UDC 005.95/.96
JEL Classification: M12
DOI: 10.15587/2706-5448.2024.314344

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FORMATION OF LEADERSHIP COMPETENCES IN THE CONTEXT OF EMERGENT DEVELOPMENT OF THE IT INDUSTRY

The object of research is processes and approaches to the development of leadership competencies of personnel in IT organizations.

The research is devoted to the analysis of the features of the formation of leadership competencies in the context of the emergent development of the IT industry. The work examines the evolution of concepts of corporate training and their adaptation to the specifics of the IT sphere, which is characterized by a high rate of technological changes and innovation. Traditional and innovative forms of personnel development are analyzed, with a special emphasis on their effectiveness in the context of the IT industry.

A survey was conducted among employees of IT companies, which revealed high leadership potential and willingness to accept responsibility among industry specialists. At the same time, certain gaps in the development of certain competencies have been identified, in particular, regarding the ability to effectively delegate tasks and make risky decisions. The results of the study emphasize the need to adapt traditional leadership models to the unique requirements of the IT industry, with a focus on the development of technical competence, innovative thinking and adaptability.

The paper offers recommendations for improving leadership development programs in IT companies. These recommendations include the implementation of flexible learning formats that combine online and offline components, as well as the use of modern technologies, such as virtual and augmented reality, to develop leadership skills. Special attention is paid to the development of such competencies as managing virtual teams and cross-cultural leadership, which are becoming more and more relevant in the context of the globalization of the IT industry.

The paper outlines directions for further research, in particular the study of the impact of artificial intelligence and machine learning on the formation of leadership competencies in the IT sphere. The results of the study have both theoretical and practical value for the development of effective strategies for the development of leadership potential in IT companies, which will contribute to increasing their competitiveness on the global market.

Keywords: *leadership competencies, IT industry, emergentity, leadership development, adaptive leadership, technical competence, personnel development programs.*

Received date: 21.08.2024
Accepted date: 30.10.2024
Published date: 31.10.2024

How to cite
Zhylinska, O., Tyshchenko, A. (2024). Formation of leadership competences in the context of emergent development of the IT industry. Technology Audit and Production Reserves, 5 (4 (79)), 19–24. https://doi.org/10.15587/2706-5448.2024.314344

1. Introduction

Accelerated deployment of "Industry 4.0" based on such breakthrough technologies as artificial intelligence, Big Data, automation, "cloud" technologies, virtual and augmented reality. Intellectual services are beginning to dominate all types of economic activity. This radically changes the prioritization of the factors of their generation. Market leadership belongs to enterprises with low material intensity and capital intensity and at the same time with high and highest levels of human capital, where the core of the competence characteristics of their carriers is formed by both hard skills and soft skills. The system-forming core and driver of the development of "Industry 4.0" is the IT sphere, which enables the transformation of the labor market and causes the disappearance of a number of professions with routine tasks, the performance of which is transferred to machines and artificial intelligence. At the same time, the demand for highly qualified workers who are able to perform complex intellectual tasks with the highest level of uncertainty of the main parameters in distributed teams in remote mode is growing.

A feature of the modern accelerated development of the IT industry is its emergent nature, the manifestation of this property in IT companies is demonstrated by the phenomenon of leadership. Let's consider such systemic manifestations as emergentity of the 1st kind – a property of the system that can be characterized based on the elements of the system itself [1]. A fundamental feature of the development of IT products and services is the variety of parameters and characteristics of the future object that

ISSN 2664-9969

will function in conditions of uncertainty. Such diversity should be offset by the corresponding diversity of the potential of developers of the future product (diversity of their hard and soft skills). As well as effective team interaction in the process of its development, not only between the developers themselves, but also with the customer of the IT product, and the presence of leadership competencies in both the team leader and its members. The accelerated dynamism of the IT industry creates unique challenges for the formation of leadership competencies of IT specialists. This requires leaders to have both technical expertise and the ability to quickly adapt to changes, effectively manage virtual teams, embrace and promote innovation in the process of constant interaction with customers of IT products and services, etc. The effects of the emergent development of the IT industry are based not only on the massive nature of the effects of synergism in the creativity of teams with the effective implementation of the leadership competencies of all their members. And also, on the fact that there is a chain reaction of changes in the behavior of IT workers in subsequent teams during the implementation of new projects.

The analysis of the scientific literature proves the growing interest in the issues of leadership in the IT sector. Researchers, in particular the authors of papers [2–4], emphasize the need to develop leadership competencies as a key factor in the success of IT organizations. At the same time, existing approaches to the formation of leadership qualities often do not take into account the specifics of the IT industry, in particular, the emergent nature of its development.

A critical review of research reveals a gap in understanding the specifics of the formation of leadership qualities in the context of the emergent development of the IT sector. In particular, the issues of adaptation of traditional leadership models to the challenges of the digital age and the development of specific competencies necessary for the management of high-tech projects and teams remain insufficiently studied [5, 6]. Since only the massive manifestation of the phenomenon of leadership in IT companies generates the effects of the emergence of the entire IT sphere, it is not possible to select only certain categories of IT workers for the formation and development of their leadership competencies. At the same time, as noted by experts of the World Economic Forum [7], the avalanche-like growth in the number of distributed teams necessitates new approaches to the implementation of leadership functions during the management of IT employees in a remote format using the latest technologies. As well as a new vision of organizational culture and innovative strategies for working with personnel.

The relevance of research is determined by the need to develop effective approaches to the formation of leadership competencies that would meet the requirements of the modern IT industry and ensure the competitiveness of IT organizations in the long term.

The aim of research is to identify and analyze the features of the formation of leadership competencies in the conditions of the emergent development of the IT industry.

The scientific part of the aim is to identify key factors affecting the development of leadership qualities in the IT sphere.

The practical part of the aim assumes that the research results will enable IT companies to optimize their leadership development programs and increase the effectiveness of the formation of leadership qualities of personnel in the conditions of a rapidly changing technological environment.

2. Materials and Methods

The object of research is processes and approaches to the development of leadership competencies of personnel in IT organizations.

The research was based on a combination of theoretical and empirical methods. An analysis of the scientific literature was carried out on the systematization of approaches to the interpretation of leadership in the IT industry and the identification of potential gaps in research on the development of leadership in this field.

The empirical part included a survey of 50 employees of IT companies. The questionnaire contained 10 closed questions aimed at evaluating the effectiveness of various methods of developing leadership qualities.

Methods of statistical analysis, in particular descriptive statistics, were used for data analysis. This made it possible to draw conclusions about the effectiveness of various methods of developing leadership qualities in IT organizations and the possibilities of their integration.

3. Results and Discussion

Within the framework of the conducted research, the peculiarities of the formation of leadership competencies in the conditions of the emergent development of the IT industry were considered. Therefore, the specificity of the industry, which is characterized by a high rate of technological changes, global competition and the need for effective management of virtual teams, was noted [3]. The concept of "development of leadership competencies of the personnel of IT companies" in accordance with the functional approach is defined as a positive and sustainable change in the level of leadership behavior of IT employees with the help of evaluation. As well as support and provision of challenge opportunities, which occurs at the individual (due to professional training of personnel), team (due to group dynamics) and organizational levels (due to the action of subsystems of organizational design), which is shown in Fig. 1.

At the same time, it is stated that the corporate training of IT employees relates to a greater extent to the professional development of technical competences and takes place in a secondary way through conducting trainings on leadership issues. While team forms of development and organizational design technologies directly affect the level of leadership competencies of the staff of IT enterprises.

At the beginning of the third decade of the 21st century, experts discovered and provided a quantitative assessment of the relationship between corporate personnel training and company productivity – on average, a one percent increase in corporate training costs per employee generates a 0.2 % increase in company revenues already this year. An important general conclusion is that every dollar invested in corporate training per employee generates an additional 4.7 USD in future company revenue per employee [8].

The evolution of concepts, formats and models of corporate training of personnel at the beginning. The 21st century is systematized in Table 1. Analysis of the evolution of the concepts of corporate personnel training demonstrates a rapid transition from standardized forms of training to more individualized and technologically advanced approaches. This is especially noticeable in the context of the development of leadership competencies in the IT industry, where the speed of change actualizes the continuous development of training methods.

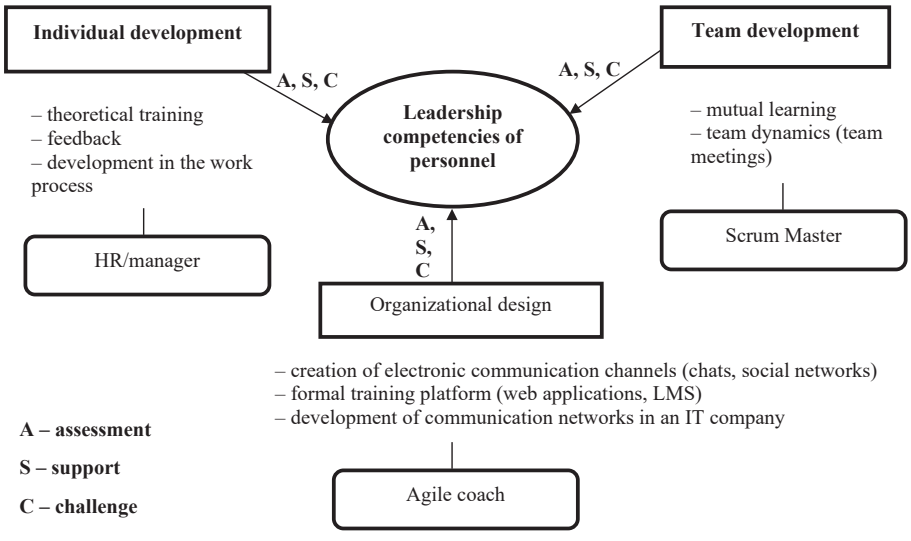

Fig. 1. Management technologies for the development of leadership competencies of IT company personnel (compiled by the authors based on materials [2, 3])

Table 1

Evolution of corporate personnel training concepts*

Years	2005	2010	2015	2018	2024
Stage	Electronic learning	Combined learning	Continuous learning	Digital learning	Individual and personalized training
Formats	Course catalogs, online universities	Individual development plans	Video lessons, feedback	YouTube, live shooting, social networks	Virtual and augmented reality, gamification, chat bots
The dominant concept	Kirpatrick model	Blended learning	Taxonomy 10-20-70	Microlearning	Personal professional development programs
Key users	IT specialists, employees	Lecturers, career-focused employees	Mentors, HiPO	Anyone from internal and external counterparties, leaders of public opinion	Individuals who are studying; "prosumers"
Online platform	LMS as a content management system	LMS as a talent management system	LMS as a knowledge management system	Mobile and web applications and social networks	Integrated solutions that combine LMS, personalized curriculum, social features and analytics

Note: compiled by the authors based on materials [9]

In the first phase of the evolution of corporate personnel training, presentation online courses played a key role. Among the advantages of online courses, let's single out various aspects of convenience (the ability to choose the optimal time for completion, the absence of the need to travel, the individual pace of learning the material), which are especially appreciated by busy managers of large IT companies. Although passing a long online course requires a sufficient level of self-discipline, which most workers do not possess [10, 11]. Therefore, in order to increase the level of practical application of acquired skills, IT companies had to start using qualitatively new development tools.

In [12], it is stated that in the second phase of the evolution of personnel training concepts, those companies that were able to integrate various forms of development into a single system and make it convenient to use thanks to the model of blended learning (Blended Learning) were favored. In [13] it is emphasized that combined learning provides a number of opportunities, which consist in the combination of the use of the Internet, digital content and traditional classroom classes, which involve the physical presence of the teacher and students. Online courses remained the central element of the training system, but the format changed from presentation to video courses. In addition, employees motivated for development were able to combine online and classroom trainings in accordance with developed individual development plans.

Over the past decade, the development of leadership and management competencies has been dominated by the "70-20-10" approach, which was first proposed as a result of many years of research conducted by the Center for Creative Leadership. During these studies, more than 200 top managers were interviewed, which made it possible to establish the relationship between different methods of competence development (Fig. 2):

– 70 % of development managers received through development at the workplace, participation in new projects, performance of non-standard work tasks;
– 20 % – through feedback, coaching, monitoring the activities of one's own manager;
– 10 % – thanks to training, self-education, reading books and articles, etc. [14].

It is worth noting that in the conditions of the dynamic development of the IT industry, the classic "70-20-10" model acquires a new meaning. Thus, 70 % of on-the-job training in the IT field covers participation in innovative projects, working with the latest technologies and solving non-standard tasks. This contributes to the development of adaptability and innovative thinking – key leadership qualities in this field.

Let's consider in more detail management technologies for the development of competences separately through the analysis of traditional and innovative forms of personnel development, which is systematized in the Table 2.

ISSN 2664-9969

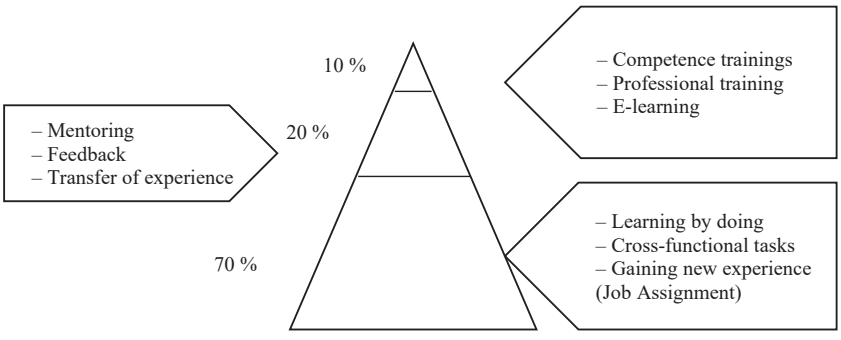

Fig. 2. Classical forms of "70-20-10" development (summarized by the authors based on [14])

Table 2

Traditional and innovative forms of personnel development

Percent (%)	Traditional	Innovative
10	Trainings, webinars, books and articles, formal meetings to share experiences, conferences, specialized development circles	MOOC (massive open online courses), quests, film clubs, SMS trainings, team training, social networks, electronic blogs, specialized video channels, micro-learning (short training modules), gamification of learning, AR/VR trainings (training using augmented and virtual reality)
20	Centers for assessment and development (C&D), mentoring, coaching, feedback sessions, shadowing (observation of the work of an experienced employee), buddying (mentoring of colleagues)	Automated continuous feedback systems, peer-learning, AI assistants for personalized learning, platforms for cross-functional knowledge exchange
70	Action learning (learning through action), employee rotation, Job Assignment (assignment to new projects, positions, transfer to other units)	Team learning, self-organized teams, networking (creating networks of contacts), hackathons and innovation marathons (intensive events where teams work on solving complex tasks or creating innovative projects in a limited time), project rotations in global teams
Online	Learning Management System (LMS)	

Note: summarized by the authors based on [12, 15]

The analysis of traditional and innovative forms of personnel development in the IT sphere shows a tendency to increase the role of technological solutions in education. In particular, the use of virtual and augmented reality, as well as AI assistants in education is becoming more and more common. This makes it possible to create realistic scenarios for practicing leadership skills in conditions as close as possible to real situations in IT projects.

In today's IT environment, traditional methods of developing leadership competencies, such as corporate libraries and standard trainings, are not effective enough. Studies show that only 6 % of the knowledge gained at typical trainings is applied in practice [16]. This encourages IT companies to implement innovative approaches to learning, including informal development tools and interactive techniques. It is also important to note that in the context of the IT industry, where technological innovation is a key success factor, the development of leadership competencies should include not only traditional soft skills, but also the ability to anticipate technological trends, understand their impact on business processes, and lead transformational initiatives.

Given the specifics of the IT industry and the need for practical application of leadership skills, special attention should be paid to the development of competencies directly at the workplace. In this context, three key groups of management technologies aimed at the formation of leadership qualities in real conditions of professional activity are distinguished:

1) expansion of the field of activity of specialists;
2) development through new experience;
3) learning by doing.

The first group covers the provision of new areas of responsibility, reduced control from the manager and work with experts in other technical areas. The second group is aimed at fulfilling the functions of other departments, increasing contacts with senior management and rotation. Research shows that thanks to rotation, employees expand their business vision (46 % of respondents), increase adaptability and flexibility (31 %) and develop leadership skills (19 %) [15]. It is possible to note that the following provision must be taken into account when implementing the rotation: the level of development of leadership competencies increases if the new work tasks coincide with the needs of personal development.

The third group – "action learning" – assumes that employees learn new skills, immediately apply them at work, and then in groups reflect on the obtained results [16]. The authors of the work [17] identified six components for implementation of action learning in practice:

1) project (a problem to be solved and developed);
2) team (from four to eight people);
3) request (all discussions take place only in response to outlined questions);
4) action (implementation of solutions to problems);
5) training (equality of all team members in readiness to develop both at the individual level and in the group);
6) presence of a coach who asks the team questions and facilitates meetings.

Leadership development should integrate tools to help professionals interact with others, maintain shared team commitments, and build social networks. The development of leadership in organizations is based on the expansion of opportunities for collective involvement in the performance of leadership roles and processes, so management needs to integrate it as an element of the organization's culture.

Special attention should be paid to the development of such leadership competencies as managing virtual teams and cross-cultural leadership, which are becoming more

and more relevant in the context of the globalization of the IT industry and the spread of remote work practices.

Theoretical statements about the need for leadership development in organizations, which integrates tools for establishing interaction, meeting team obligations and expanding opportunities for collective leadership, find practical confirmation in the results of a survey among employees of IT companies. The results of the survey among 50 respondents – employees of Ukrainian IT companies – revealed a number of important trends regarding the development of leadership qualities in this area. In particular, about 70 % of respondents feel confident in their ability to take responsibility for others, which indicates a high leadership potential in the IT industry. A similar share of respondents (about 64 %) noted that they can clearly articulate their thoughts and ideas, which is critical for effective leadership. The majority of respondents (57 %) agreed that they are able to motivate and inspire to achieve common goals.

Slightly more than half of the respondents (58 %) believe that they can effectively resolve conflicts and solve problems. However, only 40 % of respondents are confident in their ability to delegate tasks, indicating the need to develop this important leadership competency. More than half of the respondents (60 %) are also not ready to make risky decisions, which can become a challenge for the innovative development of IT companies.

It is a positive fact that 70 % of respondents feel confident in their ability to creatively approach problem solving, demonstrating creativity and the ability to find non-standard solutions. In addition, 95 % of respondents noted that they can learn from their own mistakes and failures, which proves a high level of self-awareness and readiness for personal growth – important qualities of a leader.

Overall, the survey results highlight significant leadership potential among IT workers, while identifying areas that need more attention in the leadership development process in IT companies. Data analysis also revealed an interesting correlation between respondents' technical skills and their leadership qualities. In particular, employees with high levels of technical expertise are more likely to demonstrate confidence in decision-making and the ability to motivate others. This underscores the importance of integrating technical and leadership development in future IT workforce training programs.

The research results testify to the actualization of the need for specialized leadership development programs that would take into account the specifics of the IT industry. Such programs should focus on the development of adaptability, innovative thinking and the ability to effectively manage change – key competencies for leaders who will operate in conditions of uncertainty.

An important aspect of the formation of leadership competencies in the IT industry is also the development of ethical leadership. In the context of the growing impact of technology on society, IT leaders must be able to balance innovation and ethical considerations, taking into account the potential social consequences of technological decisions.

In general, the research results emphasize the need for a comprehensive and adaptive approach to the development of leadership competencies in the IT industry. This approach must take into account both the traditional aspects of leadership and the specific requirements posed by the dynamic nature of the industry and constant technological innovation.

Interpretation of the results: The research results indicate that the formation of leadership competencies in the IT industry requires a comprehensive approach that takes into account the emergent development of the industry, the absence of a selective approach to the development of leadership competencies of IT workers. Factors such as the speed of technological change, the globalization of the labor market and the need to manage virtual teams play a special role.

Differences from the results known from the literature: In contrast to traditional leadership models, our research revealed that in the IT sphere, such competencies as adaptability, technological literacy, and the ability to continuously learn are especially important. It confirms and extends the findings of previous studies, adding the specific context of the emergent development of the IT industry.

Practical significance: The obtained results can be applied by IT companies to develop and improve leadership development programs. In particular, the introduction of flexible training formats that combine online and offline components, the use of virtual and augmented reality technologies for the development of leadership skills is recommended.

Limitations of the research: The research was conducted on a limited sample of IT companies, which may affect the generalizability of the results. In addition, rapid changes in the industry may require constant updating of findings and recommendations.

Influence of martial law conditions: Martial law conditions in Ukraine affected the conduct of the research, in particular due to the need to adapt to remote forms of work and training. This, however, made it possible to obtain valuable data on the development of leadership competencies in crisis conditions and remote work conditions.

Prospects for further research: Future research could focus on studying the impact of artificial intelligence and machine learning on the formation of leadership competencies in the IT sphere, as well as on the development of individualized approaches to leadership development, taking into account the personal characteristics and career trajectories of IT workers.

4. Conclusions

The conducted study of the features of the formation of leadership competencies in the conditions of the emergent development of the IT industry revealed a number of important results. First, a high level of readiness of IT workers to assume leadership roles was established, which is confirmed by the fact that 69.4 % of respondents demonstrated confidence in their ability to take responsibility for others. This indicates the presence of significant leadership potential in the industry. At the same time, the study revealed certain gaps in the development of individual leadership competencies, in particular, only 40 % of respondents are confident in their ability to effectively delegate tasks.

The obtained results are explained by the specifics of the IT industry, which is characterized by a high rate of change and innovation. This contributes to the development of such qualities as adaptability and creativity, as evidenced by a high percentage of respondents (70 %), who feel confident in their ability to creatively approach problem solving. However, the dynamism of the industry generates challenges for the development of skills related to long-term planning and making risky decisions, which

ISSN 2664-9969

is confirmed by the unwillingness of 60 % of respondents to make such decisions.

These results have significant theoretical and practical value. From a theoretical point of view, they expand the understanding of the specifics of leadership in the IT sphere, demonstrating the need to adapt traditional leadership models to the unique requirements of the industry. The practical value lies in the possibility of using this data to develop more effective leadership development programs in IT companies. In particular, the results indicate the need to focus on the development of delegation skills, risk-taking decision-making and long-term strategic planning, along with the further development of creativity and adaptability.

A comparison of the obtained results with the data of previous studies in the field of leadership demonstrates the uniqueness of the requirements for leaders in the IT industry. If traditional models of leadership often focus on charisma and the ability to inspire, then in the IT sphere technical competence, innovative thinking and the ability to quickly adapt to changes come to the fore. This emphasizes the need to develop specific approaches to leadership development in the IT industry.

Thus, the conducted research not only revealed the key features of the formation of leadership competencies in the IT industry, but also outlined directions for further improvement of leadership development programs in this dynamic and innovative field. The obtained results can serve as a basis for the development of more effective strategies for the development of leadership potential in IT companies, which will ultimately contribute to increasing their competitiveness on the global market.

Conflict of interest

The authors declare that they have no conflict of interest with respect to this study, whether financial, personal, authorship, or otherwise, that could affect the study and its results presented in the article.

Financing

The study was performed without financial support.

Data availability

The manuscript contains no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating this work.

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