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The Skills' Gap of Management Staff in Poland: Results of a Research of IT Companies*

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Abstract:

Purpose: *This article attempts to answer the following questions: What key competences and skills should characterise managers in the information technology (IT) sector; is there a skills' gap, that is, a discrepancy between the desired and actual skills of IT managers; and what activities can contribute to minimising the identified skills' gap?*
Design/Methodology/Approach: *Answering the above-mentioned research questions required reviewing the literature on the subject and conducting research. The research covered 504 managers representing all levels of management in IT companies operating in Poland. The collected data were subjected to statistical analysis, based on which conclusions were drawn.*
Findings: *It has been found that the smallest skills' gap includes: using technological solutions efficiently, cooperating with others, disposing of the knowledge possessed and drawing conclusions based on one's own mistakes. The greatest skills' gap occurs in the areas of obtaining funds from outside an enterprise, making accurate assessments of the emotions occurring in a team, and making accurate personnel decisions as well as correcting mistakes, synthetic thinking and managing finances properly.*
Practical Implications: *The presented results on the skills' gap is part of a wider research project aimed at identifying and assessing the levels of the key competences of managers employed in IT companies. In order to minimise the identified skills' gap, specific actions were recommended to be taken to improve these skills.*
Originality/Value: *The value of the conducted research procedure is the identification of key skills of tactical and operational level managers of IT companies and their arrangement due to the size of the gap between the actual and desired state. Actions to improve key managerial skills were also identified. These activities may help increase the effectiveness and competitiveness of Polish IT companies.*

Keywords: *Key competences, skills' gap, managerial competences, managerial skills, IT companies, Industry 4.0, strategic management.*
JEL codes:
Paper Type: *Research Paper.*

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1. Introduction

Competences occupy a special place in management sciences. They play an important role in finding answers to the question about the sources of a company's competitive advantage. Managerial competences vary depending on the industry, the specificity of a manager's work or the requirements set for a manager. It is therefore postulated shaping key competences, that is, those competences that people holding managerial positions need for self-fulfilment and personal development, social integration and employment, as well as being active in an organisation. Developing a set of key competences is now becoming a strategic goal not only at the level of enterprises, but also at the socio-cultural environment level. The key competences of managers are particularly important in the IT sector (Gang *et al.*, 2014). Due to the positively assessed role of this sector in stimulating socio-economic development, various initiatives are undertaken aimed at making this sector more dynamic.

These initiatives take the form of support instruments aimed at reducing development barriers and strengthening the development opportunities of enterprises. Support for enterprises representing the IT sector (Kanovska and Tomaskova, 2012) is also related to strengthening the potential of managerial personnel. Their competences have a significant impact on a company's success or failure. The importance of the issue prompted the authors of this article to conduct research aimed at identifying the key competences of IT managers and assessing the gap in skills, which are among the components of the key competences (Hua and Sijie, 2021). The problem outlined above was the basis for the formulation of three research questions that defined the scope of the research described in this publication:

RQ1: What key competences and skills should characterise the managers of companies in the IT sector?
RQ2: Is there a skills gap, that is, a discrepancy between the desired and actual skills levels of IT managers?
RQ3: What activities can contribute to the minimisation of the identified skills gap?

This article describes the results of the research aimed at identifying the key competences and skills of IT managers and assessing the gap between the expected and declared managerial key skills, and indicates the directions and methods for improvement.

2. Skills as Components of Key Competences

Researchers have been exploring the issues of managerial competences in Poland and abroad for many years. The concept of competence was first used by the American social psychologist D. McClelland in the late 1960s and early 1970s. A breakthrough in interpreting the concept of competence was the emergence of a definition by R.E. Boyatzis, according to which competences are the sum of general

knowledge, motivation, features, ideas about oneself, social roles and the skills that are necessary for the proper performance of one's job (Boyatzis, 1982). Since then, many definitions of competences have appeared in the literature on the subject. The analysis of the definition of competences allows two approaches in defining this concept to be distinguished.

The first links competences directly with a human being – personal competences (Friensen and Anderson, 2004; Dessler, 2009; Whiddett and Hollyforde, 2003; Woodruffe, 2003). The second of these approaches, on the other hand, links competences with the job and / or position performed (Cheetham and Chlvers, 2005; Dubois and Rothwell, 2003; Bach and Sulikova, 2019; Huang *et al.*, 2019). Regardless of these differences, most authors of both approaches struggle with the need to define the components of competences (Quinn *et al.*, 2021).

Namely, they find it difficult to indicate what constitutes the Boyatzisian 'potential existing in a human being', which is revealed in action and allows them to perform work at an appropriate level. It has been most often emphasised that the main components of competencies are knowledge, skills and managerial attitudes (Hörisch *et al.*, 2015). Authors believe that competencies are the knowledge, skills and attitudes related to the performance of specific activities, regardless of the manner in which they were acquired and whether they have been confirmed by a validation procedure.

A similar approach to competences is presented by Bartkowiak *et al.* (2020), who claim that competences concern the harmonised use of abilities and personality traits, as well as acquired knowledge and skills in order to successfully complete a complex mission within an enterprise (Ribeiroa and Amaralb, 2021). Thus, competencies concern what an employee should do and how they should do it (Jarosz-Lewandowska, 2016). Managerial competences, on the other hand, constitute a manager's potential, including their personality, knowledge, skills, attitudes, experience and responsibility, which remain in a cause-and-effect relationship with the behaviours that determine efficient management (Milton *et al.*, 1999).

Competences differ depending on the industry (Grzybowska and Łupicka, 2017), the specifics of the work and the requirements set for managers. It is therefore postulated shaping key managerial competences, that is, those that have the greatest impact on the effectiveness and efficiency in carrying out managerial tasks in a managerial position (Lakstigala and Balina, 2019).

This approach is also reflected in the recommendations of the European Parliament and the Council of the European Union of 18 December 2006 on key competences for lifelong learning (2006/962/EC). The European Parliament and the Council point out to the member states of the European Union (EU) the need for all people to develop key competences as part of their lifelong learning. Key competences are

defined in this document as a combination of the knowledge, skills and attitudes appropriate to the situation.

This article assumes that managerial competencies are a special case of competencies in general and mean the ability of persons holding a managerial position to effectively use their knowledge (Sammour *et al.*, 2008), skills and attitudes to achieve organisational goals. Moreover, it has been assumed that the features of managerial competences are:

- complexity – managerial competences are constituted by managers' knowledge, skills (Grubaugh, 2018) and attitudes;
- operability and purposefulness – managerial competences are manifested in managers' actual behaviours and actions;
- situationality – managerial competences depend on the context;
- changeability – managerial competences are dynamic, subject to development and change along with managers' experience and professional and life development;
- measurability – they can be defined, and indicators for their observation, measurement and evaluation can be determined.

Skills are among the important components of key competences. It should be emphasised that there is no clear-cut definition of the mutual relations between skills and competences. Skills relate to what an employee can actually do and are often equated with experience or the ability to act. Skills mean the knowledge of specific issues and the proficiency in carrying out related tasks. Assuming that skills are a manager's ability to function efficiently in an organisation, it should also be stated that researchers are not unanimous in defining a universal set of managerial skills.

Moreover, there is no conceptual precision. Despite the indicated difficulties, it is postulated designating so-called key managerial skills, that is, those skills that are particularly important for a person holding a managerial position in an enterprise. It is worth mentioning that many countries have implemented programmes that contribute to the development of key skills, which has also been reflected in the reform of Polish education. When developing the draft core curriculum announced in the Regulation of the Minister of National Education of 23 December 2008 on the core curriculum for pre-school education and general education in individual types of schools, the Recommendation of the European Parliament and of the Council of 18 December 2006 on key skills for lifelong learning has also been taken into account.

The concept of key skills has been popular in Poland since 1995 in connection with the work on the KREATOR programme, among others. This defines key skills as cross-curricular skills (Ramingwong and Manopiniwe, 2019). For the purposes of this programme, five skills have been defined, which are, the ability to plan, organise

and evaluate one's own learning, the ability to communicate effectively in various situations, the ability to work effectively in a group, the ability to solve problems in a creative way, and the efficient use of IT.

Regardless of the number of key skills formulated, it should be remembered that they differ from other skills in certain characteristics. Key skills play a special role in the learning process, are extremely important for people to achieve social goals and are essential in workplaces, as they enable the development of key competences (Kuz'mina *et al.*, 2020), which is particularly important in managerial work.

3. Research Method

The research, aimed at identifying the key competences and key skills of IT managers and assessing the skills gap, included three stages:

Stage 1: Identifying the key competences of IT managers based on the opinions of managers and experts representing selected businesses and academic centres in Poland.
Stage 2: Identifying variables characterising the key skills of IT managers based on the opinions of managers and experts.
Stage 3: Identifying the skills gap understood as the difference between the expected state determined based on the answers of strategic-level managers and the declared state based on the answers of tactical- and operational-level managers.

To assess the expected and declared key skills, a seven-point Likert scale was used (1 – Strongly disagree, 2 – Disagree, 3 – Somewhat disagree, 4 – Neither agree nor disagree, 5 – Somewhat agree, 6 – Agree, 7 – Strongly agree).

The research of the skills' gap covered 504 representatives of the management staff of all levels of management in IT companies operating in Poland. The data obtained in the research, using face-to-face interviews, the expert method and a survey questionnaire, were sorted, grouped and analysed. The first and second stages of the work, which included, *inter alia*, techniques for examining the concordance of expert assessments (Kendall's coefficient of concordance) and the reliability of the survey (Cronbach's alpha) have been described in detail in the work by Roszyk-Kowalska (Roszyk-Kowalska, 2018).

The first step in the implementation of the third stage, which was defined as 'Identifying the skills gap', involved selecting strategic-, operational- and tactical-level managers in IT enterprises. At the same time, it is worth adding that the survey only covered enterprises with 250 or more employees.[4]

[4] *According to the classification used by the Central Statistical Office, these are the so-called 'large enterprises', cf. https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5502/28/2/1/zeszyt_metodologiczny._badania_przedsiebiorstw_niefinansowych_2019.pdf, p. 40.*

In the research sample, the most numerous were representatives of the management staff associated with entities declaring computer programming activities (63.6%)[5] and other IT and computer service activities (55%). On the other hand, respondents from enterprises conducting computer facilities management activities were the least numerous (7.6%).

The managers of IT companies who participated in the survey were aged 28 to 65. The mean age was 43.6 years with a standard deviation of 9.1 years. The oldest women in the sample were women employed at strategic management levels, whose average age was 49.4 years. Men employed at this management level were younger – their average age was 48.1 years. Tactical- and operational-level managers were younger than strategic-level managers by five years for men and by as much as 10.2 years for women.

The group of managers at the strategic management level showed the lowest differentiation by age – the coefficient of variation ranged from 10% for men to 15% for women. For the tactical- or operational-management levels, the age differentiation of managerial staff was slightly greater – the coefficient of variation exceeded 20% and amounted to 22% for men and 21% for women (Table 1).

Table 1. *Descriptive characteristics of the age of people employed in managerial positions in the research sample by gender and management level*

Management level	Gender	Mean	Minimum	Maximum	Standard deviation
Strategic	male	48.1	39	53	4.7
Strategic	female	49.4	41	58	7.6
Tactical or operational	male	43.1	28	65	9.6
Tactical or operational	female	38.9	28	54	8.2
Total		43.6	28	65	9.1

Source: *Own study based on the research sample.*

4. Research Results

At the first stage of the research, the managers and experts participating in the survey were presented with a set of 18 potential key competences, which were identified based on literature studies and practical experiences. Taking the opinions of managers and experts into account, as well as limiting the number of key competences to those nine out of 18 to which experts assigned the highest average importance, the key competences of IT managers were selected:

- high level of entrepreneurship,
- high level of creativity,
- effective processes of acquiring, using and sharing knowledge,
- high level of using the potential of teamwork,

[5]*The respective shares are given in parentheses.*

- high level of innovation,
- ability to cooperate in relational systems,
- high independence,
- skilful management of research and development (R&D) activities,
- using communication systems based on modern information technologies.

The second stage of the research aimed at transforming the key competences of IT managers into a set of variables characterising key skills. Based on the opinions of managers and experts, a set of 54 potential key skills was reduced to the 27 skills of the highest importance. Table 2 shows the variables characterising the key competences transformed into a set of variables characterising the key skills.

Table 2. *Key competences of IT managers transformed into a set of variables characterising key skills*

Key competences (abbreviation)	Key skills (abbreviation)
Entrepreneurship (E)	making decisions with ease (E1) comparing the actual and planned results of an enterprise (E2) planning one's own activities and motivating oneself (E3)
Creativity (C)	creating and implementing new solutions (C1) creating visualisations (C2) formulating conclusions based on one's own mistakes (C3)
Knowledge management (KM)	analysing the resources of a company and the environment (KM1) making accurate personnel decisions (KM2) having a positive attitude in dealing with others (KM3)
Teamwork (T)	motivating (T1) cooperating with others (T2) making accurate assessments of the emotions in a team (T3)
Innovation (I)	analytical thinking (I1) synthetic thinking (I2) predictive thinking (I3)
Cooperation in relational systems (Co)	shaping proper relations with the closer and more distant environments (Co1) managing a company in a multicultural environment (Co2) taking care of the positive image of a company (Co3)
Empowerment (Em)	organising the resources necessary to carry out tasks (Em1) organising work stations (Em2) correcting one's own and other people's mistakes (Em3)

R&D management (RDM)	obtaining funds from outside a company (RDM1) managing finances properly (RDM2) disposing of the knowledge possessed (RDM3)
Using communication systems based on modern information technologies (U)	exchanging information quickly and easily (U1) using technological solutions efficiently (U2) identifying trends in the development of modern information technologies (U3)

Source: *Own study based on the research sample.*

To assess the significance of the key skills gap, the Mann-Whitney U test was used, in which the null hypothesis was formulated in such a way that the distributions of the mean indications of the significance of a given key skill in the compared populations (strategic-level managers and tactical- or operational-level managers) are equal. The level of significance was set at a p-value = 0.05. The W test statistic was determined as follows:

$$W = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \quad (1)$$

$$W' = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2 \quad (2)$$

where:

n_1, n_2 – are the sizes of the samples taken from population 1 and population 2, respectively,

R_1, R_2 – are the sums of the ranks for the samples taken from population 1 and population 2, respectively.

The lesser of the values W, W', is subject to interpretation.

The analysis of the research results allows the following conclusions to be formulated (Table 3):

- the smallest skills gap includes: using technological solutions efficiently (0.9), cooperating with others (1.4), disposing of the knowledge possessed and formulating conclusions based on one's own mistakes (1.5),
- the greatest skills gap occurs in the fields of: obtaining funds from outside an enterprise (2.5), making accurate assessments of the emotions occurring in a team and making accurate personnel decisions (2.4), as well as correcting one's own and other people's mistakes, synthetic thinking, and managing finances properly (2.2).

The analysis of the data contained in Table 4 leads to the conclusion that the greatest gap covers the skills constituting such key competences as R&D management (6.2) and empowerment (6.1). On the other hand, the smallest skills gap covers the following key competences: using communication systems based on modern

information technologies (4.3) and entrepreneurship and creativity (5.2). Additionally, in terms of the key competences examined, the following has been found:

- R&D management – the largest gap is in the ability to obtain funds from outside an enterprise (2.5) and the smallest one concerns the ability to dispose of the knowledge possessed (1.5);
- empowerment – the greatest gap is in the ability to correct one's own and other people's mistakes (2.2) and the smallest one concerns the skills in organising work stations (1.9);
- knowledge management – the largest gap occurs in making correct personnel decisions (2.4) and the smallest one concerns the ability to analyse the resources of a company and the environment (1.7);
- innovation – the largest gap is in the skill of synthetic thinking (2.2) and the smallest one concerns the skill of analytical thinking (1.7);
- cooperation in relational systems – the largest gap is in the skills of managing a company in a multicultural environment and taking care of the positive image of a company (2.0), and the smallest one concerns the skill of shaping proper relations with the closer and more distant environments (1.9);
- teamwork – the biggest gap is in making correct assessments of the emotions occurring in a team (2.4) and the smallest one concerns the ability to cooperate well with others (1.4);
- entrepreneurship – the gaps in terms of all skills, that is, comparing the actual and planned results of an enterprise, making decisions with ease and planning one's own activities, are at the same level (1.7);
- creativity – the greatest gap is in the ability to create and implement new solutions (1.9), while the smallest one concerns the formulation of conclusions based on one's own mistakes (1.5);
- using communication systems based on modern information technologies – the biggest gap exists in the ability to identify trends in the development of modern information technologies and to exchange information quickly and easily (1.7), and the smallest one concerns the key skill of using technological solutions efficiently in the surveyed companies (0.9).

Table 3. *Key skills gaps[6] and the significances ranked from smallest to largest*

Key competences	Key skills	Average assessment strategic-level managers	Average assessment by bytactical- or operational-level managers	Skills gap	Test statistics (W)	p-value
U	U2	6.7	5.8	0.9	581.5	<0.05
T	T2	6.3	4.9	1.4	700.0	<0.05

[6] The skills gap is defined as the difference between the average indications made by strategic-level managers (the expected state) and the average indications made by tactical- or operational-level managers (the declared state).

RDM	RDM2	6.8	5.2	1.5	749.0	<0.05
C	C3	6.5	5.0	1.5	715.5	<0.05
E	E2	6.8	5.1	1.7	756.0	<0.05
U	U3	6.4	4.7	1.7	699.5	<0.05
E	E1	6.4	4.7	1.7	736.5	<0.05
C	C2	6.4	4.7	1.7	714.5	<0.05
U	U1	6.8	5,1	1.7	744.5	<0.05
KM	KM1	6.6	4.9	1.7	723.5	<0.05
I	I1	6.4	4.6	1.7	722.5	<0.05
E	E3	6.2	4.4	1.7	699.0	<0.05
KM	KM3	6.4	4.6	1.8	720.0	<0.05
Co	Co1	6.6	4.7	1.9	733.5	<0.05
Em	Em2	6.8	4.9	1.9	794.5	<0.05
T	T1	6.7	4.8	1.9	779.5	<0.05
C	C1	6.6	4.7	1.9	779.5	<0.05
Co	Co3	6.7	4.8	2.0	742.5	<0.05
Em	Em1	6.7	4.8	2.0	771.0	<0.05
I	I3	6.6	4.7	2.0	762.5	<0.05
Co	Co2	6.2	4.2	2.0	713.0	<0.05
RDM	RDM1	6.6	4.4	2.2	756.5	<0.05
I	I2	6.7	4.5	2.2	784.5	<0.05
Em	Em3	6.5	4.3	2.2	761.0	<0.05
KM	KM2	6.8	4.4	2.4	799.5	<0.05
T	T3	6.7	4.3	2.4	794.0	<0.05
RDM	RDM3	6.4	3.9	2.5	750.0	<0.05

Source: *Own study based on the research sample.*

Table 4. *Skills gap in the key competence structure*

Key competences	Key skills	Skills gap	Total
R&D management	obtaining funds from outside an enterprise	2.5	6.2
	managing finances properly	2.2	
	disposing of the knowledge possessed	1.5	
Empowerment	organising resources necessary to carry out tasks	2.0	6.1
	organising work stations	1.9	
	correcting one's own and other people's mistakes	2.2	
Knowledge management	analysing the resources of a company and the environment	1.7	5,9
	making accurate personnel decisions	2.4	
	having a positive attitude in dealing with others	1.8	
Innovation	analytical thinking	1.7	5.9
	synthetic thinking	2.2	
	predictive thinking	2.0	
Cooperation in relations with other	shaping proper relations with the closer and more distant environments	1.9	5,9
	managing a company in a multicultural environment	2.0	
	taking care of the positive image (reputation) of a company in the environment	2.0	
Teamwork	Motivating	1.9	5,8

	cooperating with others	1.4	
	making accurate assessments of the emotions occurring in a team	2.4	
Entrepreneurship	making decisions with ease	1.7	5,2
	comparing the actual and planned results of an enterprise	1.7	
	planning one's own activities and motivating oneself	1.7	
Creativity	creating and implementing new solutions	1.9	5,2
	creating visualisations	1.7	
	formulating conclusions based on one's own mistakes	1.5	
Using communication systems based on modern information technologies	exchanging information quickly and easily	1.7	4,3
	Using technological solutions efficiently	0.9	
	identifying trends in the development of modern information technologies	1.7	

Source: *Own study based on the research sample.*

In conclusion, the largest gaps between the expected and actual states in IT enterprises in terms of key skills concern obtaining funds from outside a company (the gap concerns the R&D management key competence), making accurate assessments of the emotions occurring in a team (the gap concerns the teamwork key competence) and making accurate personnel decisions (the gap concerns the knowledge management key competence).

In order to minimise the identified skills gap, it is postulated taking actions that may contribute to the improvement of these skills. However, it is important to be aware that the acquisition of skills alone is not a sufficient condition for a manager to become a competent manager. Activities aimed at improving the skills of IT managers should include:

- entrepreneurship – improving a manager's ability to compare the actual and planned results of a company and increasing their concentration on planning their own activities and motivating themselves, as well as improving their decision-making skills;
- creativity – improving the ability to create and implement new solutions; this skill seems to be of particular importance in the case of operational- and tactical-level managers in the IT sector;
- knowledge management – improving the process of making personnel decisions aimed at, *inter alia*, acquiring creative employees and those focused on ensuring the success of the companies in which they will be employed;
- teamwork – improving the skill of making more accurate assessments of the emotions occurring in a team, which may contribute to improving the motivation process and building relationships that facilitate cooperation with others;

- innovation – improving synthetic and predictive thinking skills in connection with a more open attitude towards innovation;
- cooperation in relational systems – improving decision-making skills in a multicultural environment, tolerance for cultural and national differences and greater care for ensuring the positive image of a company;
- empowerment – undertaking more activities aimed at correcting one's own et al.' mistakes and improving work under time pressures as well as coping with difficult situations;
- R&D management – improving the ability to take effective actions aimed at obtaining various forms of support, including funds, for R&D activity from outside an enterprise and managing them properly (Borut et al., 2019) (pp. 69-85);
- using communication systems based on modern information technologies – using incentives to encourage learning, which should facilitate the identification of trends accompanying the development of modern information technologies and improve the exchange of information between participants in an organisation.

5. Conclusions

In modern enterprises, the key competences of managers are a particularly important resource. The constant striving to improve the key competences of managers in IT sector enterprises by improving their key skills should be treated as a specific organisational challenge on which the activities of the participants of the organisations should be focused. These activities may increase the efficiency and competitiveness of Polish enterprises in the IT sector.

The research results indicate different levels of managerial skills. The best assessed skills belong to the following key competences: creativity, entrepreneurship and using communication systems based on modern information technologies. The relatively low assessment of skills characterising key competences such as, R&D management, empowerment, knowledge management, innovation and cooperation in relational systems, should be considered disturbing. These key competences of managers are assessed the lowest.

The difference between the levels of these skills desired by strategic-level managers and those declared by tactical- and operational-level managers can be interpreted as a gap that requires taking priority and particularly intensive actions aimed at improving these skills. The presented research results on the skills gap are part of a wider research project aimed at identifying and assessing the level of key competences of IT managers. As part of the research project, an attempt was also made to identify the remaining components of key competences, that is, the level of knowledge and attitudes of the managers of Hi-Tech companies.

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