Volume 17 • Issue 2 • 2025

sciendo

ISMSME International Society for Manufacturing, Service and Management Engineering

received: 1 October 2024
accepted: 1 May 2025

pages: 106-116

© 2025 A. Deptuła and C. S. Nosal
This work is published under the Creative Commons BY-NC-ND 4.0 License.

Expert-innovator behaviour questionnaire as a new tool for selecting potential experts

Anna M. Deptuła
Czesław S. Nosal

ABSTRACT

The effects of global change on development and the sustainability of the economy are visible in implementing innovations. Appropriate selection of experts, considering various knowledge areas, should use selected tools. The article introduces a research tool for selecting experts for innovation risk assessment. In particular, it aims to present individual measurement scales and their reliability assessment (Cronbach's alpha). The article presents the factor structure of a potential expert's competencies measured using a questionnaire. The questionnaire was developed for the appropriate selection of specialists from various industries, including production, mechanics, and management. The questionnaire constitutes a tool applicable for assessing and selecting people involved in the implementation and risk assessment of innovations. It is based on the following four scales (factors): open mind, closed mind, cognitive motivation, and response to uncertainty. The questionnaire's effectiveness was studied using two research samples, n= 224 and n= 349, comprised of entrepreneurs and individuals professionally related to business and development and implementation of innovations. The interviewees were selected randomly. Factor analysis was used to reduce the test items in the questionnaire. The internal reliability of items was analysed using Cronbach's alpha. The proposed questionnaire forms a new tool that can be used in selecting experts who deal with the risk assessment of innovations and in the broadly understood process of recruiting staff with appropriate competencies in terms of mindset characteristics. The article presents an analysis related to the conduct of typical research in Management and Quality Sciences, as well as practical principles guiding the use of the questionnaire, which may have wider application in the practice of risk management. The article presents the measurement tool with the answer key, which is a valuable guide for interpreting the results. The questionnaire facilitates the selection of individuals focused on independent and courageous problem-solving and the statement of evaluations. At the same time, an adequate level of caution should be respected, characterising people with risk aversion. Furthermore, creativity and openness are coupled with a considerable ability to develop new solutions and rationally respond to difficult and unpredictable situations.

KEY WORDS

expert, innovation, creativity, risk, questionnaire, assessment, open mind, closed mind, cognitive motivation, response to uncertainty

10.2478/emj-2025-0015

Anna M. Deptuła
Opole University of Technology,
Ozimska 75, 45-370, Opole, Poland
ORCID 0000-0002-2073-4971

Corresponding author:
e-mail: an.deptula@po.edu.pl

Czesław S. Nosal
SWPS University in Wroclaw,
Ostrowskiego 30b, 53-238, Wrocław, Poland
ORCID 0000-0002-1693-2692
e-mail: cnosal@swps.edu.pl

Introduction

The need to develop a research tool in the form of a questionnaire was mainly due to the research gap that was perceived in this area and the experience of practitioners involved in project implementation in the enterprise. The key objective of this activity was to increase the effectiveness of the work carried out by specialists dealing with innovation, particularly those related to risk assessment. The guidelines related to the assessment procedure and, more broadly, to risk management became the determinant for the study of

Deptuła, A. M., & Nosal, C. S. (2025). Expert-innovator behaviour questionnaire as a new tool for selecting potential experts. *Engineering Management in Production and Services, 17*(2), 106-116. doi: 10.2478/emj-2025-0015

the new research tool. The right selection of experts is the key to effective risk analysis, devoid of overestimated and underestimated assessments (Deptuła, in preparation).

The expert-innovator behaviour questionnaire (EIBQ) forms a new tool that offers support in selecting potential experts for tasks related to creating and implementing innovations. Its structure is a response to the research needs related to the correct process of assessing the risk of innovation on a narrow scale of an enterprise and a wide scale of society. In the absence of available tools for diagnosing of experts' competencies (Deptuła & Nosal, 2021), corresponding to, among others, the purposeful selection of experts for the team that implements innovations, the authors developed a new measurement tool. The questionnaire facilitates the selection of individuals who fulfil the following criteria:

1. They are focused on independent and courageous problem-solving and the statement of evaluations. At the same time, they respect an adequate level of caution characterising people with risk aversion.
2. They are creative and open, coupled with a considerable ability to develop new solutions.
3. They can respond rationally to difficult and unpredictable situations.

The article aims to present a new tool for employee evaluation, EIBQ. The article proposes new scales, which, according to the authors, best describe selected characteristics of the expert mindset. The previous article (Deptuła & Nosal, 2021) presented a draft version of the questionnaire based on the three measured characteristics of the mindset and personality of the expert. In this article, the discussion focuses on factor analysis results based on which new measurement scales (sets of items) were selected. An answer key is also presented that can be applied to selecting potential experts. The paper presents the individual test items for measurement: open mind, closed mind, cognitive motivation, and response to uncertainty.

It also provides the proposed answer key for diagnosing the expert's state of mind.

It should be noted that EIBQ does not measure direct expert behaviour as the questionnaire is based on self-assessment.

1. Literature review

Choosing the right expert is a difficult and complicated task. Creating and implementing technological and organisational innovations is a task that requires the innovator to be open-minded and adapt quickly to changes that will undoubtedly take place in the future. Another important expert attribute is a balanced reaction to risk and estimation of uncertainty. In creating the new method for diagnosing expert attributes, the authors attempted to balance the psychological attributes with the diversity of tasks.

The expert-innovator behaviour questionnaire (EIBQ) proposed in this article is a new method attempting to consider the characteristics of the expert's mind. No such diagnostic tool was found in the literature. As a rule, the literature is dominated by efforts focused on the content of projected changes or narrow technological solutions. There is a distinct lack of methods for diagnosing the mind and personality traits of experts. Also, as a rule, these analyses used the Delphi method and did not consider the mind or personality traits of experts. Therefore, EIBQ fills an important gap in diagnosing the expert mind and personality.

The interdisciplinary nature of innovation projects means that the expert is required to have knowledge of, among other things, economics, management, design, marketing, environmental protection or legal regulations. Increasing the effectiveness of the work carried out by specialists in innovation, particularly related to risk assessment, may prove to be a recipe for many of the shortcomings and deficiencies faced by the company in adapting innovation to the requirements of society. The right selection of experts will play a key role here, and the effects will be seen in sustainable, socio-economic, scientific and integrated approaches to sustainable development. However, many efforts in the literature indicate the importance of this task (Ayag & Özdemir, 2007; Dey & Ogunlana, 2004; Dotgson, 2008; Kahraman et al., 2007; Lee et al., 2006; Manuel, 2007; Mobey & Parker 2002; Mullins & Sutherland, 1998; Nadkarni & Shenoy, 2001; Robin & Riedel, 1997; The Institute of Operational, 2012; Simon, 1992; Tversky & Kahneman, 1983; Ericsson, 1981; Ericsson, 1982; Larkin et al., 1980; Bouman, 1980; Reber et al., 2007; Ungson & Braunstein, 1984; Busenitz, 1999; Austin et al., 2007; Neubauer & Freudenthaler, 2005). An extensive group of methods is represented by behavioural models that use the knowledge and skills of the expert (Mobey & Parker, 2002; Mullins & Sutherland, 1998; Slovic, 2000).

Most often, these relate to describing the effectiveness of an expert's predictive judgments of a patient's condition (Sarbin, 1944; Dörfler & Ackermann, 2012). It turns out that learning about the cognitive qualities of expert minds lays the groundwork

for more effective and efficient decision-making (Dörfler & Ackermann, 2012; Petrides et al., 2022; Garb, 1989; Gustafson, 1963; Goldberg, 1970; Goldberg, 1992; Alegre, Pérez-Escoda, López-Cassá, 2019). However, these studies are rather selective and directed at a general overview of the expert's role in decision-making.

Contemporary support in this area is personality questionnaires. They are designed to assess a person's selected behaviour. Currently, tools, such as self-assessment questionnaires, are used where the individual answers questions about their behaviour, feelings, or thoughts (Credé et al., 2012). Most commonly, questionnaires address self-reported neuroticism, extraversion, cognitive motivation, novelty tolerance, and positive valuing of life (The Big Five questionnaires) and have dimensions to support psychological issues or the HR process more broadly (Gustafson, 1963; Goldberg, 1970; Goldberg, 1992; Alegre et al., 2019; Andrei, 2016). Available methods use various combinations of measurement of selected traits of both personality and human temperament (Catell, 1943; Catell et al., 1993; Cloninger et al., 1993; Costa & McCrae, 1992). However, the available questionnaires are not geared towards the purposeful selection of an expert with an emphasis on elements of a managerial and organisational nature. In practice, companies are looking for the right specialists to direct to specific tasks due to selected personality traits. Particularly important in this regard is selecting experts for innovation risk assessment.

In the literature, most of the methods used for risk assessment are expert-based. In particular methods of project management are currently used in the innovation risk assessment (Ayag & Özdemir, 2007; Dey & Ogunlana, 2004; Dotgson, 2008; Kahraman et al., 2007; Lee et al., 2006; Manuel, 2007; Mobey & Parker 2002; Mullins & Sutherland, 1998; Nadkarni & Shenoy, 2001; Robin & Riedel, 1997; The Institute of Operational, 2012). An extensive group of methods is represented by behavioural models that use the knowledge and skills of the expert (Mobey & Parker, 2002; Mullins & Sutherland, 1998; Slovic, 2000).

The authors also frequently use fuzzy logic for the risk assessment process (Deptula & Rudnik, 2017; Deptula & Rudnik, 2018; Choi & Ahn, 2010; Kahraman et al., 2007).

Differences between expert opinions significantly affect the outcome of the assessment; therefore, there is a need to continuously improve and objectify such methods (Choi & Ahn, 2010; Chin et al., 2009). Thus, the method of selecting experts gains importance. The selection of an expert should be based on certain rules. Personality questionnaires can be helpful in this regard. An example of a measurement tool characterising selected personality traits of an innovator is the expert-innovator behaviour questionnaire (EIBQ) presented in this article.

The starting point for developing the EIBQ questionnaire was the analysis of 54 statements, presented in detail by Deptuła and Nosal (2021). The statements describing the practically observable behaviours of innovators concerned three personality characteristics related to locus of control, motivation in activities, and the need for stimulation (Deptuła & Nosal, 2021; Deptuła & Nosal, 2021; Knosala & Deptuła, 2018; Larsen et al., 2013; Nosal, 1990, 1992, 2001; Rokeach, 2015; Rotter, 1966; Singer, 1975; Strelau, 2014; Zimmerman, 2000; Zuckerman, 2007).

2. Research methods

In the development of the version of the questionnaire presented in the article, the following research procedure was carried out several times:

1. Correlation coefficients within each variant (different variants were created by changing the number of statements in the measurement scales) of the questionnaire were analysed.

2. Factor analysis was conducted to extract measurement scales for assessing a person's predisposition to be an expert.

3. Basic statistics of the model with the extracted factors (measurement scales) were developed. Each of the extracted scales was developed according to the following assumptions:

- The measurement strongly impacts the decision-maker's preference for risk perception.
- The items address behaviours from everyday life and work.
- The questions provide a broad spectrum of research on the decision-maker's personality and cognitive abilities.

4. The reliability and relevance of the questionnaire were determined based on Cronbach's alpha.

Two research samples were used in the development of the questionnaire. The first was used to develop IBQ. The sample selection was random; however, the survey was conducted among entrepreneurs implementing innovations. The survey was conducted using paper questionnaires. The sample size, in this case, was 224. The survey was conducted in early 2020 in Poland. The first version of the ques-

tionnaire was used to conduct research to develop EIBQ. The research sample was purposive. The research was directed at entrepreneurs, innovators, designers, researchers, and people implementing innovations that appeared in publicly available reports and registers on innovation development in Poland. The research was funded by the research grant MINIATURA 4, 2020/04/X/HS4/00632. The survey was conducted in 2021 in Poland. As the study coincided with the period of the COVID-19 pandemic, in the implementation of the survey, an electronic version of the questionnaire was used.

The study of the EIBQ was carried out among 224 entrepreneurs and individuals professionally related to business, development, and implementation of innovations. The interviewees were selected randomly. Their number was determined by the minimum threshold resulting from the methodological rules for developing a personality questionnaire (Cohen et al., 1999; Crocker & Algina, 1986; Cronbach, 1990; Hornowska, 2007; Nunnally, 1978; Zakrzewska, 1994).

Factor analysis is a multivariate method used for data reduction purposes. It was originally developed by Spearman (1927) to analyse scores on mental tests and extract the general factor (factor g) as a structural basis of human intelligence. Based on a long history, the factor analysis methods are useful in a much wider range of situations. The basic idea is to represent a set of variables (matrix of correlations) with fewer new variables as vectors. In this solution, the vectors are called factors. These factors can be thought of as underlying correlations. Factor analysis is designed for interval data, although it can also be used for ordinal data (e.g., scores assigned to Likert scales) (Anderson, 2003; Manly & Navarro, 2016; Rencher, 2002).

In the studies, the following steps were taken to determine the final structure of the factors:

Tab. 1. Factor structure of items

Factory structure of test items after rotation - main components					
Lp	Statement	Factor 1	Factor 2	Factor 3	Factor 4
1	When buying new products, I choose well-known brands (companies)		0.492		
2	I like to accomplish new tasks as a means to learn something			0.244	
3	Too many changes make me feel uncomfortable				0.414
4	In my life, I am guided by the advice/suggestions provided by my parents		0.426		
5	Sometimes I do not know how to act in many situations				0.477
6	I like to deal with difficult issues	0.563			
7	Most success stories of companies are related to pure coincidence			-0.406	
8	At school, I sought honours and good grades			0.520	
9	Rapid changes make me feel confused				0.539
10	I feel anxious when a new employee appears in the company		0.406		
11	Existing work methods and techniques should not be changed		0.522		
12	Companies should offer products similar to their competitors		0.490		
13	Most of the company's successes are the result of its employees' activities			0.114	
14	In general, I am looking for tasks that I have never performed	0.515			
15	When I feel unsure of something, I do not undertake any action				0.558
16	I like to follow/walk/run along unknown paths	0.516			
17	When I carry out tasks in a company, I like to focus on new solutions	0.581			
18	I cope well with uncertain situations				-0.116
19	I am happy to provide new solutions and ideas	0.697			
20	I like complicated tasks	0.676			

1. The correlation coefficients between the 54 variables (IBQ items) were determined and analysed.
2. An exploratory factor analysis was performed for the matrix of all variables using the principal components method.
3. Values of factorial loadings for four factors were analysed. Values greater than 0.4 were qualified for the content analysis. Factor loadings prior to and following rotations were considered.
4. Names were specified to four main factors, which will further be referred to as scales for measuring an expert's mind competencies: open mind, closed mind, cognitive motivation, and reaction to uncertainty.

The coefficient of factor loads (for the four identified scales) is provided in Appendix 1. Table 1 shows the factor structure of the 20 items that make up the final draft of the questionnaire. The final version also had four control statements from the social desirability scale.

3. Research results

As a result of factor analysis, four factors characterising the competencies of the potential expert were identified. In total, these four factors all account for 13.26% of the identified variance. This is not a large range of explanations but indicates that the identified factors are specific in their nature. Further studies have been planned to extend (add to) this range with new factors.

The first factor, open mind (OM), forms the major factor, as it means directing the mind to new information and preference to coping with difficult tasks. However, other studies demonstrate that open-mindedness is positively correlated with intuition, imagination, and curiosity (Nosal, 2021). It is these qualities of mind that will be the focus of the projected research and factor analysis.

The second factor, defined as the closed mind (CLM), can be understood in a nearly literal sense. It means a mind that limits its field of exploration and new information. The problem of characteristics of such a mind has a long history dating back to Rokeach's pioneering research on dogmatism (1960). The dogmatic mind limits the scope of information search because it is thinking about formulated judgments based on narrow conceptual categories.

Factor three (cognitive motivation, CM) and factor four (response to uncertainty, RU) involve the attributes that characterise the stability of this type of motivation and behaviour under uncertainty. A favourable organisation of the mind should condition not only a constant tendency to seek information but also an appropriate attitude toward an emergence of uncertainty. This attitude is a kind of substitute for the ability to anticipate and not block the mind in the face of emerging changes and various forms of uncertainty in the environment. As emphasised by Prigogine (1996), we live in the conditions marked by uncertainty.

All the presented factors of the expert's mind form a rather clear structure. The justification for its feasibility is provided by the correlation matrix between the factors (Table 2).

Tab. 2. Matrix of correlation between factors

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.00	0.04	-0.42	0.02
Factor 2	0.04	1.00	-0.24	0.14
Factor 3	-0.42	-0.24	1.00	0.14
Factor 4	0.02	0.14	0.14	1.00

Table 2 shows that the open mind is independent of the closed mind. These two types of minds and their associated cognitive orientation clearly oppose each other. In turn, the third factor (cognitive motivation) correlates negatively with the second factor (closed mind). Summarising the results of the factor analysis, it can be argued that competencies related to the open mind may constitute adequate criteria for the selection of potential experts. In turn, the indicator of mental closure can be used as a control since it is not beneficial for an expert to have this kind of mental orientation. The questionnaire also proposed a general simplified version of the control scale (SD).

The resulting factor structure was developed for a research sample equal to n=224. It concerned the analyses of the first version of IBQ presented in the article (Deptula & Nosal, 2021). The following section presents a comparison of the factor analysis results for the new research sample n=349 (EIBQ 2).

4. Discussion of the results

Item internal reliability EIBQ was analysed using Cronbach's alpha. Cronbach's alpha is certainly the most used statistic in the area of social sciences. It is a measure of reliability, specifically internal consistency reliability or item interrelatedness, of a scale or test (e.g., questionnaire). Internal consistency refers to

Tab. 3. Analyse Cronbach's alpha for two questionnaire versions

IBQ*	Cronbach's alpha N=224	EIBQ**	Cronbach's alpha n= 349
UO 6 items	0.7	UO 4 items	0.71
UZ 5 items	0.38	UZ 6 items	0.57
MP 4 items	-0.06	MP 4 items	0.68
RNNS 5 items	-.04	RNNS 4 items	0.77
Number of items tested	54*		41**
Number of items of the Q	24		22
*The factor structure in Appendix 1 **The factor structure in Appendix 2			

the extent to which all items on a scale or test contribute positively towards measuring the same construct.

It should be noted that the test items presented in the article are still an object of research and will be subject to changes in subsequent versions of the questionnaire. Currently, two estimations of the reliability of the developed scales have been carried out for a sample equal to n=224 and n=49. The results show an upward trend for the index Alpha.

A summary of the results is presented in Table 3.

A further stage of the study will also be to conduct a CFA to determine the validity of the factorial structure of the questionnaire. However, this requires the collection of new data, which is currently underway. Nevertheless, the visible progress already suggests that the effectiveness of the developed scales is relatively high.

4.1. Brief characteristic of measurement scales in EIBQ — originality

Statistical analysis forms an important element of the assessment of the effectiveness and accuracy of each questionnaire; however, the knowledge of the scope of the presented topic and experience in conducting research is an equally important and significant element that determines the final draft of the research tool. Considering these two aspects means that the EIBQ presented in the work may be recommended for use as an assessment tool for people involved in the risk assessment of innovation and support in the recruitment process to the team of experts.

The statements in the first factor, open mind, characterise the desired expert mind orientation, so the more points a person scores on this scale, the higher their competencies as an expert.

The statements in the second factor, closed mind, indicate that if a person agrees with them, such individuals are challenging themselves with difficult, complicated and paradoxical experiences. Hence, the higher the score on this scale, the lower their competencies as experts. In such conditions, the selection of such a person should not be considered for tasks related to risk assessment and innovation implementation.

The statements in the third factor, cognitive motivation, are intended to determine the level of a person's motivation to create new solutions and ideas. People who need to create new solutions are very desirable for tasks where the scope of uncertainty and risk is high. The more points a person scores on this scale, the higher their competence as an expert.

The statements included in the reaction to uncertainty scale refer to the analysis of the familiar and commonly accepted attitudes towards risk: risk aversion, neutrality, and preference. Determining how a person reacts to uncertain situations may significantly limit the irrational decisions that bypass the substantive analysis of facts and data. The higher the result obtained by an employee on this scale, the more it proves the lack of resistance to action in unexpected

and uncertain situations, i.e., their poor adaptation to work in stressful conditions and a low level of competence as an expert.

In the final draft, the new questionnaire (EIBQ) contains 18 basic statements and four control statements from the social desirability scale. Apart from the many advantages of the questionnaire survey, there are some difficulties associated with the use of this survey form. The biggest problem is related to the degree of honesty (truthfulness) and reliability of the data derived from the questionnaire. Some respondents may consciously or unconsciously evaluate individual statements using conformist and schematic behaviour patterns and actions undertaken under the effect of generally accepted social norms and principles. Therefore, the use of the social desirability scale is widely known and accepted and recommended for this type of research tool.

It should also be emphasised that the independence of the created measurement scales allows them to be used as control scales. For example, the closed mind scale can be applied to successfully verify the reliability of the respondent's answers for the open mind scale. Moreover, the reaction to the uncertainty scale in relation to the cognitive motivation scale may have a similar application. The independence of the created scales can also be a good starting point for measuring the selected competencies of people applying for various positions in the company. Detailed principles for using the developed scales as control scales and the possibility of verifying the dependencies that can be established between them will be found in the reported research (Deptula, in preparation).

The factor analysis and the authors' experience in conducting research allow for proposing a presented version of EIBQ (Appendix 3).

4.2. Implications — the interpretation of questionnaire results

Completing the questionnaire, the respondents reply by expressing their opinions in support or rejection of a statement. A 5-point rating scale is employed to evaluate the statements: "I completely disagree", "I disagree", "It is difficult to say", "I agree", and "I completely agree", which correspond to a point scale from 1 to 5, respectively.

If an overall result equals 0, the respondent's competency as an expert can be assumed to be considerable. In the interpretation of the questionnaire results, it is assumed that the lower the result, the higher the competency. The overall result of the questionnaire or partial results for individual measurement scales can be interpreted (Table 4). The overall score for EIBQ is calculated according to the formula:

$$EIBQ = |-31+OM-CLM+CM-RU| \quad (1)$$

where:
OM — point value obtained on the open mind scale,
CLM — point value obtained on the closed mind scale,
CM — point value obtained on the cognitive motivation scale,
RU — point value obtained on the response to uncertainty scale.

The most suitable candidates for experts include candidates with a score in the range of 0 to 21. These people are creative and open-minded, and, at the same time, they can offer stability to the implementation of the innovation process while maintaining an appropriate level of caution. They are not excessively focused on generating risky activities, and, at the same time, they cope well with the fast pace of activity and accept the need for frequent divergence from a plan.

The individuals scoring between 22 and 41 points will be slightly worse at adjusting to frequent changes. Such individuals can display many contradictory features and strongly depend on specific events and situations.

The least desirable candidates include persons with scores above 42 points. In this situation, an individual will very often make decisions in a fearful or hasty manner and, thus, very often ill-considered. It is recommended that people with a score above 42 points should not be involved in innovative tasks.

The interpretation of the results of the questionnaire based on the given scale is only indicative. It was developed to evaluate expert applicants quickly. Detailed and unambiguous assessment requires experience and knowledge of the constructs described in the questionnaire. The authors encourage readers to carry out the questionnaire themselves and then interpret its result, and in case of doubts, to contact the authors to clarify any ambiguities. One should be aware that the interpretation of the questionnaire given in the article is simplified and does not consider the feedback between the personality traits tested in the questionnaire. Detailed rules for the interpretation of the results can be found in (Deptuła, in prepa-

ration). Nevertheless, the simplified interpretation of the EIBQ offers a tool for an accurate and independent characterisation of the candidate for an expert.

Conclusions

The article proposes an expert-innovator behaviour questionnaire (EIBQ) to facilitate the effective process of selecting experts for projects related to implementing innovations.

Individual statements were selected so that it was possible to indicate individuals who are potentially the most suitable candidates for work on innovative projects. The practical use of the questionnaire will make it possible to eliminate people who may overestimate or underestimate the innovation risk assessment. In this respect, the results from the literature and this research concerning the features of the mind of an innovator's expert were extensively considered. On this basis, the following factors were considered to be the determinants of selecting an expert: a mental quality defined as an open mind, cognitive motivation, and a stable reaction to uncertain situations. For this purpose, potential innovators were tested, and the described version of the EIBQ was prepared using statistical and content analysis.

The questionnaire presented in the paper is a new tool that can be used to characterise experts-innovators, but also for the broadly understood process of recruiting employees. A broader profile of experts will be possible thanks to the IMQ Innovator Mind Questionnaire, which is in the development of o measuring the expert's intuition (IMQ characteristics will soon appear in subsequent papers).

The results presented in the article may constitute the basis for the development of research in the discipline of Management and Quality Sciences, as well as have an extensive practical application due to the advantages of the presented research tool.

The EIBQ questionnaire is considered a preliminary solution, although it meets basic psychometric standards such as consistency coefficients (Cronbach's alpha) and factor structure indices. The EIBQ requires further research and confirmation in different criterion groups. The authors also plan to include attrib-

Tab. 4. Interpretation of the EIBQ results

Competence level	LOW	MEDIUM	HIGH
OM **Items:** 8, 17, 19, 20	**Score from 4 to 10 points** Individuals scoring in this range are characterised by an open mind to a limited degree. When such a person is selected for the expert team, it is recommended to undertake decisions on the basis of the overall result of the questionnaire.	**Score from 11 to 15 points** Individuals scoring in this range tend to vary in their beliefs, may be hesitant, and defining their mindsets as open may be ambiguous. In the case a high result is obtained on the control scale, the participation of such a person in the team implementing innovations should be considered.	**Score from 16 to 20 points** Scores in this range demonstrate strong open-mindedness. In combination with a moderate result from the control scale, such candidates can be successfully selected for tasks related to the implementation of innovations. An employee scoring in this range will be creative, curious and tolerant of discrepancies.
CLM **Items:** 2, 5, 6, 13, 14, 15	**Score from 30 to 20** **points** Individuals who score in this range are characterised by a closed mind. They do not tolerate unclear and uncertain situations and, at the same time, may demonstrate the characteristics of overly self-confident people, which, in the case of innovation, could limit its implementation. When selecting such a person for the expert team, it is recommended to make decisions based on the overall result of the questionnaire.	**Score from 13 to 19** **points** Individuals who score in this range are characterised by changing mindsets, may be indecisive, and the ability to define their mind as closed may be ambiguous.	**Score from 6 to 12** **points** People with scores in this range demonstrate little characteristics of a closed mind. In combination with a moderate result in the control scale, they can be successfully selected for tasks related to the implementation of innovations.

Tab. 5. Interpretation of the EIBQ results - continued

Competence level	LOW	MEDIUM	HIGH
CM **Items:** 3, 10, 21, 22	**Score from 4 to 10** **points** Individuals scoring the results in this range have a low need to learn new things. They prefer well-proven solutions and working methods and, therefore, may be reluctant to constant changes and improvements related to the development of innovation.	**Score from 11 to 15** **points** Individuals who score in this range may be hesitant or reluctant to provide the actual reasons for their behaviour. Their participation in the team of experts should be monitored and confronted with the needs of the project on an ongoing basis. In the case of obtaining a high result on the control scale, the participation of such a person in the team implementing innovations should be considered.	**Score from 16 to 20** Individuals who achieve results in this range demonstrate a willingness to create new solutions. In combination with a moderate result in the control scale, they can be successfully selected for tasks related to the implementation of innovations. In conjunction with the low RNNS score, their participation in the team of experts is desirable.
RU **Items:** 4, 9, 11, 18	**Score from 16 to 20** **points** Individuals who score high on the scale of responding to uncertain situations could be susceptible to suspending its implementation; therefore, their participation in the expert team should be limited or strongly controlled.	**Score from 15 to 9** **points** Individuals who score in this range may be hesitant or reluctant to reveal the true reasons for their behaviour. Their involvement in the team of experts should be monitored and confronted with the current needs of the project. In the event of a high score on the control scale, the participation of such a person in the team should be considered.	**Score from 8 to 4** **points** Individuals who achieve scores in this range demonstrate resistance to new and difficult situations. They do not immerse themselves in an unforeseen situation and try to deal with it so they can be successfully selected for tasks related to the implementation of innovations.
SD **Items:** **1, 7, 12, 16**	**Score from 4 to 8** **points** A result in this range may mean that the employee will be pushing through their ideas with determination and will not be afraid to express their personal opinions.	**Score from 9 to 15** **points** The result in this range is difficult to interpret. It can indicate individuals who do not intend to stand out too much and choose safe answers, and thus, at work, will act in accordance with the "instructions" guidelines.	**Score from 16 to 20** A score in this range means that the employee tried to fit into the generally accepted patterns and norms of a creative employee. Their answers might not be entirely dictated by the inner conviction of the will to get a good result.
Overall test result	**Score from 42 to 64** Scorers in this range are individuals who like to be supervised. They work better when they know exactly what to do and their participation in the project implementation is limited to following orders. Their participation in the team of experts implementing innovations is not excluded; however, it needs to be adequately planned.	**Score from 22 to 41 points** Individuals who score in this range may be creative and inventive; however, they also show many contradictory features and are strongly dependent on specific circumstances and situations. They may also tend to fit in with generally accepted standards and recommendations. Their participation in the team of experts, however, will not impede the potential innovation development opportunities.	**Score from 0 to 21 points** The individuals who achieve a result in this range are most likely creative and outgoing individuals. Their participation in a team of experts is very welcome.

utes of the mind such as intuition and critical thinking. It is understood that a method of this kind requires constant changes in language and terminology. Regardless of the practical (diagnostic) purpose of EIBQ, we view the method as a step on the road to better understanding the characteristics of the mind of experts.

Literature

Alegre, A., Pérez-Escoda, N., & López-Cassá, E. (2019). The relationship between trait emotional intelligence and personality. Is trait EI really anchored within the Big Five, big two and big one frameworks? *Frontiers in Psychology*, *10*, 866. doi: 10.3389/fpsyg.2019.00866

Anderson, T. W. (2003). *An Introduction to Multivariate Statistical Analysis. Third Edition*. New York, USA: A John Wiley & Sons.

Andrei, F., Siegling, A. B., Aloe, A. M., Baldaro, B., & Petrides, K. V. (2016). The Incremental validity of the Trait Emotional Intelligence Questionnaire (TEIQue): a systematic review and meta-Analysis. *Journal of personality assessment*, *98*, 261-276. doi: 10.1080/00223891.2015.1084630

Austin, E. J., Farrelly, D., Black, C., & Moore, H. (2007). Emotional intelligence, Machiavellianism and emotional manipulation: Does EI have a dark side? *Personality and Individual Differences*, *43*, 179-189. doi: 10.1016/j.paid.2006.11.019

Ayağ, Z., & Özdemir, R. G. (2007). An Analytic Network Process-Based Approach to Concept Evaluation in a New Product Development Environment. *Journal of Engineering Design*, *18*, 209-226. doi: 10.1080/09544820600752740

Bouman, M. J. (1980). Application of information-processing and decision-making research. In G. R. Ungson & D. N. Braunstein (eds.), *Decision making: An interdisciplinary inquiry* (pp. 129-167). Boston, USA: Kent Publishing.

Busenitz, L. W. (1999). Entrepreneurial Risk and Strategic Decision Making. *The Journal of Applied Behavioral Science*, *35*, 325-340.

Cattell, R. B. (1943). The description of personality: Basic traits resolved into clusters. *The journal of abnormal and social psychology*, *38*, 476-506.

Cattell, R. B., Cattell, A. K., & Cattell, H. E. P. (1993). The sixteen personality factor fifth edition questionnaire. *The SAGE Handbook of Personality Theory and Assessment: Personality Measurement and Testing*, *2*(2), 135.

Chase, W. G., & Simon, H. A. (1973). Perception in chess. *Cognitive Psychology*, *4*(1), 55-81.

Chin, K. S., Tang, D. W., Yang, J. B., Wong, S. Y., & Wang, H. (2009). Assessing New Product Development Project Risk by Bayesian Network with a Systematic Probability Generation Methodology. *Expert Systems with Applications*, *36*(6), 9879-9890. doi: 10.1016/j.eswa.2009.02.019

Choi, H. G., & Ahn, J. (2010). Risk Analysis Models and Risk Degree Determination in New Product Development: A Case Study. *Journal of Engineering and Technology Management*, *27*(1–2), 110–124. doi: 10.1016/j.jengtecman.2010.03.006

Cloninger, R. C., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of general psychiatry*, *50*(12), 975-990.

Cohen, R. J., Swerdlik, W. J., & Tobin, R. M. (2021). *Psychological testing and assessment: An introduction to tests and measurement (10 th ed.)*. New York, USA: McGraw-Hill Education.

Costa, P. T., & McCrae, R. R. (1992). The NEO Personality Inventory Manual Revised. Odessa, USA: Psychological Assessment Resources.

Credé, M., Harms, P., Niehorster, S., & Gaye-Valentine, A. (2012). An evaluation of the consequences of using short measures of the Big Five personality traits. *Journal of Personality and Social Psychology*, *102*(4), 874-88. doi: 10.1037/a0027403

Crocker, L., & Algina J. (1986). *Introduction to classical and modern test theory*. New York, USA: Harcourt Brace Jovanovich.

Cronbach, L. J. (1990). *Essentials of Psychological Testing (5th ed.)*. New York, USA: Harber Collins Publisher.

Deptuła, A. M., & Nosal C. S. (2021). Innovator Behavior Questionnaire as an Expert Selecting for Technical Innovation Risk Assessment. *European Research Studies Journal*, *14*(1), 107-119. doi:10.35808/ersj/2032

Deptuła, A. M., & Knosala R. (2015). Risk Assessment of the Innovative Projects Implementation. *Management and Production Engineering Review*, *6*, 15-25. doi: 10.1515/mper-2015-0032

Deptuła, A. M. (In preparation). *Criteria of expert selection for the risk management process in an enterprise. Supporting tools - Method of selection - Research results*. Oficyna Wydawnicza Politechniki Opolskiej.

Deptuła, A. M., & Rudnik, K. (2017). Risk Assessment of Innovative Project Using Fuzzy Inference System with Expert's Psychological Conditions. In: *Proceedings of the 29th International Business Information Management Association (IBIMA)*, p. 3093-3105. Vienna, Austria.

Deptuła, A. M., & Rudnik, K. (2018). Fuzzy Approach Using Experts' Psychological Conditions to Estimate the Criteria Importance for the Assessment of Innovative Projects Risk. *Management and Production Engineering Review*, *9*(1), 13-23. doi: 10.24425/119396

Dey, P. K., & Ogunlana, S. O. (2004). Selection and Application of Risk Management Tools and Techniques for Build-Operate-Transfer Projects. *Industrial Management and Data Systems*, *104*(3), 334-346. doi: 10.1108/02635570410530748

Dörfler, V., & Ackermann, F. (2012). Understanding intuition: The case for two forms of intuition. *Management Learning*, *43*(5), 545-564. doi: 10.1177/1350507611434686

Dotgson, M., Gann, D. M., & Salter, A. (2008). *The Management of Technological Innovation*. Oxford, Great Britain: Oxford University Press.

Ericsson, K. A., & Chase, W. G. (1981). Exceptional memory. *American Scientist*, *70*(6), 607-615.

Ericsson, K. A., & Polson, P. G. (1988). An experimental analysis of the mechanisms of a memory skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *14*, 305-316.

Garb, H. N. (1989). Clinical judgment, clinical training, and professional experience. *Psychological Bulletin*, *105*, 387-396.

Goldberg, L. R. (1970). Man versus model of man: A rationale, plus some evidence, for a method of improving on clinical inferences. *Psychological Bulletin*, *73*, 422-432.

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment*, *4*(1), 26-42. doi: 10.1037/1040-3590.4.1.26

Gustafson, J. E. (1963). The computer for use in private practice. In: *Proceedings of Fifth IBM Medical Symposium*, p. 101-111. White Plains, USA: mM Technical Publication Division.

Hornowska, E. (2007). *Testy psychologiczne. Teoria i praktyka* [*Psychological tests. Theory and practice*]. Warsaw, Poland: SCHOLAR.

Kahraman, C., Büyüközkan G., & Ateş N. Y. A. (2007). Two Phase Multi-Attribute Decision-Making Approach for New Product Introduction. *Information Sciences*, *177*, 1567-1582. doi: 10.1016/j.ins.2006.09.008

Knosala, R., & Deptuła, A. M. (2018). *Ocena ryzyka wdrażania innowacji* [*Risk assessment of implementing innovations*]. Warsaw, Poland: Polskie Wydawnictwo Ekonomiczne.

Larkin, J., McDennott, J., Simon, D. P., & Simon, H. A. (1980). Expert and novice performance in solving physics problems. *Science*, *208*, 1335-1342.

Larsen, R., & Buss, D. (2013). *Personality Psychology: Domains of Knowledge About Human Nature*. London, England: McGraw –Hill, Higer Education.

Lee, S. F., Tsai Y. C., & Jih W. J. (2006). An Empirical Examination of Customer Perceptions of Mobile Advertising. *Information Resources Management Journal*, *19*, 39-55. doi: 10.4018/irmj.2006100103

Manly, B. F. J., Jorge, A., & Navarro, A. (2016). *Multivariate statistical methods: a primer*. Boca Raton, USA: Chapman and Hall/CRC.

Manuel, E. (2007). Innovation and Risk Management. *Munich Personal RePEe Archive*, *2277*. doi: 10.2139/ssrn.969028

Mobey, A., & Parker, D. (2002). Risk Evaluation and Its Importance to Project Implementation. *Work Study*, *51*, 202-208. doi: 10.1108/00438020210430760

Mullins, J., & Sutherland, D. J. (1998). New Product Development in Rapidly Changing Markets: An Exploratory Study. *Journal of Product Innovation Management*, *15*(3), 224-236. doi: 10.1016/S0737-6782(97)00081-7

Nadkarni, S., & Shenoy, P. P. (2001). Bayesian Network Approach to Making Inferences in Causal Maps. *European Journal of Operational Research*, *128*, 479-498. doi: 10.1016/S0377-2217(99)00368-9

Neubauer, A. C., & Freudenthaler, H. H. (2005). Models of emotional intelligence. In Schultz R and Roberts RD (eds.), *Emotional intelligence: An international handbook*, 31-50.

Nosal, C. S. (1990). *Psychologiczne modele umysłu* [*Psychological models of mind*]. Warszawa, Polska: Państwowe Wydawnictwo Naukowe.

Nosal, C. S. (2001). *Psychologia Myślenia i Działania Menedżera: Rozwiązywanie Problemów, Podejmowanie Decyzji, Kreowanie Strategii* [*Psychology of Managerial Thinking and Acting: Problem Solving, Decision Making, and Strategy Formation*]. Wrocław, Poland: Akade.

Nosal, C. S. (1992). *Diagnoza typów umysłu* [*Diagnosis of mind type*]. Warszawa, Poland: Państwowe Wydawnictwo Naukowe.

Nosal, C. S. (2021). On the relationship between intuition, consciousness and cognition: in search of a unified concept of mind. *Annals of Psychology: Perception and Cognition*, *24*(3-4), 345-360.

Nunnally, J. C. (1978). *Psychometric theory*. New York, USA: McGraw-Hill.

Petrides, K. V., Perazzo, M. F., Pérez-Díaz, P. A., Jeffrey, S., Richardson, H. C., Sevdalis, N., & Ahmad, N. (2022). Trait Emotional Intelligence in Surgeons. *Frontiers in Psychology*, *13*, doi: 10.3389/fpsyg.2022.829084

Prigogine, I. (1996). *La fin des certitudes*. Truffaut, Paris: Editions Odile Jacob.

Reber, R., Ruch-Monachon, M. A., & Perrig, W. J. (2007). Decomposing intuitive components in a conceptual problem solving task. *Consciousness and Cognition*, *16*(2), 294-309. doi: 10.1016/j.concog.2006.05.004

Rencher, A. C. (2002). *Methods of Multivariate Analysis. Second edition*. New York, USA: Wiley-Interscience.

The Institute of Operational. (2012). *Sound Practice Guidance.* Retrieved from https://www.ior-institute.org/sound-practice-guidance, access 8.04/2022

Robin, R., & Riedel, J. C. K. H. (1997). Design and Innovation in Successful Product Competition. *Technovation*, *17*(10), 537-548. doi: 10.1016/s0166-4972(97)00050-3

Rokeach, M. (2015). The Open and Closed Mind. Investigations into the Nature of Belief Systems and Personality Systems. Connecticut, USA: Martino Fine Books.

Rotter, J. B. (1966). Generalized Expectancies for Internal versus External Control of Reinforcement. *Psychological Monographs*, *80*, 1-28. doi: 10.1037/h0092976

Sarbin, T. R. (1944). The logic of prediction in psychology. *Psychological Review*, *51*, 210-228.

Simon, H. A. (1992). What is an 'Explanation' of behavior? *Psychological Science*, *3*(3), 150-161.

Singer, R. (1975). *Motor Learning and Human Performance*. New York, USA: Macmillan and Company.

Slovic, P. (2000). The Perception of Risk. In: P. Slovic (Ed.), *The Perception of Risk*. London, England: Earthscan Publications.

Spearman, C. (1927). *The abilities of man: Their nature and measurement*. London, England: Macmillan.

Strelau, J. (2014). *Różnice Indywidualne. Historia – Determinanty – Zastosowania* [*Individual Differences: History – Determinants – Applications*]. Warsaw, Poland: Wydawnictwo Naukowe Scholar.

Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, *90*(4), 293-315.

Ungson, G. R, & Braunstein, D. N. (1984). Decision Making: An Interdisciplinary Inquiry. *Administrative Science Quarterly*, 29, 479.

Zakrzewska, M. (1994). *Analiza czynnikowa - zastosowania naukowe. Psychologia – metodologia* [*Factor analysis - scientific applications. Psychology – methodology*]. Poznań, Poland: Wydawnictwo Naukowe UAM.

Zimmerman, B. J. (2000). Attaining Self-Regulation. *Handbook of Self-Regulation*, 13-39. doi: 10.1016/b978-012109890-2/50031-7

Zuckerman, M. (2007). Sensation Seeking and Risky Behavior. Sensation Seeking and Risky Behavior. *American Psychological Association*; New York, doi: 10.1037/11555-000