

The Use of IT Tools in the Assessment and Development of Leadership Abilities

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This paper aims to present the findings of research into the possibilities of deploying IT tools to support the assessment and development of leadership abilities. The research procedure consisted in an analysis of four case studies from the business and military sectors. The primary research methods were a case study analysis, participant observation, Development Centre, and a source literature analysis. Under individual case studies, the following techniques were applied: individual and group interviews, brainstorming, and role playing. The tools applied included psychometric software (Thomas International, Extended Disc, Talento) and military simulators. The division of roles between man and computer was investigated throughout two processes: business problem solving in metallurgical and mining companies, and conceptual work on incorporating IT tools in the teaching activities of a military school. Another important dimension addressed by the paper is the development of talents in an organization, which is illustrated by a case study from the metallurgical sector. Given the increasing opportunities for IT applications in developing leadership potentials, the article also deals with the mechanisms for implementing IT tools in the areas being examined. Based on the research conducted, it is concluded that contemporary IT technologies have substantially enhanced the processes of testing and developing leadership abilities, but have not fully automated them. In the context of the authors' research outcomes and based on an analysis of source literature, directions for further development are proposed.

Keywords: leadership, hiring, employment decision, psychometric systems, recruitment.

Wykorzystanie narzędzi informatycznych do badania i rozwoju predyspozycji przywódczych

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Celem niniejszego artykułu jest przedstawienie wyników badań w zakresie możliwości wspomaganie oceny i rozwoju predyspozycji przywódczych narzędziami informatycznymi. Zastosowana procedura badawcza polegała na analizie czterech przypadków z obszaru biznesu oraz wojskowości. Głównymi metodami badawczymi były metody analizy przypadków, obserwacji uczestniczących, Development Centre oraz analizy literatury. W ramach poszczególnych przypadków stosowane były następujące techniki: wywiady indywidualne i grupowe, burze mózgów, odgrywanie ról. Wykorzystane narzędzia to m.in.: programy

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psychometryczne (Thomas International, Extended Disc, Thamento) oraz symulatory wojskowe. Analizowano podział ról pomiędzy człowiekiem oraz komputerem w procesach rozwiązywania problemów biznesowych w firmach z sektora hutniczego oraz górnictwa, a także prace koncepcyjne nad procesem zastosowania narzędzi informatycznych w działalności dydaktycznej uczelni wojskowej. Kolejnym istotnym wymiarem tej problematyki jest rozwijanie talentów w organizacji, czego przykładem jest przypadek z branży hutniczej. W nawiązaniu do badań wskazujących na postępujące możliwości wykorzystania narzędzi informatycznych do rozwoju predyspozycji przywódczych w artykule podjęto również problematykę mechanizmów oraz zakresu wykorzystania narzędzi informatycznych w rozważanym obszarze. Na podstawie przeprowadzonych badań stwierdzono, że współczesne technologie informatyczne usprawniają procesy badania oraz rozwijania predyspozycji przywódczych, ale ich w pełni nie automatyzują. W odniesieniu do uzyskanych wyników oraz na podstawie analizy literatury zaproponowano kierunki rozwojowe.

Słowa kluczowe: przywództwo, zatrudnienie, decyzja o zatrudnieniu, systemy psychometryczne, rekrutacja.

JEL: L86, M51, M54

1. Introduction

Whether in an upmarket or a downmarket, effective leadership is just as important and figures among the most vital issues for any organization. Business leaders are expected to demonstrate expertise and commitment to delivering financial results as well as an understanding of their organization's position in a broader business context. Companies need efficient leaders to be able to cope in the increasingly dynamic market realities (Metrycki, 2015). The leadership style attuned to "competency-based organizations" requires managers to support their staff's development and influence the way they work (Moszoro, 2011). Leaders hence become enablers who provide inspiration and guidance for personal growth and involvement, driving their employees' job satisfaction and motivation (Bass, 1999). Leadership based on engaging employees in developing decisions and creating organization values is increasingly recognized (Rzycka & Porosło, 2015). Likewise, in military institutions, authoritarian approaches based on the traditional patterns of giving orders and enforcing actions are being abandoned in favor of leadership and the ideal role model of leader. The decline of traditional leadership/command patterns puts increasing pressures on the process of selecting and developing leaders. Today these processes require the application of standardized procedures to ensure that reliable HR information is acquired, burdened with just the slightest risk of subjectivity. Generational factors and changes in societal awareness triggered by modern technologies entail the need to not only adjust traditional leader selection and training methods to the characteristics of contemporary generations but also to embrace the abundance of technology tools available. Technological facilitation of communication and data processing has greatly extended human capabilities in lots of areas. Technology has given a powerful boost to traditional methods for personnel selection and staff development – such as interviews,

questionnaire surveys, tests, employee assessment, simulation techniques, assessment and development center, training games – making it possible to move them into the virtual world and execute the most complicated, costly and time-consuming procedures without human involvement. On the other hand, the development process continues to require the presence of a human (teacher, coach, trainer, mentor, psychologist, advisor), even though many operations can be successfully automated and the latest IT tools can be deployed to provide genuine support to the development and improvement of leadership abilities.

2. Theoretical Underpinning

2.1. Leadership Abilities

In psychology, an ability or predisposition stands for an innate tendency for specific behaviors or activities, or a natural gift, i.e. an extraordinary aptitude for doing something (Pieter, 2004). Everyone is born with a unique set of individual abilities. These innate abilities form part of our genetic heritage, i.e. they represent traits that one inherits from their ancestors. These abilities or aptitudes are often matched by preferences for performing specific activities. Owing to such abilities and preferences, a naturally gifted or predisposed individual has a greater chance of attaining a positive outcome with activities where these abilities can be put at work (Kulesza & Kos, 2010).

The latest research in the area of leadership abilities includes the study conducted by Sunnie Giles (Giles, 2016). Seeking to answer the question of what it is that makes an effective leader, researchers requested 195 leaders from 15 countries and over 30 global organizations to choose 15 crucial competencies from a list of 74. Based on neuro-biological information and the top ten skills indicated by the respondents, Giles proposed five major themes/priorities for leadership development programs: strong ethics and a sense of safety, empowering people to self-organize, fostering organizational learning, nurturing growth, and fostering a sense of connection and belonging.

Interestingly enough, the neuro-biological studies quoted by Giles show that people can also have biological “counter-dispositions” for certain behaviors, e.g. an inability to show behavior that is desirable in someone entrusted with a leadership role.

Organizations wishing to benefit from IT applications in exploring and developing leadership competencies can choose from a rich variety of all-purpose tools offered in the market. A/B level tests (i.e. usable by persons without psychological education) as well as C level assessments (i.e. those dedicated to professional, licensed psychologists only) are often applied in conjunction with simulation techniques. Psychometric tools, whose use

was once confined to psychology and psychiatry clinics and to diagnosing psychopathology, are now widely available to everyone for use in guiding one's personal and professional development. The market for work and organizational psychology tools has been growing rapidly for several decades. They have already become run-of-the-mill in occupational medicine, viz. in diagnostics for regulated professions, while their use in recruitment, selection and development processes has long been on the upsurge. Scholars acknowledge that more and more organizations will use psychometric tests in assessing leadership skills or creating balanced teams as well as to support their efforts at improving internal communication, enhancing performance and strengthening collaboration (Stabile, 2002; Bartram, 2004). What can fuel corporate attempts at leveraging test-based assessments is the need to identify personality traits or behavior patterns, determine IQs and values, measure emotional intelligence and cognitive skills, or obtain insights into motivations. Most such tests are model-based and can be traced back to a psychological theory or research concept that they were originally built around and before they were transformed into a computerized tool. Modern software applications are most commonly powered by the Big 5 model and the DISC model.

2.2. The Big 5 Model

One of the best known models used to analyze personality and define it in terms of traits is the Big 5 Model (Five-Factor Model) developed by Paul Costa and Robert McCrae. Its origins date back to the works of Hippocrates, Galton, Pavlov, Thurstone, Allport and Odbert, Cattell and Eysenck. Under this model, fundamental personality traits are grouped into five broad dimensions: conscientiousness, extraversion, openness to experience, agreeableness, and neuroticism. Conscientiousness is the degree of an individual's self-organization, persistence, and motivation for the pursuit of goal-oriented activities. Extraversion refers to the quality and quantity of social interactions as well as to the breadth of activity, energy level, and the capacity to experience positive emotions. Openness to experience reflects an inclination for positive attitudes and evaluations of life experiences, tolerance of novelty, and cognitive curiosity. Agreeableness describes a positive attitude toward other people, and interpersonal orientation manifested through altruism. Neuroticism denotes susceptibility to negative emotions and sensitivity to psychological stress. Each of the dimensions comprises a specific set of descriptors that account for the human personality. The model assumes that the dimensions are biologically ingrained (characterized by a high degree of heritability), universal (independent of e.g. race, gender, culture), and unchanging from childhood through adulthood. Based on the model, Costa and McCrae themselves developed test tools known as NEO-FFI and NEO-PI-R to measure each personality trait. Inventories examining the five super-factors are nowadays one of the world's most fre-

quently used assessment tools (Fazeli, 2012). On many occasions and across various cultures, they have proven their considerable psychometric merit (Chapman, 2007; Young & Schinka, 2001; Murray et al., 2003). They have been translated into many languages, both European and Asian, a fact that has fueled the expansion of international research on personality aspects and their correlates. Notably, the factor paradigm gave new momentum to leadership research and, over the past 30 years, has spurred rapid advances in personality theory, new inquiries into the cognitive properties of the human mind, and ongoing refinement of psychometric tools. Interesting correlations between leadership and the Big 5 model personality dimensions were unveiled by meta-analyses conducted by T.A. Judge et al. (Judge et al., 2002, 2004, 2006, 2009). Their evidence shows that there is a significant positive correlation between leadership and extraversion, conscientiousness and openness to experience, as well as a negative correlation between leadership and neuroticism.

2.3. DISC Model

DISC is a behavioral model based on the theory of William Marston (co-inventor of the first lie detector in history). The theory was first expounded in his 1928 book entitled *Emotions of Normal People* (Marston, 1928). The model's name was coined from the first letters of the English-language labels given to the primary types of human behavior, or emotional expression, that the model distinguished: D for Dominance, I for Inducement, S for Submission, and C for Compliance. Type D describes individuals who are self-confident, strong-willed, competitive and challenge-seeking, strongly focused on goals and results, good problem solvers, self-starters, and bold decision makers. Type I denotes optimistic, cheerful, sociable and emotionally expressive individuals with a positive sense of humor and infectious enthusiasm; persuasive peace makers and creative problem solvers that are great value to team; encouragers who can motivate others to achieve. Type S designates well-organized team players focused on collaboration and mutual support; loyal, dependable, warm and patient individuals; understanding and empathetic, good listeners; steady, predictable and change-resistant. Style C depicts thorough, conscientious and accurate individuals; analytical, risk-averse fact-finders who are quality oriented and procedure driven. Although Marston himself did not create a psychological tool to identify people's behavioral types, his theory inspired many so his followers spawned an array of practicable DISC-based tools that have found ample business applications, e.g. in hiring for managerial positions, designing development plans, and building employee motivation schemes.

2.4. Gamification

To put it simple, gamification means using the mechanisms, thinking patterns and aesthetics that stem from the world of games to engage people

and galvanize them into action, to promote learning and to facilitate problem solving (Kapp, 2012, p. 10). It is about adopting a framework anchored in the earliest human experience that evolved through games and fun activities, it is a summons to unleash creative thinking and immerse in an environment where new approaches to tasks and responsibilities are welcome. Gamification is therefore a process whereby a more stimulating and more rewarding work experience can be offered. Those who are most likely to benefit from gamification are hence creative, self-governing individuals with a competitive streak and independent spirit (Cardador, Northcraft, & Whicker, 2017). However, positive feedback provided by games is highlighted in the context of developing cognitive competencies of both young and older people (Anguera et al., 2013; Chmielarz & Szumski, 2016). What today's business trainers find extremely challenging about shaping leaders of the digital generation is dealing with millennials themselves, as they will respond to very different stimuli than former generations would (e.g. they will require quick and short responses mimicking human-machine dialog, expect utmost proficiency in performing repetitive, even if parallel, actions, and show aversion to divergent thinking). Weak leadership can affect organizational performance in multiple ways, leading to inflated costs, shrinking productivity, declining employee involvement, growing dissatisfaction, misconduct or rebellion and, consequently, escalating staff turnover. It is several years now since the US Army began using games to develop such key competencies as leadership (Roth, 2011). While soldiers may be well-trained in hard skills, e.g. the use of weapons or war tactics, gamification has proven to be key to upgrading their soft skills, related e.g. to socializing, identifying micro-expressions, or understanding value systems and standards found in other cultural environments.

3. Tool Basics

3.1. Origins of the Problem

Whether a social group, a small or medium-sized business, a multinational corporation, a nation or state, all of them seek the best leaders they can get – to thrive and face the challenges of tomorrow. A key lesson that has been learned over the years from assessing and developing leaders is that what makes the real difference is the tools that humans use as catalysts for action, or, in other words, the “secret attributes” of experts, managers, engineers, and innovators. In the wake of that realization came the proclamation of the “War for Talent” in the late 1990s and ensuing proliferation of talent assessment and development tools emerging from the Human Resource Development domain. By then, the possibility to deploy IT tools in the HRD area had already been signaled by e.g. Synodinos and Brennan (1990), who predicted that “beyond the radically

changing nature of business research, interactive computerized software would become the preferred method for collecting and analyzing survey responses.” Extensive comparative studies focusing, on the one hand, on projects implemented by traditional “paper-and-pencil” methods and, on the other hand, on approaches utilizing specialized IT tools have contributed to significant improvements in the capabilities offered by such tools and to a better understanding of the opportunities inherent in extending their practical application.

3.2. Overview of Selected Psychometric Tools

Thomas PPA

One of the most popular tools based on the DISC model is the Thomas PPA questionnaire, developed by Thomas Hendrickson around the turn of the 1960s. The questionnaire became part of the Thomas International Management Systems – a complex system of diagnostic solutions and tools available in more than 60 countries and 56 languages. Hendrickson extended the DISC theory so that it could be used in professional environments, thus designing the classical Thomas PPA questionnaire that was published in 1958. The PPA is an ipsative test based on self-assessment. This means that it describes people in the way that they perceive themselves without benchmarking against the standard for a given population. Essentially a forced-choice questionnaire, it consists of 24 rows of descriptive words, from which the individual being examined chooses the terms that apply the most and the least to his/her style of behavior. The procedure requires making 48 choices from among 96 descriptors, and takes about 8 minutes to complete. The Thomas PPA tool is subjected to reliability and validation tests. It has a Registration Certificate of the British Psychological Association (BPS), affirming that it fulfils all psychometric criteria for this type of tool. It has also been tested against the technical standards determined by an international validation authority affiliated with the European Federation of Psychologists’ Associations. Importantly enough, it can be used online.

Besides describing individual behavioral styles, the tool helps determine a person’s strengths and limitations, communication style, values added to the organization, key motivations and fear factors, and his/her likely performance under pressure. Hence, it can too provide valuable insights into his/her managerial potential in such areas as: management and motivation, decision making, planning and problem solving, communication style, administrative skills, and commitment to the professional development of staff. Additionally, it can identify the individual’s immediate training needs, indicating areas where investments are likely to bring payoffs. The outcomes are delivered in the form of transparent reports that are easy to generate and easy to interpret. In summary, the Thomas PPA is a robust tool that

can meet a number of specific requirements, yet particularly efficient with the identification of leadership abilities.

Extended DISC

Another tool based on the DISC model is the Behavioral Analysis Questionnaire Extended Disc®, being part of the digital tool known as Extended Tools. The questionnaire was developed more than 20 years ago and is founded on the above-mentioned theory of W. Marston (1928) and the theory of psychological types by C.G. Jung (1923). The questionnaire is used in more than 40 countries worldwide. The vendor declares that detailed statistical analyses are conducted in every country where the tool is used. The tool measures the concentration of individual behavior styles (from amongst the DISC list) in a respondent's potential and the linkages between them. In addition, it offers an insight into which behaviors associated with performing responsibilities typically assigned to a leader (questioning the status quo, setting challenges, persuading, motivating, relationship building, supporting, planning, assuring quality, etc.) are easily handled by respondents and which require greater effort on their part. The questionnaire thus distinguishes between effortless behaviors (more comfortable ones), corresponding with their natural abilities and talents, and behaviors calling for deliberate effort, concentration, and energy (less comfortable ones). The underlying theory has it that individuals are capable of developing any behavior as long as it falls within the area of their conscious developmental effort. What can be also derived from the assessment is information on motivating and de-motivating factors, and a warning list providing a description of the individual's fears and vulnerabilities, e.g. an unpredictable reaction to stress exposure. Drawing on the theory of Jung, who tracked differences in personality to the way that a person thinks and processes information, it could be stated that, in a manner of speaking, the assessment portrays an individual's mind, with its prevalent pattern for receiving (perception, intuition) and interpreting information (thinking, feeling), hence revealing specific traits attributable to a mentality type. On the other hand, the tool does not give a complete picture of an individual's cognitive abilities/capacity. However, overall, it is a fairly advanced tool that proves particularly effective in supporting sales training.

Thalento® (TH-PQ)

Another questionnaire-based tool built around the Big 5 Model by Costa and McCrae and Murray's motivation theory is the Thalento® Personality & Motivation Questionnaire (TH-PQ), forming part of the cloud-based Thalento® diagnostic platform (TH Cloud). The Thalento tool establishes the traits and criteria determining an individual's behaviors and performance in a workplace context. The questionnaire is an assessment tool accessible online, measuring 30 indicators of activity, behavior, attitude, and motiva-

tion. The tool is available in 26 languages and undergoes thorough scientific validation. It relies on local standardization groups for its adaptation to usage in diverse cultures. The tool's reliability is warranted by massive international research involving the use of the TH-PQ questionnaire that has enabled the Talento® R&D department to collect a rich body of data and juxtapose it with data on hundreds of managers evaluated via the Assessment Center method. In this context, the Talento® model can be seen as a universal set of competencies expected of individuals holding managerial positions. The model covers all of the activities and responsibilities usually attributed to the management function, spanning across five areas: decision making, people management, adaptation to environment (flexibility), problem solving, communication, and exerting influence. For each of these five areas, three key competencies were isolated, making up a total of 15 key managerial competencies. All competencies are assessed on a five-grade scale in relation to a reference group. Appended to that quantitative assessment is a description of an individual's management style and personality traits (under the Big 5 Model), and a listing of personal motivators and needs. Overall, albeit not as popular as Thomas or DISC, Talento has already come to be widely used in personnel recruitment and, importantly enough, has been found to run smoothly in a cloud computing environment.

3.3. Evolution Trends

At the current stage of our civilization's advancement, as talent management is becoming a central problem and as IT technologies, notably data management and artificial intelligence, are increasingly at hand, traditional solutions such as face-to-face interviews and resumes or "paper and pencil" projects will not suffice to anyone. On the other hand, despite the accelerating pace of innovation, embracing new solutions is a risk-encumbered process that may not always be as seamless as expected. The following could be underscored among the developmental trends that have already found their practical applications:

Unproctored Internet Testing

It has already been mentioned that a number of psychometric assessment tools have been developed into computer applications and can be run online via the Internet. The model called Unproctored Internet Testing (UIT) is a singularly popular solution. As the name suggests, under the UIT there is no proctor administering tests or a network administrator monitoring test events. A lot of people can be tested simultaneously, and the assessment results are returned instantly on an ongoing basis. This obviously poses new challenges and entails special requirements regarding identification, monitoring, and safety. The two key concerns are test safety and test taker's honesty. While these issues have not been resolved completely, over more

than 30 years it has been possible to lay down reasonable guidelines for computer-based and internet-delivered testing (Bartram, 1987; Bartram, 2009; Pulakos & Kantrowitz, 2016) that now underpin two international standards: the European Euro-Test-WO and the global ISO-10667 standard.

Mobile Assessment

Observation of the IT market clearly indicates a trend for replacing computers with smartphones. Software companies are catching up quickly by releasing mobile versions of their flagship products. While appreciating the convenience of mobile devices and exploiting their obvious advantages, it is advisable to be realistic about their drawbacks: some researchers (Arthur et al., 2017; LaPort et al., 2016) have pointed out e.g. inferior results for cognitive functions on mobile vs. non-mobile devices, valid complaints about unreliable Internet connectivity that tends to vary with location, limitations associated with physical size that make it difficult to display large tables and graphics, or changing weather conditions (e.g. sunshine) that may cause problems operating the device (e.g. scrolling) or even interrupt communication.

Simulations

Simulations can demonstrate how a candidate performs in the workplace context or other real-life situations. As a precondition, evaluators themselves must know precisely how the activities should be performed. Simulations may be time-consuming or/and expensive to develop. Although scores still happen to be awarded by trained assessors, most evaluation and feedback processes are these days automated. In recent years, the use of simulators has increased significantly (e.g. the Mettl platform skyrocketing between 2016 to 2017 with spectacular 219% growth in talent acquisition applications).

Computerized Adaptive Testing

It is an intelligent computer test that smartly adapts to each test taker's skill level. Intelligent adaptive testing systems emerged as an attempt to address dissatisfaction with the way that conventional exams measured skills using pre-defined sets of questions and offering an outcome without any further analysis. In an adaptive system, if the test taker answers a question correctly, the following question is tougher. On the other hand, if the test taker fails to respond correctly, an easier question follows. This process continues until the test taker's skill level is established. Adaptive computer-based tests ensure greater safety, reliability and efficiency of assessment while using fewer questions to accomplish the assessment task. Since each test instance is different, cheating is much less likely to occur.

The above examples of recent supportive technologies represent just the tip of an iceberg, being barely emblematic of the actual capabilities and advances. It has already been observed in the introductory chapter that not all possibilities that we have seen or envisaged ever reach the stage of implementation. Experience shows that successful, full-fledged implementations are, more often than not, the cases of simple and well-prepared solutions. Things get much more difficult with sophisticated designs based on the discovery approach and unproven methodologies. An interesting compilation of unrealized ideas has been presented by Ann M. Ryan and Eva Derous (2019). Some authors, like Charles Handler (2015), go as far as contending that the ongoing technological progress is bound to soon make all of the current solutions obsolete.

Further discussion in this paper will center on solutions with a large market share but negligible growth, such as psychometric tests, and on solutions having a small market share but experiencing impressive growths, such as simulations.

4. Case Studies

4.1. Research Questions and Research Procedure

The preceding leadership discussion has some practical implications that appear relevant to the functioning of organizations. A service company recruiting and developing premium talents for business companies must not only be able to identify and meet customer requirements, but also to determine and negotiate the right working conditions for those with high-grade leadership abilities. In parallel, a military school headquartered in a NATO member country faces the need to recruit talents with leadership abilities and to help these abilities flourish. Further, it is just as necessary to boost learning and develop knowledge in organizations. In this context, the following research questions could be raised:

1. To what extent can modern psychometric systems satisfy the practical needs for assessing and improving leadership abilities?
2. Is the use of psychometric tools justified in the admissions process for an institution of higher education training future military leaders?
3. Can gamification, involving the use of advanced computerized simulators, effectively support leadership development?

These research problems were in focus when taking successive steps in a research effort that yielded the following four case studies. Based on the theoretical and tool-related underpinnings discussed in the previous chapters, a research procedure was designed that is described in Table 1.

Tested sample	Case description	Research actions	Theoretical basis	IT tools
1.	Recruitment of production line managers for a metallurgical company	Concept. People selection. Computerized assessment. Outcome processing. Traditional interviews. Results analysis. Reporting and delivery of results.	DISC Model	Psychometric tool Thomas PPA
2.	Training and development plan for a metallurgical company	Diagnosis. Reports. Providing feedback to participants. Assessment of potentials. Preparation of recommendations. Support for individual development plans.		Psychometric tool Extended DISC
3.	Recruitment of students for a military school	Master's thesis concept. Thalento in support of online training, delivery of licenses and documentation. Thesis development. Expert support for results interpretation (turned out to be unnecessary). Results analysis.	BIG 5 Model	Psychometric tool Thalento
4.	Development of leadership competencies in a military school	Preparation of de Bono discussion. Brainstorming sessions in relevant lectures. Virtual forum discussion. Development of Master's thesis concepts and their implementation.	Gamification	Simulators LLS, VBS 2, and others

Tab. 1. Research procedure. Source: Own study.

4.2. Case Study 1

A metallurgical industry company set out to align its organizational structure to the inflow of orders for its key products (new contracts). It was estimated that, over long-term, manufacturing plants would experience increased demand for production management competencies. Thus, the company resolved to launch a 1.5-year development program geared to training selected employees from within the organization to assume management roles in production. An internal selection process was carried out, where managers recommended their employees for participation in the program based on the managerial competencies model that was in place in the organization. The main objectives of the program were defined as follows: support individuals preparing to adopt new roles, equip them with the knowledge prerequisites for the new position, and develop their leadership skills. The program was individualized to the greatest possible extent,

placing special focus on personalized development plans for leadership competencies. To this end, information on the candidates' strengths and areas for development was sourced from their direct supervisors. A Thomas International® IT tool was then used to determine the managerial abilities of each of the candidates, and structured interviews with the candidates were conducted (composed of biographical and competence-related sections and a discussion of developmental needs). The online assessment employing the Thomas PPA did not encounter any problems. Subsequently, the assessor retrieved the candidates' personal profiles generated by the system, outlining their strengths and limitations, communication styles, values added to the organization, key motivators, fear factors, and likely performance under pressure. In the next step, the assessor was given access to further reports automatically compiled by the system. Insights from the report *Description of managerial abilities – audit* proved exhaustive, illustrating the following areas of the test takers' work performance: management and motivation, decision making, planning and problem solving, communication style, administrative skills, commitment to the professional development of staff.

The interviews were conducted with all of the candidates and were based on the same standardized form. Each interview lasted about 90 minutes, and all the answers provided by each respondent were recorded in writing. The responses were conveyed to the candidates, their superiors, and the HR department through a comprehensive report that combined the Thomas PPA test findings with the interview results and was broken down into four sections: candidate's general profile, description of managerial abilities, strengths and weaknesses, and further development recommendations. In addition, each candidate was given direct feedback on his/her individual results from a Certified Thomas PPA Consultant.

4.3. Case Study 2

A mining industry company sought to develop a training and development plan for their managerial team. The program was supposed to be individualized to the greatest possible extent based on a prior identification of each of the managers' strengths and areas for development. Development center was chosen as a method for diagnosing the existing managerial competencies. The Extended DISC tool was additionally selected as a method for testing managerial abilities. The objective of the development center was to obtain an independent assessment of the participants' competencies against the competence model adopted for relevant roles in the organization, provide feedback to the participants about their strengths and areas for development, prepare development recommendations, and support participants in building their individual leadership competence development plans for the year to come. In the development center process, the following five competencies were measured: effective communication, people management, result-orientedness, problem solving and decision making,

change management. The competencies were evaluated on a five-grade scale and across four tasks: simulated discussion among co-workers, simulated discussion with a subordinate employee, a business case study followed by a presentation of its findings, and a structured interview using the STAR[®] method. All of the tasks had been tailor-made for this particular assessment session to ensure their close alignment vis-à-vis the specific set of competencies adopted for the role. The Extended DISC assessment ran online on an Internet-based testing platform. All of the questionnaire items were conveniently displayed on the screen, and the test takers had no problems operating the system, even though they were first-time users. The process was unproblematic and progressed without disruptions. As soon as it was complete, the Extended Tools system automatically generated the *I, the Leader* reports including descriptions of the test takers' natural predispositions (natural behaviors) on which to best build up new skills and develop their managerial potential, as well as descriptions of less natural behaviors that lie outside the comfort zone and can only be developed through deliberate effort. The results of the Extended DISC test served as an additional source of input for the assessment of leadership abilities performed in the development center and for personalized development recommendations. At the close of the development center process, each participant received a written report (copies handed over to supervisors and the HR department) containing quantitative and qualitative assessment results alongside developmental recommendations, and individual face-to-face feedback sessions were carried out with a Certified Extended DISC Consultant.

To address the research question “To what extent can modern psychometric systems satisfy the practical needs for assessing and improving leadership abilities?”, structured interviews were conducted with the users of the IT tools applied in assessing and developing leadership abilities. The conclusions were as follows: the interviewees saw it as paramount that the entire assessment procedure could be tackled by an information system; they placed most emphasis on the convenience of automatically requesting the intended respondents to fill out the questionnaire, obtaining their consent to the processing of their personal information, and the facility of tracking the whole procedure on a computer screen. They also pointed to the ease of automated processing of input data and of generating quantitative as well as qualitative reports across bodies of data. Last but not least, they liked the possibility of merging the online survey results with the output of other assessment instruments, such as assessment/development centers or traditional questionnaire surveys. On completion of the survey, it was ascertained that all of the psychometric systems being examined, i.e. Extended Tools, Talento and Thomas PPA, can meet all of the needs voiced by users in the interviews.

4.4. Case Study 3

In a cadet training institution, a test was conducted as part of a Master's degree project (Pływaczyk, 2019) aimed at verifying a hypothesis on the viability of applying computer software to effectively support the identification and assessment of leadership abilities. The use of psychometric tools was postulated. The research process involved a simulation experiment (Kowalczyk, 2016) whereby 40 students took part in a leadership abilities assessment employing the Thalentio (PH) system. In the experiment, the software was found to be ideally suited for the assessment of leadership abilities. In the first place, the software relied on the Big 5 personality model – one widely known, proven empirically, and grounded in solid research (a high correlation between dimensions in the model and leadership traits). Second, being founded on Henry Murray's motivation model, the software does not downplay such aspects as personality-related motivators, providing insights into an individual's source of motivation. Third, quantitative results returned by the software help specify the level of meaningful leadership abilities that an individual demonstrates. Fourth, the underlying technology allows intuitive usage by both the test taker and the test administrator, permits instant analysis of results, and ensures reliable protection of confidential data. In its computerized form, the test was seen as a much more comfortable solution than completing paper-based questionnaires. For the test taker, it reduced the workload related to filling in the answer sheets, for the test administrator – it removed the need to migrate the answers into the calculation program for further analysis and interpretation. At the same time, it eliminated errors arising through manual data input. It was concluded that the program could offer most valuable assistance for selection processes involving a large number of candidates, since it allows the user to define custom screening parameters to short-list candidates by producing a ranking of best matches. Further, in selection and development processes where questionnaire methods are employed alongside other tools (for instance, the assessment and development center method), the wealth of quantitative data supplied by the software can be easily incorporated into further in-depth analysis of the participants' abilities or competencies. Vis-à-vis the control group, the experimental group acquired insights that can guide their choices of study majors as well as their pursuit of individual learning paths or group learning objectives. Both the discussion of findings and the conclusions stressed the remarkable amount of information that the questionnaire can provide on every individual examined. Given the fact that this information pertains to leadership abilities, motivational factors and behaviors exhibited in a variety of situations, such tests should definitely be performed on candidates for preparatory military service, helping identify leadership talent to make commanders of the future (Pływaczyk, 2019).

4.5. Case Study 4

An institution of higher military education held a test involving simulation tools available to cadets and aiming to verify a hypothesis on rationale for gamifying the development of leadership competencies. The primary research problem was to identify the potential that the IT tools known to cadets had in relevant areas. The first step was a research experiment geared solely to introducing approximate quantitative measures (Dolik, 2019). The experimental group was made up of mechanized infantry units that did not use the laser shooting simulator in their first year of leadership training. In the second year, however, the group started using the simulator. The first data series produced showed evaluations given by the cadets (mechanized infantry majors) to their leadership training program prior to the simulator experience, while the second series showed scores awarded after the experience.

The percentage distribution of grades shifted as follows, POST-experience cadets relative to PRE-experience cadets:

- the number of Excellent (5) grades grew by 57%;
- the number of Very Good (4.5) grades increased by 50%;
- the number of Good (4) grades 4 rose by 64%;
- the number of More than Satisfactory (3.5) grades decreased by 29%;
- the number of Just Satisfactory (3) grades dropped by 93%.

At the same time, the mean score awarded by the platoon being examined grew from 3.57 to 4.19. Arguably, the statistics are indicative of the following facts:

- improvement in the cadets' performance,
- improvement in the cadets' engagement,
- improvement in the cadets' morale,
- improvement in the cadets' knowledge,
- improvement in the cadets' leadership skills,
- improvement in the cadets' self-organization,
- improvement in the cadets' responsibility and awareness.

The next step in the hypothesis verification process was a brainstorming session conducted during a relevant lecture using de Bono hats. The heated student debate was followed by a discussion held in virtual space (about 200 comments). Selected excerpts from the virtual forum are presented in Table 2.

Hat	Selected comments on VBS 3 and LSS simulators ¹
Facts	One of the simulators that I have had experience with is the VBS simulator. VBS simulators originate from Operation Flashpoint – a Czech FPS class computer game marketed in the first decades of the 21st century. What differentiated it from its competitors was unique complexity and an option to edit scenarios. VBS 3 is a virtual tactical simulator, offering a wide range of training opportunities...

Hat	Selected comments on VBS 3 and LSS simulators ¹
Intuition	Today's technology solutions enable you to move into a simulated battlefield, developing your leadership abilities, your sense of tactics, and your physical fitness, as long as the product you are running is equipped with sensors that help reflect the movements of a soldier in the combat simulator.
Critical review	The system does have some flaws, too. In LSS, the beam flies along a straight line at the speed of light rather than at a specific speed along a parabolic trajectory, like a bullet would. Sometimes it is difficult for the shooter to determine if the opponent has been hit as he/she can be hidden in thick grass... VBS is an excellent tool for simulating battlefield, yet targeted primarily at higher-ranking soldiers. This is because the simulator is oblivious of the motivations of soldiers, their goals, desires, morale, and physical endurance. In real combat, nothing is as easy as clicking a simulator button; you have to interact with your subordinates in ways that VBS cannot imitate. Numerous scientific studies have emphasized human morale as a decisive factor in the battlefield.
Benefits	After a few months training with VBS 3, our ability to make decisions has visibly increased. Most of all, firing commands now make more sense, and cooperation between crews and squads has much improved. Our tactical imagination is better and we make decisions a lot more quickly. With the LSS, soldiers get used to situations where they aim at other men, fire and eliminate them from the battle. Commanders in charge of operations seem to actually lead their people. However, whenever an error is made (e.g. marching while leading a platoon of tanks), simulators allow us to go back and analyze the incident thoroughly.
Innovation	I think it would be an excellent idea to combine the best features of VBS 3 and Beskid-2M/K simulators. Setting up a training facility where they would operate at platoon level while each team could use them, might be a breakthrough in the training of tank crews. And, by the way, LSS could be extended to include real (rather than virtual) aviation and artillery.
Summary	You cannot get perfectly trained using simulations alone. Although this kind of training should obviously be complemented with field training, it is an important and useful option for ranks and files as well as for commanders that can facilitate their upskilling and advancing their military careers. It is also vital for any modern army that depends so heavily on having highly qualified personnel at every level.

Tab. 2. Excerpts from a discussion conducted with the use of de Bono hats. Source: Own study.

The findings of further research, including detailed specifications and quantitative data, are reported in two Master's theses².

Military simulations³, where theories can be tested and refined without the need to engage in actual combat operations, are widely used by leading schools educating future army commanders. Currently, these are mostly hybrid solutions designated as LVE – a blend of real (Live), virtual (Virtual) and constructive (Constructive) components. Involving soldiers in drills employing modern technology develops their ability to lead, plan and make decisions. Computerized modeling and simulation systems make it also possible to practice analytical skills that are instrumental in processing

data incoming from the battlefield, and hence diagnosing and rectifying errors, monitoring the operations in progress, and staying ahead of developments via modeling, planning and projecting moves. Further, simulator tools provide a safe environment for multilateral exercises focusing on cooperative skills or testing for compliance with NATO interoperability standards. Most simulation devices offer an option to work back through the training program and analyze individual performance or strengths and weaknesses. In that way, military school students can see the consequences of their decisions before harm is done that cannot be undone.

5. Conclusion

Quantitative research reveals continued expansion of psychometric systems into leadership abilities assessment and leadership training, clearly driven by ease of use and increasingly superior results delivered by such systems vis-à-vis traditional “paper-and-pencil” approaches. The remaining challenges are to identify preconditions for successful implementation of projects involving the use of psychometric tools, and to explore pathways toward further enhancements.

Modern psychometric systems are built on solid theoretical foundations and are subject to scientific validation. They usually come with prestigious accreditations, are culturally adapted, and comfortably meet such quality criteria as objectivity, honesty, accuracy, and standardization. On the IT side, they keep evolving in line with end users’ changing needs (they can operate online and in clouds; they are available for mobile devices, albeit in some cases for selected operating systems only; they have user-friendly interfaces and multimedia content to support self-study).

The case studies described in the paper highlight the benefits over traditional paper-and-pencil approaches, help delineate roles between humans and computers, and indicate scope for further refinement of existing IT tools. This is particularly visible in the first case study presented, where a metallurgical sector company experiencing explosive growth would initially search management talent outside the organization. However, the poor retention of personnel thus hired, coupled with the high costs associated with the “continuous and traditional” recruitment process, brought the company to a point where a decision was made to rely on its own talent and the use of IT. There were two decisive factors that led to a speedy implementation of the project: first, because the company already had the manager profile in place, a list of acceptable candidates could be easily, even if manually, made; and second, the choice of a very efficient Thomas International® module that adequately assessed the candidates’ individual abilities as well as their training and development needs. What was done the traditional way were face-to-face interviews consisting of a biographi-

cal and a competence-related section alongside an analysis of individual development needs. A supporting module to handle the recording, maintenance, analysis and presentation of multi-dimensional data could significantly reduce administrative workload, hence streamlining the interview process. Large projects, on the other hand, could benefit the most from machine learning or big data support.

The mining industry project, concerned with the training of the company's own leaders, was more difficult to accomplish. Unfortunately, the company did not have a suitable framework in place, which was a significant risk factor in the project. The team of seasoned implementers used the development center method to perform the competencies assessment, and the Extended DISC module for participant selection and classification (*I, the Leader* reports). Classifications generated by the software turned out to strongly converge, indicating a homogeneous participant group. Recommendations derived from the case study are as follows: firstly, development center users would certainly welcome support from a dedicated module; and secondly, that other solutions could fit other specific settings and contexts, e.g. a computerized adaptive test powered by an artificial intelligence algorithm, or a more labor-intensive version relying on simulations (where largely heterogeneous input data are expected to arrive).

The third and the fourth case involved a military school. In the third, classifications offered by the *Thalento* system were highly divergent. All that was needed for their basic analysis and presentation was an Excel spreadsheet. The only missing element seemed to be an IT platform for collecting, maintaining, integrating, and presenting each candidate's scores across different evaluation criteria (e.g. secondary school grade point averages, language test results, physical fitness assessment, psychological tests and occupational aptitude tests). Developing leadership competencies was a much tougher challenge to address. Bearing in mind the American experience, the project team considered the option of gamification around military simulators. During a brainstorming session, some of the students on the team observed the absence of solutions focusing on soft skills that could be critical to the advancement of a military career. That led them to the conception of a leader support system that is fully responsive to the leader's determinations and governs a gamified process of training for motivation, morale, and endurance.

The deployment of new IT solutions to the recruitment and selection or the leadership abilities assessment processes has tremendous quantitative effects, taking the calculation and delivery of results onto an entirely new level of efficiency, and opening new vistas on practicing established methodologies. At the same time, the outcomes can be presented in a form that is easier to understand, maintain, retrieve and reuse across platforms by both the test administrator and the test taker.

Endnotes

- ¹ For brief descriptions of the simulators, see <https://www.awl.edu.pl/en/vbs-3>.
- ² The social science portion of the research carried out in Poland's Armed Forces has been classified and encoded for national security considerations.
- ³ A term replacing the former notion of war games as less related to the market for popular games targeted at a wide user audience.

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