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## KNOWLEDGE MANAGEMENT SIGNIFICANCE AND COMMUNICATION COMPLEXITY IN THE CONTEXT OF INNOVATIVE ENTERPRISES: CASE OF POLISH NEWCONNECT MARKET

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**Abstract.** The main goal of this study is to show how the communication complexity influences the knowledge sharing in the organizational dimension, on the example of the NewConnect market in Poland. This paper presents and investigates the above mentioned topics of showing the importance of different forms of communication in sharing knowledge in innovative enterprises based on the questionnaire that has been conducted in NewConnect market in Poland. The empirical study proved that: (1) there is no correlation between the level of communication management in innovative enterprises, (2) the age of the enterprise level and the significance of knowledge management in innovative enterprises, (3) the age of the enterprise and the level of communication complexity in innovative enterprises. The findings of this research give varied and valuable arguments to managers from each sector in paying much attention to different forms of communication with stakeholders in sharing knowledge. This paper is valuable to academics and practitioners in search of reliable data on the influence of modern and traditional forms of communication on sharing knowledge in innovative enterprises, showing the fulfilment of the gap this type of study in the literature.

**Keywords:** Stakeholders; Knowledge management; Communication complexity; Innovative enterprise; NewConnect market

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**Additional disciplines:** sociology; information and communication

### 1. Introduction

Communicating with stakeholders and knowledge management processes are the basis for the functioning of today's businesses—in different industries and sectors. In addition, establishing lasting relationships with stakeholders (both internal and external) can determine the broadly understood quality of innovative processes. Therefore, it is possible—in some simplification—to assume that communication with stakeholders and sharing resources (in particular the knowledge) have an impact on the development of enterprises by delivering the

expected value to different units in a business environment. Therefore, communication management and knowledge sharing should be at the heart of the attention of modern managers and businesses' owners (as well as of other groups of employees). It is therefore worth considering how communication with stakeholders and knowledge management are correlated in the context of innovative enterprises' functioning.

The purpose of the article is to show how innovative enterprises operating on the NewConnect market implement communication processes with different classes of stakeholders, as well as treat the knowledge significance in their development. The research problem assumes the following: At what level is the complexity of communication processes with stakeholders (internal and external) in innovative enterprises operating in Poland (on the NewConnect market), and what is the direction and strength of dependence between communication with clients and knowledge management in the context of the development of innovative enterprises?

The research examines traditional and emergent forms of communication with main stakeholders as the communication complexity and its influence on knowledge management in innovative enterprises on the example of Polish market. Traditional communication forms include traditional ways in the form of paper documentation, in the form of direct conversations (face to face communication) and team meetings, traditional phone-call communication. While emergent communication forms include mostly extended IT solutions as email communication, Intranet communication (e.g. exchange of electronic documents, execution of orders, preparation of schedules with tasks, etc.), Extranet technologies and other Internet technologies—enterprise's/corporate's websites, external messengers or memory cases (e.g. for storing and sharing documents), and social networks (Woźniak, Wereda 2018).

## **2. Communication complexity with stakeholders – selected aspects**

Communication with stakeholders in contemporary enterprises can be implemented in various ways, using specific tools and methods (see: Wereda 2018; Dlamini, Ocholla 2018; Shatri 2019). Generally, the way of communicating with the environment is determined by the needs, possibilities and limitations of individual groups of stakeholders (Cai, Yang 2014; Shehu, Shehu 2015; Mišún, Paprskárová, Mišúnová-Hudáková 2019). Global trends (e.g. the development of ICTs) and society's propensity to use them in everyday life and business processes as well as regulatory conditions have the very important role here (see: Zehetner 2019). Unique adaptation to the specificity of a given group of stakeholders makes it necessary to specify the complexity of communication processes. The complexity of this process can be understood as the number of individual, elementary activities undertaken as part of the processes of communication of an enterprise with a definite stakeholder, aimed among others at acquiring, processing and providing information resources (see: Binbin, Haifeng, Yuda, Gibbons 2014). The complexity of communication processes of contemporary enterprises with stakeholders is associated e.g. with the following forms of data, information and knowledge exchange: traditional forms of promotion (press, TV, radio, etc.), paper documentation, direct talks (face to face) and meetings, traditional telephone calls, email accounts, corporate portals (personalized user accounts), external instant messaging, e.g. GTalk, Hangout, Skype, as well as social networking sites/portals (see: Dlamini, Ocholla 2018; Ganis, Waszkiewicz 2018; Shatri 2019; Redeker, Kessler, Kipper 2019). The complexity understood in this way is also determined by the scope of communication processes, that is the number of stakeholders with which the enterprise is in constant contact/relations (business and non-business) as well as the number of functions and processes in the enterprise that are affected by the processes of communicating with stakeholders (see: Binbin, Haifeng, Yuda, Gibbons 2014).

The complexity of the processes of communication with stakeholders—especially in innovative enterprises—requires taking into account knowledge management mechanisms and the operation of this knowledge in the so-called value chain. Therefore, the complexity of communication should be tailored to the given group of stakeholders (Wereda 2018). As a result, it will be possible to determine the optimal level of complexity and

thereby increase the solidity and effectiveness of communication processes. It is worth remembering that active and long-term communication with various, diversified classes of entities (both internal and external) is a source of costs for the enterprise. This is a kind of "an investment". Therefore, the complexity of communication should be properly planned, organized, implemented and controlled, as well as integrated with innovative processes.

At this point it is also worth emphasizing that the complexity of communication of contemporary enterprises—also operating in innovative industries and sectors—should not be determined only by modern forms/methods of communication. Traditional forms are still of great importance, e.g. direct conversations with employees or clients and business partners (Woźniak, Wereda 2018). Such activities, seemingly "outdated", give the opportunity to create trust between the enterprise and stakeholders (Wereda, Zaskórski 2018). It is worth remembering that trust is particularly important in the processes of creating, developing, implementing and commercializing innovations. This indicates the legitimacy of a specific diversification (by combining modern and traditional solutions) of activities and methods taken into account in shaping the complexity of communication processes of innovative enterprises with various groups of stakeholders.

### 3. Methodology of the research

The subject scope of the study concerns methods of communication (in a traditional or modern way) of innovative enterprises with various stakeholder groups (internal and external). The article also links the issue of the complexity of communicating with stakeholders and the importance of knowledge management in the development of enterprises. The subjective scope of the research is innovative enterprises operating on the NewConnect market in Poland. The study included 60 enterprises (15.7% of entities from the population—population comprised 381 companies from Poland). Data are actual for December 2018 (New Connect Statistic Bulletin 2018). The subject structure of the activities of the surveyed entities is contained in Table 1.

**Table 1.** Leading business profiles of enterprises (N=60)

Leading business profile	Number of enterprises	Leading business profile	Number of enterprises
Trade	11	Advice and training	7
Computer science	11	Recycling	2
Industrial processing	11	Media	1
Building and construction	8	Eco-energy	1
Financial services	8	Total	60

*Source:* own elaboration

The study used a random systematic selection (taking into account the criterion of the leading profile of activity indicated for the purposes of the NewConnect registry) in the layers. Respondents were CEOs or managers (of the highest or middle level) responsible for the area of relations with the environment, IT or innovations, employed in enterprises listed on the NewConnect market. One respondent from each company was qualified for the study (Table 2). The structure of the research sample—taking into account different criteria—is described in detail in Table 3.

The empirical study was carried out between November and December 2018 and covered the entire country (16 provinces in Poland). The largest number of surveyed enterprises is based in central Poland. In turn, the least studied entities are located in northern and eastern Poland (Figure 1). Such spatial distribution of the surveyed entities results mainly from the location of companies listed on the NewConnect market—the selection of entities for the research sample reflected the spatial distribution of entities in the entire population. In addition, such a

spatial distribution of the surveyed enterprises points to the fact that the so-called "innovative" entities predominate in western, southern and central Poland—and therefore in the areas that are best developed in terms of industry, services and trade. Northern and eastern Poland are mainly agricultural and recreational areas.

**Table 2.** Methodology of the research

The components of methodology	Specification
Research scope	An indication of how innovative companies operating on the NewConnect market pursuing communication processes with different classes of stakeholders
Research tool	Computer Assisted Self-Interviewing (CASI)
Entity contracting the study	Institute of Organization and Management, Military University of Technology in Warsaw, Poland
Period of study	2 months (November–December 2018)
Scope of study	Area of whole country (16 voivodships in Poland)
Respondents	Managers or managers responsible for IT, environment or innovation, employed in NewConnect-listed companies (1 respondent per business)
Criteria for selection of research sample	Systematic random sampling (including the criterion of the leading business profile indicated for the purposes of the NewConnect market record) in layers (layers correspond to enterprise size)
The size of the research sample	N=60 enterprises (15.7% of the population—the population constituted of 318 companies, i.e. SMEs and large enterprises, which are based in Poland and mainly operate in Poland)

Source: own elaboration

**Table 3.** Criteria for description of the research sample (N=60)

	Criteria	Percent of enterprises
Size of enterprise	Micro and small(1–49 employees)	37
	Medium(50–249 employees)	22
	Large (more than 250 employees)	1
Scale of enterprise's operation (multiple choice question)	Local	58
	Regional	60
	Domestic	60
	European	25
	International	5
Age of enterprise (years)	4–9	16
	10–15	19
	16–24	15

Source: own elaboration

The research tool was the Computer Assisted Self Interviewing questionnaire. Respondents on a 5-point scale assessed both the level of use of particular communication channels with stakeholders and the degree of influence (importance) of knowledge management on the development of the enterprise. The results of the evaluation of each question (factor) determined by the respondents were subjected to statistical analysis—factor analysis. The calculations were carried out using the IBM SPSS Statistics 24 software (PS IMAGO 4.0). The study also employed a method of critical analysis of the literature, as well as methods of analysis, synthesis and induction.

Five hypotheses were put forward to achieve the goal of the study:

1. Hypothesis No. 1: Knowledge management significance is at a high level in innovative enterprise.

2. Hypothesis No. 2: Communication complexity with internal and external stakeholders is at a high level in innovative enterprises.
3. Hypothesis No. 3: The higher level of communication complexity (with internal and external stakeholders), the higher level of knowledge management significance in innovative enterprises.
4. Hypothesis No. 4: The older enterprise, the higher level of knowledge management significance in innovative enterprises.
5. Hypothesis No. 5: The older enterprise, the higher level of communication complexity (with internal and external stakeholders) in innovative enterprises.

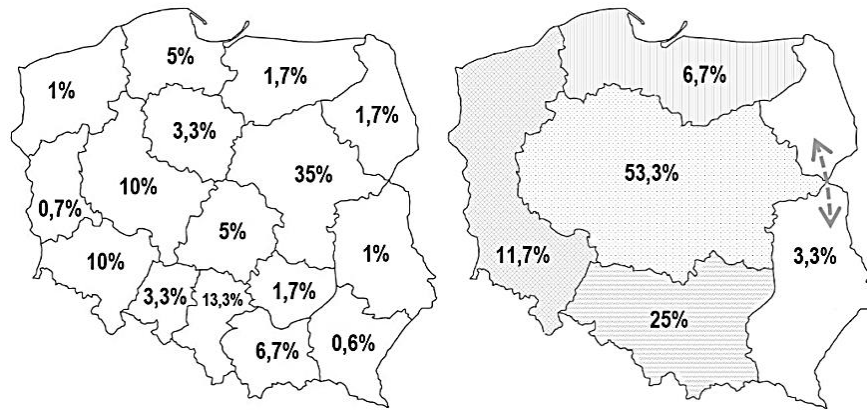


Fig.1. Geographical distribution of surveyed companies in Poland

Source: own elaboration

In order to verify the hypotheses, five composite indices were constructed:

1. Knowledge Management Significance Index–KMSI,
2. CommunicationComplexity Index–CCI, including 4 partial factors:
  - CCI\_int–internal (within the enterprise–with employees),
  - CCI\_indcust–with individual customers,
  - CCI\_instcust–with institutional customers,
  - CCI\_buscoop–with business co-operators.

In order to answer the above problem, the article will present the methodology of constructing these indicators, referring to specific partial factors (Table 5 and Table 7). These factors (as generalizations of various activities and processes) have been specified based on the analysis of the subject literature on the forms and tools of modern and traditional communication with stakeholders, as well as the standards and elements and specificity of knowledge management and knowledge activities in enterprises (Czakov 2012; Dejnaka 2013; Tarabasz 2013; Todeva 2006; Wereda, Zaskórski 2018; Witek–Hejduk et al. 2016; Yashin 1998; Jui–His et al. 2019; Hameed et al. 2019; Park, Kim 2018; Kach et al. 2015; Gao et al. 2019).

Composite ratios were used in the study because: they give a chance to take into account a large number of factors, enable holistic analysis, and provide the basis for a complex, multi–faceted quantification and evaluation of the studied phenomena (Nardo et al. 2005).

Factors included in the study (both for the purposes of the construction of KMSI and CCI) were designed to measure (on a 5–point scale) the approach of enterprises to the implementation of individual activities as part of communicating with stakeholders and the impact of these relationships on knowledge management. The value of

"1" meant that the activity is very rarely implemented or its impact is very low, and the value of "5", that the action is implemented very often or its impact is very large. The reliability of the scale was analyzed using the Cronbach's alpha coefficient to verify the quality of the data.

**Table 4.** Alfa Cronbach factor for knowledge management significance

Alfa Cronbach	Number of factors	Number of delated factors
0.689	13	0

Source: own elaboration

**Table 5.** Main factors in the area of knowledge management significance and alfa Cronbach after deleting factors

Factors	Mean of scale after deleting factor	Total correlation of factors	Alfa Cronbach after deleting factor
f1–the formation of specialized organizational cells or posts related to acquisition, processing and sharing data, information and knowledge	41.17	0.496	0.638
f2–the introduction of conscious restrictions to data, information and knowledge for the various positions and management levels	41.58	0.445	0.649
f3–the introduction of the principles of electronic documents interchange	40.73	0.310	0.672
f4–increasing the scope of obtained data, information and knowledge from the environment	40.02	0.262	0.680
f5–increasing the scope of obtained data, information and knowledge from employees	40.10	0.260	0.679
f6–increasing the match of provided data, information and knowledge to the information needs of a given post/managerial level	40.72	0.388	0.661
f7–increasing the level of virtualization (in teams)	41.40	0.371	0.663
f8–enhancing the competences (knowledge and skills) of employees	39.92	0.182	0.686
f9–increasing the level of executives' responsibility for tasks and objectives in the enterprise	40.98	0.234	0.682
f10–increasing the level responsibility of employees which are not managers for tasks	41.12	0.312	0.672
f11–increasing demand for trainings	39.80	0.194	0.686
f12–increasing the reluctance of workers to changes in the enterprise	42.30	0.221	0.688
f13–increasing the scope and level of processing in the direction of active functions supporting the planning, forecasting, as well as multi–dimensioned analysis of data	40.77	0.376	0.663

Source: own elaboration

In order to increase the transparency of the analysis, all indicators will be described together. The KMSI indicator will be presented first. For a full list of 13 factors describing the impact of knowledge management on the development of an innovative enterprise, the value of Cronbach's alpha coefficient was 0.689 (Table 4). Taking into account the methodological recommendations, the obtained value could be considered sufficient. The conducted analysis also indicated that there is no possibility to increase the reliability and quality of the scale in case of removing further factors (Table 5). In contrast, for the four CCI indices, the following Cronbach alpha coefficient values were obtained: CCI\_int (0.725), CCI\_indcust (0.898), CCI\_instcust (0.731) and CCI\_buscoop (0.701) (Table 6).



For the construction of KMSI, as well as up to four CCI-indicators, methodological recommendations regarding the development of composite indices developed by OECD (2008) were used. The adopted methodology for the construction of all indicators included the following stages (Nardo et al. 2005):

1. determining the scope of measurement and the legitimacy of using the composite indicator,
2. selection of partial factors,
3. evaluation of the quality of empirical data,
4. assessment of the relationship between partial factors,
5. giving weights to the partial factors and their aggregation to the composite indicator.

The results of the implementation of the first three stages for the KMSI indicator are included in Tables 4 and 5, and for the four CCI indices in Tables 6 and 7.

**Table 6.** Alfa Cronbach factor for communication complexity with stakeholders

Indicator	Alfa Cronbach	Number of factors	Number of delated factors
CCI_int	0.725	4	4
CCI_indcust	0.898	8	0
CCI_instcust	0.731	8	1
CCI_buscoop	0.701	6	2

Source: own elaboration

**Table 7.** Main factors in the area of communication complexity with stakeholders and alfa Cronbach after deleting factors

Factors	Mean of scale after deleting factor	Total correlation of factors	Alfa Cronbach after deleting factor
CCI_int			
f1–In the form of paper documentation	13.85	0.590	0.616
f2–Direct talks (face to face) and meetings	13.82	0.447	0.708
f3–Phone (traditional telephone calls)	13.77	0.699	0.534
f4–Email accounts	13.32	0.474	0.723
CCI_indcust			
f1–Traditional forms of promotion (press, TV, radio, etc.)	14.33	0.677	0.888
f2–In the form of paper documentation	13.75	0.880	0.864
f3–Direct talks (face to face) and meetings	12.93	0.423	0.810
f4–Phone (traditional telephone calls)	13.45	0.953	0.855
f5–Email accounts	13.37	0.936	0.858
f6–Corporate portals (personalized user accounts)	14.78	0.240	0.813
f7–External instant messaging, e.g. GTalk, Hangout, Skype	14.27	0.723	0.883
f8–Social networking sites/portals	14.30	0.693	0.887
CCI_instcust			
f1–Traditional forms of promotion (press, TV, radio, etc.)	23.72	0.198	0.721
f2–In the form of paper documentation	21.65	0.739	0.638
f3–Direct talks (face to face) and meetings	21.92	0.617	0.662
f4–Phone (traditional telephone calls)	21.47	0.660	0.670
f5–Email accounts	21.37	0.606	0.682
f6–Teleconferences	24.18	0.389	0.720
f7–Social networking sites/portals	25.08	–0.026	0.714
f8–Corporate portals (personalized user accounts)	24.13	0.344	0.730

Factors	Mean of scale after deleting factor	Total correlation of factors	Alfa Cronbach after deleting factor
CCI_buscoop			
f1–In the form of paper documentation	17.52	0.627	0.593
f2–Direct talks (face to face) and meetings	17.63	0.505	0.638
f3–Phone (traditional telephone calls)	17.12	0.416	0.685
f4–Email accounts	17.08	0.297	0.698
f5–Teleconferences	20.12	0.500	0.642
f6–Corporate portals (personalized user accounts)	20.12	0.374	0.692

Source: own elaboration

In the assessment of relations between partial factors and their aggregation, the factor analysis method was used for the composite indicators KMSI and CCI (by means of the main component analysis–PCA) (Hudrliková 2013). The Kaiser–Mayer–Olkin coefficient and the Bartlett sphericity test were used to verify the correctness of the PCA analysis. The limit value of the KMO coefficient is commonly adopted at the level of 0.5 to 0.7 (Williams et al. 2012). In the case of the KMSI coefficient, the value of KMO statistics was 0.554 (Table 8), and for CCI, respectively: CCI\_int (0.675), CCI\_indcust (0.713), CCI\_instcust (0.740) and CCI\_buscoop (0.729) (Table 9). Bartlett’s sphericity test for all five indicators showed that the hypothesis of uncorrelated coefficients can be discarded–test statistics are at a significance level lower than 0.001. Further PCA analysis is justified and methodically correct (Table 8 and Table 9).

**Table 8.** KMO sample adequacy and Bartlett test for KMSI

KMO sample adequacy		0.554
Bartlett test	Approximate chi–square	296.830
	df	78
	Significance	0.000

Source: own elaboration

**Table 9.** KMO sample adequacy and Bartlett test for all CCI indexes

		CCI_int	CCI_indcust	CCI_instcust	CCI_buscoop
KMO sample adequacy		0.675	0.713	0.740	0.729
Bartlett test	Approximate chi–square	61.981	554.143	224.915	76.294
	df	6	28	28	15
	Significance	0.000	0.000	0.000	0.000

Source: own elaboration

In a further analysis for all five indicators, the method of distinguishing main component factors with Varimax rotation was applied. However, the selection of components was based on the Kaiser criterion, which assumes that the eigenvalues of factors will be greater than "1" (Table 10). In the case of the KMSI indicator, factor analysis gave the basis for qualifying 13 factors to 5 components (Table 11).



**Table 10.** Identification of the main components of KMSI

Component	Initial values of eigenvalues			The sum of squares after rotation		
	Total	% variance	% cumulated	Total	% variance	% cumulated
1	2.877	22.129	22.129	2.540	19.538	19.538
2	2.512	19.324	41.453	1.991	15.312	34.850
3	1.786	13.740	55.193	1.855	14.268	49.118
4	1.228	9.449	64.642	1.703	13.100	62.217
5	1.058	8.138	72.780	1.373	10.563	72.780
6	0.840	6.459	79.239			
7	0.707	5.436	84.674			
8	0.627	4.824	89.498			
9	0.498	3.828	93.326			
10	0.349	2.684	96.010			
11	0.291	2.240	98.250			
12	0.127	0.975	99.225			
13	0.101	0.775	100.000			

*Method of extracting factors—principal components.*

Source: own elaboration

**Table 11.** Matrix of rotated components for KMSI

Factors	Component				
	C1 (acquisition of information resources)	C2 (increase in liability of employees)	C3 (support for data analysis and trust development)	C4 (information circulation and knowledge diffusion)	C5 (informational consistency)
f1	0.170	0.154	0.638	0.076	0.278
f2	-0.146	0.050	0.540	0.653	0.126
f3	0.135	-0.035	0.088	0.740	0.186
f4	0.876	-0.197	0.112	0.071	0.048
f5	0.936	-0.082	0.003	0.109	0.032
f6	0.372	0.263	-0.063	0.416	0.421
f7	-0.102	0.095	0.189	0.187	0.883
f8	0.393	-0.049	0.315	-0.514	0.397
f9	-0.044	0.908	0.039	-0.006	0.041
f10	-0.041	0.946	0.041	0.054	0.091
f11	0.650	0.289	0.152	-0.284	-0.092
f12	-0.250	0.155	0.612	0.385	-0.321
f13	0.189	-0.100	0.772	-0.056	0.079

*Rotation method—Varimax with Kaiser’s normalization. Rotation reached convergence in 13 iterations.*

Source: own elaboration

Assigning individual factors to constituents made it possible to name all components of the KMSI indicator and to give component weights. The weights have been normalized by the sums of the squares of charges that correspond to the part of the variance explained by the component. The construction of four CCI indices was carried out in the same way. The CCI\_int indicator consists of only one component, CCI\_indcust and CCI\_buscoop ratios from two components, and CCI\_instcust from three components. The rules of all five indicators are included in 12.

**Table 12.** Formulas of all indicators specified for the empirical research

Indicator	Formula
KMSI	$= (0.268 \cdot C1)/3 + (0.210 \cdot C2)/2 + (0.196 \cdot C3)/3 + (0.180 \cdot C4)/3 + (0.145 \cdot C5)/2 = (0.268 \cdot (f4 + f5 + f11))/3 + (0.210 \cdot (f9 + f10))/2 + (0.196 \cdot (f1 + f12 + f13))/3 + (0.180 \cdot (f2 + f3 + f8))/3 + (0.145 \cdot (f6 + f7))/2$
CCI_int	$= C1/4 = (f1 + f2 + f3 + f4)/4$
CCI_indcust	$= (0.760 \cdot C1)/7 + (0.240 \cdot C2)/1 = (0.760 \cdot (f1 + f2 + f3 + f4 + f5 + f7 + f8))/7 + (0.240 \cdot f6)/1$
CCI_instcust	$= (0.545 \cdot C1)/4 + (0.265 \cdot C2)/2 + (0.190 \cdot C3)/2 = (0.545 \cdot (f2 + f3 + f4 + f5))/4 + (0.265 \cdot (f6 + f8))/2 + (0.190 \cdot (f1 + f7))/2$
CCI_buscoop	$= (0.545 \cdot C1)/4 + (0.455 \cdot C2)/2 = (0.545 \cdot (f1 + f2 + f3 + f4))/4 + (0.455 \cdot (f5 + f6))/2$

Source: own elaboration

The obtained formulas of KMSI and CCI indicators will be used to verify hypotheses, and the values adopted by these indicators will be described in further parts of the article.

#### 4. Research results

The distribution of KMSI values is characterized by weak left-side skewness, which means that the majority of values were above the average value (Table 13). Considering the fact that each of the 13 factors included in the structure of the KMSI indicator was assessed on a 5-point scale ("1" means very rare/sporadic use of the action, and "5" very frequent use of the measure), the average value of the indicator at the level 3.4354 indicates that on average, the entirety of the importance of knowledge management in the development of innovative enterprises is at a moderate level. The "limit" (median) on a 5-grade scale is 3.00. Generally, it can be assumed that the low level of significance of knowledge management is for KMSI values in the range <1, 2.5, average level in the range <2.5, 3.5), and high in the range <3.5; 5>. However, this is a contractual and standardized division, because precise indication of the level of the importance of knowledge management requires the identification of the needs and capabilities of the company in this respect.

**Table 13.** Chosen descriptive statistics for KMSI and its components

Statistics	KMSI	KMSI_C1 (acquisition of information resources)	KMSI_C2 (increase in liability of employees)	KMSI_C3 (support for data analysis and trust development)	KMSI_C4 (information circulation and knowledge diffusion)	KMSI_C5 (informational consistency)
N (important)	60	60	60	60	60	60
Gap (Max–Min)	1.67	0.71	0.74	0.72	0.48	0.51
Min	2.51	0.63	0.32	0.20	0.36	0.22
Max	4.19	1.34	1.05	0.91	0.84	0.73
Mean	3.4354	1.1375	0.6650	0.5499	0.6250	0.4580
Standard deviation	0.42265	0.14791	0.16705	0.16462	0.11389	0.12768
Variance	0.179	0.022	0.028	0.027	0.013	0.016
Skew	-0.145	-1.064	0.342	-0.142	-0.274	0.248
Kurtosis	-0.816	2.312	-0.033	-0.408	-0.317	-0.973

Source: own elaboration

The distribution of CCI\_int values is characterized by strong left-side skewness, which means that the vast majority of values were above the average (Table 14). The CCI\_instcust indicator also has left-sided skewness (Table 15). On the other hand, relatively low right-side obliquities are characterized by CCI\_buscoop (Table 16) and CCI\_indcust (Table 14)–which means that just over half of the values were below the average value.

Taking a similar assumption, as in the case of RBM, that the low level of communication with a given stakeholder class is CCI in the range <1; 2.5), average in the range <2.5; 3.5), and high in the range <3.5; 5>, it can be assumed that communication complexity:

- with internal stakeholders (in an enterprise) is at a high level (average at the level 4.5625) (Table 14);
- with individual customers is at a low level (average at the level 1.8690) (Table 14);
- with institutional customers is at an intermediate level (average at the level 3.4067) (Table 15);
- with business co-operators is at an intermediate level (average at the level 3.3146) (Table 16).

**Table 14.** Chosen descriptive statistics for CCI\_int, as well as CCI\_indcust and its components

Statistics	CCI_int	CCI_indcust	CCI_indcust_C1 (traditional communication and networking)	CCI_indcust_C2 (communication taking into account the information asymmetry)
N (important)	60	60	60	60
Gap (Max–Min)	2.75	2.71	2.71	0.72
Min	2.25	1.00	0.76	0.24
Max	5.00	3.71	3.47	0.96
Mean	<b>4.5625</b>	<b>1.8690</b>	1.6050	0.2640
Standard deviation	0.53604	0.94175	0.91081	0.10550
Variance	0.287	0.887	0.830	0.011
Skew	<b>-1.874</b>	<b>0.590</b>	0.591	5.475
Kurtosis	5.004	-1.403	-1.378	33.381

Source: own elaboration

Knowing the average level of importance of knowledge management for the development of innovative enterprises and the complexity of communication of these enterprises with various stakeholder groups, it is possible to make an in-depth analysis of this issue from the perspective of individual thematic areas (i.e. two components of KMSI and CCI indicators). For this purpose, the results of the factor analysis were used. This enabled the grouping of individual factors for KMSI characterizing the activities under knowledge management in five thematically coherent components (Table 13). Due to the fact that particular factors and components of the KMSI were assessed on a 5–point ordinal scale, the Friedman test was used to assess the degree of importance of knowledge management and the design of a uniform ranking of components (Table 17 and Table 18). The lowest level of significance of knowledge management in the surveyed enterprises concerned the informational consistency (the C5 component)–a result in the Friedman test with an average rank of 1.57. The highest complexity was noted for the component (C1) associated with the acquisition of information resources–the average rank at 4.95 (Table 17).

A detailed list of 13 partial factors assumed in the study for the construction of the KMSI indicator and those subjected to the Friedman test is presented in Table 17. The respondents relatively most often indicated that in the development of enterprises the activities related to: increasing demand for trainings (f–11), enhancing the competences (i.e. knowledge and skills) of employees (f–8), increasing the scope of obtained data, information and knowledge from the environment (f–4), and increasing the scope of obtained data, information and

knowledge from employees (f-5). On the other hand, in the enterprises surveyed, the least chance for development of enterprises (in the context of knowledge management) is seen in: increasing the reluctance of workers to changes in the enterprise (f-12) and the introduction of conscious restrictions to data, information and knowledge for the various positions and management levels (e.g. in the form of procedures of access to information resources) (f-2).

**Table 15.** Chosen descriptive statistics for CCI\_instcustand its components

Statistics	CCI_instcust	CCI_instcust_C1 (traditional communication)	CCI_instcust_C2 (virtualization of communication)	CCI_instcust_C3 (communication aimed at promotion means)
N (important)	60	60	60	60
Gap (Max–Min)	3.30	2.18	0.93	0.38
Min	1.00	0.55	0.27	0.19
Max	4.30	2.73	1.19	0.57
Mean	3.4067	2.5161	0.5455	0.3452
Standard deviation	0.59066	0.40174	0.28874	0.10777
Variance	0.349	0.161	0.083	0.012
Skew	-1.759	-3.287	0.496	0.342
Kurtosis	5.188	12.584	-1.081	-0.537

Source: own elaboration

**Table 16.** Chosen descriptive statistics for CCI\_buscoop and its components

Statistics	CCI_buscoop	CCI_buscoop_C1 (traditional communication)	CCI_buscoop_C2 (modern communication–Internet)
N (important)	60	60	60
Gap (Max–Min)	2.73	1.36	1.37
Min	1.82	1.36	0.46
Max	4.55	2.73	1.82
Mean	3.3146	2.4956	0.8190
Standard deviation	0.62606	0.29839	0.44761
Variance	0.392	0.089	0.200
Skew	0.231	-1.572	0.985
Kurtosis	-0.419	2.775	-0.161

Source: own elaboration

**Table 17.** Statistics of Friedman’s test and average ranks for each component of KMSI

Components	Average rank	Friedman’s test	
KMSI_C1 (acquisition of information resources)	4.95	N	60
KMSI_C2 (increase in liability of employees)	3.05	Chi-square	151.185
KMSI_C3 (support for data analysis and trust development)	2.35	df	4
KMSI_C4 (information circulation and knowledge diffusion)	3.08	Significance	0.000
KMSI_C5 (informational consistency)	1.57		

Source: own elaboration

**Table 18.** Statistics of Friedman’s test and average ranks for each factor of KMSI

Factors	Average rank	Friedman’s test	
		N	
f1	6.11	60	
f2	4.73	Chi-square	273.797
f3	7.23	df	12
f4	9.49	Significance	0.000
f5	9.18		
f6	7.07		
f7	5.09		
f8	9.92		
f9	6.17		
f10	5.73		
f11	10.38		
f12	2.93		
f13	6.98		

Source: own elaboration

For a detailed analysis of the complexity of communication with stakeholders, the results of factor analysis were also used. This enabled the grouping of factors for individual CCI indices in (Table 19):

- one component–for CCI\_int;
- 2 components–for CCI\_indcust;
- 3 components–for CCI\_instcust;
- 2 components–for CCI\_buscoop.

Also for all four CCI indices, the Friedman test was used to assess the complexity of communication with stakeholders and to create a uniform ranking of components (Table 19 and Table 21).

For the area of communication with individual clients (CCI\_indcust), the lowest level of communication complexity in the surveyed enterprises concerned the communication area–the information asymmetry (C2 component)–result in the Friedman test with an average rank of 1.00. The highest complexity was noted for the component (C1) associated with traditional communication and networking–the average rank at 2.00 (Table 19). For the area of communication with institutional clients (CCI\_instcust) the lowest level of communication complexity concerned the communication target for promotion means (component C3)–result in the Friedman test with the average rank at 1.32. The highest complexity was noted for the component (C1) associated with traditional communication–the average rank at 3.00 (Table 19). For the area of communication with business partners (CCI\_buscoop), the lowest level of communication complexity concerned the area of modern communication–Internet (C2 component)–result in the Friedman test with an average rank of 1.00. The highest complexity was noted for the component (C1) associated with traditional communication–the average rank at 2.00 (Table 19).

For communication with internal stakeholders, a detailed list of 4 partial factors adopted in the study to construct the CCI\_int index and subjects subjected to the Friedman test is presented in Table 20. Respondents relatively often indicated that in the formation of the complexity of communication with internal stakeholders the most important is the action related to email accounts (f-4 ), and the smallest of communication in the form of paper documentation (f-1). For communication with individual clients, a detailed list of 8 partial factors adopted in the study to construct the CCI\_indcust index and subjects subjected to the Friedman test is also presented in Table 20. Respondents relatively most often indicated that in shaping the complexity of communication with individual clients the most important activities are: communication in the form of direct meetings (f-3), email accounts (f-5)

and traditional telephone calls (f-4), and the smallest with the use of social networking sites/portals (f-8) and corporate portals (personalized user accounts) (f-6).

**Table 19.** Statistics of Friedman’s test and average ranks for each component of CII indexes

Components	Friedman’s test				
CCI_indcust					
CCI_indcust_C1 (traditional communication and networking)	2.00	N	Chi-square	df	Asymptotic significance
CCI_indcust_C2 (communication taking into account the information asymmetry)	1.00	60	60.000	1	0.000
CCI_instcust					
CCI_instcust_C1 (traditional communication)	3.00	N	Chi-square	df	Asymptotic significance
CCI_instcust_C2 (virtualization of communication)	1.68	60	94.033	2	0.000
CCI_instcust_C3 (communication aimed at promotion means)	1.32				
CCI_buscoop					
CCI_buscoop_C1 (traditional communication)	2.00	N	Chi-square	df	Asymptotic significance
CCI_buscoop_C2 (modern communication-Internet)	1.00	60	60.000	1	0.000

Source: own elaboration

For communication with institutional clients, a detailed list of 8 partial factors adopted in the study to construct the CCI\_instcust index and subjects subjected to the Friedman test, is presented in Table 20. Respondents relatively often indicated that in the formation of the complexity of communication with institutional clients the most important are activities related to: email accounts (f-5), traditional telephone calls (f-4) and in the form of paper documentation (f-2), and the smallest of: corporate portals (personalized user accounts) (f-8), teleconferences (f-6), as well as social networking sites/portals (f-7). In turn, for communication with business partners, a detailed list of 6 partial factors adopted in the study to construct the CCI\_buscoop indicator and those subjected to the Friedman test is presented in Table 20. Respondents relatively often indicated that in the formation of communication complexity with business partners the most important activities include: email accounts (f-4), traditional telephone calls (f-3) and in the form of paper documentation (f-1), and the smallest of: teleconferences (f-5) and corporate portals (personalized user accounts) (f-6).

**Table 20.** Average ranks for each factors of all CII indexes

Factors	CCI_int	CCI_indcust	CCI_instcust	CCI_buscoop
f1	2.25	3.90	3.34	4.26
f2	2.27	4.64	6.25	3.97
f3	2.43	5.73	5.87	4.74
f4	3.05	5.25	6.55	4.83
f5	————	5.39	6.74	1.58
f6	————	3.32	2.68	1.62
f7	————	3.92	1.81	————
f8	————	3.86	2.77	————

Source: own elaboration



**Table 21.** Statistics of Friedman’s test for each factors of all CII indexes

	CCI_int	CCI_indcust	CCI_instcust	CCI_buscoop
N	60	60	60	60
Chi-square	33.538	120.802	345.746	247.865
df	3	7	7	5
Asymptotic significance	0.000	0.000	0.000	0.000

Source: own elaboration

On the basis of the above analysis (Table 13–21) can be made a negative verification of both hypothesis No. 1, that says that knowledge management significance is at a high level in innovative enterprise, and hypothesis No. 2, that says that communication complexity with internal and external stakeholders is at a high level in innovative enterprises. At this point, however, it should be noted that only the complexity of communication with internal stakeholders is at a high level.

In order to verify hypotheses 3–4 the Spearman’s rho correlation coefficient was used (Table 22 and Table 23). On this basis, one can make a negative verification of the hypotheses:

- No. 3, that says that the higher level of communication complexity (with internal and external stakeholders), the higher level of knowledge management significance in innovative enterprises; however, it should be noted that a weak, positive and statistically significant correlation only occurs in the complexity of communication with institutional clients and business partners (Table 22);
- No. 4, that says that the older enterprise, the higher level of knowledge management significance in innovative enterprises;
- No. 5, that says that the older enterprise, the higher level of communication complexity (with internal and external stakeholders) in innovative enterprises; however, it should be noted that a weak, positive and statistically significant correlation only occurs in the complexity of communication with internal stakeholders of innovative enterprises (Table 23) .

**Table 22.** Correlation between CCI indexes, the age of enterprise and KMSI

		KMSI
CCI_int	Correlationcoefficient	0.097
	Significance (reversible)	0.460
	N	60
CCI_indcust	Correlationcoefficient	0.007
	Significance (reversible)	0.957
	N	60
CCI_instcust	Correlationcoefficient	0.305*
	Significance (reversible)	0.018
	N	60
CCI_buscoop	Correlationcoefficient	0.385**
	Significance (reversible)	0.002
	N	60
Age of enterprise (years)	Correlationcoefficient	0.002
	Significance (reversible)	0.987
	N	60
*Correlation significant at 0.05 (reversible).		
**Correlation significant at 0.01 (reversible).		

Source: own elaboration

**Table 23.** Correlation between the age of enterprise and CCI indexes

		CCI_int	CCI_indcust	CCI_instcust	CCI_buscoop
The age of enterprise (years)	Correlation coefficient	0.310*	0.081	0.018	0.073
	Significance (reversible)	0.016	0.537	0.893	0.578
	N	60	60	60	60
*Correlation significant at 0.05 (reversible).					

Source: own elaboration

## Conclusions

Communication with stakeholders and knowledge management are important processes related to the planned and structured development of innovative enterprises. It is worth noting that these processes do not have to always be correlated with each other. They can often overlap independently and affect themselves only seemingly. Furthermore, an enterprise, in order to be considered as the innovative unit, may not have both the complexity of communication with stakeholders and knowledge management development (knowledge significance) at a high level. It must be emphasized that the peculiarity of these both categories depends heavily on industry, market, regulations, customers, etc. The universal (global) dependencies and applications should not be adopted here.

The example of the NewConnect market in Poland shows, that neither knowledge management significance nor communication complexity with internal and external stakeholders is not at a high level in innovative enterprises. What more, it cannot be noticed that the higher level of communication complexity (with internal and external stakeholders), the higher level of knowledge management significance in innovative enterprises, as well as the older enterprise, the higher level of knowledge management significance and the higher level of communication complexity (with internal and external stakeholders) in these enterprises. However, it is important to emphasize that the surveyed companies are widely recognized as innovative business units, operate in modern and progressive industries, as well as are largely oriented at realization innovative projects.

## References

- Binbin, Ch.; Haifeng, Y.; Yuda, Z.; & Gibbons, Ph. 2014. The Cost of Fault Tolerance in Multi-Party Communication Complexity, *Journal of the ACM* 61(3): 19:1-19:64. <https://doi.org/10.1145/2597633>
- Cai, S.; & Yang, Z. 2014. On the relationship between business environment and competitive priorities: The role of performance frontiers, *International Journal of Production Economics* 151: 131-145. <https://doi.org/10.1016/j.ijpe.2014.02.005>
- Czakon, W. 2012. *Networks in strategic management*. Warsaw: Wolters Kluwer Business.
- Dejnaka, A. 2013. Building a customer relationship, in Dutko, M. (Ed.). *Bible of e-business*. Gliwice: Publishing House Helion.
- Dlamini, P.; & Ocholla, D. 2018. Information and Communication Technology Tools for Managing Indigenous Knowledge in KwaZulu-Natal Province, South Africa, *African Journal of Library, Archives & Information Science* 28(2): 137-153.
- Ganis, M.; & Waszkiewicz, M. 2018. Digital Communication Tools as a Success Factor of Interdisciplinary Projects, *Problemy Zarzadzania* 16(4/77):85-96. <https://doi.org/10.7172/1644-9584.77.5>
- Gao, F.; Wang, J.; & Wang, S. 2019. Understanding knowledge workers' job performance: a perspective of online and offline communication networks, *Enterprise Information Systems* 13(1): 107-131.
- Hameed, Z.; Khan, I.U.; Sheikh, Z.; Islam, T.; Rasheed, M.I.; & Naem, R.M. 2019. Organizational justice and knowledge sharing behaviour, *Personnel Review* 48(3): 748-773.

- Hudrliková, L. 2013. Composite indicators as a useful tool for international comparison: The Europe 2020 example, *Prague Economic Papers* 4.
- Jui–His, Ch.; Jiun–Kai, H.; Jian–Feng, Z.; & Ping, W. 2019. Pen innovation: The role of organizational learning capability, collaboration and knowledge sharing, *International Journal of Organizational Innovation* 1(3): 260–272.
- Kach, A.; Azadegan, A.; & Wagner, S. 2015. The influence of different knowledge workers on innovation strategy and product development performance in small and medium–sized enterprises, *International Journal of Production Research* 53(8): 2489–2505.
- Mišún, J.; Paprskářová, P.; & Mišúnová–Hudáková, I. 2019. Relationship between Changes in Business Environment and Introducing New Methods, Tools and Procedures of Control(-ling), *Ad Alta: Journal of Interdisciplinary Research* 9(1): 203–207.
- Nardo, M.; Saisana, M.; Saltelli, A.; & Tarantola, S. 2005. *Tools for Composite Indicators*. Brussels: European Commission.
- Netter, S.; Pedersen, E.R.G.; & Lüdeke–Freund, F. 2019. Sharing economy revisited: Towards a new framework for understanding sharing models, *Journal of Cleaner Production* 221: 224–233.
- New Connect Statistic Bulletin. 2018. Retrieved from [https://newconnect.pl/pub/NEWCONNECT/statystyki/statystyki\\_miesieczne/201812NC.pdf](https://newconnect.pl/pub/NEWCONNECT/statystyki/statystyki_miesieczne/201812NC.pdf).
- OECD. 2008. *Handbook on Constructing Composite Indicators. Methodology and User Guide*, Brussels: OECD.
- Park, S.; & Kim, E.–J. 2018. Fostering organizational learning through leadership and knowledge sharing, *Journal of Knowledge Management* 22(6): 1408–1423.
- Redeker, G.A.; Kessler, G.Z.; & Kipper, L.M. 2019. Lean information for lean communication: Analysis of concepts, tools, references, and terms, *International Journal of Information Management* 47: 31–43. <https://doi.org/10.1016/j.ijinfomgt.2018.12.018>
- Shatri, B. 2019. Communicating through Technological Tools: An Evaluation of Their Impact on Face-to-Face Communication, *Vizione* 32: 65–79.
- Shehu, A.M.; & Shehu, R. 2015. The Moderating Role of Business Environment in the Relationship between Entrepreneurial Orientation and Business Performance among Nigerian SMEs, *Jurnal Pengurusan* 43: 119–128.
- Tarabasz, A. 2013. The reevaluation of communication in customer approach–towards Marketing 4.0, *International Journal of Contemporary Management* 12/4.
- Todeva, E. 2006. *Business Networks. Startegy and Structure*. New York: Routledge.
- Wereda, W. 2018. Model of Building Stakeholder Engagement in the Functioning of the Organization–Trust and Risk, *Annales Universitatis Mariae Curie-Skłodowska. Sectio H (Oeconomia)* LII(6): 111–127.
- Wereda, W.; & Zaskórski, P. 2018. Creating relationships with clients in the IT environment, in Brătianu, C.; Zbucea, A.; & Vitelar, A. (Eds.). *STRATEGICA. Challenging the Status Quo in Management and Economics*. Bucharest: Tritonic.
- Williams, B.; Brown, T.; & Onsman, A. 2012. Exploratory factor analysis: A five–step guide for novices, *Australian Journal of Paramedicine* 8(3).
- Woźniak, J.; & Wereda, W. 2018. Premises of using information and communication technologies (ICTs) in communication with stakeholders: risk management perspective, *Hyperion International Journal of Econophysics and New Economy* 11(2).
- Yashin, T. 1998. *Integrated Marketing Communications. The Holistic Approach*. Oxford: Butterworth Heinemann.
- Zehetner, A. 2019. The Relationship between Emotional Intelligence and Sales Performance in a Business-to-Business Environment; With Implications for Cross-Cultural Adaptability, *Marketing Science & Inspirations* 14(2): 10–20.

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