. Modification of the Stöber method by adding $\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ allowed for the elimination of the activation stage and obtaining 6.6 mmol/g of carbon dioxide at 0 °C [22]. Another modification of the Stöber method, consisting in replacing resorcinol with aminophenols, resulted in obtaining carbon spheres of significant porosity without the need for an activation step or adding an activating agent during the synthesis [23]. Unfortunately, the adsorption of carbon dioxide at 0 °C and 1 bar pressure was only 3.6 mmol/g. The carbon spheres obtained by the Stöber method were also activated by mixing for 2 h in KOH solutions of various concentrations. Then they were washed and carbonized [24]. The adsorption of carbon dioxide was then 7.34 mmol/g at 0 °C and 4.83 mmol/g at 25 °C.

Dassanayake and Jaroniec also developed the synthesis of carbon spheres from 3-aminophenol and pyrrol and ammonium persulfate and p-toluenesulfonic acid [14]. The spheres were calcined under nitrogen at 600 °C and activated with KOH at 600 and 700 °C. The highest adsorption of carbon dioxide at 1 bar pressure was 7.73 and 5.42 mmol/g at 0 and 25 °C.

Sweet drinks such as Coca Cola, Push Orange [16] were also used to obtain carbon spheres with the hydrothermal method. The liquids were placed in an autoclave at a temperature of 220 °C for 24 hours. The obtained material was carbonized under a stream of nitrogen at a temperature of 1000 °C. The adsorption of carbon dioxide was 4.65 and 2.99 mmol/g at a pressure of 1 bar at 0 and 25 °C. When carbon spheres were synthesized from Coca Cola in the presence of ammonia and CATAB. Then calcined with KOH, carbon dioxide adsorption at 25 °C, 1 bar equal to 5.22 mmol/g was obtained [15].

The method of obtaining porous carbon spheres with the use of silica-based templates [25-26], which are suitable hydrogen sorbents, is also widely known.

In this work, spherical carbon materials were obtained by the hydrothermal method and then activated with KOH solution. The work aimed to obtain porous carbon materials from molasses and to determine their adsorption capacity.

Experimental

The raw material for the preparation of carbon materials was beet molasses - waste from the sugar industry containing approximately 50% of sucrose. Molasses solution was prepared with sucrose concentration of 1 mol/dm³. The sample was labeled as MB_1 according to the scheme MB_sucrose concentration, MB beet molasses. The solution was placed in an autoclave for 12 h at the temperature of 200 °C. After the completion of the hydrothermal synthesis, the sample was removed from the autoclave, rinsed with deionized water until it was neutral, and then dried at 110 °C. After drying; a spherical carbon material was obtained.

The morphology of the obtained carbon materials was examined with the Hitachi SU 8200 field emission scanning electron microscope. Fig. 1 shows exemplary SEM images of the obtained carbon materials made at different magnifications for the MB_1 sample.

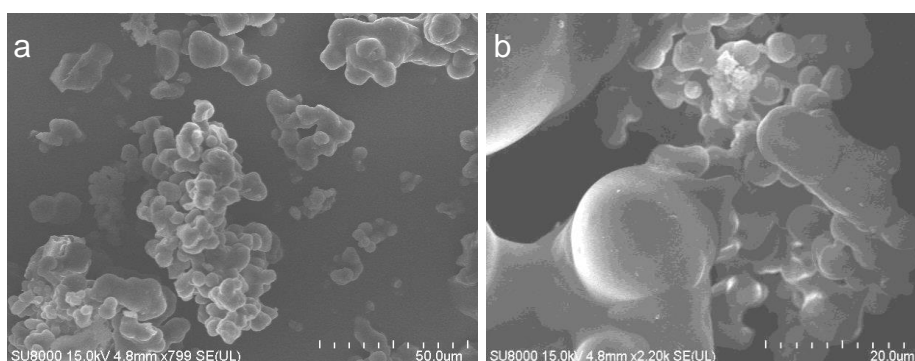


Fig. 1. SEM images of the obtained carbon materials made at different enlargements:
a) x799, b) x2200

The obtained materials have a spherical structure. The grains are spherical, slightly deformed, and their diameters range from 6 - 10 μm.

After drying, the material obtained from a hydrothermal synthesis from 1 mol/dm³ sucrose solution was modified with a KOH solution for 3 hours. The mass ratio of carbon to modifier was changed in the range from 1 to 2. The material was heated at the temperature of 750 °C. The samples were designated MB_1: 1_750 and MB_1: 2_750, respectively. The annealing process was carried out in a nitrogen atmosphere (flow 18 dm³/h). The obtained activated carbon-containing the decomposition products of potassium hydroxide was rinsed with distilled water until the reaction was neutral. Then, the sample of carbonaceous material was flooded with HCl solution with a concentration of 1 mol/dm³ and left for 20 h. The obtained carbon material was washed with distilled water until the pH was neutral. In the final stage, the material was dried at 110 °C for 20 h to obtain the desired carbon material.

The textural characterization of the carbon materials was performed using the Quantachrome Instruments Quadrasorb Evo apparatus. Measurements of low-temperature N₂ adsorption isotherms

at -196 °C were performed. Data was recorded digitally in the QuadraWin program. Before measuring the adsorption, to remove impurities, samples of carbon materials were heated at the temperature of 250 °C for 12 h under reduced pressure, using a MasterPrep apparatus coupled with a computer. Based on the measurements of N₂ adsorption, the following was determined:

- specific surface area (S_{BET}), which was calculated from the BET equation (Brunauer-Emmet-Teller) in the partial pressure range $p/p_0 = 0.05-0.2$ (p - pressure N₂, $p_0 = 760$ mmHg);
- total pore volume (V_{por}), based on the maximum nitrogen vapor adsorption for $p/p_0 = 0.99$;
- pores in the range of micropores (V_{mic} , N₂) and mesopores were determined by N₂ analysis at -196 °C, using the nonlinear method of Density Functional Theory (DFT);
- pores with smaller diameters (0.3 - 1.47 nm) were determined using CO₂ at a temperature of 0 °C. The pore size distribution was determined by the DFT method.

CO₂ adsorption studies at 0 °C were also carried out in the Quantachrome Instruments Quadasorb Evo apparatus. To control the temperature of the measurements, the test sample was placed in a bath with a mixture of water and ice. Before the analysis of CO₂ adsorption, the samples were annealed at the temperature of 250 °C for 12 h under reduced pressure.

Results and discussion

The table shows the fundamental physicochemical properties of the obtained KOH-activated carbon materials. A more developed specific surface area was obtained for the sample with a higher amount of KOH introduced, which was 1141 m²/g compared to the activated KOH sample in the ratio 1: 1. The surface value of which was 969 m²/g.

Tab. 1. Summary of specific surface area and total pore volume, and the volume of micropores

Sample	S_{BET} , m ² /g	V_{por} , cm ³ /g	$V_{\text{mic,N}_2}$, cm ³ /g
MB_1:1_750	969	0.79	0.32
MB_1:2_750	1141	0.66	0.49

` Source: selfmade results

Low-temperature (-196 °C) nitrogen adsorption isotherms for the tested carbon materials are shown in Fig. 2. At low relative pressure p/p_0 values, the isotherms exhibit high N₂ adsorption, which is characteristic for microporous materials. The nitrogen adsorption capacity increased for the carbon sample with more activator. According to the IUPAC classification, the nitrogen sorption isotherm on MB_1: 2_750 carbon is a type I isotherm, and the carbon adsorption isotherm MB_1: 1_750 corresponds to type I in the initial range of relative pressure p/p_0 , and in the range of medium and higher pressures - type IV. The type I isotherm for the sample MB_1: 2_750 indicates high nitrogen adsorption in the range of low relative pressures and applies to materials with significantly developed microporosity. In the pressure range up to 0.9 p/p_0 , this isotherm runs almost parallel to the abscissa, which indicates that the mesoporosity is poorly developed. Thus, in the case of MB_1: 2_750 sample, one can expect well-developed microporosity and poorly developed mesoporosity. On the other hand, the course of the isotherm for the sample MB_1: 1_750

indicates the fact that a porous material was obtained which, apart from relatively well-developed microporosity, also has a well-developed mesoporosity. A characteristic feature of type IV isotherms is the occurrence of a clearly formed hysteresis loop related to the phenomenon of capillary condensation in the area of mesopores.

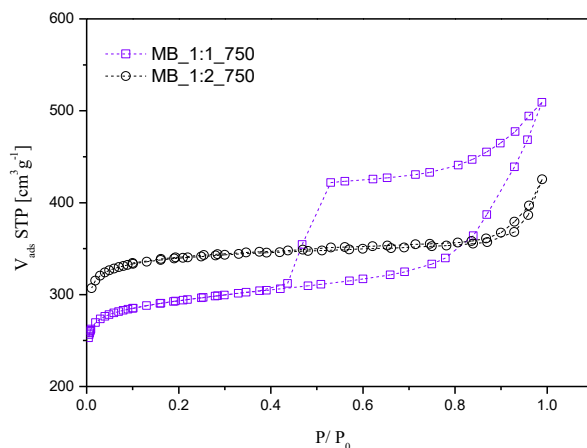


Fig. 2. N₂ adsorption-desorption isotherms at -196 °C

Based on the analysis of the pore size distribution determined by the DFT method, from measurements of N₂ adsorption at -196 °C presented in Fig. 3 and from the measurements of CO₂ adsorption at the temperature of 0 °C shown in Fig. 4, more complete information about the structure of the tested materials can be obtained.

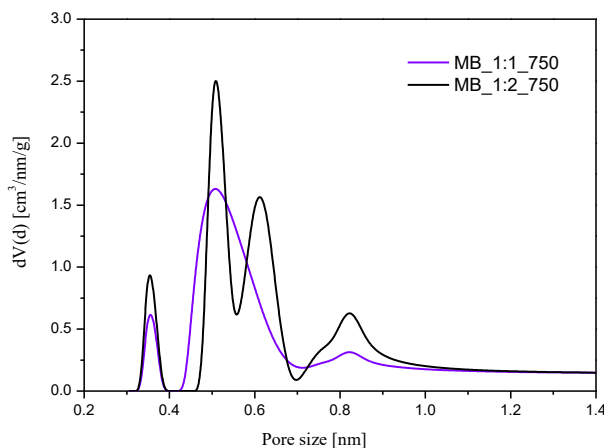


Fig. 3. Pore size distribution of carbon materials determined on the basis of N₂ adsorption isotherms at -196 °C

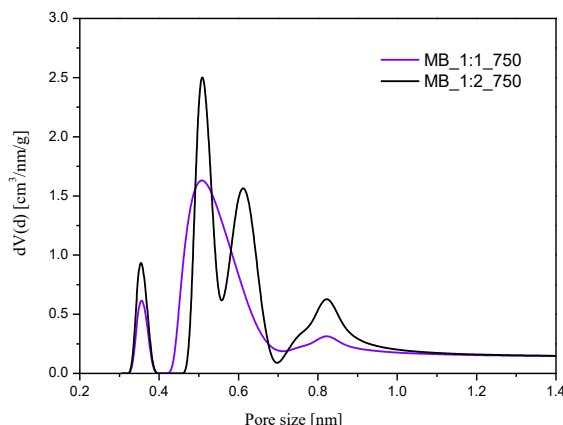


Fig. 4. Pore size distribution of carbon materials determined on the basis of CO₂ adsorption isotherms at 0 °C

Based on the presented pore distributions, it was found that the analyzed carbons contained pores with a diameter of approx. 0.35 nm and pores in the range of 0.5 - 0.6 nm and approx. 0.8 nm. The carbon material MB_1: 1_750, apart from narrow micropores, also contained a lot of mesopores with dimensions of 4.5 - 6 nm, as shown in Fig. 4. This is confirmed by a wide hysteresis loop on the adsorption-desorption isotherm of sample MB_1: 1_750, indicating a well-developed mesoporous structure of this carbon.

Fig. 5 shows the CO₂ adsorption studies on the obtained carbon materials up to a 1 bar pressure at a temperature of 0 °C. For both samples, the CO₂ adsorption isotherms follow a similar course. They were characterized by a sharp increase in values at low pressures combined with a smoother course of curves at higher pressures.

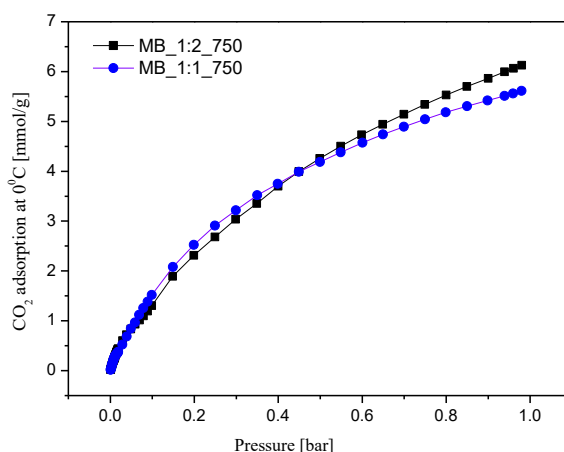


Fig. 5. CO₂ adsorption isotherms at 0 °C

Based on Fig. 5, it was found that the value of CO₂ adsorption at the temperature 0 °C, at 1 bar pressure for MB_1: 2_750 material was 6.13 mmol/g and was higher than the sample with less activator. The CO₂ adsorption value of 5.6 mmol/g was obtained on the MB_1: 1_750 carbon material. The CO₂ adsorption studies at 0 °C and 1 bar pressure showed that the CO₂

adsorption efficiency largely depended on the degree of development of the porous structure of the carbons, including the degree of development of microporosity.

Summary

The paper presents the process of obtaining carbon materials from carbon spheres based on molasses. The obtained carbons can be successfully used as adsorbents in the CO₂ adsorption process.

Based on the research, it was found that the carbonaceous materials obtained from molasses had a spherical structure. The applied activation of carbon spheres with potassium hydroxide contributed to achieving active carbons with a well-developed porous structure. It was found that the obtained parameters of the porous structure, such as the specific surface area or the volume of micropores, were increased by using a larger amount of KOH in the process of activating carbon spheres.

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DOSING SYSTEM OF N-OCTYLPHENOTHIAZINE DERIVATIVE BASED ON PEDOT

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Abstract:

N-octylphenothiazine derivative (PTZN) was used as a newly synthesized drug substance for dosing system from poly(3,4-ethylenedioxythiophene) platform. Such system could be used in the field of psychotic disease treatment. The purpose of the research is to synthesize by cyclic voltammetry PEDOT loaded with biologically active PTZN and characterize it as potential drug delivery system. Stimulation of such system by potential causes releasing of drug substance. Changing parameters of electropolymerization different thickness of layers were obtained. Release of drug substance from PEDOT matrix was characterized by UV-Vis spectroscopy by registration of spectra during stimulation using chronoamperometry. The layers were investigated by FTIR spectroscopy to identify whether the PTZN has been successfully incorporated into the matrix. Results show that potentially stimulated PEDOT matrix is able to release PTZN. Such systems show promising application in the field of medicine.

Keywords:

conducting polymers, PEDOT, phenothiazines, neural dosing system

Introduction

Conducting polymers are materials with semiconducting properties. Such polymers are used as a drug delivery system, biosensors, diodes and capacitors [1]. They show the extremely unique structure, conductivity, biocompatibility and electrochromicity [2]. Electrochromic properties are caused by charge transfer process which has influence on the optical properties of polymers. Poly(3,4-ethylenedioxythiophene) is an example of conducting polymers used as a flexible electrochromic device due to low weight, compatible with high-throughput processes and has a form of thin films [3]. PEDOT is commonly use as a drug delivery system in the treatment of neuronal, anti-inflammatory medical conditions [5]. The mechanism of electrochemical controlled drug release is that drugs become incorporated into the polymer during synthesis as a result of the polymer intercalating with the surrounding electrolyte during the redox cycle. Doping is a process

involving the introduction of ions to change properties and compensate the charge. Anionic drugs are incorporated into positive charged polymer as a dopant. One of the example is PEDOT:TUDCA (tauroursodeoxycholic acid) system, which shows the low cytotoxicity and could prolong the time span of chronic neural recording brain implants [6]. IBU (ibuprofen) is a non-steroidal, anti-inflammatory and analgesic drug, which was introduced with synthesized EDOT making it promising material for neuroprosthetics use [5]. Anti-cancer agent could also be delivered by potential triggered drug delivery system. PEDOT:betulin system was synthesized and exhibits cytotoxicity against the tumor cell lines [7]. Phenothiazine (PTZ) derivatives show reversible oxidation processes and intense luminescence causing the promising use as a drug system in the treatment of antipsychotic and neuroleptics drugs [8]. The PTZ derivatives namely 10-octyl-7- {2-[4- (trifluoromethyl) phenyl] ethynyl} -10,10a-dihydro-4aH-phenothiazine-3-carbaldehyde (PTZN) has a ability to increase cell sensitivity to cytostatic drugs. It re-establish sensitivity of cancer cell to drugs [8, 9]. In this article the synthesis of PEDOT with phenothiazine derivatives and characterization of new material as a drug delivery system was introduced. The purpose of the work is to synthesize PEDOT as a matrix with embedded molecules of PTZN derivative and characterize the thickness of obtained layers, charge flow, composition of layer after synthesis to explore the incorporation of drug substance into material and register releasing curves. The newly synthesize material show the promising application as a drug delivery system in the treatment of psychotic, neural disease to the further research.

Materials and methods

Materials

EDOT (Sigma Aldrich), which is colorless viscous liquid ($M_w = 142.17\text{g}$, $M_p = 10.5^\circ\text{C}$) was used with a drug substance (7-[2-(4-trifluoromethylphenyl)ethynyl]-10-octyl-10H-phenothiazin-3-carbaldehyde - PTZN) ($M_w = 508.19\text{ g}$) to prepare the solution. The synthesis was done on ITO substrate (Sigma Aldrich, surface resistivity = $100\ \Omega/\text{sq}$) taking into account protocol derived from the literature [8]. Molar ratio of 5:1 for EDOT:PTZN was used in all synthesis with concentration of monomer equal to 0.01 M. A solution of tetrabutylammonium tetrafluoroborate (Bu_4NBF_4) was made by dissolving the tetrafluoroborate salt (95% pure) in acetonitrile (ACN). Concentration of electrolyte solution in acetonitrile (TBABF_4) was equal 0.1 M. Prior to the measurements the solution was purged with argon. All potentials were scaled versus the internal standard which was ferrocene couple (Fc^+/Fc). Measurements were carried out in room temperature (25°C).

Methods

Cyclic voltammetry

Electrochemical cell was used in the three electrodes system including counter-electrode (CE) made from platinum, pseudo-reference (RE) silver electrode and working electrode (WE) in a form of indium tin oxide on elastic PET substrate. Before the measurements the electrodes were conditioned by cleaning with tetrahydrofuran (THF). Electropolymerization was carried out by cyclic voltammetry (CV), which is a method that measures the current passing through the electrode as a function of a linear change in potential applied to the WE [10]. Electrodes were immersed in

electrolyte solution in the 6 mL cell, which was connected to the potentiometer AUTOLAB PGSTAT 12. Data were recorded and analyzed by GPES 4.9 software.

Chronoamperometry

This method was used to stimulate potentially the polymer platform to release the drug substance. Chronoamperometric method measures the intensity of current as a function of time. The potential steps in a range of (0.1 : 0.7) V with 0.10 V intervals were used. The steps were applied after 10 seconds pulse duration.

UV-Vis spectroscopy

The measurements were carried out in a 6.0 mL transparent cuvette made from PC (polycarbonate). Biowave II spectrometer was used for measurements. Release of PTZN was observed in an experiment by recording UV-Vis spectra every 10 seconds during stimulation of the system by step potential protocol described previously by use of AUTOLAB PGSTAT 12 device. Releasing was carried out in room temperature (25 °C) in the TBABF₄ solution. The construction of the cuvette was planned in a way that allowed to pass the light beam through the investigated solution, but not through polymer layer.

FTIR spectrophotometry

The samples were examined by FTIR before releasing the drug substance to determine the functional groups and chemical composition of materials. Research was performed on Shimadzu IR Prestige-21 Fourier Spectrometer and analyzed by LabSolution software.

Results and discussion

Synthesis of PEDOT:PTZN (5:1)

PEDOT:PTZN were synthesized by cyclic voltammetry. The process parameters shown in Tab. 1 were used.

Tab. 1. The coding system of the investigated samples

Parameters	working electrode material	scan rate [V/s]	Potential [V vs. Fc ⁺ /Fc IS]	no of cycles
sample 1	platinum	0.05	0.81	10
sample 2	platinum	0.05	0.81	20
sample 3	platinum	0.05	0.93	10

The changes in synthetic procedure were proposed based on two reasons. One of them is to compare the thickness of the layer by the changes in the number of the applied scans (the comparison of the sample no 1 and 2), while the second assumed verification of the influence of the applied potential boundaries (the comparison of the sample no 1 and 3). Fig. 1. shows CV reflecting the synthesis of sample 3. The blue curve represents the first cycle of polymerization while the red curve - the last cycle. The current axis has been scaled to current density using the formula (1):

$$J = \frac{I}{S} \left[\frac{A}{mm^2} \right] \quad (1)$$

where:

I - current [A];

S- electrode surface area [mm²].

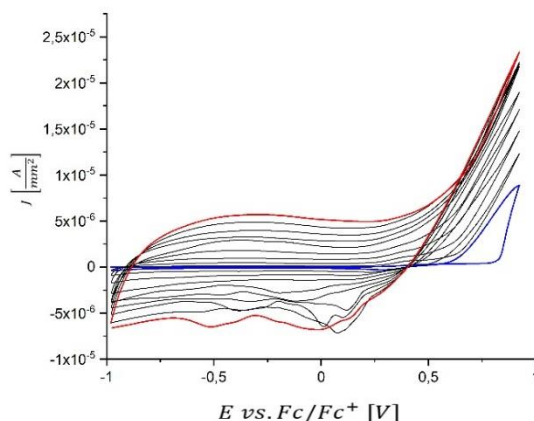


Fig. 1. Cyclic voltammograms for sample 3 (5:1 molar ratio of EDOT:PTZN solution) with total molar concentration = 0,01 M in 0,1 M TBABF₄ electrolyte solution

Source: own calculations

The intensity of the anode current generated during the oxidation reaction related to (1) was recorded. As the potential increases in the first forward oxidation half-cycle the current start to grow rapidly at 0.6 V named as the onset potential (E_{onset}), which corresponds to beginning of oxidation process. It is at this point where the EDOT radical – cations are started to be generated. After reaching the maximum potential of 0.81 V, the direction of polarization reverses and the cathodic peak was recorded. After each cycle, the value of the current density were increased for the anodic cycle and were decreased for the cathodic cycle. The electric density were increased, which confirms the conductivity of the forming layer. Voltammogram of pure PEDOT [11, 12] shows regular shapes of CV curves and smooth peaks. Incorporation of PTZN in PEDOT matrix disturb polymerization process by hindering the formation of chain due to the spheric structure and interaction of ions. During the polymerization of EDOT, PTZN were started oxidized, a cation radical was formed, which could interacted with another radical generated on the polymer chain and solution ions (BF_4^-). It was seen on irregular shape of CV curves on sample 3. During synthesis the products such oligomers could be created.

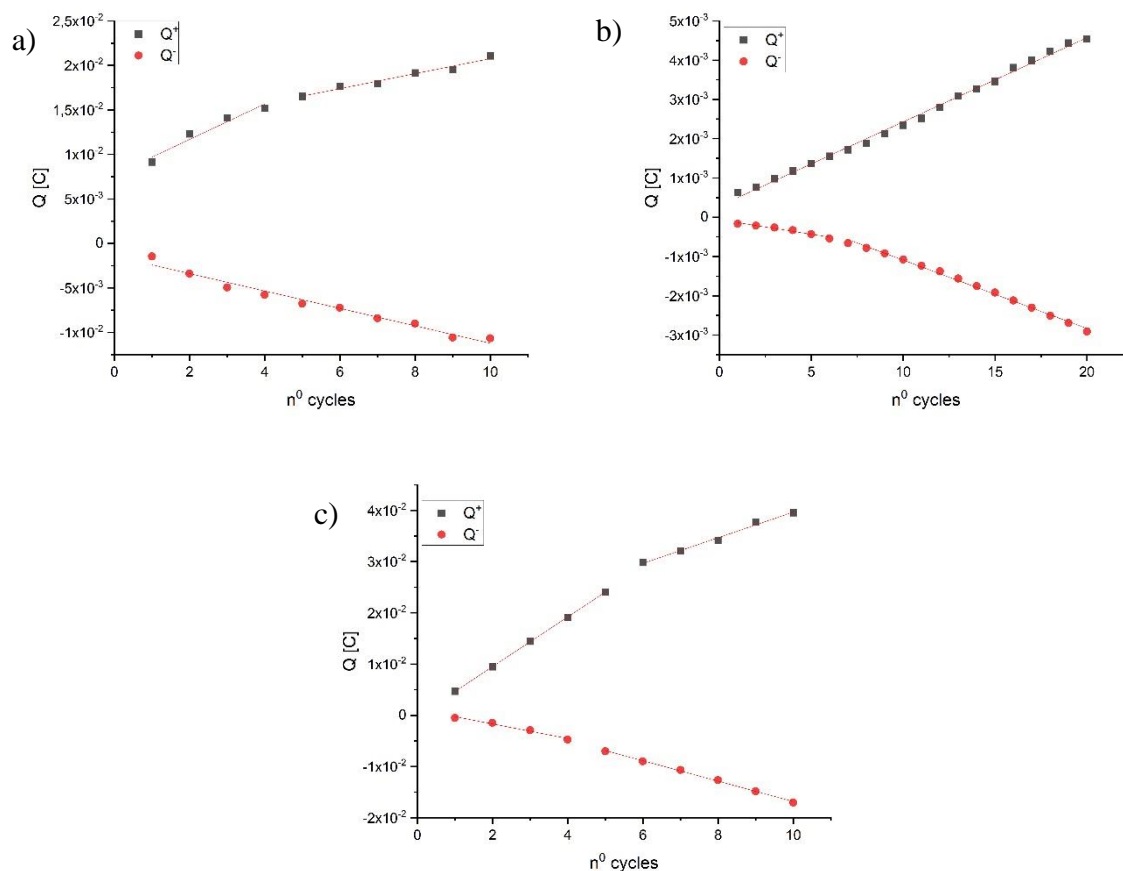


Fig. 2. Dependence of charge consumed during electropolymerisation in the function of number of cycles in EDOT:PTZN system: a) sample 1, b) sample 2, c) sample 3

Source: own calculations

Fig. 2. shows the dependence of the charge flowing in the cathodic (Q^-) and anodic (Q^+) half-cycle as a number of cycles. The charge is calculated using equation (2) [13].

$$Q = \int_{t_1}^{t_2} I d\tau \quad (2)$$

where:

Q - charge [C];

I - electric current [A];

t - time [s].

Tab. 2. Line coefficients of charge flow in anodic (Q+) and cathodic (Q-) cycles

	Q ⁺ [C]	Q ⁻ [C]
sample 1	a= 1.99E-03; b=7.69E-03; R ² = 0.922 a= 8.43E-04; b=1.23E-02; R ² = 0.962	a= -9.78E-04; b=1.44E-03; R ² = 0.970
sample 2	a= 2.14E-04; b=2.86E-04; R ² = 0.996	a= -7.39E-05; b=-6.60E-05; R ² = 0.956 a= -1.74E-04; b=6.48E-04; R ² = 0.996
sample 3	a= 4.85E-03; b=-1.85E-04; R ² = 0.999 a= -1.74E-04; b=6.48E-04; R ² = 0.996	a= -1.42E-03; b=1.16E-03; R ² = 0.971 a= -1.99E-03; b=3.07E-03; R ² = 0.997

The increasing value of the charge during oxidation process during the subsequent polymerization cycles were indicated. In the oxidation (anodic) cycle of sample 1 and 3 (Fig. 2) two stages were shown (Tab. 2) . Consumption of charges were faster in the first stage. Second stage were slower due to disorder generated with the increasing thickness of layers and occupation of free spaces on the electrode surface. The variability of the values of the coefficients in reduction process were much smaller than in oxidation, which means that the de-doping process in subsequent cycles is more repeatable than the doping and polymerization process.

It is possible to calculate the thickness of the layers obtained during electropolymerization by cyclic voltammetry. Thickness was calculated using the formula (3) [14].

$$g = \frac{q \cdot M}{n \cdot F \cdot A_w \cdot \rho} \quad [cm] \quad (3)$$

where:

q - charge consumed during polymerization (defined as charge of last anodic cycle) [C];

M - molar mass of monomer $\left[\frac{g}{mol}\right]$;

n - the number of electrons involved in the oxidation of one monomer unit (assumed 2);

F - Faraday constant $96500 \left[\frac{C}{mol}\right]$;

A_w - working electrode area covered with a polymer layer [cm²];

ρ - density (approximately 1) $\left[\frac{g}{cm^3}\right]$.

The result of the thickness calculation are shown in Tab. 1. The higher is the potential of polymerization the thicker is a layer.

Tab. 1. Thickness of obtained layer

Parameters	Thickness [cm]	q_{anodic}^{last} [C]
sample 1	3.0E-06	0.0045
sample 2	1.4E-05	0.021
sample 3	2.6E-05	0.039

Source: own calculation

Comparing the influence of the number of the applied scans on thickness of layers it was shown that the greater the number of cycles the thicker the films were. Comparison of the results obtained by for the synthesis performed with the different potential boundaries showed that thicker

films were obtained when the range of potential is higher. The thickest layer was obtained during synthesis sample 3 and the thinnest by sample 1. Increased of potential caused the growth of layer about $0.12\mu\text{m}$. Higher amount of cycles caused increased concentration of cationic radicals and therefore the length of chains and finally the thickness.

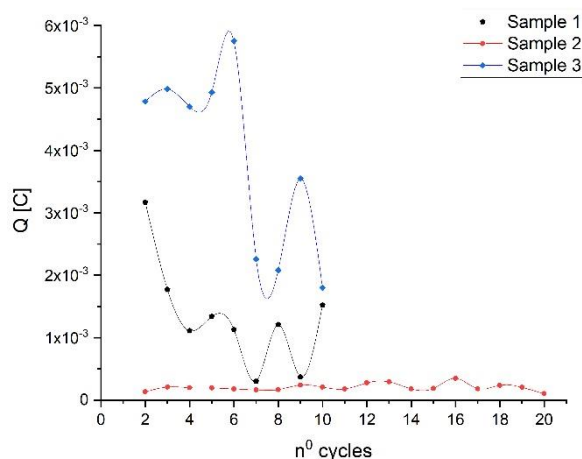


Fig. 3. Charge growth during polymerization as a function of successive cycles for EDOT:PTZN films
Source: own calculations

As the chain increased, a thicker film was made and the solubility decreased. Thick film with the complete coverage electrode surface caused difficulties in monomer diffusion in the subsequent cycles. The polymerization process slowed down due to reduction of generation of radicals. The thickest sample 3 showed the increased in charge till sixth cycle and then declined confirmed the slowdown of process due to their form on the surface. Fig. 3 showed the slight increase of charge during polymerization process of sample 2, so diffusion of monomer was not hindered.

FTIR spectroscopy of PEDOT:PTZN film

FTIR spectra were recorded to identify the components of layer obtained after electropolymerization (Fig. 4). The spectrum of film sample 3 shows the characteristic bands for PEDOT and PTZN indicating successful polymerization accompanied by inclusion of drug substance in the built matrix. Blue numbers (Fig. 4.) belongs to peak characteristic to PEDOT and red - to PTZN.

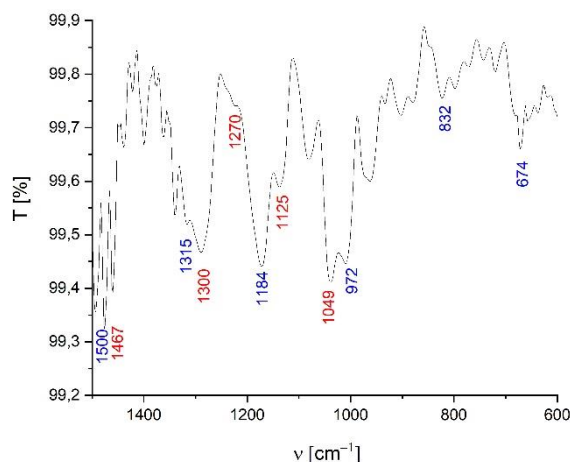


Fig. 4. FTIR spectrum of film PEDOT:PTZN sample 3

Source: own calculations

There are several bands derived for PEDOT material like the ones at 1500 cm^{-1} and 1315 cm^{-1} assigned to asymmetric C=C bond stretching [15]. The bands at 1187 cm^{-1} , 1138 cm^{-1} , and 1048 cm^{-1} are identified as C-O-C bending vibrations of the ethylenedioxythiophene. At the same time the bands at 972 cm^{-1} , 915 cm^{-1} , 832 cm^{-1} and 674 cm^{-1} correspond to the stretching vibrations of the C-S bonds. The spectrum also reveals to PTZN molecule bands in particular the ones located at 1467 cm^{-1} , 1300 cm^{-1} , 1270 cm^{-1} , 1125 cm^{-1} and 1049 cm^{-1} . The area spanning in a range of $1500\text{--}1100\text{ cm}^{-1}$ shows intense bands characteristic of aromatic compounds. 1467 cm^{-1} peak corresponds to the asymmetric flexing of the $-\text{CH}_2$ groups, while the one at 650 cm^{-1} is assigned to the C-S stretching vibration in the phenothiazine bend ring.

Releasing PTZN from PEDOT matrix

Chronoamperometry and UV-Vis spectroscopy were coupled to register releasing curves of PTZN from PEDOT matrix. The potential steps in a range of (0.1 : 0.7) V with 0.10 V step intervals were applied. After each 10 seconds pulse duration potential was raised. During this time, the drug substance was released from the layer goes into solution and UV-Vis spectrum was registered at the end of this period. Chronoamperogram current density through an experiment as a function of time (Fig. 5.) being subjected programmed step potential.

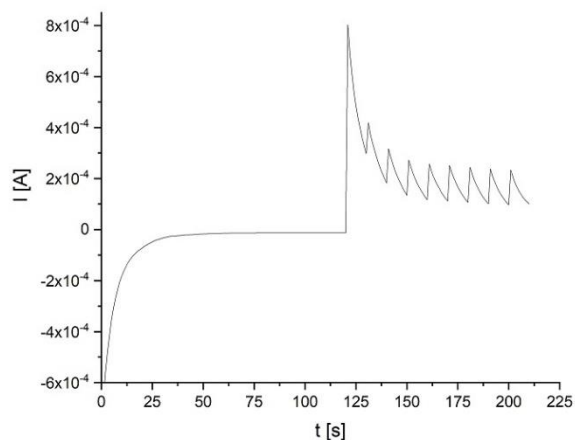


Fig. 5. Chronoamperogram of film PEDOT:PTZN (parameters: sample 3)

Source: own calculations

The set of spectra recorded every ten seconds are shown as (Fig. 6). The spectra were superimposed on each set within the time of experiment.

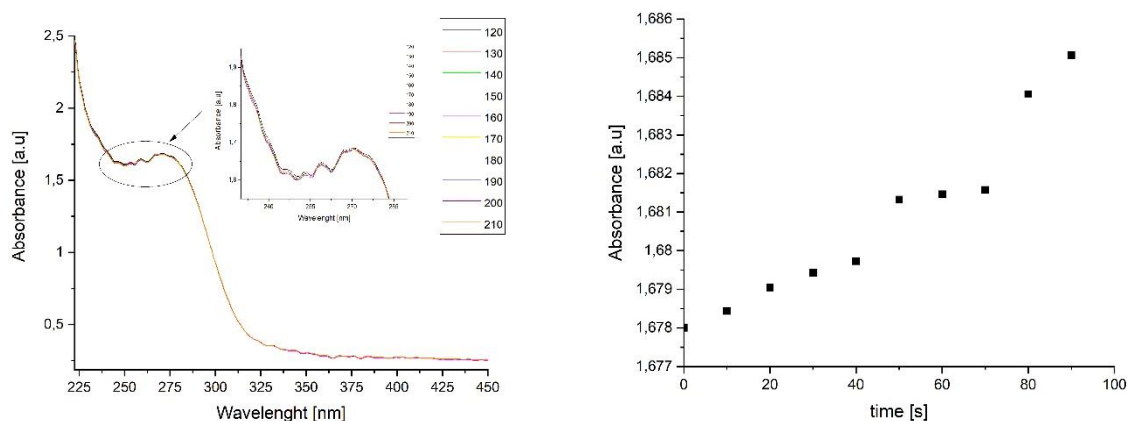


Fig. 6. UV-Vis spectrum of releasing PTZN from PEDOT of sample 3. Insert: Spectrum of sample 3 in terms of 230-290 nm. Right: Changing of absorbance in time for band 273 nm

Source: own calculations

Spectra showed a characteristic band at wavelength $\lambda = 273$ nm corresponding to the phenothiazine derivative PTZN [16]. The bands in the range of 350 and 400 nm belong to PEDOT [15] and were characterized by low absorbance, because small amount of material was released into the solution in the form of soluble products. In the case of spectra recorded during the potential material conditioning after synthesis, one dominant band is visible at 273 nm (Fig. 6). This observation suggests changes in the structure of electronic transitions of the PTZN molecule. There is a slight increase in the absorbance of PTZN over time and the potential increases (Fig. 6). The increase in absorbance varies little because of several possible reasons. The release times were relatively short and did not allowed for the release of deeply trapped PTZN molecules. It is especially important for thicker films. Furthermore, the applied potential was relatively high during

synthesis leading to oxidation of PTZN molecules, which formed ions of the positive charge being repulsive to cationic type charge carriers of the polymer chains. In case of the studied phenothiazine-core molecule release mechanism is connected with the physical entrapment of molecules or interaction with trapped residual doping ions originating from the electrolyte solution. Hence PTZN molecules were able to enter next to the undoped regions of the polymeric matrix to avoid repulsion. Some amount of the PTZN may also interact ionically with the trapped residual doping ions originating from the electrolyte solution (BF_4^-), however as their concentration is usually low than the amount of PTZN bounded in this way is relatively low also. The best release conditions in terms of releasing time are exhibited by the layers formed during the synthesis of sample 3.

Conclusions

Research presents the results of synthesis and characterization of PEDOT:PTZN system in a molar ratio (5:1) using different synthetic protocols. The PEDOT matrix with embedded newly synthesized PTZN molecules was obtained by cyclic voltammetry. This method was also used to characterize the charge flow during each cycles and determine the thickness of films. The thickest film was obtained using higher potential. FTIR spectra confirm successful polymerization as well as the presence of drug system in the matrix. Coupling chronoamperometry and UV-Vis spectroscopy allowed to detect releasing of PTZN from PEDOT by applying the step potential protocol. Controlled release of PTZN occurs at low, stepwise applied potentials and a short time showing promising condition of sample 2 and 3. The layer obtained by sample 1 required increased time and potential for the transport of the phenothiazine derivative. The results shows that PEDOT:PTZN system is able to potentially release drug substance acting promising application in the medicine reducing the frequency of taking medications for patients.

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THE LINGUISTIC AND COMMUNICATIVE FUNCTIONING OF A CHILD WITH SPEECH IMPAIRMENT DUE TO BILATERAL PRELINGUAL PROFOUND HEARING LOSS - A CASE STUDY

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Abstract:

The article presents a case study of a child with bilateral, prelingual profound hearing loss at the age of 10 years and 4 months, using hearing aids. During the study, patient's history, document analysis, observation and diagnostic tests were performed, using the D. Emiluta-Roza's Global Logopedic Test and K. Krakowiak and M. Panasiuk's Communication Behaviours Assessment Card. The aim of the conducted case study was to provide a full surdologopedic diagnosis and to show the disorders of linguistic development and communication skills in a child with bilateral, prelingual profound hearing loss, as well as to show the necessity to perform a multi-aspect, in-depth surdologopedic diagnosis in order to create an appropriate therapeutic programme determining the next steps of work for a specialist in surdologopedics (speech therapy for the deaf and hearing impaired people).

Keywords:

surdologopedics, case study, diagnosis, hearing loss

Introduction

A hearing impairment has various consequences and, above all, involves difficulties in communicating and acquiring the language system. A child who is naturally unable to develop speech requires many specialist treatments. Therapy for children with profound hearing loss is difficult and lasts over the whole period of childhood and adolescence. It is often continued in adult life.

One of the oldest definitions of a person with hearing impairment is by B. Hoffman [1], who points out that such a person "due to difficulties in independent language and speech acquisition, resulting from the damaged auditory analyser, requires special assistance in teaching, upbringing and adaptation to social life". This definition draws attention to the importance of the effect hearing impairment has on linguistic and speech development.

There are several typologies of hearing impairment. One of the basic typologies is the audiological typology, developed by the International Bureau for Audiophonology (BIAP), which

takes into account the arithmetic mean of the threshold values that are determined by the audiometric curve for air conduction in the frequency range of speech sounds. It is, therefore, a typology that takes into account the degree of hearing loss profundity and distinguishes mild hearing loss, (above 20 to 40 db), moderate hearing loss (above 40 to 70dB), severe hearing loss (above 70 to 90dB), profound hearing loss (above 90dB) [2].

An important typology is also one that takes into account the relationship between the time when the hearing loss occurred and the stage of development of the child's speech. This psycholinguistic typology distinguishes pre-lingual, perilingual and post-lingual hearing loss. A pre-lingual hearing loss is one that occurs before the start of speech development, a perilingual hearing loss - during speech development, a post-lingual hearing loss - after speech development [3].

The degree of speech mastery by a deaf child depends on a number of factors, including the degree of hearing loss, the time when the hearing loss occurs in relation to the child's stage of speech development, the location of the exact damage, the use of hearing aids and the time when the hearing loss was detected. The child's environment also has an important role to play in providing the right amount of auditory and verbal stimuli. Early diagnosis, intensive care and support provided by specialists are essential for the child's speech development [4].

Children with pre-lingual, profound hearing loss are at risk of difficulties in learning the language system, which causes difficulties in understanding verbal expressions, difficulties in understanding and using appropriate grammatical forms and impoverished vocabulary. Such children does not develop speech spontaneously, they have difficulties in the realisation of many phonemes, which often causes distorted linguistic communication.

Children who are characterized by a speech impairment due to a hearing loss develop primarily in the visual world, have poorer vocabulary and lack understanding of abstract, ambiguous and metaphorical concepts, showing deficiency of specialist, literary and archaic vocabulary. In their passive and active vocabulary there are mainly nouns, which are names of things, phenomena, animals and plants and people from their immediate environment. The same applies to verbs, which are usually the names of everyday activities performed by a child. It is difficult to understand and use verbs with prefixes and reflexive verbs.

Studies also show that deaf children acquire later the ability to use verb forms in the first and third person, and that they are best able to use forms in the second person, e.g. give (me). Difficulties also arise in understanding and using secondary words (adjectives, adverbs), pointers (pronouns), order words (numbers) and loose morphs (conjunctions, particles, prepositions). Children with speech impairment due to hearing loss most often use adjectives that denote colours, shapes, sizes and weights, and rarely adjectives for valuation and evaluation. The most common adjectives are those that indicate where, when and how to do things. The pronouns most often used are the personal pronoun *me* and the possessive *my*. These children use few conjunctions, as they usually use simple sentences. Limitations in mastering the lexical system cause distortions in content and language form. Such children have difficulties in understanding and building verbal expressions, thinking in the abstract, generalising, understanding metaphors and proverbs. Deaf children are often aware of the existence of various inflection forms, they know the inflection endings of words, but are unable to apply them correctly [5].

The limitation of a child's language experience results in: narrowing or expanding the content and meaning range of words, tendency to create neologisms and neosemantisms, difficulties in determining the stylistic function of words, difficulties in understanding the expressive value and emotionality of words, tendency to determine the meaning of words only on the basis of their morphology, incorrect understanding of phraseological relationships, errors in using inflected forms, errors in syntax [6].

Often, surdologopedic therapy for children with profound hearing loss, whose main channel of speech reception is visual, requires the use of total communication, sign language support and other supporting methods available to the child. Children with profound hearing loss often have dysphonia. The voice is often colourless, silent, monotonous, with nasal sound, devoid of melodic elements [7].

A ten-year-old child should have already assimilated the language system and completed the speech acquisition process. At this age, the child only develops skills in this area and learns the grammar and spelling rules, which serves the purpose of the correct use of language in speech and writing. The child learns the structure of words and their role in conveying messages, paying more attention to the way they are expressed and the form and precision of the word. An increasing mastery of linguistic rules affects the ability of correct spelling and the effectiveness of the child's verbal and written expressions [8]. A child with speech impairment due to profound hearing loss does not have an acquired linguistic system.

Working with such children does not involve improving language skills, but shaping and consolidating these skills.

Own research methodology

This case study concerns a boy aged 10 years and 4 months with a bilateral profound prelingual hearing loss. The aim of the research was to perform a complete surdologopedic diagnosis to determine the level of the boy's linguistic and communicative functioning and to create a long-term therapeutic programme to guide the surdologopedic work with the boy. The study comprised the following: taking history from the parents and the child, as well as from teachers and specialists working with the boy, observation of the child, analysis of the available medical records, opinions and certificates that the child has, diagnostic tests. For the sake of the diagnosis, the author used the Global Logopedic Test by D. Emiluta-Rozya [9], the Communication Behaviour Assessment Card by K. Krakowiak and M. Panasiuk, and own attempts concerning development of sign language communication skills.

The entire diagnostic process took place during several meetings and was based both on verbal communication and sign language - the author of the article and at the same time the researcher is a sign language interpreter and its fluent user.

The person under study and the characteristics of his family and therapeutic environment

The person involved in the study was a boy at the age of 10 years and 4 months, a student of grade V of a primary school. The boy has a profound bilateral prelingual hearing loss and is educated in a primary school which belongs to a special school and educational centre for the deaf and hard of hearing. He is one of the most talented students of this centre. The boy's parents are deaf. The boy's mother has a profound prelingual hearing loss and, therefore, a speech impairment. She can read speech from mouth, tries to communicate verbally with the hearing persons, although her pronunciation is significantly distorted. She communicates with the deaf using sign language. She uses hearing aids on a daily basis and tries to speak to her son as well as to use sign language. The boy's mother comes from a hearing family, graduated from schools for the deaf and has a secondary education. The boy's father also has a profound prelingual hearing loss and therefore a speech impairment. He comes from a family of deaf people, does not use hearing aids, communicates only with sign language, does not use sound speech, has poor speech reading from the mouth, and has completed vocational school for the deaf. The boy is an only child and has a constant, very good contact with all his grandparents.

The atmosphere at home and the interrelationships among the family members are very good. The boy treats his parents with respect, his mother is very committed to working with the child. She helps him every day to learn and acquire language skills. The boy talks very positively about his parents, presenting his dad as a role model. The boy has very good contact with his peers in the school and educational centre he attends. He communicates with them mainly by means of sign language. They spend most of their free time on physical and sports activities. Outside the centre, the boy has one deaf friend with whom he meets once a week; he has no friends in the housing estate. His parents say that children living in the same courtyard do not want to play with him, play a ball, and get discouraged when trying to talk to the boy. Then the communication barrier becomes very visible. In his free time, the boy enjoys playing computer games, swimming in the pool and playing football and basketball on the pitch together with his father. He also plays with his cats and enjoys watching movies with subtitles together with his mother, who explains to him what he does not understand.

Although parents suspected their son of having a hearing loss from birth, the doctors assured them that the child had no hearing loss. The performed tests indicated normal hearing (screening at birth, at the age of 6 months and 10 months). It was only after the intervention of the boy's grandmother and subsequent tests, when he was 12 months old, when it turned out that he had a bilateral profound hearing loss, which was confirmed by the ABR test - bilateral hearing loss of the RE (right ear): 80dB; LE (left ear): 90dB. After such a late diagnosis, he received his first hearing aids when he was 13/14 months old.

When he was 27 months old, he started attending a kindergarten for deaf children, where he also started working with a speech therapist (4 times 30min each week) and a specialist in surdologopedics. Previously, for half a year (18-24 months), he attended speech therapy classes once a week 30 minutes in the same kindergarten. For a year (aged 9-10 years), the boy also attended additional speech therapy classes once a week. Currently, as part of the school classes, the

boy has one hour of speech therapy class per week and two hours of remedial classes with a specialist in surdologopedics.

Results of initial diagnosis of the child's development and communication

The boy is very eager and easy to make contacts, he joins the conversation. He communicates with his parents mainly using sign language. He also tries to use verbal speech in contact with the hearing people, but is aware that he may not be understood by them. If he sees an interest and willingness to understand his messages on part of his interlocutor, he tries to convey his message in all forms of communication that are known to him so that it is understood exactly. He feels more at ease among people who know sign language and can then express his needs, thoughts and emotions more easily. He is a polite, helpful and smiling boy. He maintains eye contact during communication and willingly interacts with others. The boy quickly and willingly enters new task situations, but the tasks requiring him to express himself correctly are very stressful for him. He is an ambitious boy, with a very good memory, well-functioning in terms of cognitive functions, he learns quickly and is very eager to use newly acquired knowledge in various everyday situations.

Sign language signs prevail in his communication. Sign language signs are often combined with speech (school influence), but this is very distorted. Verbal speech is dominated by simple sentences or coordinating compound clauses and there are many errors in terms of inflection and syntax.

Understanding of verbal messages is limited due to the limited auditory reception of the statement. When receiving verbal messages, the boy relies primarily on reading speech from the mouth. The limited possibilities of speech perception to recognise the articulatory image of words result in an incomplete and inaccurate reception of the messages transmitted. Messages in sign language are freely received and fully understood. The boy also understands written communications consisting of words contained in his vocabulary. The boy's vocabulary is limited when compared to his age and there is a prevalence of incorrect grammatical forms. The prosody of statements is significantly disturbed (speech devoid of melodic elements, monotonous, without proper accent), as is phonation - audiogenic dysphonia (voice is low, dull, with nasal sound, limited to several frequencies, nasality occurs). There are respiratory and phonation coordination disorders (shortening of the expiratory phase, frequent and too deep inhalations and lack of synchronisation of the expiratory phase with the phonation).

The boy's behaviour is communicative. With the help of various means (sign language, facial expressions, verbal speech, natural gestures), he tries to fully convey his messages in order to be understood correctly.

Results of detailed logopedic tests

After repeated attempts at numerous meetings with the boy, using Danuta Emiluta-Rozya's Global Logopedic Test, the results of KOZK and the author's attempts, the results were obtained, the analyses and conclusions of which are presented in the table below (Tab. 1).

Tab. 1. Results of detailed logopedic tests

Functions assessed	Conclusion on the results of the study
orienting and cognitive skills	well mastered cause-effect reasoning strategies
ability to formulate statements	verbal statements below the level required for age short messages consisting mainly of single sentences, most of which are syntactically incorrect and contain erroneous inflectional forms
ability to understand messages	developed ability to understand several sentences long messages in sign language and to understand an easy, uncomplicated text with words from his passive vocabulary understanding longer verbal messages is impossible due to limited auditory perception
ability to engage in a dialogue	mastered ability to freely initiate and maintain a dialogue in sign language free dialogue using verbal speech without gesture support is not possible due to the limitations of speech perception and the significant distortion of articulation that results from hearing impairment
ability to understand and use inflectional and grammatical forms	The boy is aware of the existence of inflection in Polish, he happens to use inflection forms correctly, but only in fixed structures. He understands most of the constructions of the accusative and instrumental cases, regardless of the word order in the sentence. The use of single and plural forms of nouns and verbs is not fully formed. He is not able to correctly use forms of noun cases, apart from the denominator the use and understanding of grammatical structures is slowly being developed, but is far below the level required for his age The tense forms have been passively assimilated, and the use of the forms of the past and the future is not consolidated.
vocabulary-creating skills	undeveloped
the use and understanding of words and their implementation on their own and during repetition	the use and understanding of the words is at a lower level than required for the boy's age most nouns, adjectives and verbs which are the most frequently used in everyday life undeveloped ability to call fractions and verbs with a prefix, and the unconsolidated ability to use reflexive verbs
phonemes implementation	the articulation of consonants and vowels is significantly distorted, constant in the most frequently used words, unstable in new and less frequently used words

	<p>there is centralisation of the pronunciation of vocal segments and a sound similar to the vowel of the schwa [ə], no differentiation between vowels [i] and [y], the nasalisation of oral sounds, devoicing of voiced consonants, voicing of voiceless consonants - most often in final position, numerous deformations, reductions and epenthesis of sounds (primarily the [x]), numerous deformations and disturbances of complex sounds, during some of the realizations there is an asynchronous and two-segmental realization of softness, the silent series realized most often as a deformed humming series, frequent centralization of the front sounds, there are intermediate sounds with an aspiration, backing vowels are pronounced</p> <p>the articulation of vowels and consonants is unstable and significantly distorted.</p> <p>hearing impairment prevents self-control and self-correction of the spoken sounds</p> <p>the visual pattern of the voice does not produce the expected results when the speech is corrected</p>
implementation of the word structure	disturbances in the structure of words occur with great intensity - voice reductions, syllable reductions, consonant group reductions, epenthesis, involuntary quasi-vowel vocalisations following consonants, combined changes within the word
structure of articulatory apparatus and efficiency and muscle tension of articulatory apparatus	<p>no anatomical anomalies within the articulatory system</p> <p>the efficiency and muscle tension of the boy's articulatory apparatus (especially within the tonsillar ring) are insufficient and need to be improved</p>
assessment of functions (physiological activities) within the articulatory apparatus (masticatory organ): breathing, biting, chewing and swallowing	<p>breathing at rest through the nose with closed jaws and freely closed lips</p> <p>breathing while speaking along the oral-nasal route, however, there are visible disorders of respiratory and phonatory coordination (shortening of the expiratory phase, frequent and too deep inhalations and lack of synchronisation of the expiratory phase with the phonation). As a result of many exercises, the boy knows the correct way of breathing using the diaphragm and intercostal muscles and tries to use it.</p> <p>biting off, biting and chewing correct, frontal</p> <p>mature swallowing</p> <p>parafunctions: nail biting and frequent biting of writing utensils</p>
assessment of the main channel of reception of verbal	no use of auditory perception when receiving verbal messages

expressions	the boy's main channel for receiving messages is the visual-graphic channel mastered reception of single words and some simple sentences/equivalent sentences by means of a visual-articulatory channel, but this is not sufficient for longer statements.
phonemic perception	insufficiently developed
verbal memory	The result of the verbal memory test depends on the message reception channel. When receiving through the visual-graphic channel, the boy remembers most of the elements.
lateralisation	Eye: right Hand: left Leg: left
Reading and writing	reads longer texts with understanding misunderstanding of read texts is related to the presence of metaphors, complicated phrasemes, specialist, difficult, archaic and rarely used words, going beyond the boy's vocabulary writes well known words quickly in the written text, there occur difficulties in using syntax and correct inflectional forms, which also occur in verbal speech, inability to create coherent written texts - instead, separate sentences starting from the next line, they are linked with each other in terms of content, but there are no phrases that prove their cause and effect relationship using the structure of the question to formulate structurally correct but not inflectionally correct answers.
Assessment of phonic behaviour (KOZK)	at the level of 63% indicates speech development sufficient to establish and maintain verbal contact with the closest people, insufficient for free verbal communication with people from outside the immediate environment.
Assessment of gesture-mimic behaviour (KOZK)	at the level of 100% indicates the level of mature mastery of sign language communication skills.
General assessment of communication behaviour (KOZK)	at 82% shows the ability to establish and maintain contact with the immediate social environment, which satisfies basic communication needs.

Source: own study

Results analysis and logopedic diagnosis

Summarising the results of the diagnostic tests carried out and the results of specialist examinations, it should be noted that the boy perceives speech only through visual and articulatory route, and his phonemic perception is insufficiently developed. The boy has a profound, bilateral hearing loss and his main channel for transmitting and receiving messages is the gesture-mimic channel. Despite the fact that no anatomical dysfunctions within the articulatory apparatus have

been determined, articulation of consonants and vowels is significantly distorted, it is constant in words with a high frequency of use, it is not constant in new and less frequently used words, and there are numerous distortions in the realisation of the word structure. The expressions are uttered accompanied by audiogenic dysphonia and no auditory control. Despite the limitations of the auditory perception of the world, he has highly developed cognitive functions and social skills. He has mastered cause and effect reasoning strategies. His verbal expressions are below the level required for the age, and his ability to understand multi-sentence expressions in sign language and to understand a short, uncomplicated text with words from a passive vocabulary is well mastered. It is impossible for him to understand longer verbal messages because of limited auditory perception, as is free dialogue using verbal speech, without gesture support. Non-verbal communication is rich and effective, the ability to freely initiate and maintain a dialogue in sign language has been mastered. The boy has difficulties in understanding and using appropriate inflected forms of words. This mainly concerns the use and understanding of appropriate forms of the singular and plural nouns and verbs, the use and understanding of grammatical constructions, the use of appropriate tense forms. Nevertheless, correct inflection forms in consolidated structures are present in boy's expressions, and he understands most of the structures of the accusative and instrumental cases, regardless of the word order of the sentence. Word-formation skills have not been developed and the use and understanding of the words is below the level required for his age.

On the basis of the analysis of the boy's history, the above mentioned results from all the tests, the results of specialist tests and thorough observations of the child, led to a diagnosis of *speech impairment due to profound hearing loss*.

This is justified by the fact that the boy, despite his high cognitive potential, high intelligence, developed ability to think logically, broad interests, motivation for self-education, the use of appropriate hearing aids and support from parents in the process of rehabilitation, has not acquired language skills at the appropriate level.

His passive and active vocabulary is too narrow, below a level appropriate for his age. He also has not mastered the grammatical rules of syntax and inflection (dysgrammatism), which, together with the narrow vocabulary, makes it difficult for the boy to understand and create verbal expressions. In addition to the linguistic difficulties, the boy also suffers from audio-visual dysphonia, which causes significant impairments in the realisation of word structures, disturbed voice realisation and thus lack of clarity of verbal expressions. All this affects the limitations of the boy's communication with the hearing persons, above all in terms of its effectiveness.

Well-developed cognitive functions and the willingness and motivation for linguistic development support the therapeutic process. Intensive speech therapy can result in an increase in the volume of vocabulary, improving skills in the scope of syntax and understanding and use of appropriate inflection forms. Despite the possible achievement of significant improvements in the boy's linguistic development, attention should be paid to his age and large hearing limitations, which determine the prognosis of the therapy: the boy will not fully assimilate the language system. Despite not entirely satisfactory prognoses, logopedic therapy is necessary and with the great involvement of the therapist, the boy and his parents, as well as intensified, well-thought-out, appropriate, long-term surdologopedic activities can be very effective.

Tips for logopedic therapy

The logopedic therapy should be implemented gradually, throughout the boy's entire life, significantly intensified during the period of attending school and gaining education. The main goal of the long-term therapy is to improve the boy's communication with the hearing community. The main assumption and aim of the therapeutic programme should be to develop and improve linguistic and communication skills in the area of gesture-mimic, written and verbal communication.

The presence of the boy's mother is important in the therapy, particularly giving her instructions to continue the therapeutic work at home. It would also be positive to give therapeutic advice to the boy's grandmother and grandfather, who are hearing people and who could support the therapeutic procedure, apart from meetings with the therapist, in a verbal way.

The range of therapeutic activities should be broad and include improving the ability to understand and generate correct verbal and written expressions, exercises in verbal perception by reading speech from the mouth, listening exercises improving residual auditory remains, breathing and phonation exercises, motivational work, encouraging reading and vocabulary enrichment, exercises to improve overall speech clarity and exercises to improve the articulatory apparatus (additional).

Such an extensive therapeutic programme should be carried out gradually, systematically repeated and in a spiral way, to consolidate and develop further skills.

Ending

This work is a presentation of a case study of a 10-year-old boy with speech impairment due to profound hearing loss. After analysing the literature on surdopedagogy and speech therapy (logopaedics) and on the basis of practical knowledge, it was possible to describe the child's language abilities and skills in detail. The study, which was carried out in accordance with the recommendations of the Global Logopedic Test, allowed for a thorough analysis of the language areas to be developed and improved. The detailed diagnosis is the basis for creating therapeutic programmes that focus on the most important areas of speech and communication development. A rich, but also well thought-out and structured therapeutic programme allows for effective interactions, which - in effect - lead to better functioning of the individual in society. Work on building the boy's linguistic system requires many meetings and constant repetition of skills introduced in the therapy. It is a difficult and tedious task, which brings small and slow effects, but is very important for his further development.

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POLAND'S COOPERATION WITH OTHER COUNTRIES IN ORDER TO JOIN TO NATO AND THE INITIATION OF POLAND-NATO RELATIONS

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Abstract:

After the collapse of the post-war order of that time and the dissolution of the Warsaw Pact in 1991, on the one hand, the sense of NATO's further functioning was questioned, and on the other, the possibility of extending this organization to include sovereign states of Central and Eastern Europe was considered. The greatest polarization of attitudes was characteristic in the United States, where the motives of opposition to the enlargement of the Alliance were quite diverse. Opponents of this idea were the so-called isolationists who believed that the United States should only defend itself. Moreover, some of them believed that the weak states of the former Eastern Bloc in Central and Eastern Europe were of little importance in terms of American security. They were in favor of an agreement with Russia that would guarantee security and cooperation.

Keywords:

Poland, Russia, cooperation, NATO

Introduction

The supporters of the enlargement of the Alliance were, first of all, the American Polonia and the Polish American Congress. Of key importance, however, was the decision of the Bill Clinton administration, which, before the presidential election in 1996, invited the first candidates to membership during the 1997 Madrid summit. From then on, NATO enlargement to include Poland, the Czech Republic and Hungary was the most important goal of US foreign policy. On October 22, 1997, at an election rally in Detroit, Bill Clinton announced that he would make every effort to ensure that the first new members were admitted to the Alliance in the spring of 1999 [1]. The role of the Polish American community, which was keenly interested in the affairs of the Polish state after World War II, is also important here. An example to confirm this thesis are aid actions for the then democratic opposition (especially in the 1980s), as well as the lobbying activities of the Polish American Congress (PAC) in the United States. After the fall of communism in Poland in 1989, PAC supported the aspirations of the authorities in Warsaw in the field of Polish

membership in NATO. As early as the mid-1990s, the Polish community was involved in activities aimed at influencing the US authorities, pressure groups and the American society in order to accelerate the process of NATO enlargement. At the beginning, these were information campaigns, although these activities intensified before the approval of the executive power by the Senate. PAC's role has been crucial, particularly through the expansion of its Washington office. First of all, they sought the support of other organizations supporting the Polish American Congress, mobilized private persons and individualities of the Polish diaspora, sent letters to congressmen, and collected signatures for petitions. In addition, the Internet was used, sending letters to Americans, in which they were persuaded of the need to admit Poland, the Czech Republic and Hungary to the North Atlantic Alliance [2].

Poland's cooperation with other countries

The Polish authorities recognized that an extremely important area of Polish interests was Central and Eastern Europe, which were in the same geopolitical position as Poland. Not only geographic but also historical factors were important - the countries of this region were dominated by the USSR for almost 45 years. Poland's goal was to empower this region and strive for joint actions for integration with the West. In addition, it was also about supporting all the countries of the former Eastern Bloc, in particular those that emerged after the collapse of the USSR, in the development of democratic transformations [3]. Representatives of Central and Eastern European countries believed that the joint initiative of regional integration would allow the countries of the region to move closer to Western structures, including NATO.

The efforts of Polish diplomacy focused primarily on joining the European Union and NATO, and therefore Poland supported the strengthening of regional cooperation. The new initiatives served as a bridge connecting Central and Eastern Europe with Western countries, and were also a means of independence from the influence of the USSR. Moreover, cooperation with a regional dimension contributed to stabilization in the region and to the improvement of relations between the countries of Central and Eastern Europe. It was believed that mutual cooperation would strengthen the position of the countries in the region, while positively influencing their image, thanks to which these countries could create themselves as partners capable of consensus [4]. Apart from Poland, Hungary and Czechoslovakia also supported closer regional cooperation. The first idea of cooperation between Poland, Czechoslovakia and Hungary was officially proposed by the President of Czechoslovakia, Vaclav Havel during his visit to Poland in January 1990 [5]. The fact is that the first meeting in April 1990 in Bratislava on the issue of regional integration did not bring the expected effect, and this was due to the different interests of the three parties, who feared that the problems of others would slow down their process of joining Western structures. During the meeting, it turned out that the Czechoslovak side was not interested in the cooperation of only three countries, because it aspired to the role of a link that would be a bridge for East and West and an intermediary between southern and northern Europe. Poland, on the other hand, was not enthusiastic about the Czechoslovak concept, as it was afraid of a closer cooperation between southern Europe and the Western world, which could lead to a situation in which Poland would find itself alone between Germany and the USSR. The nature of the transformations in the USSR was

also uncertain and the issue of the status of the border with Germany remained unresolved at that time. Hungary, on the other hand, was not interested in closer political and economic cooperation because it was feared that cooperation with Poland, which was an economically unstable state, could lead to deterioration of relations with Germany and the USSR. Hungary was much more oriented towards cooperation with Italy, Yugoslavia, Austria and Czechoslovakia, as they felt that this would lead to a more effective modernization of their economy [6]. It should also be noted that Slovakia's leaders, after the dissolution of Czechoslovakia in 1993, decided to use cooperation within the Visegrad Group as an option to establish closer relations with Western countries and build their position on the international arena. Moreover, the Slovak side recognized that the development and intensification of the Visegrad Group will, in a way, strengthen its position in the context of accession negotiations with the European Union [7].

The summit of the leaders of Poland, Czechoslovakia and Hungary in February 1991 in Visegrad only gave an institutional form of cooperation between these countries - the Visegrad Triangle was created (after the collapse of Czechoslovakia in 1993, the name was changed to the Visegrad Group) [8]. Undoubtedly, this cooperation was facilitated by the ideological ties of the new political elites, which had an opposition pedigree, as well as the joint opposition to the USSR's domination over the states of Central and Eastern Europe. The declaration signed by Lech Wałęsa, Václav Havel and József Antall established close economic, social and political cooperation, as well as cooperation in the aspect of security, and to this end joint efforts to integrate with Western structures were coordinated. The strategic goal of establishing the Visegrad Group was the fastest possible accession of the founding countries to the European Union and NATO.

Hungary was the first to speak about integration with the North Atlantic Alliance within the Visegrad Group. At that time, this concept seemed unrealistic due to the opposition of NATO member states to extend the structures of this organization to include Central and Eastern European states. At that time, the belief was expressed that it would be impossible to create a peace and security system without Russia, therefore, instead of quick NATO membership and security guarantees, the former Eastern Bloc countries were suggested to establish closer relations and dialogue. It was believed that the admission of post-communist states would not guarantee the Alliance's security, but would only weaken it.

An interesting initiative was also the cooperation of states within the so-called Quadrangone, established in 1989 by Austria, Yugoslavia, Hungary and Italy. After Czechoslovakia and Poland joined this organization, the name of this organization was changed to the Central European Initiative (1992). The fundamental objectives of this initiative were set out in the declaration of August 1, 1990, which stated that it was a new form of cooperation in Europe, which was to be a stimulus for the countries of the former Eastern bloc to accept the *acquis* of Western European countries, integrate these countries with the Western world and join them to structures such as the European Union, Western European Union, Council of Europe and NATO [9]. The originators of this initiative were Italy, which wanted to fill the void left by the Eastern bloc with an organization ensuring the stabilization of the entire region, taking care above all for the security of the West. Poland, as a member of the Central European Initiative, sought to enlarge this organization, thanks to which it eventually included several countries in the region. As a consequence, there were difficulties in working out a common position, and moreover, there were no tools and means that

would be used to achieve the goals of the created institution. The initiative ultimately served as a facade, which was oriented towards the cooperation of the countries of Central, Eastern and Southern Europe with Western structures [10].

Another integration initiative to which Poland was a party was the Council of the Baltic Sea States. Although this organization did not talk about cooperation with Western structures in its first declarations, it was noticeable that almost from the very beginning it had been in dialogue with the European Communities and the European Union. The initiators of this project were Poland and Sweden, which proposed to organize a conference for the protection of the Baltic Sea environment. This conference was held on 2-3 September 1990 in the Swedish town of Ronneby. In the following months, efforts were made to develop Baltic cooperation, where finally Denmark and Germany in March 1992 in Copenhagen initiated the establishment of the Council of the Baltic Sea States. The aim of this organization was to cooperate on issues such as economy, culture, education, tourism, communication, environmental protection, and, importantly, to support the development of democratic structures. Paying attention to the history of this region, it should be noted that it was unstable due to numerous wars, both in the north, where the borders and domination of individual Scandinavian countries constantly changed, and in the south, where Prussia sought to dominate the territory of what is now Latvia and Estonia. Russia, which fought for influence in the Baltic Sea region, was also a threat to the smaller Baltic states [11]. Due to the historical past and fears of Russia, countries such as Poland, Lithuania, Latvia and Estonia sought wider regional integration, which ultimately was to allow these countries to create themselves as actors guided by the principles of democracy and law on the international arena. At that time, Poland also sought membership in the Organization for Economic Co-operation and Development, while Lithuania, Latvia and Estonia sought membership in the World Trade Organization. However, the final goal of these countries was to join the European Union and NATO. The development of democratic structures was a factor facilitating the dialogue between countries aspiring to become NATO members, and NATO itself.

The initiation of Poland-NATO relations

Initially, the North Atlantic Alliance was skeptical about enlargement to include Central and Eastern European countries. The North Atlantic Council at the ministerial level, in a document of December 15, 1989, recognized the countries of the Eastern Bloc as allies of the USSR in Europe. In addition, the Warsaw Pact still existed at that time, and its member states were not able to join NATO due to their links with the Soviet military bloc. NATO countries distanced themselves from the enlargement of the Eastern bloc countries because of their desire to maintain proper relations with Moscow. Therefore, at the beginning of the 1990s, some Western states were against the inclusion of new states into the Alliance. Both NATO and its members expressed the conviction that as long as the USSR would exist and be ruled by Mikhail Gorbachev, it would be impossible for the former satellite states to join NATO. However, it was realized that the countries of Central and Eastern Europe could not cope without support, as they were not able to ensure their own security. There is no doubt that joining NATO is a time-consuming process and requires a lot of work from countries that want to become its members [12].

The collapse of the Eastern Bloc was directly related to the need to reform NATO's military strategy. In connection with the end of the Cold War and new challenges to international security, it was necessary to develop a strategy adequate to the existing political situation. Therefore, during the summit of heads of state and government in London in 1990, cooperation was offered to the countries of Central and Eastern Europe. This cooperation was to take place through the development of military and political contacts, including permanent diplomatic contacts between these countries and NATO. During a meeting of heads of government and state in Rome in 1991, agreement was reached on the reform of the military strategy, known as the 1991 Strategic Concept [13]. This concept assumed extensive cooperation with the countries of Central and Eastern Europe, while striving to ensure the security of NATO allies and all of Europe. In addition, the Strategic Concept was about conflict prevention in the context of peacekeeping missions [14]. In the late 1990s, NATO representatives revised the Strategic Concept in order to reaffirm the Alliance's fundamental goal of collective defense, and to ensure Alliance members adapt to the problems and challenges of the 21st century. It was considered to engage in the resolution of the bloody conflict in the Balkans, although it was impossible at the time by the then strategic concept, which made this intervention impossible, because a NATO member had not been attacked. The main goal, however, was to invite Poland, the Czech Republic and Hungary to negotiate the accession of these countries to NATO, as well as Ukraine and Russia, to cooperate within the North Atlantic Cooperation Council. In the context of cooperation with NATO, a positive factor was also the normalization of Polish-German relations, when on November 14, 1991 the Republic of Poland and the Federal Republic of Germany declared that the border between them was inviolable and that both sides would not put forward any territorial claims. Polish-German relations were precisely defined in the "Treaty of Good Neighborhood and Friendly Cooperation", concluded on June 17, 1991 in Bonn [15]. At that time, regulating relations with Germany was one of the most important achievements of Polish diplomacy. In the 1990s, Germany supported Poland's candidacy as a future member of NATO and the European Union, seeing it as an opportunity to ensure its own security in its close neighborhood.

Officially, the first Poland-NATO relations were initiated on March 21, 1990 with a visit by the Polish Minister of Foreign Affairs, Krzysztof Skubiszewski, to NATO Headquarters in Brussels. During the meeting of the chief of Polish diplomacy with the NATO Secretary General (Manfred Wörner) and the North Atlantic Council, he had the opportunity to present his position on his point of view on European security issues. The Polish side was in favor of the presence of American troops in Europe, considering it a stabilizing factor [16]. After the NATO summit on August 9, 1990 in London, a Liaison Office at NATO was established within the structure of the Polish embassy in Brussels. A few weeks later, the first-ever visit of the Secretary General of the Alliance to Poland took place, where the main message for him was confirmation of Warsaw's interest in increasing NATO's activity in the region.

After the official dissolution of the Warsaw Pact on July 1, 1991, a de facto security vacuum was created during the Prague summit in Central and Eastern Europe [17]. After the dissolution of the military structures of the Treaty, during the meeting of the North Atlantic Council in Copenhagen, NATO's relationship with the countries of Central and Eastern Europe was established. The Alliance precisely defined the boundaries of contacts, avoiding discussions about a potential

association with the countries of the region mentioned above. The Strategic Concept of 1991 expressed interest in the Alliance's cooperation with neighboring countries, although a threat was perceived as regards the destabilization of the processes of political, economic and social transformation. At the same time, Polish diplomacy tried to engage the Alliance in Central Europe, without addressing the issue of its enlargement yet. The collapse of the Warsaw Pact was presented as the process of freeing itself from the domination of the Soviet Union, which identified the West as a threat.

The disadvantage of the policy of opening up to cooperation with the countries of the former Eastern Bloc by NATO countries was the poor institutional support. At the end of 1991, the fears of the Western world parted to some extent - the united Germany was a monolith and entered the Alliance as a unified state. In addition, the Warsaw Pact was dissolved, and the formerly part of it raised the issue of the withdrawal of USSR troops from their territory. Most of these countries declared and developed a desire to develop democracy and free market mechanisms, while striving for international cooperation on a larger scale. As far as NATO's ties with Central Europe are concerned, the decisive factors were the fear of destabilization in the region and the understanding of the region's problems, requiring active action from the Western world. One of the Alliance's policy tools was the North Atlantic Cooperation Council (NACC) established in 1991. This institution was of a consultative nature on security-related issues with non-NATO states. According to the Polish authorities, the establishment of the NACC was one of the stages of integration with NATO. Poland's active activity on its forum distinguished her from other partners - apart from participation in the preparation of documents on peace operations (the Athens report), Poland has repeatedly declared its readiness to appoint a military contingent for the purposes of peacekeeping missions under the auspices of the UN and the CSCE. On December 21, 1991, a day after the end of the first NACC ministerial session, Prime Minister Jan Olszewski in his expose clearly emphasized the will to strengthen further ties with NATO.

An important issue was also the role of Poland in the Yugoslav conflict, where it must be admitted, however, that Warsaw was not capable of much activity in this field at that time. However, peace in the Balkans was one of the operational goals which, in a way, influenced the security and prestige of the Polish state, with the special role played by Poland's membership in the Alliance and proper relations with the East. Due to the fact that the Balkans did not constitute a priority area for Poland, the authorities in Warsaw limited themselves to recognizing the primacy of NATO and the European Union with regard to the problem of solving the conflict in the Balkans. Polish diplomacy was limited to symbolic initiatives, often referring to Western models, such as e.g. involvement through the introduction of peacekeeping forces or through mediation. The intervention in the Balkans was inevitable due to the disintegration of Yugoslavia, which resulted in increasing national and ethnic conflicts. The imbalance in this region caused destabilization, which neither NATO nor the UN could safely look at [18]. From the very beginning, the Polish side, based on the principle of self-determination of nations, recognized the independence aspirations of Slovenia, Croatia and other countries of the decaying Yugoslavia, emphasizing the role of human rights and national minorities. Due to the growing conflict in Bosnia and Herzegovina, Poland expressed its support for international sanctions and peace proposals presented by representatives from the West. Moreover, both Poland and the West opposed the division of

Bosnia and Herzegovina. Poland's symbolic success in resolving the conflict in the Balkans was the creation in 1995 of a permanent working group for the reconstruction of Bosnia and Herzegovina and Croatia, chaired by Poland. Warsaw also highlighted the issues of human rights and assistance to refugees, declaring help for three thousand people from Bosnia and Herzegovina through their temporary admission, regardless of nationality, and humanitarian aid. It should also be noted that about a hundred soldiers took part in the UN mission in eastern Slavonia, of which about fifty were GROM soldiers, whose task was, among others, capturing people suspected of war crimes. Admittedly, the Alliance's cooperation with the countries of Central and Eastern Europe gained more momentum after the creation of the North Atlantic Cooperation Council in 1991, which was finally transformed in 1997 into the Euro-Atlantic Partnership Council. Through cooperation within this institution, Poland was able to actively participate in the activities of the Alliance and cooperate with it, which was a positive sign of Warsaw's efforts in the context of the start of accession negotiations [19].

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DIFFERENCES IN DAIRY CATTLE BREEDING IN POLAND AND BELARUS

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Abstract:

Modern production is mainly based on specialised cattle breeds. However, for their genetic potential to be fully utilised, specific environmental conditions and coverage of both existential and production demands are required, which is often very problematic. Milk production in Poland is based on the most efficient Holstein-Friesian breed, whose genetic potential allows to obtain even over 10000 kg of milk during 305-day lactation period. In Poland, however, this production is based on its local variety, i.e. the Polish Holstein-Friesian (PHF), whose breeding books are kept from January 1st, 2005, by the Polish Federation of Cattle Breeders and Dairy Farmers (PFCBiDF). In addition to high productivity, this breed is also characterised by a decrease in the level of functional features, that is, among others: health, longevity, reproduction rates. Most of it is associated with the high demand of this breed for fodder of very good quality. However, breeders did not have such problems only 50 years ago, when it was difficult to find such demanding breeds on farms. The contemporary agriculture was based on the varieties and breeds of animals bred in our country and known for years, which were perfectly adapted to the conditions prevailing here local breeds. In Belarus, the local breed is still used, but is it really so?

Key words

Polish Holstein-Friesian breeds, local breeds, Poland, Belarus

Introduction

Cattle are one of the three main livestock species kept in Poland and Belarus. The market destinations of this species in both countries are milk and meat production, but the dominant market destination is milk extraction.

Poland is one of the leading milk producers in the European Union - 5th place behind Germany, France, the Netherlands, and Italy (this is related to the favorable environmental conditions for this type of production. Belarus also has similar conditions, but milk production has developed there mainly due to the embargo that Russia imposed on food products from the European Union, including, of course, Poland and Ukraine in 2014. The situation increased the

chances of greater exports of goods from Belarus to Russia, thanks to which Belarus was among the 5 leading exporters of dairy products in the world.

According to the data of the Polish Federation of Cattle Breeders and Milk Producers (PFHBiPM), in Poland milk is obtained from 12 breeds of cattle in the dairy type (including one breed with two color variants) and meat-and-dairy type, as well as interracial hybrids and breeds that are small in numbers. The Polish Holstein-Friesian (PHF) breed is definitely dominant in terms of the active population number - 88.68% of the active population, occurring in two color varieties, i.e. black and white (PHF HO) - 84.87%, and red and white (PHF RW) - 3.81%. In addition, dairy production uses such breeds known around the world as: Simmental (SM), jersey (JE), Montbeliarde (MO), brown swiss (BS), Swedish red (SR), Norwegian red (NR), and four local breeds: Polish red (RP), white-backed (BG), Polish red and white (ZR) and Polish black and white (ZB), which are covered by the Genetic Resource Protection Program. However, herd books are kept in Poland for 10 breeds: by PFHBiPM for the PHF, SM, JE, MO, BS, SR and ZR, ZB and RP breeds, and by the Department of Breeding and Protection of Cattle Genetic Resources at the University of Life Sciences in Lublin.

For many years, it was the breeds that were now included in the Program for the Protection of Genetic Resources that formed the basis of cattle production in Poland, but were gradually replaced by the currently most common Polish Holstein-Friesian breed, which was created as a result of crossbreeding Polish native breeds with bulls that replaced cows. Holstein-Friesian.

In Belarus, on the other hand, three breeds of cattle are kept: Belarusian black and lionfish, red steppe, and Simmental cattle. The Belarusian black and lion breed (99.8% of the total cattle population in Belarus) plays a definitely dominant role here, as it is recognized as a local breed of dairy cattle, while the remaining ones play a negligible role in the production of white raw material [1].

Polish Red

It is the oldest Polish cattle breed, which comes from the short-horned brachyceric cattle used by the Slavic and Scandinavian peoples as triple-purpose cattle, i.e. dairy-meat-draft cattle [2, 3].

It used to be present throughout Central Europe and Scandinavia, and now it is a small percentage of cattle kept in this area. Red cattle came to Poland in the 16th century due to the migration of people. This breed was maintained throughout Poland, but the largest population was located in what was then Galicia, i.e. in the south of the present country. The first breeders' association was established in 1894 at the Lesser Poland Agricultural Society and was called the Red Cattle Breeders Association. Twelve years later, the official evaluation of the utility value of cattle began, and in 1913 the first herd book was published.

In the interwar period, the population of the Polish Red breed constituted as much as 25% of all cows in Poland, then three varieties of the breed began to be distinguished, i.e. Podgórze, Valley, and Silesia. After World War II, this breed still maintained a high share in the total cattle population in Poland, accounting for 18% of cows. In connection with the desire to increase the efficiency of this breed of cattle, from the late 1950s the semen of Danish Red bulls, and in some parts of the

country of the Jersey breed, began to be used to improve it. In connection with the introduction of regionalization of the maintenance of individual breeds of cattle at the end of the 1960s, the authorities of Poland at the time adopted a resolution on the allocation of the areas where PC cattle were kept for the development of other local breeds: black and white and red and white, which resulted in a drastic decline in the population of this breed. At the beginning of the 1970s, the breeding area of cattle of this breed was limited to 3 districts in the Krakow Province, then the breeders purchased 100 bull mothers from other areas where these animals were still present, in order to preserve the diversity of the population that was already at that time very few. In 1975, a second region was designated in the Nowy Sącz Voivodeship, where about 55,000 cows of this breed were kept, and the breeding itself was supported by subsidies equal to 100 liters of milk for each animal. Additionally, breeders were provided with free insemination or natural mating, as well as an evaluation of utility value. These activities allowed the breed to survive and ensure the continuation of breeding work, unfortunately, such a model of support was carried out only until 1982. At that time, zoning and all forms of aid were abolished, which in turn led to a slow reduction of the breed's stock. Displacement breeding with such breeds as Angler became popular, as well as displacement by more efficient breeds such as Holstein-Friesian. It was only in 1999 that this breed was again included in the Genetic Resource Protection program, and the program started with a herd of 150 cows [2-10, 12, 13].

Polish red cattle are classified as the dairy-meat type, which was established in the interwar period. They are medium-sized animals, cows reach 120-130 cm high at the withers with a weight of 440-450 kg, and bulls are about 140 cm, 550-600 kg respectively. Currently, thanks to the actions of breeders, the animals are uniformly colored in different varieties of red. The sludge and hooves are definitely darker, the skin is thin and the hair is soft and delicate. The silhouette of adult animals should be harmonious, noble, inscribed in a rectangle, muscle profiles clearly outlined in proportion to the animal's build [8].

These animals are classified as medium-early maturing animals, and the first calving occurs most often at the age of around 30 months. Moreover, this breed is characterized by very good fertility [2-10, 12, 13].

Whiteback

White-backed cattle are descended from primitive cattle kept in Eastern and Northern Europe. It is associated primarily with the areas located near the lower Vistula, Bug, San, and Narew, hence it was referred to as the Vistula or the Powiśle, as well as the Nadświerzanie or the Bug River. These cattle were also widespread in the north of present-day Poland, near Żuławy, hence it was referred to as Żuławy in that area. They could also be found in the areas of today's Belarus and Lithuania, constituting about 10% of the population in these countries. The given names functioned at the turn of the 19th and 20th centuries in studies on the Warsaw Governorate during the partitions and in published textbooks, but the term "Białogrzbiety" on the Vistula began to be used more and more often. In the 1930s, cows of this breed accounted for approximately 6.1% of the cow population in the area of the Lublin Agricultural Chamber. And just before the outbreak of World War II, Kobryn and Brest districts accounted for as much as 33% of the population.

Due to the war and the change of Polish borders, the population of white-backed cattle decreased drastically, and in the 1970s the breed was even considered extinct, although some sources stated that in Poland you can find individual animals [3, 6, 12-16].

Work on the restoring this cattle population was undertaken by the Rector of the University of Life Sciences in Lublin, Prof. dr. hab. Zygmunt Litwińczuk in the 1990s. Restitution of this breed took place on the few individuals that were kept in areas where they were once popular, i.e. in the area of the Narew, Bug, and Biebrza rivers. As part of the work on the restitution of this breed, a breeding program was developed at the request of the Team for the Protection of Animal Genetic Resources, and in 2003 the Minister of Agriculture and Rural Development opened herd books for this breed and the Program for the Protection of Genetic Resources was started with a population of only 20 cows [3, 6 12-16].

The white-backed breed is a dual purpose meat and dairy cattle type. It owes its name to the color of the coat, which is characterized by a white stripe that is narrow on the head and widening towards the rump. A white stripe running across the back is connected to the colored sides with irregular hyphae. The presence of colored sides meant that the cattle were called bacon cattle. Animals of this breed can be both black (about 80% of the cattle population of this breed) and red (about 20% of the population). The white back is a highly inherited trait, hence for many generations using displacement crossbreeding, this trait will be passed on to offspring. The lower abdomen and limbs are often spotted or spotted. [3, 6, 12-16].

They are medium-sized animals with a harmonious and proportional silhouette inscribed in a rectangle. Adult cows are 125-135 cm high at the withers and weigh 600-700 kg, while bulls usually measure 135-140 cm and weigh 800-900 kg. These animals are rather massive, and the muscle profiles are clearly marked and convex. [3, 6, 12-16].

Polish black and white

The introduction to our country of cows from Friesland by Dutch settlements in the Middle Ages is considered to be the origins of the Polish black and white breed. The next import of cows from those areas took place in the 16th century, then the cattle slowly spread throughout the country, and was referred to as square. In the twentieth century, it was already located in almost the entire country, hence it began to be considered a native breed of cattle, which was called lowland black and white [2, 3, 5, 6, 12, 13, 17].

The First World War led to a significant reduction in the number of animals, so it was necessary to import animals again, this time from Germany, the Netherlands, and Sweden. Due to the utility evaluation and a large number of these cows, it was decided to open herd books in 1934; at the same time regulating the principles of recognizing bulls for breeding and the assessment of milk performance. In 1937, the utility value assessment covered 53 thousand. cows of this breed. Unfortunately, during the Second World War, which destroyed almost the entire country, agriculture also suffered. At that time, the cattle population in Poland was reduced by as much as 70%, which is why our country once again needed help in rebuilding agriculture. As part of UNRA's war compensation, Poland received high-yielding cows from Sweden, the Netherlands, and Denmark, while in the 1950s, male genetic material was imported, which was intended for

refining crossbreeding. In the 1960s, insemination was widely introduced, thanks to which the semen of the best breeders began to be used on a large scale and resulted in greater interest in the semen of Holstein-Friesian (HF) bulls, which was used for crossbreeding, initially refining, and finally displacing, which was also recommended by the authors breeding programs for black and white cows in Poland. This program recommended using the semen of HF bulls for crossbreeding and increasing the proportion of HF bull blood in the population, at the expense of natural mating with native bulls and insemination with the semen of bulls with low HF blood content. Unfortunately, in connection with the model of breeding conducted in this way, it happened that the black and white lowland cattle were practically extinct. However, due to the fact that some farmers still used low HF bulls, and also imported such semen, it was possible to open breeding books in 2007, and from 2008 to start the Genetic Resource Protection Program with the changed name of the breed to Polish black and white [2, 3, 5, 6, 12, 13, 17].

Polish black and white cattle are cattle with a dual-purpose, meat and dairy utility type and medium caliber. The silhouette of the animals should be harmonious, proportional, with a clearly marked milky silhouette, but the builds should be close to a rectangle, and the muscle profiles should be clearly marked. Adult cows reach a height of 135-140 cm in the cross with a bodyweight of 600-700 kg, and bulls 135-145 cm with a weight of 900-1000 kg. The animals look rather massive, the head should be of medium size, the neck of medium length, well-muscled, very often with a clearly marked cervical fold, wide and capacious chest. As the name suggests, the cattle have a non-uniform black and white color and dark hooves [2, 3, 5, 6, 12, 13, 17].

Polish red and white

Polish red-and-white cattle have been bred in Poland for about 100 years, and they were imported from Germany to Lower Silesia, Opole, and Cieszyn Silesia, i.e. to the areas that were under Prussian partition. This breed is classified as a spotted cattle and was created as a result of crossbreeding such breeds as: Shorthorn, Breitenburger, Wilstermarsch, as well as red and white from East Friesland and Westphalia-Rhineland. After the Second World War, the population of this breed decreased significantly, the so-called recovered lands, only 14 cows and 11 bulls remained, which were entered in the breeding books. Additionally, there were also 4 breeding herds in Poland. there were still 4 breeding herds in which this breed of cattle was kept. Due to such a limited number, the value of the traits decreased, which was especially important in the case of the habit traits. The improvement of the breed until the 1950s was aimed at improving the characteristics related to the production of milk, as well as the muscles. As in the case of the Polish black and white breed, in the 1970s, the Holstein-Friesian breed began to be used to improve this breed, imported from the United States, Germany, the Netherlands, Canada, and France to improve milk yield. In connection with the breeding work conducted in this way, the meat characteristics have decreased and are not as visible as it was before. Displacement crossbreeding was mainly used in breeding and state farms, which is similar to the case of the Polish black and white breed. On the other hand, on individual farms, breeders most often used semen with the lowest possible amount of Holstein-Friesian blood for reproduction. In the 90s of the twentieth century, the number of bulls in the offer of the companies decreased drastically, therefore they started to keep their own bulls

meeting the condition of a low infusion of HF blood. Unfortunately, the tendency to keep animals specialized in a single purpose and exceeding the profits from milk production led to a large decrease in this breed's population, hence, on the initiative of breeders and with the support of scientific centers, a Breeding Program was developed, based on which animals with the characteristics of this breed were reared, which made it possible to open breeding books and give the Polish red-and-white name in 2006, and a year later to introduce the Program for the Protection of Genetic Resources [2, 3, 5, 6, 12, 13, 18].

Polish red-and-white cattle are cattle with a dual-purpose, meat-and-dairy utility type and medium caliber. The silhouette of the animals should be harmonious, proportional, with a clearly marked milky silhouette, but resembling a rectangle, and the muscle profiles should be clearly convex. Adult cows reach a height of 135-140 cm in the cross with a bodyweight of 600-700 kg, and bulls 135-145 cm with a weight of 900-1000 kg. The animals look rather massive, the head should be of medium size, the neck of medium length, well-muscled, often with a clearly marked cervical fold, and a broad and capacious chest. [2, 3, 5, 6, 12, 13, 18].

Polish Holstein-Friesian

A single-purpose breed of cattle with a dairy utility. It was created in the USA as a result of crossbreeding imported cows from the western and northern Netherlands. In the second half of the nineteenth century, two HF cattle breeders' associations were established in the United States, one under the name "Holstein" and the other "Fresian", which merged in the nineteenth century under the name of the "Holstein-Fresian Association".

Thanks to the high productivity obtained during many years of breeding work, it gained its great popularity, so bull semen was used to improve local cattle breeds around the world. In Poland there is a variety of this breed - Polish Holstein-Friesian (PHF) registered for keeping breeding books in 2005. It was created as a result of crossbreeding, displacing local Polish black and white (ZB) and Polish red and white (ZR) cows with HF bulls [12]. The first HF sires came to Poland in the 1960s and 1970s, later and now thanks to the development of reproductive biotechnologies, the imported genetic material is in the form of semen and frozen embryos.

They are large animals: cows reach a weight of 650-700 kg, at a height of 140-147 cm at the withers, while bulls reach a weight of 1000-1300 kg, at a height of 160-173 cm at the withers. The animals have a noble, harmonious body build, a silhouette similar to a triangle, where the base is the rump and the top is the head [21]. In 2019, the average number of cows of this breed in Poland was 691 836.3 for the color black and white (HO) variety, and 30 959.8 for the red and white (RW) variety. The average yield for 2018 of the HO variety - amounted to 8 519 kg of milk with a fat content of 4.01% and protein of 3.37%, while the RW - 7679 kg of milk with a fat content of 4.15% and protein 3.43% [1].

The animals of this breed, apart from their unquestionable advantages, have very big disadvantages related to the breeding work carried out for many years only to improve milk production. They are associated with low-inherited, negatively correlated functional traits such as health, longevity, and reproduction.

Health problems are mainly related to the breed's high demand for good quality feed, especially in the so-called transition period, when it is difficult to meet the energy requirements of animals. If the appropriate amount of energy is not supplied in a nutritional dose or the animal does not take it up, a negative energy balance (NEB) occurs, which is the direct cause of metabolic diseases, starting from ketosis, often turning into acidosis. The latter metabolic disease is very often accompanied by another set of diseases, most often occurring in cows of this breed, and these are diseases, including mastitis, which may reduce milk production during lactation by up to 40%. Another common problem of this breed are problems with reproduction, which is particularly unfavorable in animals with low reproductive capacity, these problems are most often the result of dietary mistakes and diseases that occur in cattle.

Belarusian black motley

This is the breed of cattle on which all cattle production in Belarus is based. It provides both dairy and meat. It is assumed that this breed comes from the Netherlands, where dairy cattle were produced between the 18th and 19th centuries. Initially, Dutch cattle were only a dairy breed, but due to the low resistance in the 20th century, it was decided to improve this breed to improve this trait, and at the same time to improve its meat content. The further stages of creating the black-motley breed indicate the crossbreeding of the Dutch breed with native breeds from the USSR, and finally with the Swedish black and white breed, which resulted in the breed being created, which was registered in 1959 [23]. Cows of this breed can boast rather good productivity indicators, but they largely depend on the animals' nutrition and housing conditions. The average milk yield varies between 3500 and 6000 kg of milk, but in Belarus, there are also much higher yields reaching even 9000 kg of milk during lactation. The fat content in milk is estimated at around 3.4-3.6%, while the protein content at 3.1-3.3%. These animals also achieve rather satisfactory parameters regarding slaughter efficiency, which reach about 55-60% [22, 23].

These animals reach the following weight: cows 550-650 kg at 130-132 cm high in the cross, while bulls even 900 - 1000 kg at 158-162 cm high in the cross. The birth weight of calves is approximately 37-42 kg [22].

As for their external features, the head is long, with an elongated neck. The animals have gray horns that are dark-tipped. Chest - Medium width, about 70-75 cm deep, flat back, with a straight lower back and a wide sacrum, limbs strong and stable. The population of black and motley cattle is rather diverse in terms of phenotypes, mainly due to the very large differences in nutrition that are found in the areas where they are kept.

According to Pestis et al. [21] the animals, despite their high production potential, should be further improved in terms of production characteristics, including the quality of milk, in order to improve the technological possibilities of the obtained raw material. For this purpose, the authors indicate further crossbreeding with the Holstein-Friesian breed by mating cows with the semen of imported bulls from Western Europe, as well as Canada and the United States.

Summary

Both in Poland and Belarus, one breed of cattle plays a dominant role in the production, but in Poland it is a local variety of the most widespread dairy breed in the world, i.e. the Polish Holstein-Friesian breed, while in Belarus the native cattle breed is considered dominant, and for many years is a perfected Holstein-Friesian breed and is, in fact, a local variation as well.

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