Identification of Key Management Graduate Profile in the Context of Industry 4.0

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Abstract:

Introduction: From the aspect of the success of an organization and its competitiveness in the market, human capital has a crucial role to play. Therefore, universities should offer their students study programs corresponding with the needs of the labour market and to adjust their graduate profiles to the current requirements.

Purpose: The authors of the paper present a project carried out by DTI University in Dubnica nad Váhom, Slovakia. The aim of the project is to design a functioning model which could help update the management graduate profile in the context of Industry 4.0. The focus is on the theoretical background of the project and the research tools applied especially at its first stage.

Methods: At the first stage of the project, a research on the key factors will be carried out. At the second stage, based on the obtained results, key aspects of the management graduate profile will be formulated and subsequently, a model having the potential to synchronize expectations, opportunities and finances will be designed and verified.

Conclusion: Based on the results, changes in the management study programme with the ambition to be implemented in the marketing strategies of both private and public universities will be suggested.

Key words: Industry 4.0, graduate profile, management, competencies, motivation, creativity, behavioural economics, study programmes.

Introduction

Universities should offer their students study programs corresponding with the needs of the labour market and to adjust their graduate profiles to the current requirements (Bilčík, 2016). One of the primary goals of Europe 2030 Agenda is to reform selected aspects of university education. Human capital is a key strategic tool especially in the case of business entities. It is expected that the

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increasing robotization of production processes will lead to changes in the qualification requirements placed on personnel in organizations. At DTI University, Dubnica nad Váhom, Slovakia, a research on the identification of the key factors is going to be carried out, including a comparison of selected behavioural economics models. Based on the gathered data, our intention is to design a functional model, the application of which will help update the management graduate profile in the context of Industry 4.0.

1 Goals of the project

The main goal of the project is to identify and update the key management graduate profile in the context of Industry 4.0. In the first year of its realization, knowledge in the field of the requirements of the market will be updated and the obtained data will be compared with models of behavioural economics. Based on the gathered data, the investigators will design a functional model, the application of which will help to update the key management graduate profile in the context of Industry 4.0.

Partial goals of the project are as follows:

- a) to collect data using:
 - a questionnaire focused on robotization in production,
 - tests on students' motivational tendencies - Schmalt's Multi-Motive Grid, performance prediction using GMA - Evaluation of Managerial Prerequisites, Personality Factors Inventory, NEO-Five-Factor Inventory - NEO-FFI (Ruisel & Halama, 2007), Coping Inventory based on Krohne's coping modes (Psychodiagnostika, a.s., 2020) – will be administered and evaluated using STATISTICA and Weka softwares;
- b) to work out interpretational schemes and statistically verify the hypothesis about the impact of mutual relationships between the observed phenomena; to compare the market's expectations with data gathered from students, with selected models of behavioural economics and cognitive psychology. At this stage, the project teams' work will be focused on the following phenomena: decision making under uncertainty; the prospect theory; sources of intuitive judgement and choice; the role of emotions; and affective heuristics. The research is inspired by Kahnemans' and Thaler's theories. According to Kahneman (2011), our brain has two separate operating systems: the automatic System I (expert, heuristic, intuitive thinking, perception, memory) and the intentional System II (rules of rationality, statistical thinking, deviation from rationality, system errors in the mechanism of cognition, overestimation and underestimation). Also Thaler's (2017) model of unpredictable behaviour is interesting in the discussed context. It is based on the following premises:
 1. Emotionality has a significant impact on rationality.
 2. Human behaviour is strongly influenced by societal preferences.

3. A lack of self-control (self-regulation) leads to the inability to synchronize short-term and long-term goals.
- c) to identify and specify the key aspects of the management student profile in the context of Industry 4.0;
- d) to design and experimentally verify a model which will have the potential to synchronize expectations, opportunities and finances;
- e) to work out and publish the suggested strategies for the development and the direction of the realization of education, as well as the designed study plans, the characteristics of profile subjects, etc.

2 Description of the project

When creating the project, the project team used the current knowledge from the fields of cognitive and social psychology. We were inspired by the requirements of the Europe 2030 Agenda focusing on reforming selected aspects of university education and preparation for the labour market. The aim of the project is derived from the needs of Industry 4.0. Not only technological solutions, but also the process of digitalization brings new aspects to leadership. The need for new skills in managing people and the continual necessity to update the technical skills of personnel in the production process and in engineering professions represent new challenges for managers in organizations which are the pioneers in introducing Industry 4.0. Creativity, team work and the personnel's emotional intelligence are more and more emphasized.

3 Theoretical background

The project is based on the work of the authors of behavioural economics Kahneman (2011), Thaler (2017, 1985, 1980), and Sternberg (2002). We were inspired by Kahneman (2011) and his theory of two systems. The second source of inspiration was the author's (Kahneman, 2011, 2012) updated theory of heuristics in processing and problem solving through the model of the "experiencing self" and "remembering self." Kahneman, Tversky and Simon (1979, 1982, 1983), already in the last century, worked on theories of processing information and models of precise intuition and decision making under uncertainty. Simon (1992, 2020) as the founder of the decision-making theory, considered decision making an important part of management, he saw situations in the context of hints and saw intuition as recognition of something. In several publications, he claims that objective, rational decision-making is impossible as it places exaggerated requirements on the decision maker's cognitive abilities. Decision making is determined by the subject's prerequisites for it - ability, knowledge, personal aspirations, interests, momentary state of mind, mood, and objective conditions of material and immaterial character (Simon, 1992). In agreement with him, Kahneman (2011) brings the concept of two systems enriched by the emotional dimension in models of "experiencing self" and

“remembering self” - being a valuable resource on which the presented research is based. The presence of emotionality, the impact of anxiety and taking action in intuitive decision making under uncertainty was discussed in the early studies by Kunreuther (Kunreuther, Pauly et al., 2013), but also in the studies by other authors, such as Slovic, Fischhoff, and Lichtenstein (1982), in which the participants indicated the possible causes of death, illnesses, lightning, etc. It was Slovic who created the concept of affective heuristics, where, in the process of judgment and decision making, individuals consult their own emotions: Do I like it? Do I hate it? How strong are my feelings towards it? According to several authors (Kahneman, 2012; Slovic, 2016; Damasio, 1994, 1996), affective heuristics is an example of substitution where the answer to a simple question (How do I feel about it?) serves as an alternative answer to a more complicated question (What do I think about it?). Damasio found out that individuals who do not show their emotions prior to making a decision, have a decreased ability to make good decisions. An inability to be healthily worried belongs to the known destructive distortions in decision making. Damasio (1996) noticed that in currently generally accepted studies, emotional appraisal of results, physical condition and approaching or avoiding tendencies related to them play an important role in decision making. These ideas are reflected in Kahneman’s (2011) model of experiencing and remembering self. Similarly, Thaler (2017) believes in the impact of emotionality and claims that the economic theory in practice assumes that problems with self-regulation do not exist. The key feature of Smith’s (1981) understanding of emotions is that they are myopic, i.e. short-sighted. “The pleasure, which we should enjoy in ten years from now, if compared to that which we can enjoy today, is not interesting to us.” Thaler (2017) comments on the current theories of economists as ignoring the impact of emotionality. According to him, the problems are caused by the model applied by economists. In contrast to the rational world of economists, people often act unpredictably, which leads to situations when economic models bring a number of misconceptions. His thesis is: conditioned optimization + equilibrium = economics (Thaler, 2017). “The cost of a missed opportunity”, represents what you give up if you perform a certain activity. Realizing that the cost of a missed opportunity equals to paying the expenses from own resources causes problems to economists as well. To let an opportunity go is not as painful as to withdraw money from your wallet to pay for something. In comparison with paying real money, the cost of a missed opportunity is vague and uncertain. Thaler (2017) describes the “acquisitive effect” as a phenomenon, in which paying extra costs means expenditure covered from own resources, while not getting a discount is only the cost of a missed opportunity. The same phenomenon is described by Kahneman and Tversky as “the phenomenon of framing.” (Thaler, 2017) Above, there are only several examples of the ideas of Nobel Prize winners for economics, so, we included emotionality among the important factors from the aspect of the identification of the key profile of management graduates.

4 Research tools

When working with the model of System I and System II (Kahneman, 2012), it is necessary to identify the sources of intuitive judgement, abilities and the applied types of heuristics for the selected samples of individuals. The key factors are: motivation, abilities, selected personality traits and emotionality, resp. affective heuristics. In the process of optimizing the human motivational potential, it is a necessity to study their motives, incentives playing an important role in potential situations. It is important in the field of work, especially in selecting people for particular job positions or finding appropriate jobs for particular persons. Such an opportunity is offered by Schmalt's, Sokolowski's, and Langens's "Multi-Motive Grid" (adapted by Koubek) (Psychodiagnostika, a.s., 2020). In both fields, the efficiency of the selected methods was proved. It proved to be similarly efficient in its clinical application, e.g. by analysing therapeutic motivation or the field of patients' anxiety. The scale satisfies all psychometric criteria, i.e. construction, validity and reliability.

An individual's abilities can be researched on by means of GMA - Evaluation of Managerial Prerequisites, which enables investigation into the structure of abilities closely related to successful work at high job positions in the field of industry, business and services. It contains three types of tests: numeric, verbal, and abstract. Each of them has two forms - "A" and "B." The verbal test is a means for diagnosing verbal comprehension skills and critical thinking, which are important at managerial job positions. It can well differentiate persons who are able to connect their abilities with practical judgement. The numeric test serves for finding out about the level of numeric judgement (it is not an arithmetic test) and provides data on the level of orientation in such numeric skills, which are becoming more and more required from a modern manager. The abstract test focuses on the abilities, which are - in psychological literature - called fluid intelligence, divergent thinking, inductive insight, and flexibility. It accentuates the level of cognition based on understanding the essence of the solution. The results are graphically displayed in tables of all measured values and the table of reactions on individual tasks including data on correct or wrong solutions, or whether a task has or has not been solved at all.

The potentials for affective heuristics, the presence and degree of emotional instability, are investigated into by NEO-FFI (NEO Five Factor Inventory by Costa and McCrae) adapted by Ruisel and Halama (2007). The questionnaire can be used for diagnosing the basic personality factors in adolescents aged 15 years and older and adults. It can be applied in counselling, clinical psychology, diagnostics in the personal sphere, as well as personality research. The inventory satisfies all psychometric criteria: construction, validity, and reliability.

Another option is Krohne' and Egloff's ABI Coping Inventory adapted by Vander. The Inventory is based on Krohne's (1989, 1993) model of coping and diagnoses individual differences in coping with anxiety, resp. stress in two major dimensions: vigilance and cognitive avoidance. It consists of two subtests: E -

captures coping with anxiety by individuals in situations, which are important for self-evaluation (e.g. exams, interviews, public speeches, sports matches, etc.); and P - measures coping with anxiety in physically risky situations (e.g. visits to a doctor or a dentist, before a surgery, etc.). Each subtest creates scales for measuring vigilance and cognitive avoidance. Alongside with that, the overall test - T - can be applied. The aim is to identify individuals, which have not developed appropriate strategies for coping with adversity, as well as leading these individuals towards a process of change. This inventory can be applied in the process of placing new employees. It satisfies all psychometric criteria, i.e. construction, validity and reliability.

5 System I and System II in the context of the new management graduate profile

For the purposes of the identification of key management graduate profile in the context of Industry 4.0 we used Kahneman's (2012) dual system.

Characteristics of System I (Kahneman, 2011):

- a fast system;
- generates impressions, feeling, inclinations, which can change to opinions, attitudes and intentions after being approved by System II;
- automatic, fast, and effortless functioning without intentional control;
- can be programmed by System II in order to attract attention when a model or a formula is detected;
- with sufficient training, it is capable of qualified reactions and generates qualified intuition;
- creates a coherent model of activated thoughts in the associative memory;
- phenomena of priming take place instead of a conscious approach (cognitive process, in which a stimulus from the past influences the future);
- creates a link between the feeling of cognitive simplicity and the illusion of truth with pleasant feelings alongside with decreased vigilance;
- distinguishes between surprising and normal;
- derives and invents causes and intentions;
- forgets about ambiguity and suppresses doubts;
- prone to trust and confirmation;
- overestimates emotional consistency (attachment);
- focuses on existing evidence and ignores missing evidence;
- generates a limited set of basic evaluation;
- represents sets according to norms and prototypes, it does not integrate;
- it compares intensity on various scales (size according to volume);
- carries out more calculations than necessary (mental shotgun);
- sometimes substitutes a complex question by a simpler one (heuristics);
- more sensitive to changes than to the status quo (prospect theory);

- overestimates low probabilities;
- shows a decreasing sensitivity to quantity (psychophysics);
- stronger reactions to losses than gains (aversion to losses);
- organizes decision making problems into frames in order to isolate them (framing);
- impressions of causality, tends to believe, the origins of religion embedded into the structures of System I (Bloom, 2020).

Characteristics of System II (Kahneman, 2011):

- a slow system;
- unwilling to invest more effort than required;
- in charge of doubting and not believing;
- conscious operations, intentional functioning requiring effort;
- engaged, analytical mode;
- estimates and calculates rates;
- makes decisions, manages System I;
- intentionally implements heuristics as strategic processes;
- approves or refuses heuristic responses;
- the slow System II often opts for the path of least resistance;
- capable of systematic and more caring approach to information;
- sorts and controls pieces of information;
- questions and tests hypotheses;
- unlike System I, it is capable of statistical reasoning;
- casual interpretation and acceptance;
- cognitive strain has a mobilizing effect on it;
- performs acts of self-control when it is necessary to overcome the need for intuition and the stimuli from System I;
- when the organism is overloaded, it is able to protect the most important activity and pay all the attention to it;
- makes mental effort at various pace: slow, running, sprinting...

Kahneman's (2012) dual system (System I and System II) served us as a source of inspiration for creating the below working characteristics:

Table 1

<i>Working characteristics</i>	
<u><i>Undesired characteristics:</i></u>	<u><i>Desirable characteristics:</i></u>
- high optimism + endurance	- optimism
- cognitive distortions – System I “What you see is all there is.” (Kahneman, 2011)	- correction of cognitive distortions, Klein's concept of Premortem Analysis (Klein, 2008)

- reluctance to change	- seeking challenges
- melancholic state of mind (a higher degree of uncertainty in decision making)	- sanguine state of mind (entrepreneurs)
- phlegmatic state of mind (a lack of energy in decision making)	- choleric state of mind (corporate managers)
- illusion of control	- risk taking
- the hypothesis of arrogance	- talents for something
- illusion of planning	- belief in good judgement
- ignoring competition	- ability to control
- ignoring the role of good luck	- admitting the importance of timing the moment and the role of good luck
- effect of superiority	- willingness to undergo questioning, insisting on statistical reasoning
- exclusive application of System I	- application of the slow System II
- excessive self-confidence	- high self-confidence compared to the norm
- inability to work with own mental contents	- control over own mental contents
- negative experiences	- experiencing success, abilities leading to success
- traumatic experiencing	- experiencing security
- over-engagement	- dual attention here and now vs. there and then
- inability to retreat	- good observer

6 Research experiment

The newly designed theoretical model of education will be applied at DTI University for three semesters in the second year of the bachelor's programme (winter and summer semesters) and in the winter semester of the third year of the programme both in the control group and in the experimental group. Prior to the realization of the experiment, both groups will complete entrance tests focused on the observed indicators. Concurrently, students' performance will be observed in the process of solving tasks throughout all three semesters together with their grades from the courses they will take. The basic principle is that the same teachers must work with both groups. In the control and experimental groups of students, such variables as critical thinking, level of numerical judgement, divergent thinking, inductive insight and flexibility, heuristics, intuitive thinking, heuristics of processing and solving problems through the experiencing self and remembering self (Kahneman, 2011) will be observed. The experimental verification will be carried restricted in time. As for the

outputs, motivation and performance in decision making under uncertainty will be the observed variables.

7 Benefits of the project

We see the benefits of the project in designing a new model applicable in preparing management students for the needs of Industry 4.0 in the fields of a managers' personality, i.e. managerial prerequisites, and in motivating management students. The model of key management graduate profile will be based on Kahneman's model of two systems and the model of experiencing and remembering self. As for the current curriculum, it will be analysed and the differences between the offered courses in management study programmes and selected theories of behavioural economics will be identified. Also a complex material, which can be used as a basic source of information for universities in recruiting students in accordance with Europe 2030 Agenda will be prepared.

Conclusion

The issues of Industry 4.0 in the context of management have not been systematically dealt with; there is a lack of publications on the key changes in profiling management as well as pre-gradual management study programmes with regards to the requirements of Industry 4.0. We believe that the model suggested by us will represent a contribution to the field of management and will not only bring the knowledge of the profile but it, based on the gathered data and in accordance with behavioural economics, has the ambition to suggest changes in management and in lifelong learning programmes and, in such a way, fill in a blank space in university pedagogy.

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