Empathy, tolerance for uncertainty and emotional intelligence among the agro-industrial complex managers to predict the decision-making efficiency in the antagonistic game

A V Vyatkin¹, L V Fomina² and Zh N Shmeleva²

¹Moscow state university named after M.V. Lomonosov, 119991, Russian Federation, Moscow, Leninskie gory, 1
²FSBEI HE Krasnoyarsk state agrarian university 90, 660049, Russian Federation, Krasnoyarsk, Mira Avenue

E-mail: lyfomina@yandex.ru

Abstract. Management of such a complex system as agriculture requires special attention to making managerial decisions. The most common situation in agriculture is decision-making in the risk environment. One of the groups of factors that affect the process of managerial decision-making are psychological factors, including what a particular person contributes to the process of developing and making the management decision, depending on personal qualities, abilities, experience, motivation, culture, competence. This paper presents the research of the empathy and emotional intelligence role for the decision-making process in the situation of uncertainty, using both known and new developed by us methods of the antagonistic game, in which the subjects have opposite interests. Research has shown that in a high-risk competitive situation, people tend to make their decisions not in the attempt to understand other people’s emotions, but in the attempt to influence the opponent’s emotional state. In a low-risk situation, managers prefer to focus on their own judgment and pay less attention to their opponent. This fact can also be interpreted as a tendency to allocate attention to more important tasks, which helps managers cope with difficulties, including those typical for the agricultural sphere.

1. Introduction

The agro-industrial complex is one of the Russian economy leading sectors. The agricultural system effective functioning makes it possible to ensure the economic security of the country. The agro-industrial complex allows to solve problems of food security, social problems. Therefore, it is one of the most state-supported sectors of the economy.

Despite the state support, the situation in this industry remains not sufficiently stable. The state agricultural authorities take responsibility and carry out the controlling of the agricultural producers support implementation. At the same time, it is very important to monitor its implementation. For this industry sustainable development and economic stability, it is necessary to systematically, timely and promptly approach the tasks set.

Management of such a complex system as agriculture requires special attention to make management decisions. Optimization of the agro-industrial sector of the economy with the help of
timely and effective management decisions is one of the most important conditions for achieving its cost-effective functioning and competitive advantage [1].

The management decision development, adoption and implementation is a complex multi-stage process in which it is always necessary to take into account the features and conditions in which it should be developed and implemented. The subject, in the process of management decision-making, faces various difficulties caused by a number of reasons. These include the following:

- decisions taken in agriculture at different levels of management are not sufficiently coordinated;
- the subject needs to analyze a large number of problems that may be in conflict with each other in the process of making management decisions;
- priorities are changeable, so it is important to separate the most important from the secondary;
- agricultural production is characterized by the emergence of unforeseen, sometimes crisis situations [2].

The most common situation in agriculture is decision-making in the risk environment. According to the degree of uncertainty (completeness of information) there are the following types: decisions under certainty, decisions under risk, decisions under uncertainty, and decisions under conflict conditions.

When developing and making the effective management decision, the agricultural entity needs to assess the degree of risk and reduce it to a minimum level. To do this, it is proposed to perform a sequence of actions including:

- prediction of potential outcomes;
- assigning a certain probability index to each outcome;
- selection of the desired criterion for the decision;
- the choice of the option that most fully satisfies the specified criterion [1].

The mechanism of management decision-making includes a set of elements that are interrelated. It is necessary to consider the ways of decision-making, principles, tools and techniques that will ensure the goals achievement based on various factors functioning. The mechanism formation should take into account the following provisions:

- management decision is always carried out in the process of management activities and aimed at resolving a specific management situation;
- management decision is always a choice of alternatives;
- management decision is always made as a result of the certain information analysis;
- management decision is made by the person within the competence defined by the official position which the person occupies at the enterprise;
- when making management decisions, it is necessary to take into account the resources available to the agricultural enterprise [1].

It is almost impossible to make a complete list of factors influencing the process of managerial decision-making. According to Smirnova I. G. they can be divided into two groups: psychological factors and environmental factors of managerial decision-making.

The group of psychological factors includes what a particular person makes in the process of developing and making managerial decisions, depending on personal qualities, abilities, experience, motivation, culture, competence, etc. [2].

Seleznev V. N. asserts that the manager training model assumes reliance not only on the model of the specialist’s activity, but also on the psychological model of the specialist’s personality, including the description of his emotional and volitional qualities that ensure the successful implementation of
tasks arising in the professional sphere [3, 4]. From this point of view, the differences between students studying in the specialty, assuming further management of people and existing managers are of interest. It should also be noted that the peculiarity of the manager’s profession is expressed in the increased responsibility, requirements for decision-making in the conditions of uncertainty [3, 4]. The decision-making process, its features presumably change with professional development, especially when it comes to decision-making in the interpersonal interaction situation.

2. Main part

In this paper, we focused on the decision-making in the situation of uncertainty on the material of the tasks, using a new developed method of playing in pairs. A person who is faced with the task of making the right decision must understand the thoughts of his opponent and calculate the probability of this or that opponent’s move. Is there the same process behind the probability estimation in both games, or is the decision made involving an understanding of someone else’s thinking and emotions when there is an interaction with a person?

The purpose of this research is to study the role of empathy and emotional intelligence in decision-making.

Decision-making should be investigated not only in the context of the situation in which decisions are made, but also in terms of the personal variables inclusion into the regulation of the decision-making process.

The same choice can be mediated by different types of mental processes (intellectual, emotional or volitional, etc.), so it is necessary to identify the processes behind the decision [5]. The inclusion of processes covered by the concept of emotional intelligence in the decision-making process, the condition of which is the use of emotional information in the situation was studied by Kornilova T. and Pavlova E. [6]. However, speaking about the situation that requires decision-making in the conditions of real interpersonal interaction, we would like to assume the inclusion of empathy in the dynamic regulatory systems created in the decision-making process.

If we start from the definition of empathy by M. Davis which says that empathy is a set of connected constructs related to the response to others, but nevertheless, clearly different from each other [7], it is interesting to see the role of empathy different components in decision-making, when a person is required to predict other people’s actions. And important here is not only the possibility of the empathy components influence on the prediction success and the decision-making efficiency, but also the form in which presumably thanks to empathy, the person receives subjective representation of own decision-making process. People with high empathy should be more likely to justify their decisions based on thoughts (cognitive side of empathy, or Perspective Taking, decentralization), emotions (affective side of empathy, the ability to experience identical emotions), and other people’s behavior.

On the other hand, self-reporting makes some demands on the ability to understand one’s own emotions, which refers us to emotional intelligence. In addition to intrapersonal emotional intelligence, understanding other people’s emotions should also influence a person’s self-reporting of the made decisions, since even if a person does make his decisions based on the observed behavior of another, it may not always seem to be a subjectively significant factor for decision-making, or not at all realized.

Making a decision about what exactly is behind the behavior of another person and what method of interaction is optimal in a particular situation, a person is in a situation of uncertainty in which his personal qualities are supposedly the basis for decision-making. But the attempt to understand other people’s thoughts and feelings does not arise spontaneously, without a corresponding situation that requires an appeal to the inner world of another person. The situation of rivalry causes such a need.

To simulate the appropriate decision-making situation, we developed a method of antagonistic game “the Mouse and the Elephant”, in which the subjects are called to play in pairs against each other with the goal – to win. In this case, the only way to win is to correctly determine the course of the enemy’s action. But emotional involvement in the game is impossible only with the help of
instructions, calling to win. Therefore, in the game, participants play two different decks, one of which is more risky, with low chances of winning, but with a high win, and the second is “safer”, with a large number of winning combinations. As a psychological concept, risk is associated with the regulatory function of the psyche (because there must be a corresponding possibility of benefit to take risks). Risk is always caused by incomplete control over the situation. However, in each deck there are both more “risky” cards, the use of which inevitably ends the round, and “safer”, the probability of winning and losing on which is lower. However, one should not forget that the “probability” here depends on the choice that the opponent makes, and which the player needs to figure out.

Accordingly, the self-report on the decision to choose a particular card may differ for playing on different decks. Presumably, playing in a higher-risk situation can “activate” attempts to observe the opponent more actively, which will accordingly affect the subjective representation of the subject about decision-making.

The methodology used:

1. Russian version of the questionnaire Interpersonal Reactivity Index (IRI) by M. Davis [7] based on the multifactorial approach to empathy. The questionnaire is based on a self-report, consists of 28 points, divided into 4 scales, each includes 7 points, reflecting one aspect of the empathy general concept.

2. Test of emotional intelligence by Lucin [8]. Psychodiagnostic technique based on self-report, designed to measure one’s own and others’ emotions and manage them. The questionnaire consists of 46 statements, with respect to which the subject must express the degree of agreement using a four-point scale (I do not agree at all, I rather disagree, I rather agree, I completely agree). These statements are grouped into five sub-scales, which, in turn, are included in four scales of a more general order.

3. The new questionnaire of tolerance for uncertainty [9]. A technique aimed at measuring such personal characteristics as tolerance for uncertainty, intolerance for uncertainty and interpersonal intolerance for uncertainty. The questionnaire consists of 33 statements, which the subject must evaluate by how “they fit him” and contains three scales.

4. The Russian version of the emotional intelligence test by Mayer – Salovey – Caruso [10]. This technique is based on one of the most extensive and detailed theoretical structures describing emotional intelligence. The technique consists of 8 sections. On each component of the emotional intelligence model by J. Mayer, P. Salovey and D. Caruso there are 2 sections.

5. Specially designed game situation “the Mouse and the Elephant”

The situation simulates decision-making in a situation of rivalry with another person with the possibility of regulating the degree of risk. Necessary for victory is the correct definition of the decision taken by the enemy. Thus, the situation is an example of an antagonistic game in which the subjects have opposing interests.

The subjects paired up within their group (managers or students). In the pair, each participant was asked to choose one of two decks. Then everyone was explained the rules of the game and shown a few examples of game situations. In the next stage, both participants could play their decks, changing if desired, any number of rounds as long as both agreed that they understood the essence of the game and were ready to start the “real” game.

Before the game the participants were given the following instruction: “One of you holds the deck of the Mouse, the other – the deck of the Elephant. Winning with the help of the Mouse deck is much more difficult and it is estimated several times higher than winning with the help of the Elephant. But you will have time to play with each deck. In this game there is no catch, I do not follow anything, just make a record of the moves themselves in this notebook, which is in your field of vision. At the end of several rounds I will ask you the same question, each – only twice, so that the second player would not hear the answer. The most important thing is to try to win at any cost”.

Then one of the participants, having the deck of the Elephant in his hands, was designated to be the “main”, he was offered to put a card only after it was put by the opponent, thus, it was possible to monitor the opponent’s behavior during the selection of the card.
After each stage of the game, the “main” subject was asked the following question: “On what did you base your decision to choose a particular card during this round, regardless of whether you won or lost?”

The object of the research is the decision-making process, empathy and emotional intelligence in students and representatives of managerial work.

The subject of the research is the peculiarities of the decision-making subjective representations among students and representatives of managerial work, as well as their relationship with empathy and emotional intelligence.

Hypotheses of the research:
1) People who identify behavior, thoughts and perceived emotions of another person in their decision-making subjective representation in the competitive environment, will have higher rates of empathy and emotional intelligence than people who explain their decisions based on their own thoughts, feelings, strategies.
2) It is assumed that there is the positive relationship between the decision-making effectiveness in the competitive situation at high risk with tolerance for uncertainty, and the negative – in the competitive situation at low risk.

Participants of the research:
60 people took part in the research on the voluntary basis.
Of these, 30 people: 9 girls and 21 boys – students of higher educational institutions, studying in specialties that involve future management of people (personnel management, management, state and municipal management, etc.), the average age is M=21.5, SD=3.5. And the other 30 people were 15 men and 15 women holding executive positions in various companies, mostly in the agro-industrial and research fields. The subjects being tested differed in the nature of their positions: most of them were heads of departments, but there were also directors and deputies. Average age: M=41.1 SD=8.4. Also the total number of subordinates of the subject being tested, including indirect subordinates were taken into account, average: M=189.6.

3. Research results
To process the self-report of the subjects on decision-making in the game “the Mouse and the Elephant”, a content analysis was conducted, during which the categories of explanations were divided into two groups, as shown in table 1.

The subjects’ self-reports were processed and divided into two groups, each of which presumably used different decision-making strategies during the game.

Table 1. Division of subjects being tested into groups according to the content of self-report on decision-making.

| Group 1. Making decisions based on own feelings, thoughts, strategies | Group 2. Making decisions based on someone else’s behavior, emotions, supposed thoughts of another person, on his previous moves |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Based on the mechanics of the game. Examples: “Spontaneously laid out cards. Then decided that it is possible to play with the elephant, since my position is winning”. “It’s simple; it’s just easier to win with the Elephant if you put it right away. One to four”. | Based on the behavior, facial expressions of the opponent, the time of the card choosing. Examples: “My opponent actively laid out his cards. Making a second’s delay, he began to get nervous, depending on how much he was nervous I understood what his card was”, “Also looked at her reaction, watched her hands, her cards”. |
Based on intuition, the impossibility of explaining one’s own choice. Examples: “Intuition, inner feelings, everything”, “just on the spot, basically”. Based on the opponent’s previous moves. Examples: “Start ahead of the game, dropped the Elephant. Played based on her style of game” “He did not repeat his actions for the second time. I tried to catch him on the first, third move”. Based on the special strategy, a plan of the move. Examples: “I always wanted to leave the winning option at the end, on the last move”, “I tried to build a mathematical model of an unpredictable move”. Based on the perception of the opponent’s point of view. Examples: “What would I do in his place?”

Each subject was assigned to the first or second group on the basis of a self-report on the subjective representation of the reasons for own decision separately for playing in a high-risk situation and separately for playing in a low-risk situation. Subjects of the first group, in their own opinion, made their decisions, more based on their feelings, thoughts, and strategies. Subjects of the second group, in their own opinion, made their decisions, more based on someone else’s behavior, emotions, supposed thoughts of another person, on his previous moves.

Table 2. Differences in winning percentage between groups of subjects who gave different explanations when playing in a low-risk situation.

|                                  | The group that explained decisions with own feelings, thoughts, strategies in a low-risk situation | The group that explained decisions using the opponent’s significance of behavior and perceived differences by thoughts and emotions in a T-criterion low-risk situation |
|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Winning percentage being the “main” player in a low-risk situation       | M=81 SD=13,4                                                                                      | M=80 SD=13,3                                                                                                                  | 0,91                                                                                       |
| Winning percentage in a low-risk situation                              | M=78 SD=9,1                                                                                       | M=78 SD=11,9                                                                                                                 | 0,82                                                                                       |

Table 3. Differences in winning percentage between groups of subjects who gave different explanations when playing in a high-risk situation.

|                                  | The group that explained decisions with own feelings, thoughts, strategies in a high-risk situation | The group that explained decisions using the opponent’s significance of behavior and perceived differences by thoughts and emotions in a T-criterion high-risk situation |
|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Winning percentage being the “main” player in a high-risk situation       | M=19 SD=14,5                                                                                      | M=29 SD=15,1                                                                                                                  | 0,019*                                                                                      |
IOP Conf. Series: Earth and Environmental Science 421 (2020) 032037   doi:10.1088/1755-1315/421/3/032037

The significant negative correlations of winning percentage on the less risky Elephant deck being the “main” player with empathic care, interpersonal emotional intelligence according to EmIn...

Table 4. Spearman’s correlation coefficient to connect winning percentage in high and low risk situations with personality characteristics.

|                        | 1.         | 2.         | 3.         | 4.         |
|------------------------|------------|------------|------------|------------|
| 1. Wins in a low-risk situation by the “main” player | 1.000      | 0.112      | 0.621**    | -0.153     |
| 2. Wins in a high-risk situation by the “main” player | 0.112      | 1.000      | 0.141      | 0.767**    |
| 3. Wins in a low-risk situation                           | 0.621**    | 0.141      | 1.000      | 0.033      |
| 4. Wins in a high-risk situation                           | -0.153     | 0.767**    | 0.033      | 1.000      |
| 5. Identification of emotions MSCEIT                      | 0.302      | 0.120      | 0.290**    | 0.078      |
| 6. Solving problems using emotions MSCEIT                  | -0.082     | -0.206     | 0.009      | -0.048     |
| 7. Understanding, analysis of emotions MSCEIT               | -0.225     | -0.193     | -0.133     | -0.089     |
| 8. Management of emotions MSCEIT                           | -0.179     | 0.085      | -0.079     | 0.177      |
| 9. Total score MSCEIT                                      | -0.033     | -0.075     | 0.053      | -0.025     |
| 10. Interpersonal emotional intelligence. Emln             | -0.339**   | -0.053     | -0.143     | 0.142      |
| 11. Intrapersonal emotional intelligence. Emln             | -0.103     | 0.000      | -0.153     | -0.097     |
| 12. Interpersonal understanding of emotions. Emln          | -0.286*    | -0.026     | -0.150     | 0.133      |
| 13. Interpersonal management of emotions. Emln             | -0.273*    | -0.080     | -0.064     | 0.108      |
| 14. Intrapersonal understanding of emotions. Emln          | -0.228     | -0.054     | -0.141     | -0.024     |
| 15. Intrapersonal management of emotions. Emln             | -0.098     | -0.030     | -0.233     | -0.059     |
| 16. Expression control. Emln                              | 0.137      | 0.151      | 0.029      | -0.089     |
| 17. Understanding of emotions. Emln                       | -0.321*    | -0.073     | -0.183     | 0.044      |
| 18. Emotion management. Emln                              | -0.142     | 0.028      | -0.145     | -0.005     |
| 19. Fantasy                                               | -0.247     | 0.025      | -0.187     | 0.195      |
| 20. Empathic distress                                     | -0.002     | -0.097     | -0.080     | -0.075     |
| 21. Empathic care                                         | -0.261*    | -0.073     | -0.054     | 0.143      |
| 22. Decentralization                                      | 0.007      | -0.041     | 0.055      | 0.064      |
| 23. Tolerance for uncertainty                            | -0.290*    | 0.112      | -0.232     | 0.370**    |
| 24. Intolerance for uncertainty                           | -0.125     | -0.107     | -0.130     | -0.123     |
| 25. Interpersonal intolerance for uncertainty             | -0.024     | -0.068     | -0.059     | -0.132     |

Note: For the MSCEIT test scales, the private correlation coefficient with the age factor was used as a covariate. For the scales of fantasy, empathic distress and empathic care, the coefficient of private correlation with the sex factor was used as a covariate, since women on average have higher indicators on these scales [11].

As can be seen from table 4, the positive relationship between the percentage of wins in a low-risk situation and the emotions identification by MSCEIT (private correlation coefficient = 0.30 at p<0.05, the excluded variable is the age of the subjects being tested) was determined, thus the effectiveness of decision-making in a low-risk competition situation depends on the ability to identify the opponent’s emotions. It is worth noting that the opponent is in a situation of high risk, which may increase the importance of this indicator, due to the opponent’s emotional tension.

However, only a positive correlation with the emotions identification by MSCEIT is preserved if we check the connection of all games results, not just those where the player was the “main” (coefficient of private correlation = 0.30 at p<0.05).

The significant negative correlations of winning percentage on the less risky Elephant deck being the “main” player with empathic care, interpersonal emotional intelligence according to Emln...
questionnaire, and tolerance for uncertainty were identified. This result suggests the impact of risk reduction on the necessity to use the opponent’s emotions to make an effective decision, and the negative relationship with tolerance for uncertainty, presumably, indicates the effectiveness of the “defensive” strategy, when the subject tries not to make a decisive move and leaves the possibility of deciding the outcome of the party to the opponent.

The only relationship between personal characteristics and the game indicators in a high-risk situation was the correlation of the tolerance for uncertainty with the percentage of wins in a high-risk situation (p<0,01). High risk in a competitive situation requires a high willingness to be independent and willingness to accept that risk, which allow the subject to take advantage of every opportunity that arises in the course of playing on the more risky side with greater confidence.

It was found that the subjective representations of the subjects’ decision-making when playing on the deck of the Elephant, suggesting a low-risk situation, students and managers differ: students are more likely to give explanations based on the opponent’s behavior, thoughts and emotions (p<0,05).

It was found that subjects who consider the opponent’s behavior, emotions, previous moves to be the main basis for making their decisions in the game, have on average a higher rate of empathic imagination than the group that justified their decisions with their own strategies, intuition: 23 and 21 points, respectively (p=0,057).

Interpersonal understanding of emotions and tolerance for uncertainty were also higher in the group that explained decisions using the opponent’s behavior and perceived thoughts and emotions (p=0,086 and 0,082, respectively).

4. Conclusions

The results indicating to the differences in the empathy and emotional intelligence involvement into the decision-making process in the situation of interpersonal interaction were received. The shift of subjective representations of decision-making “to another” in a similar situation happens due to the processes of empathy in a low-risk situation and due to the management of other people’s emotions in a high-risk situation. Because of this, it can be assumed that the uncertainty increase in the situation of competition provokes the subject to move from active perception of other people’s experiences to the active influence.

Differences in empathy and emotional intelligence in people with different subjective representations of decision-making in a situation of competition in the majority were insignificant. Nevertheless, based on the obtained connections, it can be assumed that in a situation of rivalry, the increase in the risk degree does not provoke efforts of the opponent’s deeper understanding, but rather an attempt to actively influence him.

Changes in the relationship of tolerance for uncertainty with the decision-making effectiveness in the situation of competition in the positive direction depending on the increase in the risk degree given by the situation conditions were established.

References

[1] Vanesyan M G 2006 Abstract of the dissertation Improvement of management decision-making methods in the agro-industrial complex
[2] Smirnova I G 2014 Analysis of the mechanism of management decision-making in the agro-industrial complex as an economic system Bulletin of the Volga Management Institute, pp 105-10
[3] Seleznev V N and Klimova E M 2013 Emotions as a factor of psychological stability of managers in decision-making Bulletin of the Moscow state regional University. Series Psy. Sci. 4 53–61
[4] Seleznev V N 2003 Development of managers’ mental stability in the risk management conditions. Bulletin of the Peoples’ Friendship University of Russia. Series: Psy. and pedagogy (I) 116-35
[5] Tikhomirov O K 1976 Decision-making as a Psychological Problem (Nauka) pp 77-82
[6] Kornilova T V and Pavlova E M 2012 Creativity and tolerance for uncertainty as predictors of emotional intelligence actualization in personal choice *Psy. Journal* **33**(5) 39-49

[7] Karyagina T D, Budagovskaya N A and Dubrovskaya S V 2013 Adaptation of multi-factor questionnaire of empathy by M. Davis *Counseling psychology and psychotherapy* **1** 202–27

[8] Lucin D V and Ushakov D V 2004 Modern concepts of emotional intelligence *Social intelligence: theory, measurement, research* Institute of psychology RAS 29-36

[9] Kornilova T V 2010 New questionnaire of tolerance for uncertainty *Psy. journal* **31** 1 74–86

[10] Sergienko E A and Vetrova I I 2010 Test of J Mayer, P Salovey and D. Caruso *Emotional intelligence MSCEITv. 2.0. Manual* Institute of psychology RAS

[11] Kornilov S A, Krasnov E V, Kornilova T V and Chumakova M A 2015 Individual differences in Performance on Iowa Gambling Task are Predicted by Tolerance and Intolerance for Uncertainty *EAP Cog. Sci. (Torino, Italy, September)* **1419** 728-31

[12] Vyatkin A V, Fomina L V and Shmeleva Zh N 2019 Empathy, emotional intelligence and decision-making among managers of agro-industrial complex. The role of tolerance for uncertainty in decision-making, *IOP Conf. Ser.: Earth Environ. Sci.* **315** 022081