
Innovator Behavior Questionnaire as an Expert Selecting for Technical Innovation Risk Assessment

Submitted 25/01/21, 1st revision 15/02/21, 2nd revision 01/03/21, accepted 20/03/21

Anna M. Deptuła¹, Czesław S. Nosal²

Abstract:

Purpose: The objective of this paper is to explore the basic assumptions formerly applied for the development of the innovator behavior questionnaire, and thus to describe the necessary characteristics to be considered when an expert is selected for the purposes of assessing the risk of innovation.

Design/Methodology/Approach: The assessment of the risk of technical innovations involves the need to take into account psychological, technical as well as economic criteria. Such wide range of analysis means that the selection of the staff dealing with the development, implementation and subsequent evaluation of innovations needs to be based on a multi-criteria approach.

Findings: The questionnaire adopted five categories of questions, the formation of the mind and personality, expectations, approach to accidental events that beyond expert's control, knowledge and skills, and commitment. The study was conducted in two areas of representation, in everyday life and professional life. These areas relate to three personality characteristics, locus of control, motivation and stimulation of the decision-maker. In addition, the paper explores areas related to the characteristics of these three basic personality characteristics of the expert.

Practical Implications: As a result of the application of the newly developed tool, which can be used not only in the process of creating an expert team in the company but also in the process of recruiting people to deal with innovation, there is a chance that the risk of failure of innovative solutions can be significantly reduced and the costs associated with the process of implementing and modifying innovations can be limited. Following a broader research in the expert community and a factor analysis the structure of factors characterizing the temperament, mind and personality traits of the expert will be determined and interpreted.

Originality/value: The expert selection method presented in the article forms a new solution that derives its basis in both risk theory and innovation assessment, as well as takes into account psychometric standards.

Keywords: Assessment of the risk, innovator behavior questionnaire, locus of control, motivation in activities, the need for stimulation.

JEL classification: O3, M50, G4, L21, L29, G4.

Paper Type: Research paper.

Acknowledgement: Research financed by National Science Centre, Poland, MINIATURA 4, 2020/04/X/HS4/00632.

¹Corresponding author, Ph.D. Opole University of Technology, Faculty of Production Engineering and Logistics, Poland, an.deptula@po.edu.pl

²Prof., University of Social Science and Humanities, Campus in Wrocław, Department of Psychology, Poland, cnosal@swps.edu.pl

1. Introduction

The term innovator is applied to refer to a person who deals with the development, implementation and evaluation of innovation. Innovation in Schumpeter's approach means any idea transformed into a specific action/thing that is characterized by a deliberately-designed novelty, both in the strict and in the broad sense. The condition for using this term also involves the practical application of the solution and the achievement of specific benefits (OECD/Eurostat, 2019; Dotgson *et al.*, 2008; Westland, 2008). In turn, an expert is considered to be an individual who has well-established knowledge and experience in a specific area. This knowledge forms the basis of their competence. The risk aspects of technical innovation are evaluated from the point of view taking into account: project risk, business risk and shareholder risk. The complexity of an innovative project is mainly due to the combination of know-how gained by numerous experts, which provides the basis for the development of innovation. This, in turn, induces the need to assess innovation in the light of numerous criteria by application of the following aspects (Deptuła and Knosala, 2015; Rudnik and Deptuła, 2015; Deptuła and Rudnk, 2018; Deptuła, 2017; Knosala and Deptuła, 2018; Linkov *et al.*, 2008):

- technical (operational issues, machinery and equipment failure rates, design methodology, etc.),
- economic (cost of innovation, life cycle, environmental risks, health hazards, cost effectiveness, etc.),
- psychological (simplicity and convenience of the application of the developed tools and minimizing cognitive loads of the assessment process).

In the risk assessment related to innovation carried out in (Deptuła and Knosala, 2015), includes criteria related to, among others: company and project management, project financial results, product development, production and logistics processes, optimization of the use of materials, machines and compliance with standards and guidelines contained in legal regulations (Deptuła and Knosala, 2015). The risk assessment of technical innovations in accordance with the developed method reported in (Knosala and Deptuła, 2018) takes into account the decision-maker preferences only indirectly. Bearing in mind the assumptions of the theory of perspective, we need to state that the cognitive processes and personality characteristics of an expert are of great importance in the decision-making process.

By adopting the main statements contained in Kanemann and Tversky's prospect theory and taking into account the conclusions derived from risk assessment (Rudnik and Deptuła, 2015; Deptuła and Rudnk, 2018; Knosala and Deptuła, 2018; Kahneman, and Tversky, 1973; Kahneman and Tversky, 1979; Kahneman and Tversky, 1984; Slovic, 2000; 2016; Slovic *et al.*, 1979; 1980; Montewka *et al.*, 2014; Aleksic *et al.*, 2019) carried out with regard to technical innovations, it was recognized that there was a need to develop an entirely new version of the (initially

proposed) test of preference. The objective in the article is to explore the basic assumptions formerly applied for the development of the questionnaire, and thus to describe the necessary characteristics to be considered when an expert is selected for the purposes of assessing the risk of innovation.

The need for modification results mainly from the intention to increase the viability of work carried out in studies dealing with innovation, in particular the ones related to risk assessment. The adequate selection of experts turns out to play a key role in risk assessment, which, taking into account the rational approach to the problem under consideration, reduces the hazard related to gaining overestimated and underestimated assessments.

The paper presents the design of a questionnaire applied for the selection of an expert in the process of risk assessment of technical innovations. The procedure for developing the questionnaire was based on previous areas applied in the analysis of risk perception of technical experts (Knosala and Deptuła, 2018) and a review of the literature in this area (Slovic *et al.*, 1979; Manuel, 2007; Jafari *et al.*, 2011; Zuckerman, 2007; Nosal, 2001).

By combining theoretical and practical assumptions for the conclusions resulting from the observation of works related to the assessment of innovation risk in companies, foundations were created for determining a set of necessary mind and personality characteristics of an expert associated with all stages of the process of creating, implementing and assessing the risk of innovation.

2. Literature Insights – Basic Aspects

The development and implementation of innovations poses a task that requires the innovator above all openness of the mind and capability to adapt to changes that undoubtedly take place in the future. In addition to the basic definition method proposed by Schumpeter (OECD/Eurostat, 2019; Dotgson *et al.*, 2008; Westland, 2008), innovation can be described as a goal with a specific outcome, with a well-established plan and practical application, therefore people involved in innovation processes should be firstly entrepreneurial (OECD/Eurostat, 2019; Dotgson *et al.*, 2008; Westland, 2008).

Entrepreneurship is a personality characteristic that favors actions directed with the purpose of achieving a specific goal, which is largely associated with the desire to implement ideas represented by achievements of an individual. The “Big Five of Entrepreneurship” describes the psychological characteristics describing a task-oriented, entrepreneurial manager. Vecchio includes “inclination to take risk, the drive to achieve, the need for autonomy, self-confidence and specific locus of control” as the most important characteristics of task-based management (Burdzicka-Wołowik, 2008; Strelau, 2014; Rosmus and Pawlak, 2014; Vecchio, 2003).

2.1 Locus of Control and Individual Actions

The theoretical foundations related to the sense of locus of control of reinforcements are associated with the name of Rotter, who initiated research on the location of cognitive control of and presented it later in the form of theory of social learning (Rotter, 1966; Zimmerman, 2000). According to Rotter, the individual satisfies its needs by following various instrumental behaviors. What is more, the decision-maker seeks a relation between behavior and reinforcement through the lens of control over reinforcements. The decision makers assess whether they are able to have an effect on a given reinforcement (i.e., reward or punishment for action) and then they become strongly involved in a given activity. If they consider that reinforcement is relative to external factors and is completely beyond control, they act in the opposite way. In this sense, the aspects of internality vs. externality of control are relative to the rewards forecasted by an individual. Within such an approach, one can define the sense of locus of the control of a decision-maker as the way in which an individual perceives reinforcements in the context of their behavior.

Reinforcements are relative, among others on the knowledge and skills of the decision-maker and perceiving their effect as a result of the activities of a given individual, as well as cultural and mental factors, the way of upbringing and effects associated with the effects of upbringing environment. In general, it is about the expectations of the individual as to the outcomes of events, which are greater in the case of perceiving the consequences of a given action as an event controlled by the individual, which is manifested by the ability to commit oneself. The effect of a given behavior can be perceived in two ways: as a result of an individual's actions or as a result of independent circumstances beyond personal control, e.g., random factors (Burdzicka-Wołowik, 2008; Rotter, 1966; Zimmerman, 2000).

2.2 Effect of Motivation and Stimulation on the Performance in Activities

An important condition for assessing risk perception involves the need to take into account the motivation of the reinforcement perceived by the expert. The motivation of achievements consists of the will to combat, faith in victory, self-confidence and the motive to avoid failure, fear of competition or lack of self-confidence (Atkinson and Feather, 1964).

According to Singer, the effectiveness of human activity depends on stimulation and motivation as well as the skills of an individual (Singer, 1975). An individual characterized by high motivation but lacking skills does not gain considerable performance and on the contrary – great skills devoid of motivation do not provide considerable achievements. Effective action is associated with a stimulus that defines the individual's motivational goals. The direction of action is formed by a vector including: the goal, intensity of the need for action and the will to implement it. The motivational process regulates the activities of the individual, and thus becomes a source of the person's tasks. Motivation itself can be defined as a function

of the practical value of the goal and the likelihood of achieving it. In turn the force and intensity determine performance. Studies often distinguish two types of courses developed on the basis of high motivation. The first type occurs when an individual wants to achieve something and the second type when they want to avoid something.

The first course of action involves personal desires and motivation, and the second direction involved fear, anxiety and resentment. The force of the motivation is measured in the consequences of actions followed in combination with the action. The magnitude of motivation is measured by the range of activities needed to achieve the goal and desire to meet the goal. The harder it is to persuade a person to change their behavior, the stronger their motivation is, and such a persistent person strives to perform actions that achieve a specific result. The research shows that the level of motivation force has an effect on the performance of an action; however, an increase in the force of motivation leads to an increase in efficiency, but only to a certain level, followed by its decrease (Larsen *et al.*, 2013).

The force of motivation affects the outcome of an action. According to the Yerkes-Dodson law, as the level of arousal increases, the performance increases, but only to a certain point, and then it begins to decrease, which means that in the conditions accompanied by a very high level of motivation, the performance of an action is low. If we need to convert this into the type of task performed by the individual – easy, well-known and mastered tasks are characterized by the highest efficiency at a high level of motivation, while difficult, complex tasks that are not well achieved at a low level of motivation. Motivation force tests conducted on athletes have demonstrated that usually too high levels of arousal (combined with the fear of failure motive) negatively affect the performance in actions by decreasing the accuracy and perception abilities of an athlete, and thus delay the instant responsible for taking a decision. On the other hand, if the level of arousal is too low, an individual perceives all stimuli – both important and irrelevant – which also leads to a delay in an activity. An optimally stimulated person perceives only the stimuli and has time to choose and apply the appropriate action (Czajkowski, 2005).

Therefore, suboptimal motivation seems to be the most beneficial for effective operation. Then the person's behavior is converted into all spheres of life and thus also behavior at work.

Positive motivation is encountered when an individual acts to accomplish a goal. In turn, negative one is associated with the action carried out only to avoid inconvenience, failure, as well as unpleasant outcomes of an action. Of course, the performance in activities related to positive motivation is greater than for the case of negative motivation. In turn, internal and external motivation directs the actions of the individual to those that carry value in themselves and those that are implemented through coercion. Internal motivation is a reward in itself (it has value in itself) that gives pleasure and contentment and stimulates further action. The function that informs external motivation is that rewards, money, privileges are a recognition of

the individual, and the control function has a negative tone because it is associated with the type of "I act since they pay me for it, as I am told so..." etc. In this context it should be emphasized that many studies and observations confirm the negative impact of external motivation on the quality and effectiveness of the individual (Czajkowski, 2005).

2.3 Activity as the Component of Temperament Affecting the Need for Individual Stimulation

An important determinant that defines an individual's actions is associated with the temperament, i.e., a set of relatively time-constant characteristics that manifest themselves in the formal characteristics of behavior (energy and time parameters) (Zuckerman, 2007; Strelau, 2014; Strelau, 1993). Temperamental traits begin to shape from early childhood and under the effect of individual development and the environment (Zuckerman, 2007). Individual temperament comprises the following: emotional reactivity, sensory sensitivity, endurance and activity. Emotional reactivity is a tendency by an individual to react intensively to emotogenic stimuli, expressed in terms of high emotional sensitivity and low emotional resilience (Strelau, 2014; Strelau, 1993), which means that people with high emotional reactivity more easily react with intense emotions and high excitability, and are also less able to cope with tasks performed under stress (due to low emotional resilience).

The second characteristic of the temperament or sensory sensitivity denotes "the ability to respond to sensory stimuli with a low value of stimulation, whereas endurance is defined as "the ability to respond adequately to situations requiring long-term or very stimulating action and the ability to act in conditions of strong external stimulation (Strelau, 2014; Strelau, 1993). An individual's activity is a characteristic that manifests itself in the quantity and scope of actions taken in the conditions of a given level of stimulation. It is the basic regulator of stimulation and can form its direct or indirect source (Zuckerman, 2007; Nosal, 2001). Activity is understood as an indirect source of stimulation, which is manifested through the individual's activity expressed in seeking or avoiding stimulation (Strelau, 2014; Strelau, 1993). Generally speaking, the temperament features listed above determine the level of stimulation characteristic for a given person. The theory of stimulation regulation is important in explaining the level of preferred risk (Zuckerman, 2007; Nosal, 2001; Strelau, 2014).

3. Description of Theoretical Foundations Adopted in the Development of the Questionnaire

During the process of selecting an expert capable of assessing the risk of innovation, this paper proposes the use of an innovator's questionnaire that will be applied to determine the extent to which they are characterized by specific traits of temperament, mind and personality characteristics, and thus risk perception. The proposed tool has been developed following the basic principles of psychological

measurement (Hornowska, 2007; Cronbach, 1990):

1. Definability in operational terms and in terms of relationships with other observable phenomena.
2. The targeted nature of the psychological measurements.
3. Limiting the sample of examined behaviors.

The first principle involves the selection of items in the questionnaire in such a way that they can be referred by means of measurable characteristic in terms of representing the object of measurement not only in the theoretical sphere but also in the area of observable phenomena (it results from the adopted definitions) and determining the rules for interpreting the obtained results (Hornowska, 2007). In the developed questionnaire, this means that the examined content and areas of their manifestation are strictly defined, as well as the selection of the method of responding by interviewees in which a five-point Likert scale formats is applied.

The second principle implies the need to link the measured characteristics to a set of behaviors resulting from theoretical analysis of the investigated temperament or personality traits. In the present study, the set of behaviors was determined by a set of three measured personality traits. The following definitions of three examined characteristics were adopted in the study (Knosala and Deptuła, 2018; Zuckerman, 2007; Strelau, 2014; Rotter, 1966; Singer, 1975; Larsen *et al.*, 2013; Zimmerman, 2000; Nosal, 2001):

1. Locus of control – a personality characteristic that determines how a person perceives reinforcements in the context of their behavior.
2. Motivation in activities – as an internal state, the pursuit of taking action, which the decision-maker can define in two ways: as the need to achieve success or a stimulus to act in order to avoid disappointments.
3. The need for stimulation – as a temperamental trait manifested in the amount and scope of stimulant activities with a specific stimulus value.

The third principle involves the need to narrow down the manifestation of measured behavior. In the presented study they were narrowed down strictly to those elements that are responsible for: location of the decision-maker control (first characteristic), achievement motivation (second characteristic) and scope of stimulation (third characteristic).

4. Structure of the Questionnaire

A common condition for the development of the analyzed features is the impact of education and the cultural environment. Therefore, aspects related to the upbringing of the individual were included in the content of the questionnaire. The analysis of motivational processes also shows the need to take into account the expectations and commitment of the individual. In turn, knowledge and skills in each of the analyzed

features can change the direction of a person's behavior, just like the expert's approach to random events, which is directly related to risk perception.

The questionnaire did not adopt a typical "correct or wrong" answer key. It was only assumed that individual statements are responsible for the person's characteristics.

The questionnaire identified five main areas of content examined, which include:

1. Formation of the mind and personality of the expert – as a manifestation of its development and influence of cultural factors. The main element examined in this respect will be the unit's routine activities resulting from the acquired features (symbol A).
2. Expert expectations - as the basic motivating factor for actions. Rated in the category of achieving success or task performance only to a sufficient extent (symbol B).
3. Approach to accidental events beyond the expert's control - as a direct manifestation of risky behavior; expert's approach to games of chance (symbol C).
4. Expert knowledge and skills - as the basis for the unit's operation. In this regard, the approach to experience in the implementation of similar projects will be verified and the impact on their implementation resulting from documented knowledge in the form of e.g. certificates, diplomas, etc. (symbol D).
5. Expert involvement - as a degree of consistency in targeting cause and effect (symbol E).

The study on measuring individual characteristics was carried out in two areas of manifestation: in everyday life and in professional life. To this end, the initial list of 54 statements in Table 1 was formulated.

The contents of the specific columns in Table 1 include:

- in the first - statement number,
- in the second - statements,
- in the third – data on the area of examined content is provided,
- in the fourth - '1' denotes statements focusing on the characteristic – locus of control (characteristic I),
- in the fifth - '1' denotes statements regarding characteristic – motivation in action (characteristic II),
- in the sixth - '1' denotes statements regarding the statement concerning the feature – stimulation in action or lack of it (characteristic III).

Within the area related to everyday life, 28 statements (16L+12LW) were developed. In turn, 38 statements (26W +12LW) were given in the areas related to work. We should note that the questionnaire contains 12 statements classified simultaneously in the areas related to both work and everyday life. Selected areas of manifestation

are a great place to observe individual behavior resulting from both habits and impulsive actions.

Globally, the largest number of statements, i.e., 15 relate to the expectations of the individual, because they, in the opinion of the authors, have the greatest impact on risk perception. Then, in order, the area related to the approach to independent (accidental) events beyond the expert's control was identified 11 statements. The remaining areas were given similar validity expressed in the following numerous statements contained in the questionnaire: formation of an expert 8 statements, knowledge and skills of an expert 7 statements and involvement of an expert 8 statements. 23 statements were made to measure characteristic I. Characteristic II is associated with 14 statements, and characteristic III with 25 statements. As you can see, the most statements apply to characteristics III and I. These are related to traits that directly affect the decision-maker's attitude to risk manifested by an attitude of aversion, willingness or neutrality.

Characteristic I was defined mainly by statements in group A(7), although the distribution of other statements is similar: B(4), C(5), D(4), E(3). For characteristic II, the circumstances are quite different. Here the majority of statements originated from group B(7) and E(5) whereas groups A and C are disregarded. In statements regarding characteristic III, the most statements were made in group E(9), followed by B(7) and C(6). There were also statements from areas A(2) and D(2).

During the development of the questionnaire, the authors did not set themselves the task of keeping the equivalence of statements for individual areas and personality characteristics. The priority was to include the necessary wording which, in the authors' opinion, determines the elements tested in the questionnaire.

5. Conclusions

The paper contains a discussion of the three basic personality characteristics of an expert, which are proposed to be included in the process of selecting experts. This implication results from the grounds that the personality traits significantly affect the assessment process made by experts.

The innovator's questionnaire can provide assistance in the process of analyzing the effect of individual expert characteristics on the decision-making processes. As a result of analyzes carried out in the field of theoretical and practical issues (regarding carried out innovation risk assessments), a completely new tool has been developed that significantly differs from the previously proposed risk behavior preference test. While the preference test contains 15 alternative statements, the developed questionnaire comprises 54 statements that define the personality characteristics of the expert. As a result of the use of this questionnaire, it is possible to eliminate overly cautious and overly risky individuals from the team of experts.

The development of the initial draft of the questionnaire was feasible as a result of the combination of research results on risk perception from various research perspectives. Literature analysis provided the starting point for the draft of the tool presented in the paper. Of course, this questionnaire requires appropriate further statistical analysis to determine the structure of the factors taken into account in it, which is the subject of the further work of the authors. Following a broader research in the expert community and a factor analysis (including background and insights in the area), the structure of factors characterizing the temperament, mind and personality traits of the expert will be determined and interpreted.

Verification and determination of the factor structure in various groups will soon be presented along with a description of the pilot and appropriate studies carried out.

Following the application of the questionnaire presented in this paper, it will be possible to continue theoretical and practical analyzes on the effect of risk perception by an expert on the risk assessment of technical innovations.

Table 1. Characteristic of statements applied in the questionnaire

SYMBOLS APPLIED IN TABLE:					
Symbol A - Expert formation; Symbol B - Expert's expectations; Symbol C - Approach to accidental events beyond the expert's control; Symbol D - Expert knowledge and skills; Symbol E - Expert involvement; „W” – Work; „L” – Life					
Lp.	Statement	Investigated area	Characteristic		
			I	II	III
1.	The company's success depends on the connections and knowledge possessed by its owners ^W .	A	1		
2.	Challenging tasks discourage me from effort ^W .	E		1	
3.	When buying new products, I choose well-known brands (companies) ^L .	C			1
4.	Experience possessed by an applicant is important in the recruitment process ^W .	A	1		
5.	It is necessary to keep a distance between boss and subordinates ^W .	A	1		
6.	One should arrive for an job interview in formal attire ^W .	A	1		
7.	Chances of employment in the company are relative to level of acquaintance ^W .	A	1		
8.	Swearing shows courage ^L .	A			1
9.	In my life I am mainly guided by my own experience ^L .	A	1		
10.	It is of primary importance to avoid losses in the company's operations ^W .	B		1	1
11.	I like to accomplish new tasks as a means to learn something ^W .	B			1
12.	The company's high profits are generated only by specialists ^W .	D	1		
13.	I enjoy realizing medium and difficult tasks ^{LW} .	B			1
14.	In my life I am guided by the advice/suggestions provided by my parents ^L .	A	1		
15.	At school I only desired to gain credit in the taught subjects ^L .	B		1	
16.	I like to present my work in public ^{LW} .	B		1	
17.	I am not afraid to express my views ^{LW} .	B			1
18.	Companies' financial results depend on the market situation ^W .	C	1		
19.	I likes to deal with difficult issues ^{LW} .	B	1		
20.	Most success stories of companies are relted to pure coincidence ^W .	C	1		
21.	At school I sought honors and good grades ^L .	B		1	

22.	I enjoy tasks that can be carried out quickly ^{LW} .	B		1	1
23.	Enterprises should create a new offer in such a way that it is based on proven products ^W .	C			1
24.	I wonder what caused the cup to burst after pouring boiling water into it ^L .	C	1		
25.	My ideas prove valuable ^{LW} .	E	1	1	

26.	I enjoyed competing with colleagues ^W .	E			1
27.	At school I was the organizer of many events ^L .	B		1	
28.	It is worth acquiring new knowledge and skills as the boss will perhaps appreciate them ^W .	D	1	1	
29.	When people tell me that I can't make it, I give up ^L .	B	1		
30.	I like going to new places ^L .	C			1
31.	I feel anxious when a new employee appears in the company ^W .	E			1
32.	In the recruitment process, knowledge documented with diplomas, certificates, etc. is of great importance ^W .	D	1		
33.	I like to be distinguished ^L .	B	1		1
34.	Company inspections should always be unannounced ^W .	E			1
35.	Problems in the company should not be solved using company resources ^W .	E	1		
36.	Existing work methods and techniques should not be changed ^W .	E			1
37.	Companies should offer products similar to their competitors ^W .	D		1	
38.	I like to arouse interest among people ^L .	B		1	
39.	I avoid buying very expensive things ^L .	B	1		
40.	Supervision control is a great stress for me ^W .	D			1
41.	Most of the company's successes are the result of its employees' activities ^W .	C	1		
42.	In general, I am looking for tasks that I have never performed ^{LW} .	E			1
43.	I like to follow/walk/run along unknown paths ^L .	C			1
44.	When I carry out tasks in a company, I like to focus on new solutions ^W .	C			1
45.	I am happy to provide new solutions and ideas ^{LW} .	E	1	1	1
46.	I like complicated tasks ^{LW} .	E		1	1
47.	When a cup breaks after pouring boiling water, it's a matter of bad luck ^L .	C	1		
48.	It is worth playing lotto etc ^L .	C			1
49.	One cannot know whether a given innovation (novelty) will succeed ^W .	D	1		
50.	I like time consuming tasks ^{LW} .	E		1	

Lp.	Statement	Investigated area	I	II	III
51.	A new employee in the company may cause misunderstandings and conflicts ^W .	D			1
52.	Solving the problem should start by finding its causes ^{LW} .	E			1
53.	I say no more often than yes ^{LW} .	B			1
54.	I like checking the results of my work by superiors ^W .	E			1

References:

Aleksić, A., Runić Ristić, M., Komatina, N., Tadić, D. 2019. Advanced risk assessment in reverse supply chain processes: A case study in Republic of Serbia, *Advances in*

- Production Engineering And Management, Volume 14, Number 4, 421-434.
doi:10.14743/apem2019.4.338.
- Atkinson, J.W., Feather, J., 1964. *An Introduction to Motivation*. Nostrand Company. New York.
- Burdzicka-Wołowik, J., 2008. Locus of control orientation versus the value system held by the students of physical education. *Pol. J. Sport Tourism*, 15, 59-68.
- Cronbach, L. J., 1990. *Essentials of Psychologicals Testing* (5th ed.). Harber Collins Publisher, New York.
- Czajkowski, Z., 2005. Motivation and arousal in sports activities. In polish: *Motywacja i pobudzenie w działalności sportowej*, Gdańsk.
- Deptuła, A. M., 2017. Analysis of criteria used in the risk assessment of technical innovations. *Procedia Engineering*, Volume 182, 2017.,135-142, doi: 10.1016/j.proeng.2017.03.139.
- Deptuła, A.M., Knosala, R., 2015. Risk assessment of the innovative projects implementation. *Management and Production Engineering Review*, Vol. 6 No 4, 15-25, doi:10.1515/mpere-2015-0032.
- Deptuła, A.M., Rudnk 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*, Volume 9, Number 1, 13–23, doi:10.24425/119396.
- Dotgson, M., Gann, D., Salter, A., 2008. *The Management of Technological Innovation*. Oxford University Press.
- Hornowska, E., 2007. Psychological tests. Theory and practice. In Polish: *Testy psychologiczne. Teoria i praktyka*, SCHOLAR Warsaw.
- Jafari, M. , Chadegani, A.A., Biglari, V., 2011. Effective risk management and company's performance: Investment in innovations and intellectual capital using behavioral and practical approach. *Journal of Economics and International Finance*, Vol. 3 (15), 780–786, doi: 10.5897/JEIF11.123 ISSN 2006-9812.
- Kahneman, D., Tversky, A., 1984. Choices, values and frames. *American Psychologist* 39, 341-350.
- Kahneman, D., Tversky, A., 1973. On the psychology of prediction. *Psychological Review* 80, 237-251, doi:10.1037/h0034747.
- Kahneman, D., Tversky, A., 1979. Prospect Theory: An Analysis of Decision under Risk. *Econometrica* Vol. 47 No. 2, 263-292, doi: 10.2307/1914185.
- Knosala, R., Deptuła, A.M., 2018. Risk assessment of implementing innovations. In Polish: *Ocena ryzyka wdrażania innowacji*, PWE, Warszawa.
- Larsen, R.J., Buss, D.M. Wisimeijer A., Song J., 2013. *Personality psychology. Domains of knowledge about human nature*, McGraw –Hill, Higer Education, London.
- Linkov, I., Shilling, C., Slavin, D., Shamir, E., 2008. Cognitive aspects of business innovation. In: *Real-Time and Deliberative Decision Making*, NATO Science for Peace and Security Series C: Environmental Security.
- Manuel, E. 2007. *Innovation and Risk Management*, MPRA Paper No. 2277.
- Montewka, J., Goerlandt, F., Kujala, P., 2014. On a systematic perspective on risk for formal safety assessment (FSA), *Reliability Engineering and System Safety* 127, Elsevier, 77–85, DOI:10.1016/j.res.2014.03.009.
- Nosal, C.S., 2001. Psychology of managerial thinking and acting: Problem solving, decision making, and strategy formation. In Polish: *Psychologia myślenia i działania menedżera: Rozwiązywanie problemów, podejmowanie decyzji, kreowanie strategii*, Akade, Cracow.

- OECD/Eurostat, 2019. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, doi: 10.1787/9789264304604-en.
- Rosmus, R., Pawlak, A., 2014. Entrepreneurship and a sense of control as a determinant of how decisions are made. In polish: Przedsiębiorczość i poczucie kontroli jako uwarunkowania sposobu podejmowania decyzji, *Zeszyty Naukowe Politechniki Śląskiej, Series: Organizacja i Zarządzanie z. 74*, 425–435.
- Rotter, J., 1966. Generalized expectancies for internal and external control of reinforcement. *Psychological Monograph*, 80, 1 – 28, doi: 10.1037/h0092976.
- Rudnik, K., Deptuła, A.M., 2015. System with probabilistic fuzzy knowledge base and parametric inference operators in risk assessment of innovative Project. *Expert Systems with Applications* 42, Issues 17–18, 6365–6379, doi:10.1016/j.eswa.2015.04.025.
- Singer, R.N., 1975. *Motor Learning and Human Performance*. Macmillan and Company, New York.
- Slovic, P. 2016. Understanding Perceived Risk: 1978–2015. *Environment: Science and Policy for Sustainable Development*, Volume 58, 2016 - Issue 1 25-29, doi:10.1080/00139157.2016.1112169.
- Slovic, P., 2000. The Perception of Risk. In: *The Perception of Risk* (ed.) Slovic, P., Earthscan Publications, London–Washington.
- Slovic, P., Fischhoff, B., Lichtenstein, S., 1979. Rating the risks. „*Environment: Science and Policy for Sustainable Development*”, vol. 21, no 3.
- Slovic, P., Fischhoff, B., Lichtenstein, S., 1980. Facts and fears: Understanding perceived risk. In: *Societal risk assessment*, Schwing, R.C., Albers Jr., W.A. (Ed.) Springer, Carter Country.
- Strelau, J., 1993. The location of the regulative theory of temperament (RTT) among other temperament theories. *Human Nature*, J., Deary, I.J. (ed.). *Foundations of personality*, Dordrecht: Kluwer, 113-132.
- Strelau, J., 2014. Individual differences: history – determinants – applications, In polish: Różnice indywidualne. *Historia – determinanty – zastosowania*. Wydawnictwo Naukowe Scholar, Warsaw.
- Vecchio, R.P., 2003. Entrepreneurship and Leadership: common trends and common trends. *Human Resource Management Review*, 13, 303-327, Elsevier, doi: 10.1016/S1053-4822(03)00019-6.
- Westland, J.C., 2008. *Global Innovation Management*. Palgrave, Macmillan.
- Zimmerman, B.J., 2000. Attaining self-regulation: a social cognitive perspective. In: Boekaerts, M., Pintrich, P.R., Zeidner, M. (ed.). *Handbook of self-regulation* (13-39), Academic Press, San Diego.
- Zuckerman, M., 2007. Sensation seeking and risky behavior. *American Psychological Association*, New York, doi:10.1037/11555-000.