

DETERMINANTS OF THE KNOWLEDGE DIFFUSION PROCESS AMONG PROFESSIONALS IN THE IT SECTOR

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ABSTRACT

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Today, knowledge has become dominant, creating a new dimension of the economy, a new society and a new employee. Knowledge workers have emerged as the core of a modern organisation's staff, and their job is to convert information into knowledge. The process of diffusion of these key organisational players' knowledge is critical, as it determines its availability to other employees. Both the character and importance of specialist knowledge diffusion require a detailed analysis of the process. Therefore, the main research goal of the study is to determine the conditions for this process in the IT sector. The method of triangulation was selected for this research. The procedure for obtaining empirical data consisted of three stages – direct semi-structured individual interviews, focus group online interviews (FIGO), a computer-assisted telephone interview (CATI) and a computer-assisted web interview (CAWI-based DYI). Then, Spearman's rank-order correlation coefficient was used. It was found that knowledge workers are most likely to participate in the diffusion of high-context, personalised and tacit knowledge. Knowledge sharing is the subprocess of knowledge transfer, most conservatively approached by professionals who fear the uncontrolled transmission of their specific knowledge. Closed and conservative attitudes were clearly observed in the transmission of knowledge between staff (employees other than knowledge-workers) and stakeholders. They suggest the targeted or intuitive use of knowledge protection strategies, especially in inter-organisational cooperation relationships. The considerations presented contribute theoretically and practically to the diffusion of professional knowledge. They set a framework for designing the knowledge dispersion management subsystem as the chief element of the overall organisational knowledge management system, due to the subprocesses constituting knowledge transfer, the type of knowledge exchanged, and the group of knowledge agents involved in its circulation. Identifying critical conditions that support the knowledge diffusion of professionals could help practitioners create an effective system of knowledge transfer that meets knowledge workers' requirements and stimulates the flow of the preferred types of knowledge in the planned and desired directions among selected groups of knowledge agents.

KEY WORDS

Knowledge diffusion, knowledge worker, empirical study, IT sector.

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Introduction

The current economy has made knowledge the foundation of all market activity and the benchmark for most management

decisions (Stewart, 2001; Bontis and Nikitopoulos, 2001; Jacobsen et al., 2005; Radovanović et al., 2017; Horzela and Am-

brochowicz, 2019; Latif et al., 2020). It has undeniably become the most valuable asset, the source of success in the economic, social and labour reality of the 21st century (Argote and Ingram, 2000; Morris, 2010; Harris, 2016). Knowledge has therefore been recognised as a driving force for the development of civilisation in all aspects (Gou et al., 2019) – a model of the human as a learning and knowledge-sharing entity has emerged (Cotsomitis, 2017; Tkach, 2019), whose activity is organised around the manipulation of abstracts and ideas. It is focused on developing mental models that naturally encourage the use of new knowledge and trigger rapid adaptation to changes (Podluzhna, 2017).

Knowledge has professionalised (Tammelin et al., 2017) and a new class of specialists in knowledge-intensive sectors has emerged (Mehralian et al., 2018). Spectacular social transformations have taken place; “blue” and “white” collars have evolved into “gold”, whose job it is to convert information into knowledge (Davenport, 2006) and create knowledge-based products (Erickson et al., 2014). Most of them are and will be compensated much better than manual workers have ever been, and their work will offer many more development opportunities.

Consequently, since the late 1990s, a knowledge society has formed, in which the barrier to entry is formal education. Representatives of new professions, “gold collars” (Kelley, 1985) or cognitarians, i.e. individuals who are able to use information and communication technologies for complex cognitive operations on data, are a special class, privileged because of their attributes. Their skills, based mainly on tacit knowledge, are specific and unique. Therefore, organisations invest in the development of those employees who are fast learners, which is usually conditioned by their basic knowledge. Therefore, dis-

proportions between employees and their knowledge resources are growing at a geometric pace. Significant entry barriers to the intellectual worker class are formed as a result; apart from formal education, an additional barrier is digital exclusion. Being fully aware of their value, intellectual workers are more demanding, which complicates the process of building an incentive system (Lee and Lim, 2015) and the managers’ formal impact on their activities. These workers are aware of their privileged position in the enterprise (Olsen, 2016), because the organisation is largely based on the sum of their knowledge. With a “deep-smarts” status, (Sumbal et al., 2020) they adopt attitudes that restrain the flow of knowledge, or even intentionally hide it (Arain et al., 2019), considering it too valuable (Afshar Jalili and Ghaleh, 2020) for free diffusion.

Ultimately, the character of wealth has changed. Now it is knowledge and the ability to exercise control over it (Thurrow, 2006). Therefore, two fundamental challenges may be observed: the polarisation of the labour market (Miles et al., 2019) and overcoming reluctance to exchange knowledge (Arain et al., 2019). That is why, nowadays, the critical subsystem of an effective knowledge management system is the network of connections that enable the creation of knowledge flow channels (Gupta and Govindarajan, 2000).

The development and rational use of human resources have become the essence of the new reality, as it is people who currently accumulate capital using natural resources. The main characteristic of the new economy era has therefore become the dominance of investments in human capital (Buzavaite and Korsakiene, 2019) and knowledge workers (Webster and Jensen, 2006), because the productivity of intellectual workers has become the most valuable asset of the 21st-century organi-

sation (Drucker, 1999). Talented knowledge workers, or “independent knowledge producers”, are the organisation’s greatest asset (Kucharska and Erickson, 2019), as its ability to create, transfer, accumulate, integrate and use knowledge resources has become a decisive factor in building its competitive advantage (Teece, 1998). The process approach to knowledge has been reduced to managing its flow and the related iterative and interactive processes of knowledge creation, storage, transfer and application (Zhang, 2018). Hence, organisational management has focused on acquiring, assimilating, diffusing and, above all, creating knowledge, to shape a lasting competitive advantage based on knowledge and its derivative resources (Davenport, 2010; Lee and Lim, 2015; Wu and Hu, 2018; Szelągowski, 2020).

Seen from this perspective, the role of the knowledge diffusion process increases (Lee and Lim, 2015; Secundo et al., 2019), as it is considered necessary to succeed in the effective management of a modern organisation (Amayah, 2013; Sinell et al., 2017; Luo et al., 2017; Gou et al., 2019). It becomes especially significant in terms of diversity observed in the contemporary labour market (Ren et al., 2019). Successful knowledge dispersion results in the accumulation and assimilation of new knowledge by the largest possible number of employees and the entire organisation (Cohen and Levinthal, 1990; Capaldo, 2007). After all, it conditions the full use of the potential of professionals’ knowledge, its availability to other stakeholders and voluntary dissemination and sharing (Amayah, 2013; Barnard and Pendock, 2013). Enterprises should therefore concentrate on gathering professional organisational knowledge and on preventing its loss caused by the departure of key intellectual employees (Drucker, 1999; Engle and Engle, 2010) by consciously designing the organisational

processes of knowledge circulation.

The character and importance of specialist knowledge diffusion requires a detailed analysis of this process, especially since empirical studies in this respect are still rare (Sumbal et al., 2020). Elements of the knowledge management system are not commonly studied, whether from the resource approach or the knowledge management perspectives (Razzag et al., 2019). Therefore this paper remains in the mainstream of the knowledge-based view of the firm (Barney, 1991; Nonaka, 1991; Peteraf, 1993; Grant, 1996; Argote and Ingram, 2000; Ahuja and Katila, 2004), focusing on the individual and organisational layer in interconnection. Its main research goal is to determine the conditions (stimulants, infrastructure, methods, principles) of professionals’ knowledge diffusion process in the IT sector, based on empirical research. The main research question relates to finding unambiguous answers to the question of circumstances of the internal and external organisational diffusion of knowledge among professionals and in relations with staff and co-operators. Therefore, it is related to the identification of the types of knowledge; that is, the subject of diffusion within each constellation of knowledge agents involved in its flow, the sub-processes dominating in each system of entities participating in its exchange and elements of the knowledge environment infrastructure influencing its fluid dispersion. The results of these considerations are a contribution to the theory of knowledge diffusion, especially of intellectual workers, and are aimed at determining the methods of reducing inequalities in the residence of knowledge in the organisation, thus stimulating its full use by the enterprise. In practical terms, they are a source of guidelines for knowledge management managers in building an optimal knowledge diffusion management subsystem, aimed at the

controlled supervision of its circulation in terms of types of knowledge, flow directions and recipients.

The organisation of this research paper is as follows. Section 2 and 3 contains a synthesis of the literature and postulates hypotheses. Section 4 discusses the choice of research design. Subsequently, it is followed by Section 5, on the results and a discussion thereof. Finally, Section 6 concludes the study.

1. Literature review

1.1 The essence of the knowledge diffusion process

The literature on knowledge management has identified several taxonomies of knowledge (Garud and Nayyar, 1994; Hedlund, 1994), such as know-how, know-who, know-what, know-why, know-when, and know-where (Skryme, 1999), but the dichotomy of tacit versus explicit knowledge has received most attention among scholars (Polanyi, 1966; Nonaka and Takeuchi, 1995).

Know-how covers knowledge and team skills as well as procedures of conduct and derives primarily from efficient practical executions and experiences. Know-who is related to access to various sources and carriers of knowledge and is obtained from the same industry, vertical industries and experts and research units. Know-what is the most similar structural knowledge to information. Know-why is a higher level of knowledge related to the interpretation of information in a broad context. Know-when is responsible for the level of time, including specific ways and rhythm of information transfer. Finally, know-when is the level of place and appropriate platforms for providing information (Skryme, 1999; Huang et al., 2007).

Explicit knowledge is easy to codify and communicate, and includes descriptions, verbal, formulae, patents, charts and so

on, which are often transferred in formal language through impersonal media (Hedlund, 1994; Huang et al., 2007; Filieri and Algezai, 2014). Tacit knowledge, such as non-verbal experiences or other non-expressional actions, refers to non-verbalised knowledge and is often embedded in people's minds as well as in organisational routines (Polanyi, 1966; Nonaka and Takeuchi, 1995; Huang et al., 2007).

Knowledge transfer is most often presented as a process that involves knowledge (Secundo et al., 2019) as the foundation for the effective implementation of organisational learning (Dziadkiewicz et al., 2017), essential in terms of enterprise innovation (Cohen and Levinthal, 1990; Lane et al., 2001; Luo et al., 2017) and crucial in terms of the effectiveness of knowledge management (Enderwick, 2011; De Luca and Cano Rubio, 2019). Currently, generating knowledge and deliberately controlling its circulation is necessary to create and maintain competitive advantage. This is to increase the level of innovation of knowledge agents and the dynamics of their development. That is why, for over two decades, the dispersion of knowledge has captured the attention of both theoreticians and practitioners of organisation management, who define and approach it differently (Argote and Ingram, 2000; Enderwick, 2011; Amayah, 2013; Liyanage et al., 2009; Aijth Kumar and Ganesh, 2009; Al-Salti and Hackney, 2011; Kim et al., 2016; Kuciapski, 2017). In the course of studying this phenomenon, the terms "knowledge transfer", "knowledge exchange", "knowledge transmission", "knowledge dispersion", "knowledge circulation" and "knowledge diffusion" have been used synonymously (Intezari et al., 2017). Attempts have now been made to clarify the concepts, although in some studies these terms are still used interchangeably. According to Zhang et al. (2016), the diffusion of knowledge should

be perceived as the broadest category, also taking into account new knowledge resulting from its flow, at the heart of which is the self-duplication of knowledge. It is a process directly related to the social context (Amayah, 2013; Huan et al., 2017; Al-lameh, 2018). It depends on people, the quality of their knowledge, as well as their readiness to cooperate, openness and flexibility. Thus, the process requires mutual interaction between its participants (knowledge exchange agents) and operating in network cooperation relations (Gupta and Govindarajan, 2000; Al-Busaidi and Olfman, 2017). It is also conditioned by the characteristics of the knowledge itself: its stickiness and ambiguity (Klarl, 2014; Leszczyńska and Pruchnicki, 2017). Knowledge diffusion, therefore, takes into account the effects of its transfer along with the context and prerequisites for circulation. This pertains to a greater extent to tacit knowledge and is correlated with the organisational culture of the units in which it occurs (Enderwick, 2011; Paliszkievicz et al., 2017; Yasir and Majid, 2017; Zhang, 2018). The purpose of this knowledge flow between places, people or forms of ownership is to exchange knowledge and apply it in the organisation (Liyanae et al., 2009; Anand et al., 2019). This is to result in the creation of new knowledge, which is a result of changes in the original state of knowledge of actors participating in these interactions (Ramadan, et al., 2017). Its core is therefore to convey the right knowledge content, set in the right context (Kim, et al., 2016; Gou, et al., 2019).

Knowledge transfer consists of specific sub-processes, variously described in the literature of this subject. For example, Filieri and Algezau (2014) identify the following knowledge transfer processes: knowledge search, knowledge access (acquisition), knowledge assimilation (or absorption) and knowledge integration (or combina-

tion). In order to refer to the knowledge diffusion in this paper, it was assumed that it consists of four key subprocesses: knowledge acquisition (from various sources, both internal and external), knowledge disclosure (targeted forwarding), knowledge dissemination (making specific knowledge a public resource) and knowledge sharing¹ (the mutual transfer of knowledge in the communication process, also including robots) (Mikula, 2017).

Effective knowledge transfer is challenging because employees cannot be forced to do it. Therefore it is important to understand the factors that affect knowledge diffusion (Amayah, 2013). The main groups of factors determining the effectiveness of knowledge transfer at an individual level include (Enderwick, 2011; Amayah, 2013; Butler, 2016; Luo et al., 2017; Dee and Leisythe, 2017; Huan et al., 2017; Margues et al., 2019): the learning and absorption abilities of the knowledge agent, including their innovative and citizenship behaviours, the strength of the relationship between the sender and receiver of knowledge, the character of knowledge as a special resource (its stickiness, ambiguity) and the level of organisational social and technological infrastructure of the knowledge environment (Enderwick, 2011; Lee and Lim, 2015; De Luca and Cano Rubio, 2019). At the organisational level, additional determinants are also important: leadership attitudes, the organisation's incentive system as well as its structure and company culture based on trust, cooperation and participation (Engle and Engle, 2010; Tsai, 2018; Zhang, 2018; Ali et al., 2019; Heo et al., 2019). The knowledge transfer itself

¹ Knowledge sharing is treated as the most important component of knowledge diffusion (Amayah, 2013; Arif et al., 2017; Ali et al., 2019; Wang, 2019; Afshar Jalili and Ghaleh, 2020; Zhao et al., 2020) because it is a subprocess conditioning the transformation of individual knowledge into organisational knowledge (Ramadan et al., 2017).

is conditioned by (Cohen and Levinthal, 1990; Ahuja, 2000; Gupta and Govindarajan, 2000; Amayah, 2013; Zhang, 2018; Anand et al., 2019) the type and the perceived value of knowledge, an increasing awareness of the need for development, participation, continuous learning, creativity, mutual trust, as well as the community of goals and interests, the need to think, the desire to search and be creative, as well as the awareness that one's market position is determined by intellectual wealth.

1.2 Theoretical foundations of knowledge professionalisation

Currently, knowledge has become the foundation for the well-being of the nation, the economy, the organisation and the employee (Choi and Lee, 2002; Daud and Yusoff, 2011; Khalique et al., 2013). As a result, the employment structure of modern enterprises is transformed, and knowledge workers take key positions, becoming the core of the staff (Drucker, 1999; Dahooie et al., 2018; Aydogmus, 2019; Kianto et al., 2019; Toth et al., 2020). Since they operate on knowledge, and with knowledge, their work is so characteristic that as they pursue their activities in the organisation, they take on various positions and responsibilities. This is why the term 'knowledge worker' is often a theoretical construct reflecting a more significant position occupied by a specific individual than their actual rank in the organisational structure. Hence, there is an ongoing dispute around the term and concept of the 'knowledge worker' (Surawski, 2019). L. Gaižauskiene and Ž. Tunčikiene (2016) identified three different approaches to explaining what a knowledge worker is – the data-driven approach (knowledge workers are seen as all those who work in particular organisations or in particular sectors or institutions); the job content approach (knowledge workers are seen as people who do

a certain type of job); and the conceptual approach (explains the term from the point of view of employees' importance to the organisation and their specificity of operating knowledge).

In general, knowledge work has been described as expert work involving design and technical expertise, idea generation and creative problem solving (Tammelin et al., 2017), and the knowledge worker uses knowledge as input to obtain knowledge-based intellectual output (Razzaq et al., 2019). Therefore, a knowledge worker is a person who is able to perform and work on complex issues, find, access, recall and apply information to acquire and improve their knowledge (Lee and Lim, 2015). Their knowledge is esoteric and non-substitutable, and they rely on knowledge and tacit skills that are difficult to standardise – they are professionals (Olsen, 2016) of the new era. Specific attributes of knowledge workers reveal the most about their uniqueness (Lee and Lim, 2015; Olsen, 2016; Tammelin et al., 2017; Dahooie et al., 2018; Zhao et al., 2020) – advanced specialist and interpersonal skills, independence in their professional activity, mobility, an innovative attitude, focus on building unique knowledge resources, orientation towards building relationships and extensive professional contacts, knowledge sharing in hermetic trust circles, both real and virtual, as well as a specific ethos of a professional who can effectively use their competences in accordance with the rules in force in a particular community of knowledge workers.

Due to the fact that professionals are not a homogeneous group, there are various typologies in the literature of the subject. J. Franek and E. Gublova (2011) distinguished between three categories of knowledge workers: knowledge creators, users and facilitators. M.I. Reed (1996) also identified three types of expert groups:

independent professions (e.g. lawyers, doctors), organisational professions (e.g. managers), and knowledge workers (e.g. financial consultants, IT analysts). These groups have different knowledge bases depending on the extent to which the knowledge is technical, abstract, codified, etc. (Olsen, 2016). E.N. Wolff (2006) classified knowledge workers based on the classification of their occupations. He supported the premise that knowledge workers are professional workers, and opined that different types of occupations such as architects, programmers, engineers and judges are grouped in different categories of specialists. They can be assigned to one of two groups – knowledge workers (e.g. engineers, programmers, scientists, lecturers, writers, designers) or data workers (e.g. sales engineers, pharmacists, teachers, pilots, office managers, advertising agents) (Lee and Lim, 2015).

In addition, nowadays they can create unique cohorts (Aydogmus, 2019) as gig-workers (when services/tasks are bound to a specific person) (Jabagi et al., 2019), liquid-knowledge workers (employed for a job that requires the acquisition and application of knowledge as a part-timer, a freelancer or a casual worker) (Jha et al., 2019; Miles et al., 2019), or digital nomads (individuals who work at a time and place of their own choosing, dealing independently with tasks that require the application of high-level skills) (Al-Hadi and Al-Aufi, 2019).

In conclusion, knowledge workers tend to create, share, disseminate and reuse both tacit and explicit knowledge in their day-to-day work (Lee and Lim, 2015). Usually, however, their esoteric and idiosyncratic tacit knowledge is most valuable with regard to shaping the lasting competitive advantage of the organisation. Their broad, trans-organisational cooperation relationships are also an invaluable asset

in terms of cross-linking and entanglement. For managers, boosting the productivity of knowledge workers is a major challenge (Butler, 2016; Jabagi et al., 2019). It is conditioned by many variables, but the following determinants of intellectual productivity seem to be of fundamental importance (Drucker, 1999; Dahooie et al., 2018; Kianto et al., 2019): responsibility for generating added value for the organisation, workplace autonomy, constant innovation, continuous teaching and learning, and focus on the quantity and quality of the output. This productivity, resulting from professionals' high levels of commitment (Toth et al., 2019) to knowledge-based work, is currently impacted by knowledge management processes implemented in organisations (Kianto et al., 2019) and an optimal knowledge environment (both technical and social, enabling the celebration of contacts in communities of practice and communities of expertise) creating the intellectual employee's comfort zone (Davenport, 2007; Lee and Lim, 2015; Butler, 2016; Olsen, 2016; Razzaq et al., 2019; Kaba and Ramaiah, 2020) and a properly designed psychological contract (Jha et al., 2019). This is because organisational support is more important to knowledge workers than to routine workers (Tsai, 2018) and supporting organisational culture is crucial to motivating knowledge workers to contribute their knowledge in an organisation (Zhang, 2018; Engle and Engle, 2010; Heo et al., 2019). Recognising knowledge workers' attitudes at a very early stage will enable the organisation to make better decisions and ensure commitment throughout the entire development process (Al-Busaidi and Olfman, 2017). In turn, high-quality employee motivation can contribute to an organisation's long-term success by supporting employees' well-being and performance (Jabagi et al., 2019).

From the perspective of the organisation as a whole, focusing on stimulating the process of diffusion of professionals' knowledge and providing them with optimal conditions for development, triggering attitudes of openness and voluntary cooperation with all stakeholders are, in turn, specific tasks for the implementers of the concept of knowledge management in particular enterprises. In reference to the transfer of knowledge between specialists, a key effectiveness factor is the focus on the knowledge-sharing subprocess (Heo et al., 2019). For this group of employees, as outstanding individuals, it is the most important element because they have the key knowledge resource that is very difficult to convey, and without knowledge sharing, knowledge assets are never applied in practice (Kucharska and Erickson, 2020). Often their attitudes are dominated by the belief that knowledge sharing is unnatural (Arain et al., 2019), and knowledge is the source of individual notions of power in an organisation (Butler, 2016). In the context of professionals, it includes both absorption and desorption of knowledge (Cohen and Levinthal, 1990; Kianto et al., 2019) i.e. its essence is mutual, interactive exchange (Heo et al., 2019). In their case, interpersonal relationships and personal contacts that create the context of trust and reciprocity are most important (Ensign and Hébert, 2010; Holste and Fields, 2010; Enderwick, 2011; Anand et al., 2019; Du and Wang, 2019). Knowledge workers look for specific, hermetic clusters of similar individuals, setting up communities of practice (Butler, 2016) and communities of experts (Razzaq et al., 2019) with a shared vision (Amayah, 2013). The level of trust and distrust impacts the attitudes and behaviours, e.g. entrepreneurship on the labour market, relational behaviour, risk acceptance and control behaviour (Tsai, 2018). The individual motivation of

professionals to actively participate in the knowledge transfer process is shaped by reputation, i.e. a set of attributes or abilities recognised by the environment, as well as altruism, resulting from the desire to meet one's needs of acceptance and prestige as well as status and recognition, aimed at deriving satisfaction from providing assistance (Barnard and Pendock, 2012). Reciprocity, in turn, manifests itself as the attitude of expectation towards each member of the community to help others and expect repayment or a favour in return (Taylor and Murthy, 2009; Al-Busaidi and Olfman, 2016). These elements together feature mutual commitment, mutual care, interdependence, reciprocity and fairness (Tsai, 2018).

In the context of the new economy, at the forefront of the knowledge-based economy are the industries that are the engine of a knowledge-based economy. One of them is the IT sector, closely related to information and knowledge-based activities (Lev 2003; Tsai, 2018; Jha et al., 2019), dominated by services (Raport PAIZ Sektor technologii informatycznych w Polsce 2018), which is one of the most knowledge-, service-, and innovation-intensive sectors of the economy (Kianto et al., 2019). In Poland, the labour market in IT services is the employee market (Kmiotek and Kopertyńska, 2018) – a permanent lack of qualified staff and high development potential (Jakubowski and Masiukiewicz, 2018) trigger specific actions and attitudes of IT professionals. Due to the lack of suitable specialists, enterprises often hire employees from other organisations and are not interested in building their own staff from scratch. This is associated with the demands for higher wages and, as a consequence, increases the wage level on the entire market (Rasińska, 2016) and decreases the propensity for the diffusion of knowledge, which becomes the founda-

tion for expert competitiveness. The above-mentioned trends observed in the fourth sector of Poland's economy have contributed to undertaking empirical research on IT professionals; the more so because a knowledge-worker's performance on the job is related to behaviours not results, and therefore it should also be analysed and measured (Razzaq et al., 2019).

Prior to embarking on empirical research to analyse and diagnose the conditions for the diffusion of specialist knowledge in the IT sector, the main hypothesis was formulated: it is supposed that the course of the knowledge circulation process depends on the type of knowledge and the groups of knowledge agents it concerns. At the same time, the types of knowledge (know-how, know-who, know-what, know-why, know-when, know-where, tacit, personalised, explicit, codified) were determined, as well as the dimensions of knowledge diffusion, to indicate internal knowledge flows between professionals, between specialists and other employees within the organisation and between knowledge workers and other external stakeholders of the organisation.

The main hypothesis was supplemented by the following specific hypotheses:

- the type of knowledge determines the subprocess of knowledge diffusion,
- the type of knowledge affects the dimension of knowledge dispersion,
- the individual process level is dominant in the knowledge circulation course processes,
- the dimension of knowledge diffusion affects the selection of the implementation instruments,
- the plateau of knowledge diffusion determines the most important components of its infrastructure,
- the implementation of each of the subprocesses of knowledge circulation is impacted by the different components of its relations of exchange.

The above theoretical assumptions yielded specific research questions, posing a challenge to identify:

- a knowledge transfer subprocess which is dominant in a specific dimension of its diffusion,
- the methods and tools used in a given group of knowledge agents to support the course of each of the specific knowledge transfer subprocesses,
- the social and technological infrastructure of the knowledge environment preferred by knowledge workers in the context of specific dimensions of professional knowledge diffusion,
- the dominant type of knowledge subject of individual diffusion subprocesses.

2. Methodology

To verify the presented research hypotheses and achieve the stated research objectives, as well as to ensure the validity of the research, the method of triangulation was selected. In this case, it meant the use of quantitative research to confirm the results of the qualitative research, focused on the identification of relationships between the results obtained (Bryman, 2008; Flick, 2009). This is because knowledge management scholars, combining both quantitative and qualitative methodologies, may conduct longitudinal investigation in the knowledge-intensive context across different industrial sectors (Tsai, 2018). In the process of method selection, the focus was on fully leveraging the potential of qualitative methods to describe the specific character of the world of key employees of the IT sector in Poland and to formulate theoretical and directive generalisations for managers. This was possible by focusing on one specific group of respondents (Woodside, 2010). Therefore, quantitative research takes the knowledge workers' perspective as the starting point.

The procedure for obtaining empirical data consisted of three stages. In the first stage, the direct semi-structured individual interview was used, and the research tool was an interview scenario. As part of the next stage of empirical research, focus group online interviews (FGIO) were conducted, with one focus for each dimension of knowledge diffusion (a. between professionals, b. between specialists and other employees, c. between knowledge workers and external stakeholders). Each group consisted of five people. The purpose of the first two stages was to identify individual elements of the context, tools, the environment and routines for dispersing the intellectual workers' knowledge. They were the foundation for the survey questionnaire.

As part of the last stage, quantitative research was carried out to test the research hypotheses. A computer-assisted telephone interview (CATI) was used, supported by a computer-assisted web interview (CAWI), by means of which 397 research inquiries were directed to potential respondents. The study questionnaire, consisting of 33 questions, was developed based on a seven-point Likert scale. As a result of the CATI and CAWI-based DYI research conducted from February to April 2020, 105 fully completed surveys were obtained.

The respondents themselves were professionals² (18 women – 17.14%, and 87 men – 82.86%) with higher education (98 people – 93.3%), mainly with a degree in economics and administration (63 people – 60%), IT (31 people – 29.5%) or engineering (11 people – 10.5%), representing Generation X (78 people – 74.3%), Y (24 people – 22.85%) or Z employees (three people – 2.85%), with an established professional

position (49 specialists, 25 managers, 20 directors, 11 board members) and an average seniority of 17 years, mostly employed under a permanent employment contract (81 people – 77.1%), a managerial contract (12 people – 11.4%) a contract of commission (three people – 2.85%), or self-employed (eight people – 7.6%).

In pursuit of confirmation of the research assumptions, reference was made to the responses received from respondents to individual survey questions. To examine the relationship between the analysed variables, a Spearman's rank-order correlation coefficient (r_s) was used. This is a nonparametric equivalent of the Pearson's linear correlation coefficient, suitable for use on variables measured on the ordinal scale. This coefficient is calculated according to the formula (Aczel and Sounderpandian, 2018):

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)},$$

where d_i ($i = 1, 2, \dots, n$) are rank differences and x_i and y_i ; $d_i = R(x_i) - R(y_i)$

To verify the hypothesis about the existence of relationships between the variables, a test of significance for Spearman's rank-order correlation coefficient was applied. The null hypothesis in this test assumes no relationship between the variables ($H_0: \rho_s = 0$). Rejection of the null hypothesis at the significance level of $\alpha = 0.05$ allows for the adoption of an alternative hypothesis that there is a relationship between the variables ($H_1: \rho_s \neq 0$). The dependency test statistics for large samples have the following form (Aczel and Sounderpandian, 2018)³:

$$z = r_s \sqrt{n - 1}.$$

² The group of respondents follows the division of key employees into knowledge workers (e.g. IT specialists) and management professionals (e.g. managers), often cited in the literature (Olsen, 2016).

³ The interpretation of Spearman's rank-order correlation coefficient is analogous to the interpretation of the parametric Pearson correlation coefficient.

3. Results

At the beginning, an attempt was made to verify the types of knowledge which are the object of individual subprocesses that constitute the course of its diffusion (Table 1). General regularities that can be noticed are as follows:

- knowledge workers are more open to participating in knowledge transmission processes within their own hermetic clusters, and knowledge circulation takes place at the individual level;
- specialists are more eager to participate in the diffusion of personalised (0.0562), tacit (0.4125) knowledge in the form of know-what (0.6238), know-where (0.5446), and know-why (0.5153);
- in the case of knowledge circulation involving other employees of the organisation, knowledge workers participate in the explicit (0.4444) and codified (0.4305) knowledge exchange, although they do not demonstrate commitment in this respect (negative correlations in all other types of knowledge). This may suggest deliberate protection of knowledge and the presence of mechanisms of hiding it, as well as of the attitude that knowledge equals power, or an unbelief in the reciprocity of the knowledge dispersion process;
- intellectual workers support organisational knowledge protection strategies and are not focused on the flow of knowledge in cooperative relations; if knowledge exchange occurs, it is codified (0.6790), public (0.7605), know-when type (0.3007) knowledge;
- in general, the dispersion of knowledge takes place mainly at the individual level, relating mostly to personalised (0.6180) know-what (0.6475), know-why (0.6409) and know-where (0.5787) knowledge.

Table 1. The Spearman rank correlation matrix for variable types of diffused knowledge and the dimension of knowledge transmission

Type of knowledge	between specialists	professionals and staff	key employees and business partners	individual level	inter-organisational level	meso-level employees and teams
know-how	0.5036*	-0.0707	-0.4300*	0.5096*	0.2058*	-0.2226*
know-who	0.5040*	-0.0190	-0.3868*	0.5071*	0.2762*	-0.0918
know-what	0.6238*	-0.0623	-0.3557*	0.6475*	0.2845*	-0.1055
know-why	0.5153*	-0.1261	-0.4404*	0.6409*	0.2461*	-0.1501
know-when	0.3711*	0.2954*	0.3007*	0.3016*	0.4023*	0.3798*
know-where	0.5446*	-0.1224	-0.3877*	0.5787*	0.3586*	-0.0027
personalised	0.5062*	-0.1023	-0.3566*	0.6180*	0.2797*	-0.1190
tacit	0.4125*	-0.2089*	-0.4626*	0.4685*	0.2334*	-0.1553
codified	-0.1382	0.4305*	0.6790*	-0.3316*	0.0948	0.5025*
explicit	-0.2932*	0.4444*	0.7605*	-0.4652*	0.0554	0.4823*

*p < 0.05

Source: Own elaboration.

In addition, relationships between the type of knowledge and individual subprocesses constituting the diffusion of knowledge were sought. The results obtained, presented in Table 2, can be reduced to the following generalisations:

- in knowledge distribution processes, knowledge workers are oriented towards personalised knowledge, especially when it is disclosed (0.6235), disseminated (0.6122) and shared (0.6098), and towards tacit knowl-

edge – especially in dissemination (0.6201) and sharing (0.5666),
 – knowledge acquisition mostly concerns know-what knowledge (0.5202), knowledge disclosure – know-what (0.6597) and know-where (0.6963) resources, dissemination – know-who (0.6452), know-what (0.6458) and know-where (0.7025) resources, and knowledge sharing is oriented towards know-where (0.6551) and know-what (0.6511).

Table 2. The Spearman rank correlation matrix for variable types of diffused knowledge and the subprocess of knowledge transmission

Knowledge type	knowledge acquisition	knowledge disclosure	knowledge dissemination	knowledge sharing
know-how	0.3669*	0.5048*	0.5946*	0.5541*
know-who	0.3813*	0.5961*	0.6452*	0.5869*
know-what	0.5202*	0.6597*	0.6458*	0.6511*
know-why	0.4939*	0.5826*	0.5949*	0.5485*
know-when	0.3804*	0.3678*	0.2947*	0.2985*
know-where	0.4966*	0.6963*	0.7025*	0.6551*
personalised	0.5038*	0.6235*	0.6122*	0.6098*
tacit	0.3830*	0.3968*	0.6201*	0.5666*
codified	-0.0425	-0.2526*	-0.3308*	-0.3689*
explicit	-0.1451	-0.4197*	-0.4550*	-0.4848*

*p<0.05

Source: Own elaboration.

Next, the professionals were asked to indicate how often they participated in specific knowledge transfer subprocesses, and at what levels (Table 3).

Table 3. Levels of implementation of knowledge diffusion subprocesses and the group of involved knowledge agents

Dimension and subprocess of knowledge diffusion	knowledge acquisition	knowledge disclosure	knowledge dissemination	knowledge sharing
between specialists	87.62%	80.00%	78.10%	86.67%
professionals and staff	73.33%	10.48%	75.24%	70.48%
knowledge workers and external specialists	83.81%	19.05%	73.33%	35.24%
specialists and the staff of business partners	22.86%	9.52%	15.24%	16.19%
individual level	91.43%	72.38%	79.05%	89.52%
group level	80.95%	16.19%	33.33%	75.24%
interorganisational level	34.29%	11.43%	31.43%	31.43%

Source: Own elaboration.

Subsequently, the tools characteristic by knowledge workers were indicated of particular knowledge transfer subprocesses most often used and preferred (Table 4).

Table 4. Instruments used by knowledge workers in knowledge diffusion

KNOWLEDGE DIFFUSION	Knowledge acquisition	%
	presentation	93.33
	e-mail	91.43
	analysis of information available on competition websites	85.71
	lectures/speeches at seminars, symposia and conferences	80.95
	analysis of specialised publications	74.29
	demonstration and display	38.10

KNOWLEDGE DIFFUSION	Knowledge disclosure		%
	meetings and briefings		31.43
	on-the-job training		28.57
	technical documentation disclosure		17.14
	product manuals		15.24
	Knowledge dissemination		%
	lectures/speeches at seminars, symposia and conferences		87.62
	specialised publications about the organisation and its actions		84.76
	organisational websites		84.76
	advertising the company and its products		68.57
	Knowledge sharing		%
	presentations at seminars, symposia and conferences		84.76
	meetings and briefings		40.95
	conversation lecture		32.38
mentoring		27.62	

Source: Own elaboration.

Knowledge agents, forming different groups due to the diversity of their working conditions, also demonstrate different preferences as to individual elements of the knowledge environment infrastructure (Table 5). These preferences are important due to the ongoing knowledge diffusion

subprocess and the level thereof. The preferences were verified since it is believed that knowledge management infrastructure can increase the contextual performance of knowledge workers (Enderwick, 2014; Razzaq et al., 2019).

Table 5. Levels of implementation of the knowledge diffusion processes and the optimal infrastructure of the knowledge environment

Condition	acquisition	disclosure	dissemination	sharing	between specialists	professionals and staff	key workers and business partners
focus on the individual	81.90%	88.57%	27.62%	85.71%	47.62%	36.19%	31.43%
meritocracy	81.90%	87.62%	70.48%	83.81%	94.29%	30.48%	34.29%
arrangement of knowledge around communities of practice	77.14%	82.86%	72.38%	88.57%	90.48%	22.86%	30.48%
appreciating work input	36.19%	80.00%	75.24%	88.57%	92.38%	24.76%	32.38%
access to information from many databases	84.76%	81.90%	84.76%	75.24%	40.00%	30.48%	32.38%
availability of various types of data	86.67%	79.05%	83.81%	71.43%	41.90%	37.14%	32.38%
intuitive data interfaces	85.71%	80.95%	90.48%	71.43%	35.24%	37.14%	32.38%
infrastructure conducive to the exchange of information from many sources	72.38%	74.29%	43.81%	67.62%	76.19%	28.57%	30.48%
possibility of data editing and storage	74.29%	27.62%	78.10%	63.81%	71.43%	20.00%	26.67%

Source: Own elaboration.

Often, one of the greatest challenges is to ensure the conditions necessary for a successful knowledge transfer. These are: the participants' awareness of the circumstances of the knowledge exchange (the organisational, cultural and social context), a comprehensive profitability study of the process, access to the results of these analyses and proper motivation to conduct the process. It should therefore be

emphasised that, regardless of the level of implementation of the knowledge diffusion process, the greatest challenge is to create trust and relationships between the process stakeholders (Amayah, 2013; Dohn, 2016). Hence, the author decided to verify the relationship between the components that build commitment to knowledge flow and specific components of the knowledge diffusion process (Table 6).

Table 6. The Spearman rank correlation matrix for the knowledge diffusion subprocess and the components of knowledge workers' involvement in knowledge transfer

Item	knowledge acquisition	knowledge disclosure	knowledge dissemination	knowledge sharing
mutual trust and respect of community members	0.3165*	0.1500	0.0934	0.0340
mutual support in achieving the goals	0.2358*	0.1641	0.0981	0.0903
reciprocity and citizenship behaviour	0.2323*	0.1160	0.1468	0.1820
expectation of a returned favour	0.1140	-0.1270	-0.2027*	-0.1089
satisfaction from helping others	0.0104	-0.1243	-0.1398	-0.1643
altruism based on building own knowledge resources	0.1129	0.0060	-0.0314	-0.0012
individual needs of recognition, acceptance and prestige	0.1545	0.1215	0.1815	0.2143*
building the prestige of one's group	0.2495*	0.3150*	0.3548*	0.3595*

* $p < 0.05$

Source: Own elaboration.

4. Discussion

The general observation of the presented empirical research is that specialists are aware of the main role of the sub-process of knowledge sharing and dissemination in establishing relationships, fulfilling contracts, focusing on the client and reaching other external knowledge agents.

It is clear that all elements of knowledge diffusion are most often carried out by professionals, mainly at the individual level. In the case of acquiring and disseminating knowledge, knowledge workers characteristically focus on communities of expertise, regardless of their organisational affiliation. They engage in the knowledge exchange that is part of relations with other knowledge workers of partner organisations to a greater extent than in the internal circulation of knowledge involving organisational

employees (staff) other than professionals. In the case of knowledge transferred by specialists within their group, they indicated the subprocess of knowledge sharing as important (on average 86.67%). This reflects the fact that professionals are highly aware of its importance for the creation of new knowledge, because its foundation is usually tacit knowledge. The high results for acquiring knowledge based on external contacts with other specialists are also characteristic (83.81%), demonstrating a strong determination to learn independently, directly from others, and as a result of membership in communities of practice, which are attitudes characteristic of knowledge workers. A smaller focus on disclosing and disseminating knowledge is also noticeable (the lowest results in

almost every dimension of knowledge diffusion) and no orientation toward sharing knowledge with other employees from outside the parent organisation (35.24% and 16.19% of responses). Such results may suggest low motivation of specialists in this area and reveal their attitude to knowledge as power. Therefore, it seems reasonable to consider redesigning the incentive systems to stimulate both the implementation of these subprocesses and the use of appropriate catalysing instruments. This may result in the transformation of tacit knowledge into explicit knowledge and human capital into a structural capital of the organisation. What is characteristic, however, is the knowledge workers' willingness to disseminate professional knowledge among other employees (75.24%) and a clear refusal to disclose it.

Also, it was determined that specialised presentations and analysing competitors' website content or specialised press are dominant as instruments of individual knowledge acquisition, with hardly any organisational support.

Professionals underestimate the acquisition of knowledge from various internal or external sources in direct contact, or have no opportunity to participate in it, which is a practical recommendation for managers, especially in terms of cooperation. Knowledge is generally shared in meetings and briefings as well as on-the-job instruction, which proves that specialists are most often the carriers of organisational knowledge. On the other hand, it is disseminated using the media. To share knowledge, professionals most often use conference and symposia presentations, meetings and briefings, as well as mentoring, usually limiting themselves to closed circles of professional collaboration groups. Unfortunately, they do not use the potential of communities of practice, or quality circles. They most often use tools which still

considerably restrict the free exchange of knowledge, and are strongly anchored in technological solutions. They use remote contact tools (e-mail, e-learning, social media platforms), which is related to the nature of their work but carries specific threats and does not allow for the full use of the benefits of direct contact. Unfortunately, analysing the correlation between individual tools and types of knowledge transferred showed no strong positive or negative relationships, which is why the paper does not present it.

Between the conditions of the social knowledge environment and the conditions of its technical infrastructure (Prahalad and Ramaswamy, 2005), social conditions are definitely more important in the case of the knowledge transfer process implemented in a specialised dimension (Cohen and Levinthal, 1990; Amayah, 2013). These results confirm the findings of other studies according to which key employees commonly use technological solutions (Kaba and Ramaiah, 2020); however, they are not critical to the dispersion of their knowledge (Kucharska and Erickson, 2020). Social factors are a prerequisite for efficient knowledge circulation in this case (Barnard and Pendock, 2012). However, the technical infrastructure of the knowledge environment is important at the professional level of knowledge transfer; that is, in contacts with other employees. It is easily observable, therefore, that where the knowledge transfer process is based on explicit knowledge, the advanced technical infrastructure of the knowledge environment is effective. In the case of tacit, high-context knowledge diffusion, or the basic strategy of knowledge creation or protection, the applied, required and preferred conditions are the social conditions of the knowledge environment.

The analysed research results suggest that attitudes of openness, reciprocity and altruism should be developed, with a special focus on preventing the tendency to treat knowledge as power and risk-avoidance attitudes. Designing the optimal infrastructure for knowledge diffusion and a comfort zone for professionals can, in fact, increase their involvement in knowledge exchange (Razzaq et al., 2019) and lead to more effective knowledge diffusion within the organisation and a network of relationships in which parent companies are involved. It should be remembered that a modern knowledge worker – a corporate nomad (Al-Hadi and Al-Aufi, 2019) – is more a part of the environment (the society-knowledge community) than of the organisation, and the efforts of managers should be focused on counteracting the negative consequences of these regularities.

When attempting to generalise the results obtained, it can only be said that by engaging in all knowledge transfer subprocesses, professionals aim to build the prestige of the community they co-create, which proves its integrity as well as its hermetic nature and cohesiveness. However, the prerequisite for successful knowledge acquisition is mutual trust and respect, mutual support in achieving the objectives, as well as reciprocity and civic attitudes. These components can open relationships and lead to the absorption of tacit knowledge.

Conclusions

The study attempts to capture the character and identify the individual dimensions of knowledge transfer in the perspective of selected knowledge agent groups and types of diffused knowledge. Based on empirical research, basic knowledge transfer subprocesses were identified, implemented by specific groups of knowledge agents. Also, the instruments and condi-

tions which are used in knowledge transfer subprocesses and knowledge dispersion were indicated.

It was found that knowledge workers are most likely to participate in the diffusion of high-context, personalised and tacit knowledge. In the Polish IT sector, knowledge exchange usually takes place at the individual level. Specialists are generally focused on the circulation of personalised tacit knowledge, because they perceive it as most valuable. In the case of knowledge sharing, it is a subprocess that is the domain of professionals in the closed circles of communities of practice that go beyond the framework of parent organisations. Knowledge is most often acquired within the relations of specialists with other employees. Knowledge workers are in fact knowledge carriers; hence, they are also focused on acquiring it from similar individuals. Knowledge sharing is the domain of specialists and takes place during their contacts with other employees, especially using various multimedia solutions. This is the subprocess of knowledge transfer approached most conservatively by professionals, who fear an uncontrolled transmission of their specific, high-context knowledge. Close and conservative attitudes were clearly observed in the transmission of knowledge between staff (employees other than knowledge-workers) and stakeholders. They suggest a targeted or intuitive use of knowledge protection strategies, especially in inter-organisational cooperation relationships.

Therefore, the conclusions of other researchers were confirmed, i.e. that the knowledge seeker's commitment, openness, and determination are essential to the effective diffusion of organisational knowledge (Holste and Fields, 2010; Amayah, 2013; Anand et al., 2019), and knowledge sharing and knowledge hiding seem like two sides of the same coin (Arain et al.,

2019), but social networks are particularly valuable from a knowledge perspective (Ahuja, 2000; Enderwick, 2011; Barnard and Pendock, 2012; Jabagi et al., 2019).

The results obtained allow for the formulation of general guidelines for controlling the flow of professional knowledge in the IT sector in Poland. First of all, managers should focus on stimulating the development of mid- and macro-dispersion of knowledge. The activities should aim at the development of intra-organisational exchange of knowledge and result in converting human capital in the form of personalised knowledge into structural capital. For this purpose, mature shaping of optimal knowledge environment conditions is required, adapted to the type of knowledge transferred and oriented towards a specific knowledge diffusion subprocess, which is desirable from the perspective of a specific organisation's strategy. It is recommended that organisations reorient to inter-organisational, network-based knowledge transfer as part of activities in various cooperative systems and to shape absorption skills and organisational learning at the macro level. The prerequisite for implementing these guidelines should be shaping the organisational culture supporting the course of knowledge transmission processes, including a team-oriented and supportive organisational culture, which has been proven to encourage IT professionals to share tacit knowledge (Enderwick, 2011; Borges et al., 2019). Therefore, research suggests that in the case of IT knowledge workers, nationality and place of employment are rather unimportant (Yigitcanlar et al., 2007).

The discussed results should be considered only for demonstrative purposes, as they have clear limitations due to the size of the research sample. The analysis demonstrated that some of the results cannot be generalised to the entire population

of knowledge workers of the IT sector in Poland, but only explored in the context of a verified group of respondents. Due to the size of the research sample (105), the research should only be seen as a pilot consideration that confirms the diversity of knowledge dispersions across different groups of knowledge agents and may authorise proper, multidimensional scientific explorations. It could be commonly used in the Polish IT sector because, due to the homogeneous nationality of the respondents, it does not verify whether the obtained results are determined by national or organisational culture.

Nevertheless, the considerations presented, supplemented by empirical explorations, contribute theoretically and practically to the diffusion of professional knowledge. They set the framework for designing the knowledge dispersion management subsystem as the chief element of the overall organisational knowledge management system, due to the subprocesses constituting knowledge transfer, the type of knowledge exchanged, and the group of knowledge agents involved in its circulation. Although organisations have recently adopted practices to retain knowledge on an ad hoc basis, extant research indicates that organisations are not ready to tackle the issue related to retaining knowledge (Sumbal et al., 2020). Therefore, modern organisations should introduce structured knowledge diffusion management mechanisms. The content presented is primarily of great practical value because it may lead to the creation of a knowledge-sharing comfort zone. This can be achieved by identifying the elements of the desired infrastructure of the knowledge environment that are important for the diffusion of knowledge of intellectual workers and the management's orientation towards these components. The abovementioned zone may increase their involvement in knowl-

edge transfer, not only within hermetic groups of specialists but also in various groups of knowledge agents, especially in relations with staff and co-operators.

It can also contribute to the retention or acquisition of talented employees, which in turn may result in levelling the proportions between knowledge resources and their location in the organisation, as well as digital inequalities. Thus, it may bring about better use at the level of the entire organisation, increasing the level of the company's structural capital and its innovation potential. Additionally, the knowledge distribution management subsystem constructed on the basis of research results and guidelines will enable more effective acquisition of a specific type of knowledge from external relations. The research results obtained also provide managers with hints on the directions of designing the process of controlled circulation of the desired types of knowledge, focusing on the diffusion of tacit, uncodified knowledge - the most valuable type of knowledge from the knowledge-based view perspective.

Preliminary explorations indicate further research challenges and set the direction for further scientific research. Efforts will first be made to gather sufficiently large and balanced empirical material to apply method structural equation modelling (SEM), which would allow researchers to identify statistically significant and directional relationships between directly immeasurable (latent) variables (Osińska et al., 2011; Sroka, 2012), or an attempt will be made to use fuzzy set qualitative comparative analysis (FsQCA) (Krakowiak-Bal and Ziemiańczyk, 2016). The research will be focused on identifying relationships between generational affiliation and preferences as to the type and subprocess of knowledge transfer and desired elements of the knowledge environment. The inferences will also be focused on the links be-

tween the employee's generation and the elements of trust and reciprocity that determine knowledge transfer. Attempts will also be made to set generational standards and desirable values constituting the organisational culture supporting knowledge diffusion. Finding an answer to the question of how the ambient awareness of knowledge workers affect the diffusion of their knowledge also requires empirical justification.

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