

NEGOTIATIONS AS AN IMPORTANT ELEMENT OF RESEARCH PROJECTS' COMMERCIALIZATION PROCESSES IN THE DOMAIN OF MINING MACHINES

Małgorzata MALEC^{1*}, Lilianna STAŃCZAK²

¹ KOMAG Institute of Mining Technology, Gliwice; mmalec@komag.eu, ORCID: 0000-0002-6373-4568

² KOMAG Institute of Mining Technology, Gliwice; lstanczak@komag.eu, ORCID: 0000-0002-5154-7693

* Correspondence author

Purpose: As negotiations play an important role in commercialization processes of research projects' results, the Authors of the paper decided to share their knowledge and scientific experience with present and future negotiators. In the case of six research projects the multiple dimensions of negotiation processes such as the substantial, communication and emotional aspects are presented. The paper is ended with some guidelines which can facilitate negotiation processes, enabling to avoid mistakes, often made even by experienced negotiators.

Design/methodology/approach: The objectives were achieved in the result of an in-depth analysis of six innovative projects, realized at the KOMAG Institute. Based on these case-studies it was possible to formulate general character, taking into consideration holistic aspects of negotiation processes.

Findings: In the result of the research work the following findings and conclusions were formulated: the preparatory phase of negotiations should include a development of strategy and tactics, risk assessment and contingency planning; a significance of active questioning, testing, persuading, monitoring and documenting processes can be seen clearly in the result of conducted analyses; a correct negotiation process requires an ability of coordinating activities, a good communication and a flow of information; based on in-depth analysis of the six case-studies, it can be conducted that the "win-win" process of negotiations seems to be most successful.

Research limitations/implications: The Authors intend to continue their research work in future, taking into consideration the philosophy and psychology of the art of negotiating.

Practical implications: The research results, described in the paper, have pragmatic outcomes and applications for business.

Originality/value: The paper is addressed to all the present and future negotiators. Its special value results from a pragmatic approach of the Authors to negotiating processes. The findings are based on multi-year scientific experience of the Authors in a commercialization of innovation research projects' results. Negotiations seem to be relatively easy theoretically, however in practical everyday business life they are difficult, complicated and risky.

Keywords: negotiation, research project, innovation, commercialization, mining machines.

Category of the paper: case study, research paper.

1. Introduction and theoretical background

The word “Negotiations” seems to be easy in terms of its definition. Each need can be a subject of negotiations. When people exchange views, aiming at changing relationships between or among them, when they discuss their points of view, as a matter of fact they start negotiations. A crucial part of negotiations includes communication. A full description of the process of negotiations can be described within several disciplines of knowledge such as economy, law, sociology, IT, behavioural sciences, management etc. Many experts on negotiations believe that it is absolutely necessary to learn how to negotiate successfully taking advantage of the trials- and- mistakes method. However, it is not always true. A person, conducting negotiations for many years, might have made the same mistakes without having been aware of his/her weak points. Generally speaking, negotiations seem to be the least troublesome method of solving problems because they enable to determine the spheres of mutual understanding, leading to practical solutions and decisions. Successful negotiations require mutual trust of negotiators and their will of not only taking but also giving, which enables to reach a compromise in the results of bargaining, after having analyzed common interests of negotiating parties. It is convenient to start negotiations without any assumed limitations. Life experience proves that in the majority of cases the negotiating parties do not trust each other, so negotiations are not easy and nice. It should be highlighted that a good knowledge of human reactions, human behaviour and so called body language is extremely helpful. It is important to make certain assumptions at the very beginning of negotiations. It concerns both parties. However, the strategy and tactics of negotiations play a crucial role. It should be borne in mind that each of the negotiating parties has its own needs and expectations, so it is advantageous to take into consideration the needs of the other party. When such needs are ignored, there is a total victory and a total failure, really no chance for a win-win situation.

At present more and more businessmen are aware of efficient techniques of negotiations. In particular it concerns selling of licences and know- how for innovative products or services. It often happens that creators of innovative solutions are not experienced negotiators and they make mistakes which cause that they do not reach the expected success which they most certainly desire. A sales of a state-of-the-art technology requires a good presentation which enables to attract attention. A difficult to-be-understood technical jargon should be avoided unless the presentation is addressed to a group of technical specialists who can understand this jargon. It is worth giving some examples of users who implemented that technology and reached a market success.

As it had already been mentioned before, negotiations are difficult when each party wins, so it is important to know risks and basic principles. In real life a negotiator does not know what kind of strategy his opponent intends to apply. If negotiations are perceived as a kind of game,

then a sort of rivalry starts, which can lead to a success but also to a failure. A good negotiator aims at reaching an agreement and not his victory. Both parties should believe that they gained something. Summing up, it should be highlighted that negotiations are neither a game nor a sort of war, so they must not be oriented onto a devastation of the other party. Negotiations can be called a common egotism due to the fact that this process is conducted by both parties. If negotiations are treated as a form of collaboration, it is probable that they will lead to common understanding. However, there is always a kind of competition between parties, but it is an integrating process. It enables to compare one party's competence, knowledge and experience with the other party's qualifications and draw stimulating conclusions, enabling to detect some weak points in advance. It is most convenient to determine joint objectives and always emphasize similarities not differences, as one-party's total success is rarely long-lasting. A dominating position in negotiations does not give positive effects in comparison with a collaborative position. The partner should never feel cornered. Very few negotiations go smoothly and they differ from one another significantly. Experienced negotiators can reach an agreement very quickly. They do not waste time for a small talk or unimportant issues. After an initial exchange of pleasantries they concentrate on the subject-matter itself. Experienced negotiators never treat negotiations as a game as they are aware of the fact that it is indispensable to find lingua franca and avoid traps 'I take everything or nothing'. It should be borne in mind that experienced negotiators like to give hints, avoiding a straight-forward presentation of their intentions. However, sometimes negotiations get out of control. Real professionalists know when they should stop pushing the other party. The negotiator should realize when he is close to reaching the critical point. It is easy to forget this principle when emotions take over. If it is assumed that negotiating is a process demanding a collaboration, it is indispensable to search mutual benefits. As negotiations are a form of a human behaviour and not a game, they are efficient only when the case wins.

2. Literature review

The literature review, conducted by the Authors, was oriented onto a research problem consisting in a definition of negotiations, being an important element of commercialization process in the case of innovative projects. The subject-matter fits in the scope of "Production Engineering", because the issues under analysis belong to "Engineering of Innovations". It is worth mentioning that negotiations play an important role in commercialization processes and they can have a crucial impact on their successful management (Malec, Stańczak, 2020; Stańczak, 2020).

The role of human factor in negotiations should be highlighted (Nierenberg, 1981). Each negotiation is organized in three main steps: the initialization, the refinement of the job under negotiation and the closure (Sycara, Dai, 2010). The initialization step allows to define what has to be negotiated (Negotiation Object) and how (Negotiation Framework) (Duan, Dogru, Ozen, 2012). In the refinement step participants exchange proposals on the negotiation object, trying to satisfy their constraints (Hu, Deng, 2011). The closure concludes the negotiation. To handle the complex types of negotiation scenarios different components are proposed. They include: outsourcing jobs, block service and broker's activities (Creftan, Coutinko, Jardim- Goncalves, 2012). As it has already been mentioned, negotiation processes involve a substantive, communication and emotional dimensions (Filzmoser, Hippman, Vetschera, 2016). Business negotiations based on the bargaining model of game theory are presented in (Zhang, 2021). However, it is worth considering the cross-cultural-context in relation to negotiations across borders (Schoen, 2022). An interesting approach to an effect of new potential supplier on business to business negotiations performance is described in (Delina, Olejarova, Doucek, 2021). It is also worth considering methodological issues in negotiation research (Buelens, Van der Woestyne, Mestdagh, 2008). A description of the negotiation scorecard, being a tool in business and industrial marketing can be found in (Fleming, Hawes, 2017), whereas the impact of training on negotiators and organizations is presented in (Baber 2022). International business strategy is analyzed in (Asante-Asamani, Elahee, MacDonald, 2021). However, propositions, based on the international perspective in the scope of relational business negotiations, include a linear process that follows episodic or stage models. Business negotiations are geared towards a one-time transaction. They focus on a single negotiator or negotiations in a dyad. Aspects of business negotiations are conceptualized with the industrial marketing and purchasing (IMP) perspective (Eklinder-Frick, Age, 2020). While analyzing the literature on the subject-matter of negotiations, it is worth paying attention to negotiations for future studies in the domain of business negotiation (Agndal, Age, Eklinder-Erick, 2017). Bilateral contract negotiations, concerning delays in project outsourcing process, should be studied from the point of view of subcontractors' bargaining powers or the dynamic bargaining process in negotiations. Bilateral bargaining between the client and subcontractors reflects real-world negotiations. The research results, presented in the publication (Hou, Lu, Deng, Shen, 2021) uncovered how the coordination of project outsourcing is impacted by the contract form, bargaining power structure, precedence network topology, payment timing, external opportunities and negotiation protocols. For single-task projects the fixed-price contract can achieve system coordination only when the subcontractor possesses full bargaining power. Cost-sharing and time-based incentive contracts may not be effective for projects with parallel tasks. Projects with serial tasks can be coordinated only under extreme bargaining power structures. Some researchers (Curhan, Labuzova, Mehta, 2021) concentrate their studies on the subject of criticism which enhances creativity in negotiation. A cooperative social context allows criticism to be construed positively, spurring creativity without inciting intragroup

conflict and a corresponding reduction in creativity. In a cooperative context, instructions, encouraging criticism, yielded more creative ideas, whereas in a competitive context encouraging criticism yielded fewer ideas and they were less creative. In many cases under analysis negotiators' motivations and personalities played a significant role (Maslow, 1954).

A multi-agent based negotiation system for re-establishing enterprise interoperability in collaborative networked environments is described in (Kadar, Muntean, Cretan, Jardim-Goncalves, 2013). It proposes a system for promoting sustainable interoperability between enterprises involved in complex networked environments through multi-level negotiation, communication and information sharing. This solution is based on a multi-agent system architecture that applies rule-based negotiation at various organizational levels such as: business, ICT, workflows, data systems and people. On the grounds of the literature review a selection of the following research methods was chosen:

- analyses of national and international publications enabled to formulate a research problem which is described in the Introduction,
- a method of multiple case- study which was used for an analysis of six research projects, realized at the KOMAG Institute of Mining Technology,
- a heuristic method enabling to detect new facts and relationships among them.

3. Efficient negotiation processes in the case of innovative research projects

The KOMAG Institute of Mining Technology has realized scientific, research and technical projects of innovative character for over seventy years. The experience, gained over all those years, in particular in the scope of negotiation skills with other scientific but mainly industrial partners, is an extremely valuable and useful source of pragmatic information. Negotiations seem to be relatively easy theoretically, however in practical everyday business life they are difficult and complicated. A correct negotiation process requires an ability of coordinating activities, a good will of cooperation, a good communication and a flow of information. The reasons of difficulties in negotiations sometimes result from organizational problems at the institute or the company as well as an incorrect identification of business partners' expectations and needs. Based on the experience, gained at the KOMAG institute of Mining Technology, several types of projects can be distinguished (Fig. 1).

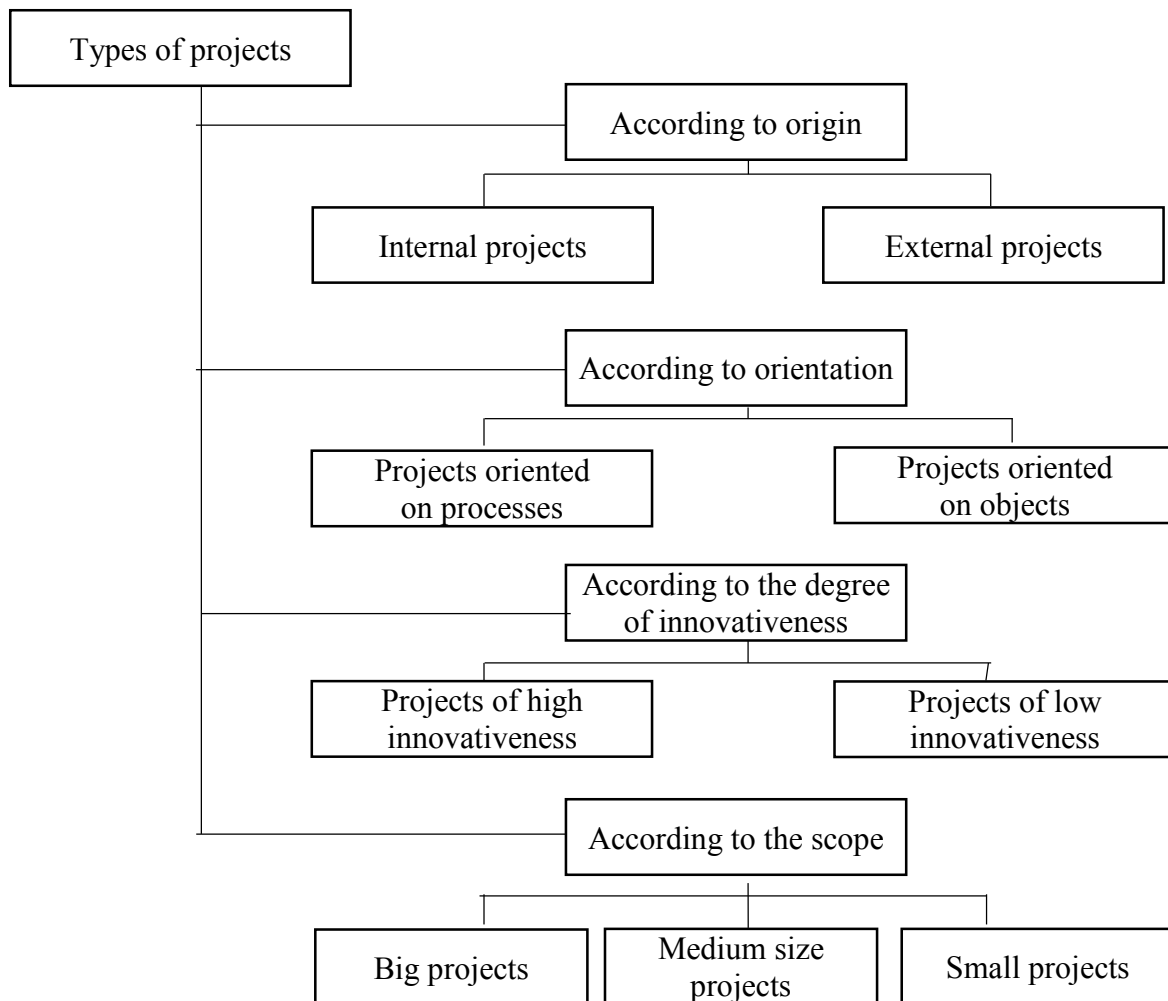


Figure 1. Types of scientific and research projects realized at the KOMAG Institute (Authors’).

Examples of different types of projects:

1. An elaboration of technical documentation of machines or equipment.
2. An implementation of an innovative technical solution.
3. A development of a new computer system.
4. A construction of a laboratory.
5. An organization of a conference.

4. Analysis of negotiation processes - case studies

Within the research work the Authors investigated twenty five innovative projects, realized at the KOMAG Institute of Mining Technology, focusing on negotiation processes and negotiators’ skills. From this set six different cases were chosen for an in-depth analysis enabling to formulate assessments of general character. The Authors concentrated on contracts and agreements taking into consideration the changes resulting from successful negotiations.

4.1. A longwall shearer external spraying system ensuring safe operation in the methane hazard conditions

It should be highlighted that the planned first user of the system, i.e. the Jastrzębska Coal Company, J.S.C. (Jastrzębska Spółka Węglowa S.A) since the very beginning has taken an active part in negotiating the conditions of the so called targeted project, including the technical requirements and the project financing. The scheduled work programme was mutually agreed and then contracts with producers were negotiated and signed. All the obligations of the parties were agreed upon, including the approval of the State Mining Authority (Wyższy Urząd Górniczy), who initiated the project aimed at improving safety in underground workings. The negotiations went smoothly due a full engagement of all the project stakeholders, i.e. KOMAG as an institute developing an innovative solution, the producers and the end users from the JSW mines. The first industrial implementation was planned at the Pniówek mine. Then a licence agreement with the producers was negotiated and signed.

4.2. System for an identification of powered roof support components

This innovative technical solution was developed by KOMAG in collaboration with the Silesian Technical University and the ELSTA company. Due to some obstacles experienced at the project initiation stage, negotiations of contacts with the project partners played a crucial role in a successful realization of the project objectives. The negotiations concentrated on the scheduled work programme and on financial issues. As in the targeted project application, the stakeholders were obliged to determine all the financial details in advance, several stages of negotiations turned out to be indispensable to find lingua franca and reach an agreement. During the project realization the contracts had to be renegotiated due to an availability of new generation identifiers and some corrective measures had to be taken. It should be highlighted that principles and conditions of paying and sharing royalties were negotiated among the parties at the very beginning, which enabled to avoid misunderstandings and conflicts during the project realization.

4.3. Small-size WMD-150 drill rig

The project was initiated by the industrial partner, the ZMUW- Mechanical Plant of Drilling Equipment, who carried out the market-survey which confirmed a demand for designing and manufacturing a drill rig for geological-and-exploratory drillings as well as for different-purpose bore-holes. In the result of negotiations a contract was formulated. It stipulated the financial conditions and obligations of the parties. The contract was subject to renegotiations due to a necessity of introducing some changes in the scope of financial conditions and the reduction of the project duration time caused by the end-user's requirements. In the result of negotiations two annexes, which enabled to manage the above mentioned changes, were signed. The third annex concerned an electronic version of technical documentation.

4.4. Research and development of solutions in the scope of using unconventional sources of energy

The project was oriented onto an innovative solution of a one-megawatt wind turbine. The producer was enthusiastic about the market potential of this product. The majority of negotiations concerned the technical specification. It was agreed orally that the initial design of the turbine will be elaborated at the KOMAG's cost and it was also agreed orally that further costs will be borne within the framework of the targeted project. KOMAG also developed a business plan which was approved by the industrial partner in the result of negotiations. When the first stage of the project at the KOMAG cost was finished, suddenly the industrial partner decided to withdraw from the consortium without any financial consequences. As there was no formal obligations in the written form, presenting the results of negotiations, KOMAG had no chance to reduce its financial losses. The negotiating party from KOMAG was a rather unexperienced one and he acted under a strong time pressure, so he did not demand any written confirmation of negotiation results which turned out to be a costly mistake.

4.5. Improvement of coal winning technology oriented onto a reduction of costs due to an application of mining prevention on the crossing of the longwall with roadway

The research project went smoothly at the very beginning. All the conditions seemed to be well negotiated and specified in detail. However, an incorrect flow of information among KOMAG researchers and the mine staff caused that there was an urgent need of renegotiating the contract. The negotiating parties did not take into account mining-and-geological conditions underground, which made a project realization impossible. A wrong assumption of these conditions made renegotiations pointless.

4.6. Intrinsically safe system of scattered structure for a control and supervision of machinery smart drives

The negotiations with the research partner, the ITR - Tele and Radiotechnical Institute (Instytut Tele i Radiotechniczny) were conducted in a professional and goal-oriented form. Then the application to the KBN - Committee for Scientific Research (Komitet Badań Naukowych) was submitted. When it was approved for financing a three-party contract was negotiated. During the negotiations the issue of product certification was omitted. In particular it concerned the ATEX Directive requirements. In fact there was no guarantee that the product will obtain indispensable certificates for an underground application where a gas explosion occurs. Based on this example, it can be seen that negotiations should cover all the issues which can have even a hypothetically negative impact on the project realization process. The mistakes made at the negotiation stage, concerning mainly the project scope, caused a failure of the whole project.

5. Characteristic features of negotiations presented in case- studies

Based on the in-depth analysis of the six case-studies, it can be concluded that a negotiation process is used to reach an agreement, compromise or settle differences between two or more parties. As all the parties want to achieve the best possible outcome for themselves and each other, “so win-win negotiations” seem to be most fruitful. They were used for a presentation of all the innovative projects described as the case-studies in the former paragraph. The five-step negotiation process is used at KOMAG in general. This process is reflected in the reports, minutes of meetings, contracts and agreements analyzed by the Authors. As some of them have the clause “confidential”, they cannot be namely mentioned in this publication. There are two kinds of negotiation approaches:

- Win-win Negotiations (Interpretive Negotiation) are when both parties come to the negotiation table and leave feeling like they have won. They focus on integrative or value - creative bargaining processes and techniques which enable each party to learn what the other one wants.
- Hard bargaining (Distributive Negotiation) is when one or both parties take an extreme position, which often creates a win-lose solution. A win-lose scenario may seem beneficial if the deals skew in your favour, but others will not want to do business with you. If such an approach is used, you might win one negotiation but lose in the long run.

The five-step negotiating process is as follows:

1. Preparation is key to successful negotiations. It is indispensable to identify most realistic outcomes. It is important to determine the best alternative to a negotiated agreement.
2. Exchange of information about your initial position with the other negotiating party is the second step. You should avoid creating the environment of aggression and pressure. Active listening skills are vital for understanding how your counterpart sees the situation during this stage. That way, it is possible to reach an agreement that benefits everybody. Key negotiation skills, needed to successfully complete this stage of negotiation process, include questioning and active listening.
3. Clarification enables both parties to justify their claims. This stage is an opportunity for one party to provide the other one with any documentation that helps support its position.
4. Bargaining is a critical component of the negotiation process because it begins a give-and-take action. Both parties have a chance to suggest different offers.
5. Commitment is the final step in the negotiation process. It formalizes the agreement reached in the previous stage. Regardless of the outcome, both parties should thank each other. It should be borne in mind that negotiations are all about creating and maintaining long-term relationships.

The five-step negotiation process is graphically presented in Fig. 2.

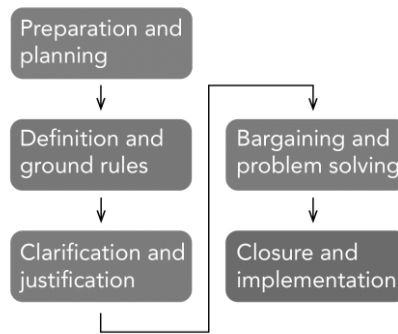


Figure 2. Guidelines enabling to conduct a successful negotiation process.

6. Role of human factor in negotiating

Negotiations are based on a collaboration between/among parties and it is crucial to bear in mind that negotiations are successful if they ensure that each party gains something. Knowledge about human behaviour is extremely useful. In general negotiations are oriented onto changing relations among negotiators who represent different characters, personalities and tempers. It should be borne in mind that one party's perception of facts is not always similar to the other party's one. Bad habits of negotiators can have a negative impact on the course of negotiations, including unpleasant gestures and mimics, however an instinct of the negotiator can be either a good or a bad advisor. Being aware of the above mentioned aspects of human behaviour, it is easier to predict the partner's reactions and to understand them. Fig. 3 presents influencing and negotiation skills. It is important to remember that special attention should be paid to personal influence and impact as well as to the psychology of persuasion.



Figure 3. A graphical presentation of influencing and negotiation skills (<https://mce.eu/open-programmes/influence-and-negotiation-skills/>).

Experience of negotiators gives them abilities enabling to conduct successful negotiations, but it will not give sufficient knowledge about a wide range of available possibilities. Each person tends to assess the circumstances in the most advantageous way for him/her. Psychologists call this approach a rationalization of results which usually happens at the final part of negotiations. It is also worth mentioning a projection which consists in attributing own motivations to the opponent in negotiations, such as for example making biggest profits (Nierenberg 1981). It leads to a deformation of real facts and situations, when a liar believes that everybody is a liar. A dislocation should be mentioned as well, i.e. unjustified emotions during negotiations can be such a dislocation. Playing different roles in negotiations is also worth analyzing because it helps to avoid mistakes in the scope of intentions and objectives. Irrational fury can be an example of a behaviour which constructs a psychological barrier which is difficult to overcome. Open-minded negotiators are definitely more creative and goal-oriented. Summing up, it can be stated that human behaviour is not a fight between mind and heart but a combination of them both and of many other factors such as cultural environment and life experience. A trial of understanding human needs leads to successful negotiations, because people rationalize, conduct projections, dislocations and play their roles. They sometimes restrain their emotions and an experienced negotiator can guess what is going on.

7. Preparation for negotiations

A good negotiator should know how to control his own emotions. He should be patient in precise presenting his opinions which helps to avoid misunderstandings. It is helpful to conduct a research on your opponent trying to detect the other party's objectives in advance as well as his professional achievements. All these activities supply information enabling to foresee the opponent's strategy as well as his strong and weak points. Such an approach enables to establish certain assumptions which can be used during negotiations. It also saves time as both parties have a common understanding of facts and circumstances. It is indispensable to bear in mind that negotiations lead to satisfying both parties' needs.

8. Motivation in negotiations

Each negotiator aims at satisfying his/her needs. Prof. A. Maslow from the Brandeis University gives seven categories of needs which can be treated as basic factors of human behaviour (Maslow, 1954):

1. Homeostatic needs (physiological).
2. Need of safety.
3. Need of love and affiliation.
4. Need of value.
5. Need of selfactualization (internal motivation oriented onto abilities).
6. Need of knowledge and understanding.
7. Aesthetic needs.

Homeostatic needs seem to dominate because they concern efforts of organism to maintain its normal, balanced condition. However, the need of value includes freedom and independence which also play a significant role in the process of negotiations. It is accompanied by competence and prestige. Gaining knowledge and life-time learning make a good and efficient negotiator. A deep knowledge about the needs, mentioned above, facilitates the process of efficient negotiations based on mutual collaboration.

In fact there are three levels of negotiations:

- Interhuman level - negotiations between two persons.
- Interorganizational level - negotiations between/among organizations.
- International level - negotiations between/among states.

There are different approaches used by negotiators:

- Negotiator is oriented onto satisfying his own needs.
- Negotiator allows his opponent to act towards meeting his needs.
- Negotiator acts towards meeting his own as well as the opponent's needs.
- Negotiator acts against his needs.
- Negotiator acts against the opponent's needs.
- Negotiator acts against his own and the opponent's needs.

The more alternative methods are used, the more chances for being successful, as the negotiator can then use different possibilities to reach his objectives. Open-minded negotiators are flexible as regards a selection of new methods.

9. Recognition of needs in negotiating

Different methods and techniques can be used for a recognition of the negotiator's opponent's needs. This step is connected with communication. A good negotiator watches his opponent's behaviour very carefully (manners, gestures, repeated expressions) which helps him to learn about objectives and hidden needs. Obviously the simplest way of getting information is asking questions such as: "What do you want to achieve during these negotiations?", "What do you expect?". It is crucial when such questions can be asked because it happens that

the obtained answers lead to nowhere. Questions are a sort of serious weapons during the negotiating process, so they should be asked carefully, because they stimulate the opponent to think critically about our proposal. General questions e.g. "Why have you said that?" make the opponent feel cornered and he will probably start looking for excuses. Careful questions, asked in a sensible way, attract attention and direct the discussion towards concrete information, making the opponent draw conclusions which are welcome by us. Apart from questions also statements can play a significant role in the negotiating process, because they enable to control it. It is recommended to avoid emotional statements which can impede negotiations. Threats and offensive words are unacceptable. It is worth concentrating on the meaning of the opponent's words and listen carefully to his statements so that to understand hidden meanings and hints. Listening is as important as speaking. A good negotiator must be open-minded and he should avoid prejudices and an advance formulation of conclusions. Non-verbal communication should also be highlighted. Gestures are extremely significant. Tension can cause contractions of muscles in the face, insincere smile and red spots, as well as body movements. Coughing can be a sign of nervousness or it can indicate that the opponent tells lies. When a person, sitting at table during negotiations, leans towards it, it means that he expresses extra interest and when he moves backward he shows a reduced interest. It is difficult to assess non-verbal communication as it is related to both the subconsciousness and emotions. Cultural differences have an impact on using and interpreting gestures. The main conclusion resulting from the information, presented above, is that a good negotiator aims at recognizing his opponent's needs, motivations and objectives. It can be done by asking questions, watching his gestures and other forms of non-verbal communication, being aware of the fact that he can be under emotional stress and that cultural differences may occur.

10. Negotiating techniques

After having prepared for negotiations, it is necessary to develop strategy and tactics of negotiations. The strategy "when" as well as "how and where" is indispensable as it facilitates time management. Each strategy can be divided into eight elements: anticipation/expectation, surprise, *fait accompli*, withdrawal, apparent withdrawal, reversal, restriction, misleading.

The basic forms of the "how are where" strategy are as follows: participation, accreditation, discreditation, cross-roads, allowing for expansion, randomization (bluff for bluff), random sample, *salami* (small steps by 'slices') and forks (how to determine the goal and hit it). The negotiating theory aimed at satisfying needs is presented in Fig. 4.

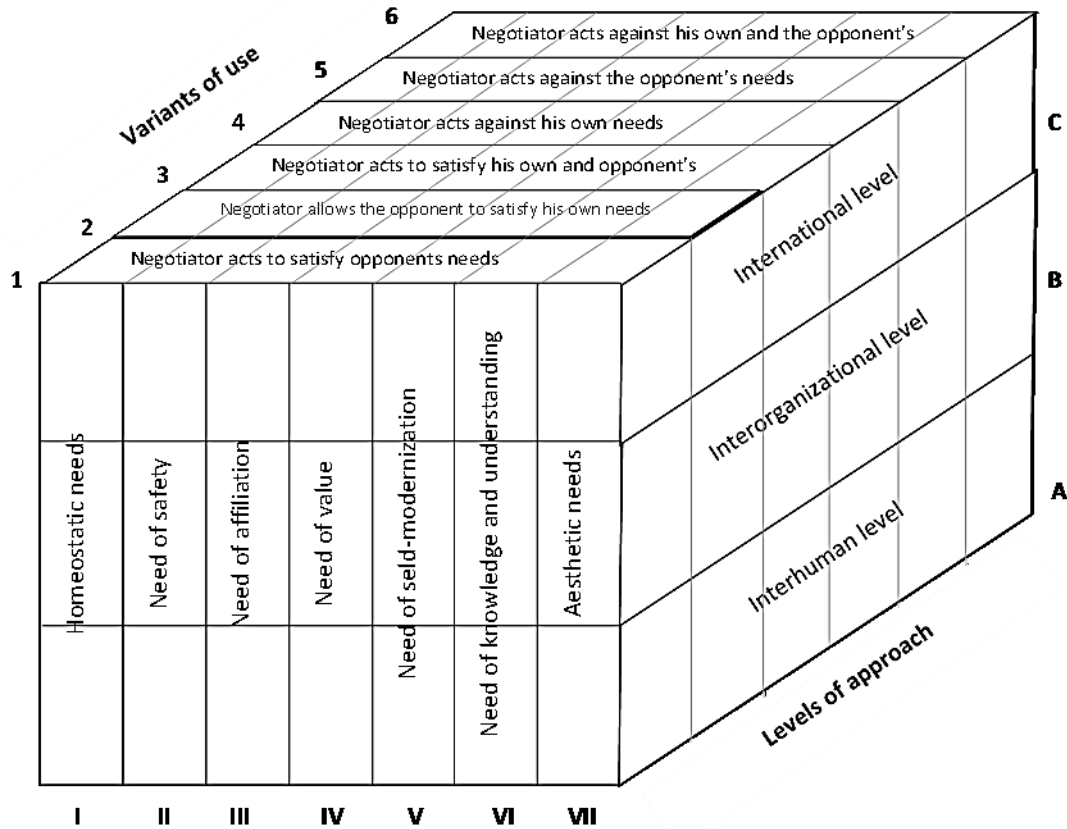


Figure 4. Structure and sequence of gambits in the framework of negotiating theory aimed at satisfying needs (Nierenberg 1981).

The schematic diagram shows a cube consisting of 126 cubes, whereas each of them represents a different gambit.

Summing up, it can be concluded that all the information, presented above, includes both the philosophy and psychology of the art of negotiating. Human behaviour was analyzed from the point of view not only of negotiations but also of basic needs. The theory of negotiations was oriented onto satisfying needs. Negotiating is a tool which can be efficiently used by a good negotiator who understands the principles of collaboration, bearing in mind that successful negotiations are a win-win event.

11. Multiple dimensions of negotiation process

According to the research results, presented in (Filmoser, Hippmann, Vetschera, 2016) negotiation processes are characterized by multiple dimensions. They involve a substantive, a communication and an emotional dimension. Research results, confirmed by the Authors of this publication after a thorough analysis of six case-studies indicate a strong linkage between communication and emotions, whereas connections to the substantive dimension are weaker. A negotiation process is viewed mainly as a sequence of offers and counteroffers based on

economic criteria like efficiency and utilities of parties. However, classification schemes for communication acts explain how communication context changes over time and influences the outcomes of negotiations, i.e. whether a negotiation reaches an agreement. The research, conducted recently, uncovered different emotional patterns in negotiations. In the case-studies, analyzed by the Authors, the negotiation processes were conducted in the unified framework as shown in Fig. 5. They were viewed as three parallel streams.

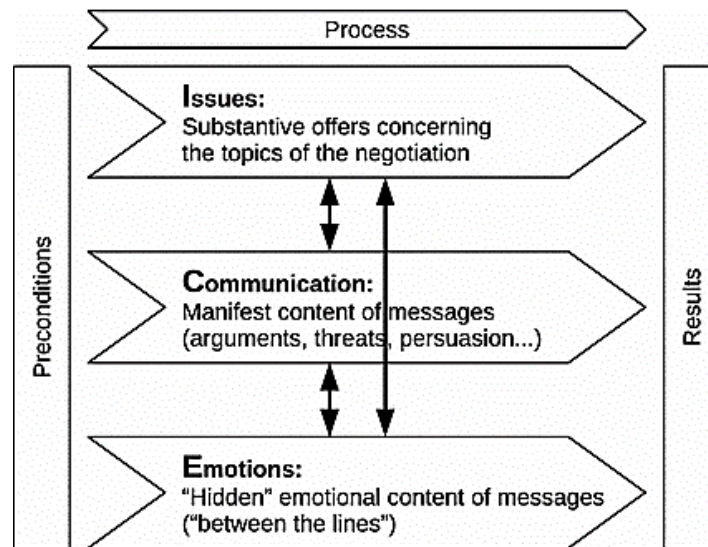


Figure 5. Issue-communication-emotions (ICE) framework for negotiation processes (Filzmoser, Hippman, Vetschera 2016).

Research on all three dimensions was concerned with their effects on outcomes. It is worth focusing on the process perspective as a common ground between dimensions. This requires a unified framework for negotiation processes which maps events in the different dimensions onto a common time scale.

Apart from presenting multiple dimensions of negotiation processes, the Authors decided to analyze a multi-agent based negotiation picture to get as much information as possible about an enterprise interoperability.

Sustainable interoperability between enterprises through a multi-level negotiation, communication and information sharing applies rule - based negotiation at various organizational levels such as: business, ICT, workflows, data systems and people. As it has been already shown in (Ray, Jones, 2006) a broad definition of interoperability refers to the ability of two or more systems to exchange information and use it. The lack of it disturbs the creation of new markets, networks and diminishes innovation and competitiveness of organizations. That is the reason why the KOMAG Institute has been trying to achieve interoperability in different fields of its scientific and technical activity. Multi-agent based negotiation system MAS plays a crucial role in e-negotiating processes (Kadar, Muntean, Cretan, Jardim-Goncalves, 2013), because in this case intelligent agents are able to assist humans in re-negotiation decisions taken at business level when breaking downs of interoperability occur. The negotiation abstract model, presented in Fig. 6., is designed with use

of the agent paradigm and the afferent tools. Agents can be regarded as computer systems (Wooldridge, Jennings, 1995). The model is an agent federation consisting of such agents as: autonomy, social ability, reactivity and pro-activeness.

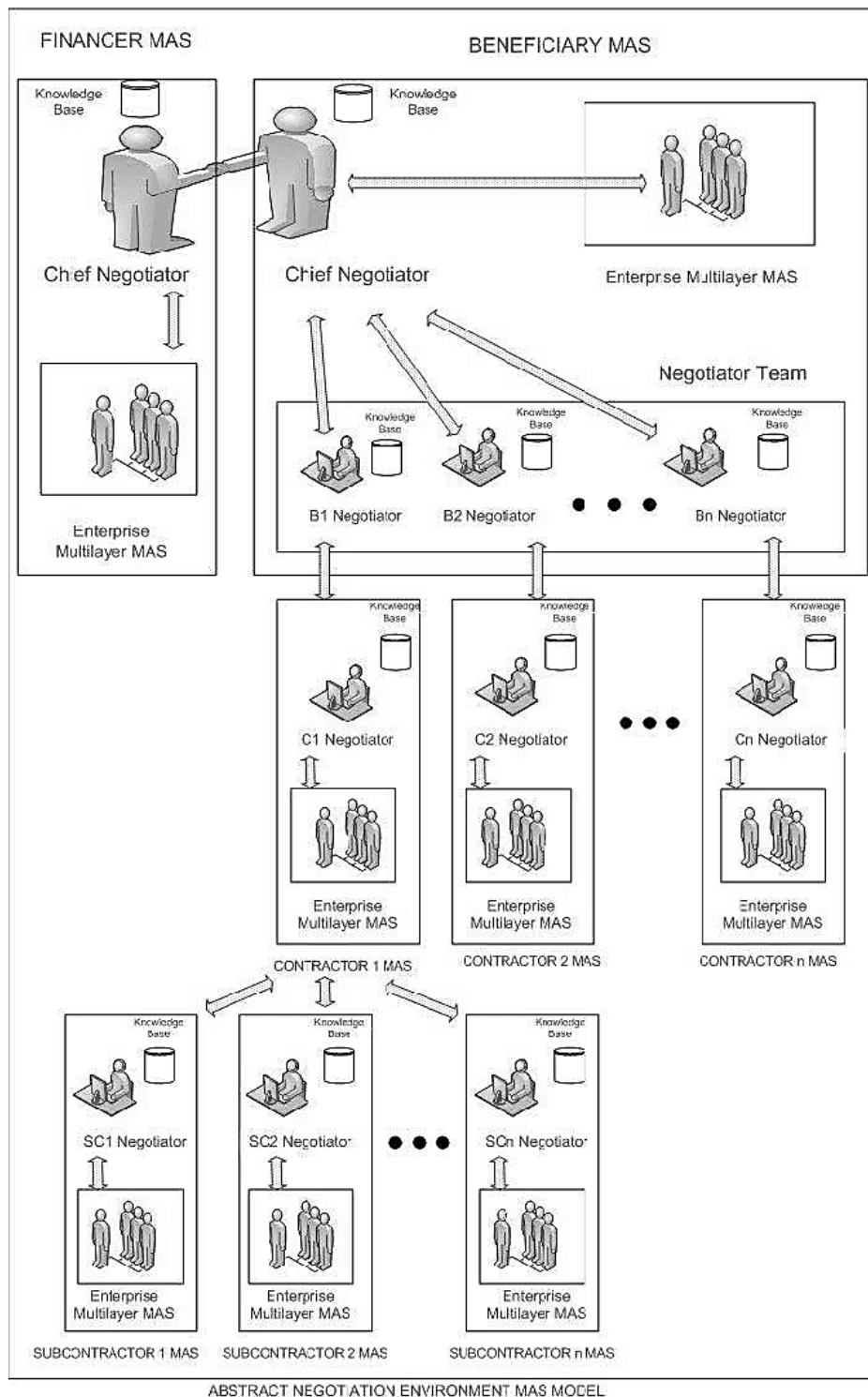


Figure 6. MAS for abstract negotiation model (Kadar, Muntean, Cretan, Jardim-Goncalves, 2013).

It should be borne in mind that group members interact with the agent acting as an intermediary. In this way the group is provided with a consistent interface. The most fundamental mechanism for managing inter-agent dependencies is negotiation, which

underpins attempts to cooperate. The architecture of the negotiation system offers mechanisms to support negotiations. This architecture is structured in four main layers: Chief negotiator, Negotiator Agent, Coordination Components and Middleware, as shown in Fig. 7.

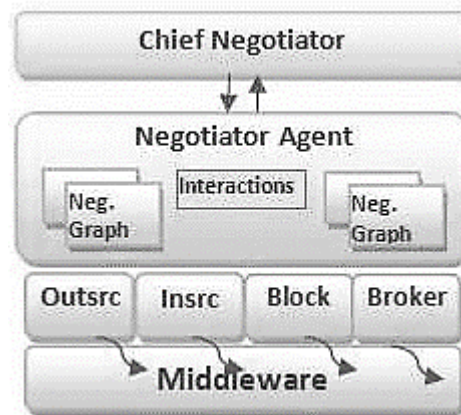


Figure 7. The architecture of the negotiation system (Hu, Deng, 2011).

Each negotiation is organized in three steps: initialization, refinement of the job under negotiation and closure (Hu, Deng, 2011). In the first layer Chief Negotiator handles all business decisions, the second layer is dedicated to the Negotiator Agent that assists the negotiations. In the third layer, Coordination Components coordination constraints are managed and the fourth layer, Middleware ensures the communication process being shared by all negotiation partners. The participants to a negotiation propose offers and each of them may accept or reject the offer received. A schematic example of negotiation process is shown in Fig. 8.

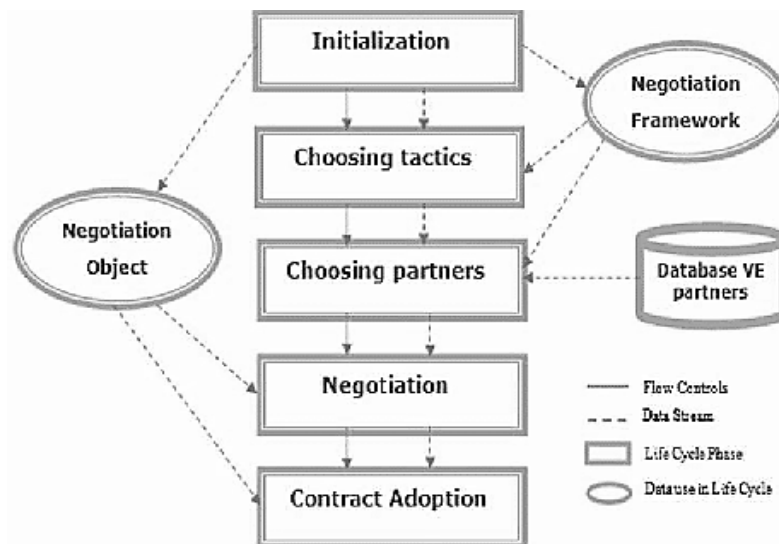


Figure 8. The structure of the negotiation process (Kadar, Muntean, Credan, Jardim-Goncalves, 2013).

The negotiation process is divided into five parts: Initialization, Choosing tactics, Choosing partners and Negotiation which enables the exchange of proposals.

The objective of the negotiation stage is to build a negotiation object whose attributes have been accepted by all partners. This object will be used to establish a contract. Contract Adoption is the final stage, in which the negotiation object has fixed values. In conclusion, the presented architecture enables to coordinate multi-phase negotiations on a multi-attribute object and among several participants. While presenting a negotiation model special attention should be paid to negotiation planning which enables to identify a set of activities which are undertaken by the negotiator to decide on the course of action to be pursued at the negotiating table. Setting long-term goals and identifying the ways of meeting them is the focus of strategic planning. Whereas tactical planning is oriented onto developing short-term steps to achieve the long-term goals. Finally, administrative planning includes making logistical and allocative arrangements for the negotiation. Negotiation planning consists in the systematic mapping of the different steps involved in the process of negotiation.

12. Summary and conclusions

The Authors concentrated their publication on the role of negotiations in commercialization processes of innovative research projects results. Their expertise is based on scientific and professional experience gained at the KOMAG Institute of Mining Technology. Six examples of research projects were chosen for highlighting crucial aspects of negotiation processes. As at present more and more businessmen are aware of efficient techniques of negotiations, it seems to be pragmatic to show their advantages and disadvantages. A good knowledge of human reactions, human behaviour and so called body language is extremely helpful. Special attention is paid to characteristic features of negotiations presented as the case-studies. Due to such an approach it has been possible to formulate some guidelines facilitating the negotiation process and enabling to avoid mistakes. The following conclusions can be drawn from the conducted analysis of the case-studies:

- The preparatory phase of the negotiating process includes strategy development, the preparation of negotiation strategy and tactics, the risk assessment and contingency planning.
- After the preparatory phase the negotiation starts. It includes active questioning for clarification, testing and probing, persuading and moving, closing, agreeing and documenting as well as deal monitoring at the very end.
- In the process of negotiation, conditioning calls for placing a starting point in the minds of the opponents are significant. Planning involves the consideration of the concerns related to the objectives which are to be achieved in the result of the negotiation process.

- A correct negotiation process requires an ability of coordinating activities, a good will of cooperation, a good communication and a flow of information.
- Based on the in-depth analysis of the six case-studies it can be concluded that the “win-win” negotiations seem to be most fruitful and successful.
- The five-step negotiating process is generally followed at the KOMAG Institute. It includes: preparation, exchange of information, clarification, bargaining and commitment.
- Recognition of needs in negotiation processes is extremely important. This step is connected with communication.
- It can be finally concluded that all the information, presented in the article, includes both the philosophy and psychology of the art of negotiating. The human factor should be analyzed not only from the perspective of the negotiation objectives but also from the point of view of basic needs, as in real life negotiations are oriented onto satisfying needs.

References

1. Agndal, H., Åge, L.J., Eklinder-Frick, J. (2017). Two decades of business negotiation research: an overview and suggestions for future studies. *Journal of Business & Industrial Marketing*.
2. Asante-Asamani, A.E.A., Elahee, M., MacDonald, J. (2021). Goal orientation and negotiation strategies: an empirical analysis. *Review of International Business and Strategy*.
3. Buelens, M., Van De Woestyne, M., Mestdagh, S., Bouckenoghe, D. (2008). Methodological issues in negotiation research: a state-of-the-art-review. *Group Decision and Negotiation*, 17(4), 321-345.
4. Cretan, A., Coutinho, C., Bratu, B., Jardim-Goncalves, R. (2012). NEGOSEIO: A framework for negotiations toward sustainable enterprise interoperability. *Annual Reviews in Control*, 36(2), 291-299.
5. Curhan, J.R., Labuzova, T., Mehta, A. (2021). Cooperative criticism: When criticism enhances creativity in brainstorming and negotiation. *Organization Science*, 32(5), 1256-1272.
6. Delina, R., Olejarova, R., Doucek, P. (2021). Effect of a new potential supplier on business to business negotiations performance: evidence-based analysis. *Electronic Commerce Research*, 1-30.
7. Duan, L., Doğru, M.K., Özen, U., Beck, J.C. (2012). A negotiation framework for linked combinatorial optimization problems. *Autonomous Agents and Multi-Agent Systems*, 25(1), 158-182.

8. Eklinder-Frick, J.O., Åge, L.J. (2020). Relational business negotiation—propositions based on an interactional perspective. *Journal of Business & Industrial Marketing*.
9. Filzmoser, M., Hippmann, P., Vetschera, R. (2016). Analyzing the multiple dimensions of negotiation processes. *Group Decision and Negotiation*, 25(6), 1169-1188.
10. Fleming, D.E., Hawes, J.M. (2017). The negotiation scorecard: a planning tool in business and industrial marketing. *Journal of Business & Industrial Marketing*.
11. Hou, C., Lu, M., Deng, T., Shen, Z.J.M. (2021). Coordinating project outsourcing through bilateral contract negotiations. *Manufacturing & Service Operations Management*, 23(6), 1543-1561.
12. Hu, J., Deng, L. (2011, October). *An association rule-based bilateral multi-issue negotiation model*, Vol. 2. 2011 Fourth International Symposium on Computational Intelligence and Design. IEEE. pp. 234-237.
13. Kadar, M., Muntean, M., Cretan, A., Jardim-Goncalves, R. (2013, April). *A multi-agent based negotiation system for re-establishing enterprise interoperability in collaborative networked environments*. 2013 UKSim 15th International Conference on Computer Modelling and Simulation. IEEE, pp. 190-195.
14. Malec, M., Stańczak, L. (2022). Impact of Managerial Skills on Innovative Projects' Management Processes in the Domain of Mining Machines. *Acta Montanistica Slovaca*, 27(2).
15. Maslow, A.H. (1954). *Motivation and personality*. New York: Harper & Row.
16. Nierenberg, G.I. (1981). *The Art of Negotiating*. New York: Simon and Schuster Inc.
17. Ray, S.R., Jones, A.T. (2006). Manufacturing interoperability. *Journal of Intelligent Manufacturing*, 17(6), 681-688.
18. Schoen, R. (2021). Getting to Yes in the cross-cultural-context: 'one size doesn't fit all'—a critical review of principled negotiations across borders. *International Journal of Conflict Management*.
19. Stańczak, L. (2020). Innovative techniques and technologies for the mining industry—conclusions from the KOMTECH-IMTech 2020 Conference. *Mining Machines*, 4.
20. Sycara, K., Dai, T. (2010). Agent reasoning in negotiation. In: *Handbook of group decision and negotiation* (pp. 437-451). Dordrecht: Springer.
21. Wooldridge, M., Jennings, N.R. (1995). Intelligent agents: Theory and practice. *The knowledge engineering review*, 10(2), 115-152.
22. Zhang, B. (2021). Behavioral Analysis in International Business Negotiations Based on the Bargaining Model of Game Theory. *Journal of Mathematics*.