
How Attributes of Organizational Structure Affects Knowledge Management Processes in High-Technology Companies?

Submitted 17/09/21, 1st revision 14/10/21, 2nd revision 21/10/21, accepted 20/11/21

Sylwia Flaszewska¹

Abstract:

Purpose: The article aims to identify links between attributes of organizational structure and knowledge management processes in high technology companies.

Approach/Methodology/Design: The research was conducted in 100 Polish high-tech companies.

Findings: The results show that high-tech enterprises carry out different number of sub-process of knowledge management in different combinations. Surveyed companies confirm that different structural features are needed depending on the phase/sub-process of knowledge management. It is recommended to redesign the organizational structure in such a way that it corresponds to the key knowledge management processes as much as possible. Flexibility was found to have the most supportive effect on five of the seven knowledge management sub-processes studied.

Practical Implications: The results can serve as a guide for managers in improving the organizational structure for knowledge management needs.

Originality/Value: The attributes of organizational structure supportive and inhibiting knowledge management processes for high-tech companies were identified.

Keywords: Organizational structure, knowledge management, high-tech enterprises.

JEL classification: O32.

Paper Type: Research paper.

Acknowledgements: The research project was funded by the Polish National Science Centre (decision no. DEC-2013/09/N/HS4/03868).

¹Lodz University of Technology, Faculty of Management and Production Engineering, Department of Management, Lodz, Poland, ORCID: 0000-0003-2022-5939, e-mail: sylwia.flaszewska@p.lodz.pl;

1. Introduction

Knowledge has become a tool of competitive advantages (Imran *et al.*, 2021). In a dynamically changing environment, knowledge is „corporate power” and a major asset for a firm (Santoro *et al.*, 2018). In order to survive, enterprises must skillfully manage their knowledge. This is especially important in the case of *high-tech enterprises* that have their own specificity (Zakrzewska-Bielawska, 2012; Vinayak and Kodali, 2014; Huang and Chialing, 2018). According to Zakrzewska-Bielawska (2011), these are companies:

- operating at the interface between economy and science in an industry recognized as high technology and/or manufacturing products classified as high technology,
- conducting active research and development, combining the features of an innovative and knowledge-based, intelligent and learning enterprise,
- making extensive use of modern information technology,
- open to cooperation with the environment, creating various types of network connections and clusters with other organizations.

In this type of company, organizational structures must undergo significant changes, as well as the methods of managing people (Kisielnicki, 2004). The changes taking place in the economy, especially the development of information technologies, the need to deal with the excess of information, and the rapid obsolescence of key knowledge necessitate the improvement of organizational structures of enterprises, primarily towards increasing their flexibility and creating conditions conducive to the generation of innovations.

The aim of this paper is to identify links between attributes of organizational structure and knowledge management processes in high technology companies. The remainder of this paper proceeds as follows: Section 2 presents the literature review for introducing key constructs of research. Section 3 provides research methodology. Data analysis and the findings are reported in Section 4. Finally, conclusions, limitations and further research suggestions are presented in Section 5.

2. Literature Review

The *organizational structure* is one of the foundations of organization management. It determines the place of each participant, and also determines the desired methods of their conduct and behavior. It links the goals and tasks resulting from the strategy and technology of executive processes with people and the ways of influencing them in the work process (Zakrzewska-Bielawska, 2014; Barbosa *et al.*, 2021). “An organizational structure implies the need of communication and decision-making patterns of organizational members” (Twanta *et al.*, 2021).

Each organizational structure can be described through the prism of its attributes. The most common set of features of an organizational structure is the proposition according to which structure should be studied in five dimensions, specialization, standardization, configuration, centralization and formalization (Hopej, 1994).

The *specialization* determines the degree of limitation of the participants' freedom in the choice of organizational tasks and responsibilities (Mintzberg *et al.*, 2003). *Standardization* determines the degree of limitation of freedom of action by unwritten habits and unified procedures. The *configuration* determines the essence and shape of relations between various functions and activities of the company, determines hierarchical and horizontal relations, illustrating the scope of integration and methods of coordinating activities in the company (Hopej, 1994). *Centralization* determines the degree of concentration of powers to make decisions at individual levels of the hierarchy or the degree of autonomy of individual levels in the conduct of activities. The *formalization* determines the degree of limitation of the freedom of actions taken by the provisions (Caruana *et al.*, 1998; Gentile-Lüdecke *et al.*, 2020).

In a constantly changing environment, two other characteristics, such as flexibility and networking, are also assigned to many organizational solutions. The *flexibility* of the organizational structure determines the possibility of its quick changes in relation to the needs of the company and the environmental conditions, and its level depends on the method of shaping the organizational structure in its other dimensions. *Networking*, on the other hand, determines the durability of the network system and its complexity (the number of network partners and their positions) (Zakrzewska-Bielawska, 2011).

A properly designed organizational structure minimizes the freedom and unpredictability of participants' behavior in each organization. Therefore, it becomes an important management instrument, including knowledge management (Flaszewska, 2016). Numerous publications confirm that most researchers agree that knowledge management is a process consisting of various stages, taking the form of certain cycles (Teece, 1998; Neuman, 1997; Saleem and Amin 2013; Hu *et al.*, 2014; Mardani *et al.*, 2018; Garcia and Sosa-Fey, 2020). Their number may vary, as well as their combinations (Alavi and Leidner, 2001). According to Imran, Bilal, Aslam, and Rahman (2017) knowledge management is essential for implementing change successfully and achieving organizational objectives.

For the purposes of the research, it was assumed that knowledge management is a management process consisting in the implementation of sub-processes of allocating, acquiring, creating, sharing, using, retaining, and transferring knowledge outside in order to achieve the company's goals (Probst *et al.*, 2004; Tabaszewska, 2012).

3. Research Methodology

The survey, in cooperation with the specialized research unit INSE Research, was carried out in 2015 on a sample of 100 representatives from enterprises operating in Poland, classified as high-tech (according to Polish Classification of Activities codes) and employing over 50 people. Units meeting the assumptions were drawn from the purchased Bisnode base. In most cases (84), the PAPI technique was used, in the remaining cases (16), at the explicit request of the respondents, the proprietary questionnaire, constituting a research tool, was completed without the participation of the interviewer, and returned by e-mail. 56 men and 44 women took part in the study, many of them were people with higher education. The age of the respondents ranged from 23 to 70 years, on average 45 years with a standard deviation 11.

Most of the respondents (73%) stated that they represent a privately owned enterprise, 22% declared belonging to a state-owned entity, while the remaining 5% indicated mixed ownership. Considering the size (measured by the employment level), most of the respondents (more than half) are representatives of medium-sized companies. Taking into account the subject of the company's activity, 39 units were classified as manufacturing companies (dominated by entities from the pharmaceutical industry), and 61 as service companies (mostly companies from the IT industry and those conducting research and development works). After accumulating the Polish Classification of Activities codes, we can see that:

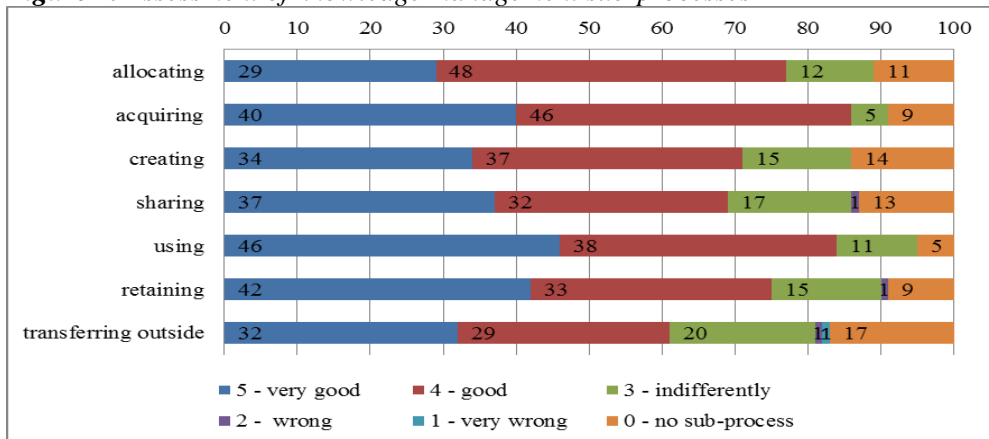
- production of basic pharmaceutical substances as well as drugs and other pharmaceutical products was represented by 26% of companies,
- production of computers, electronic and optical products - 7% of companies,
- production of aircraft, spacecraft and similar machines - 6% of companies,
- broadcasting generally available and subscription programs - 6% of companies,
- telecommunications - 7% of companies,
- activities related to software and IT consultancy and related activities - 21% of companies,
- information service activities - 7% of companies,
- research and development work - 20% of companies.

4. Research Results

The studied high-tech enterprises implement a different number of knowledge management sub-processes in various combinations. The vast majority of companies (76 units) implement all of the seven analyzed sub-processes. This mainly applies to large, private enterprises that provide services in the IT industry. Most often, as many as 95% of companies indicated that the enterprise uses the acquired knowledge. The implementation of this process in the surveyed companies was also assessed best by the respondents (Figure 1). The implementation of transferring knowledge to the outside was rated the worst. It should be noted, however, that the

implementation of each of the above-mentioned processes was rated relatively high, as evidenced by the median value ($M = 4$). Except for the sub-process of transferring knowledge to the outside world, there was little differentiation in the ratings given by the respondents. At the same time, this process, apart from the sub-process of creating, sharing and locating knowledge, was least often carried out in the high-tech enterprises surveyed.

Figure 1. Assessment of knowledge management sub-processes



Source: Own study based on Flaszewska, 2016.

The analysis of Spearman's ranks between the assessment of individual knowledge management sub-processes indicates that all of them are statistically significant and positively correlated, which means that if the selected sub-process was rated high, then another sub-process correlated with it was also rated high. It strongly correlates acquiring knowledge from the outside with transferring it to the environment ($R = 0.57$), which is quite an obvious dependency, because if a company wants to obtain knowledge from its external partners, it is most often also a source of knowledge for them. In turn, it correlates the weakest with the creation of knowledge with its preservation ($R = 0.27$), which may mean that not all ideas are stored in the knowledge repository.

As a result of the research, it was also possible to determine how in the case of high-tech enterprises the impact of the attributes of the organizational structure is perceived from the knowledge management perspective (Table 1). The features that are desirable and those that inhibit the knowledge management process were identified. Moreover, it was found that in the examined high-tech enterprises, different structural features are desired depending on the phase/sub-process of knowledge management. It is not possible to develop one universal model of the organizational structure supporting knowledge management, which will work well in every high-tech enterprise.

Three attributes are most conducive to *locating knowledge*, and thus identifying the sources of important internal and external knowledge, allowing for the determination of the knowledge gap: specialization, networking and flexibility. On the other hand, formalization, centralization and standardization have an inhibitory effect on this process. Considering the *acquisition of knowledge*, it was noticed that the acquisition of knowledge important for the enterprise, but coming from external sources, is most conducive to such features as: specialization, standardization, flexibility and networking.

Table 1. The perception of the impact of the features of the organizational structure on individual knowledge management sub-processes

Attributes of organizational structure	Strongly inhibitory impact	Weakly inhibitory impact	No impact	Strongly supportive impact	Weakly supportive impact
	on allocating knowledge				
specialization	2	6	17	44	31
standardization	3	8	24	38	27
configuration	0	8	33	36	23
centralization	0	13	31	26	30
formalization	5	11	22	36	26
flexibility	0	8	26	28	38
networking	0	6	25	35	34
on acquiring knowledge					
specialization	3	5	20	42	30
standardization	1	9	21	34	35
configuration	0	6	35	36	23
centralization	0	10	32	27	31
formalization	5	8	27	35	25
flexibility	0	6	26	34	34
networking	1	9	22	34	34
on creating knowledge					
specialization	5	7	26	25	37
standardization	4	10	21	31	34
configuration	0	12	33	32	23
centralization	2	10	32	28	28
formalization	6	7	24	34	29
flexibility	3	6	24	29	38
networking	0	5	27	30	38
on sharing knowledge					
specialization	5	14	22	24	35
standardization	4	10	26	24	36
configuration	0	9	29	35	27
centralization	1	10	31	27	31
formalization	6	8	26	35	25
flexibility	0	9	24	34	33
networking	2	5	28	31	34
on using knowledge					

specialization	6	8	22	30	34
standardization	6	6	20	34	34
configuration	2	6	29	38	25
centralization	3	11	30	24	32
formalization	7	10	17	41	25
flexibility	0	10	25	32	33
networking	1	3	24	36	36
on retaining					
specialization	2	3	25	31	39
standardization	2	1	17	43	37
configuration	0	4	34	36	26
centralization	1	3	32	30	34
formalization	3	8	21	37	31
flexibility	1	8	34	25	32
networking	0	5	32	29	34
on transferring knowlege outside					
specialization	2	6	25	32	35
standardization	2	6	23	32	37
configuration	2	6	35	32	25
centralization	1	9	36	24	30
formalization	4	12	23	33	28
flexibility	0	3	35	32	30
networking	0	8	25	34	33

Source: Own study based on Flaszewska, 2016.

According to the respondents, formalization has the most inhibitory effect on this process. It is worth noting that this sub-process should be of particular importance for high-tech enterprises because the knowledge resources acquired at this stage later constitute the basis for creating new knowledge, and this, as we know, quickly becomes obsolete in their case. The results obtained in the field of *knowledge creation* show that the creation of new and expansion of the existing knowledge resources of the organization is most favorably influenced by the network and flexibility of the organizational solution used. In this case, it is difficult to indicate which of the attributes inhibit the creation of knowledge, because apart from networking and flexibility, other features have both a lot of positive and negative impact on this sub-process.

Some previous studies show non-significant relationships between formalization and knowledge creation (Pertusa-Ortega *et al.*, 2010), whereas others find that firms with high levels of internal formalization are able to gain more from a given (high) number of knowledge sources (Ihl *et al.*, 2012). Taking into account the *sharing of knowledge*, it should be noted that the transformation of individual into team and organizational knowledge is favored especially by flexibility, networking and configuration, and inhibiting - by specialization, standardization and formalization, while in the case of the last attribute, 35 respondents were of the opinion that it had favorable influence, but weak. The results on the *use of knowledge* confirm the

particularly favorable impact of networking, flexibility and standardization on ensuring the availability and readability of the possessed organizational knowledge so that it can be used in the enterprise.

According to the respondents, standardization and specialization have the most beneficial influence on the *preservation of knowledge*. None of the listed attributes received more than three votes indicating a strongly inhibitory effect on the storage of essential knowledge for re-use. In turn, the *transfer of knowledge to the outside*, in the opinion of the respondents, is the most conducive to standardization, specialization and networking. These results empirically confirm previous literature (Chesbrough *et al.*, 2014; West *et al.*, 2006) which explains that firms that have more specialization are better prepared to find potential buyers and sell knowledge. Configuration, centralization and flexibility received the most votes as having no impact on the creation of new sources of external knowledge, while flexibility was perceived on a similar level, as an attribute having no impact on the transfer of knowledge to the environment, or as weakly or strongly conducive to this process.

5. Conclusions

Of the seven knowledge management subprocesses analyzed, five (locating knowledge, acquiring knowledge, creating knowledge, sharing knowledge and using it) confirmed the most beneficial impact of organizational structure flexibility. However, attention should be paid to the fact that the flexibility of organizational structures depends to a large extent on the condition of other structural attributes. Therefore, in order to ensure the flexibility of an organizational solution, it should be remembered that it cannot be too centralized and formalized, slim and hierarchical, as these features significantly reduce its desired flexibility.

The results obtained in this aspect are consistent with those described in the literature by other authors who claim that the organizational structure should be flexible enough to encourage the creation and sharing of knowledge across organizational boundaries (Nejatian *et al.*, 2013). Previous research also indicates that a flexible, lean and team structure is the best way to promote the development of knowledge management (Bennet and Bennet, 2004; Tyulkova, 2014; O'Sullivan and Azeem, 2007).

Due to the fact that various attributes of structures are desirable more or less depending on which sub-process of knowledge management is key in a given enterprise, it is recommended to model the organizational structure in such a way that it corresponds to the most important processes as much as possible. For example, if knowledge preservation activities are key to the enterprise, formalization may be greater, while if knowledge creation becomes the primary activity, high formalization will make the process more difficult.

This paper is not free from research limitations. First, the sample was obtained only from the members of 100 Polish high-tech companies. Therefore, perspective for the

above issue is not international. In future research, a sampling frame that combines firms from different countries could be used in order to provide a more international perspective to the subject. Also, it may be interesting to analyze companies in different periods of time to observe their advances in improving organizational structure for knowledge management needs. Third, subjective measures were included in the questionnaire. In future studies, more objective measures for the issue, will be considered.

References:

- Alavi, M., Leidner, D.E. 2001. Review: knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly*, 25, 107-136. DOI:10.2307/3250961.
- Barbosa, B., Borges, M.G., Serpa, S. 2021. The Informal in the Formal of Organizations: The Organizational Structure in Sociological Analysis. *Science Insights*, 36(4), 260-264. DOI: 10.15354/si.21.rp008.
- Bennet, D., Bennet, A. 2004. The Rise of the Knowledge Organization. *Handbook On Knowledge Management 1: Knowledge Matters*, 5-20. DOI:10.1007/978-3-540-24746-3_1.
- Caruana, A., Morris, M., Vella, A. 1998. The effect of centralization and formalization on entrepreneurship in export firms. *Journal of Small Business Management*, 36(1), 16-29.
- Chesbrough, H., Vanhaverbeke, W., West, J. 2014. *New frontiers in open innovation*. Oxford: OUP.
- Flaszewska, S. 2016. *Projektowanie organizacyjne w zarządzaniu wiedzą*. PWN, Warszawa.
- Garcia, S., Sosa-Fey, J. 2020. Knowledge management: what are the challenges for achieving organizational success? *International Journal of Business and Public Administration*, 17(2).
- Gentile-Lüdecke, S., Torres de Oliveira, R., Paul, J. 2020. Does organizational structure facilitate inbound and outbound open innovation in SMEs? *Small Business Economics*, 55(4), 1091-1112. DOI: 10.1007/s11187-019-00175-4.
- Hopej, M. 1994. *Dokonywanie zmian w strukturze organizacyjnej*. Pace Naukowe Instytutu Organizacji i Zarządzania Politechniki Wrocławskiej, nr 65, Wydawnictwo Politechniki Wrocławskiej, Wrocław.
- Hu, C., Wang, S., Yang, C.C., Wu, T.Y. 2014. When mentors feel supported: Relationships with mentoring functions and protégés perceived organizational support. *Journal of Organizational Behavior*, 35(1), 22-37. DOI:10.1002/job.1851.
- Huang, P., Chialing, Y. 2018. Key success factors in high-tech industry promoting knowledge management. *Journal of Interdisciplinary Mathematics*, 21(2), 509-517. DOI: 10.1080/09720502.2018.1451607.
- Ihl, C., Piller, F.T., Wagner, P. 2012. Organizing for open innovation: aligning internal structure with external knowledge search. Available at: https://conference.druid.dk/acc_papers/nrth91s571kxbbn6doflsftduo1.pdf.
- Imran, M.K., Bilal, A.R., Aslam, U., Rahman, U.U. 2017. Knowledge management strategy: An organizational change prospective. *Journal of Enterprise Information Management*, 30(2), 335-351. DOI:10.1108/JEIM-10-2015-0095.
- Imran, Z., Shafique, O., Sarwar, S., Jamal W.N. 2021. The Impact of Knowledge Management Environment on Knowledge Management Effectiveness: Through

- Mediating Role of Knowledge Sharing Process in Branch Banking of Pakistan. *South Asian Journal of Management Sciences*, 15(1), 97-117. DOI: 10.21621/sajms.2021151.06.
- Kisielnicki, J. 2004. Zarządzanie wiedzą we współczesnych organizacjach. In: Łopusiewicz, B. (Ed.). *Zarządzanie wiedzą w systemach informacyjnych*, Wydawnictwo AE Wrocław, Wrocław.
- Mardani, A., Nikoosokhan, S., Moradi, M., Doustar, M. 2018. The Relationship Between Knowledge Management and Innovation Performance. *The Journal of High Technology Management Research*, 29(1), 12-26. DOI:10.1016/j.hitech.2018.04.002.
- Mintzberg, H., Lampel, J., Quinn, J., Ghoshal, S. 2003. *The strategy process: concepts, contexts and cases* (4th ed.). Upper Saddle River, New Jersey, Prentice-Hall.
- Nejatian, M., Nejati, M., Zarei, M.H., Soltani, S. 2013. Critical Enablers for Knowledge Creation Process: Synthesizing the Literature *Global Business and Management Research*. *An International Journal*, 5(2-3), 105-119.
- Newman, V. 1997. Redefining Knowledge Management to Deliver Competitive Advantage. *Journal of Knowledge Management*, 1(2), 123-128. DOI:10.1108/EUM000000004587.
- O'Sullivan, K.J., Azeem, S.W. 2007. An Analysis of Collaborative Group Structure Technological Facilitation from a Knowledge Management Perspective. *The Electronic Journal of Knowledge Management*, 5(2), 223-230.
- Pertusa-Ortega, E.M., Zaragoza-Sáez, P., Claver-Cortés, E. 2010. Can formalization, complexity and centralization influence knowledge performance? *Journal of Business Research*, 63(3), 310-320. DOI:10.1016/j.jbusres.2009.03.015.
- Probst, G., Raub, S., Romhardt, K. 2004. *Zarządzanie wiedzą w organizacji*. Oficyna Ekonomiczna, Kraków.
- Saleem, S., Amin, S. 2013. The Impact of Organizational Support for Career Development and Supervisory Support on Employee Performance: An Empirical Study from Pakistani Academic Sector. *European Journal of Business and Management*, 5(5), 194-207.
- Santoro, G., Vrontis, D., Thrassou, A., Dezi, L. 2018. The Internet of Things: Building a knowledge management system for open innovation and knowledge management capacity. *Technological Forecasting and Social Change*, 136, 347-354. DOI: 10.1016/j.techfore.2017.02.034.
- Tabaszewska, E. 2012. *Wprowadzenie i funkcjonowanie systemów zarządzania wiedzą w przedsiębiorstwach*. Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław.
- Tawata, A., Akkawanitcha, Ch., Wachirasirodom, R., Eakasinth, S. 2021. Change Management: *An International Journal*, 21(1), 19-28. DOI: 10.18848/2327-798X/CGP/v21i01/19-28.
- Teece, D.J. 1998. Capturing Value from Knowledge Assets: The New Economy, Markets for Know-How, and Intangible Assets. *California Management Review*, 40(3), 55-79. DOI:10.2307/41165943.
- Vinayak, K., Kodali, R. 2014. The relationship between NPD innovation and NPD performance: the moderating role of NPD best practices in Indian manufacturing industry. *Measuring Business Excellence*, 18(2), 39-59. DOI:10.1108/MBE-03-2013-0017.
- West, J., Vanhaverbeke, W., Chesbrough, H. 2006. Open innovation: a research agenda. *Open Innovation: Researching a New Paradigm*, 285-307.

- Zakrzewska-Bielawska, A. 2011. Relacje między strategią a strukturą organizacyjną w przedsiębiorstwach sektora wysokich technologii. Wydawnictwo Politechniki Łódzkiej, Łódź.
- Zakrzewska-Bielawska, A. 2014. Ewolucja struktur organizacyjnych – w drodze do elastyczności i innowacyjności. In: Lichtarski, J., Nowosielski, S., Osbert – Pocięcha, G., Tabaszewska – Zajbert, E. (Eds). Nowe kierunki w zarządzaniu przedsiębiorstwem – wiedzące orientacje, Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Wydawnictwo UE we Wrocławiu, Wrocław, 615-624.
- Tyulkova, N. 2014. A Flexible Organizational Structure as a way of Knowledge Management in SMEs. Kidmore End: Academic Conferences International Limited. Retrieved from: <https://www.proquest.com/conference-papers-proceedings/flexible-organizational-structure-as-way/docview/1674840256/se-2?accountid=28422>.
- Zakrzewska-Bielawska, A. 2012. The strategic dilemmas of innovative enterprises: proposals for high-technology sectors. *R&D Management*, 42(4), 303-314. DOI:10.1111/j.1467-9310.2012.00685.x.