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SUPPLY CHAIN INTEGRATION THROUGH STAFF EXCHANGE ACTIVITIES

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Abstract. In the relevant literature there is a widely recognized consensus of understanding supply chain's integration (SCI) in terms of the informational, material or financial flows. However, there are very few publications including people or human as flows in the SC. We equate them with staff exchange activities – sending / delegating company employees to work in partner organizations. The main objective of the article is to explore and explain the role of staff exchange activities as a factor integrating the SC as well as projections of directions for development. In the research process 1232 enterprises from Poland, EU were included; 500 of them declared the occurrence of staff exchange activities in the SC; 732 enterprises denied such situation. The considerations in our study on the role of such activities in the context of SCI indicate the need to recognize the fact that they are an important factor of SCI.

Keywords: staff exchange, supply chain integration, supply chain management, human resources.

JEL Classification: O15, M12, M54.

Introduction

Supply chain's (SC) activities are vital and current due to the necessity of effectiveness, efficiency, optimization, and integration (Donlon, 1996; Handfield et al., 2009; Min & Zhou, 2002; Tan et al., 2002; Van Hoek, 1998). The development of theoretical ideas concerning material, informational and financial flows, as well as new approaches to their modernization, e.g., ecological, sustainable, or social ones, are visible in the relevant literature (e.g., Gunasekaran & Ngai, 2005; Li et al., 2005, 2006; Vonderembse et al., 2006; Zhu et al., 2011, 2012; Ivanov & Sokolov, 2013; Brandenburg et al., 2014). However, along with the increase in the interest in human beings among enterprises and researchers, the question of flows, as mentioned earlier, seems to be insufficiently developed (Delfmann et al., 2010; Jin et al., 2014; Themistocleous et al., 2004). The existing literature gap, concerning one of the four types of SC's flows: material, informational, financial, and human, forced the authors of the article to conduct broad research focusing on the last, almost unexamined type of flows. Meanwhile, business practice indicates quite frequent situations related to sending/delegating company's employees to work in partner organizations cooperating in the SC.

Staff exchange activities, as we were able to identify in the course of pilot empirical studies conducted in 2019, mostly concern the situations of: quality control, IT systems integration, audit, training, supplying the supplier's workforce in case of insufficient production capacity, replacement, accident, and joint tasks/projects. Providing employees, sending them on assignment to a partner organization brings about a quick transfer of knowledge and promotes its dissemination in various enterprises in the SC. Thanks to personnel exchange, suppliers and/or recipients who participate in such exchange have a real impact on the direction and shape of the solutions developed in the SC. This also increases the acceptance of such solutions by the partner organizations. Based on the above-mentioned observations, it can therefore be assumed that staff exchange activities in the SC contribute to co-operation in external dimension and constitute a factor of its integration. These human flows determine "*glues*" that bind buyers and suppliers in ways that allow

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them to collaborate, and enable enterprises to capitalize on their employees to improve material, information and knowledge flows across the SC. Such a point of view is not presented in the relevant literature, although it is used in business practice, which is shown in the empirical part of our article. This observation is in line with the trend noted by Carmeli et al. (2017), who claim that the research so far has tended to focus on the similarities and complementarities between buyers and suppliers as a way to build quality relationships, but little effort has been directed towards the study of processes that help build inter-organizational capabilities.

Thus, the article's main objective is to emphasize the role and the rank of the human factor, and in particular the thread related to the staff exchange activities in the SC, as an important component of its integration. This article addresses the following research questions:

RQ 1: Do the staff exchange activities in the SC contribute to the integration of its links?

RQ 2: Does the size of the enterprise and the sector (or branch) in which it operates affect SC's integration through staff exchange activities?

RQ 3: What types of staff exchange activities in the SC contribute, in particular, to SC integration?

The article deals with the organizational aspect related to staff exchange activities in the SC. Side threads regarding human behavior and worker motivation are not its essence, but only side topics of considerations on SCI.

In the next section, we have situated staff exchange activities within the wider area of supply chain management and supply chain integration, and we have justified our focus on human flows in supply chain. Then we have discussed how the topic has been characterised in previous researches. Second section refers to overview of methodology and research sample. Third section consists of the classification of various staff exchange activities and their role in SCI's context. In the last one, discussion section, we have identified insights from this research for SC managers and requirements for further research.

1. Literature review

1.1. Supply chain and supply chain management

The lack of relevant literature concerning human beings in SC activities begins with defining SC or supply chain management (SCM) itself. The widely recognized SC definition by Oliver and Webber created in 1982 claims that a SC is a "*network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer*" (Christopher, 2005). Accordingly, the SCM definition prepared by the Global Supply Chain Forum states that it is "*the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*" (Lambert & Cooper, 2000).

In recent years, one of the main themes related to SCM in the relevant literature has been the role of integration as a key factor in achieving improvements (e.g., Tan et al., 1999; Romano, 2003; Van der Vaart & Van Donk, 2008). Numerous publications on this subject point to positive relationships between integration and performance (Frohlich & Westbrook, 2001; Mackelprang et al., 2014; Vickery et al., 2003).

1.2. Supply chain integration – theory and factors

Integration is generally understood as the process of joining parts together. The belief that there is a need for SC's integration (SCI) is of utmost importance for both practitioners and academia (Baofeng Huo et al., 2016; Westbrook & Frohlich, 2001). SCI is "the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organizational processes, in order to achieve effective and efficient flows of products and services, information, money, and decisions, to provide maximum value to the customer" (Flynn et al., 2010). SCI is par excellence associated with SC relationships between particular links: manufacturers and suppliers or customers (Paulraj et al., 2008) and a more comprehensive range of partners (H. L. Lee & Whang, 2001).

There is an increased interest among researchers and practitioners in the field of SCI (e.g., Narasimhan & Kim, 2002; Gunasekaran & Ngai, 2004; Cousins & Menguc, 2006; van der Vaart & van Donk, 2008; Zhao et al., 2008; Wong et al., 2011; Prajogo & Olhager, 2012; Zhu et al. 2018; Chaudhuri et al., 2018; Hendijani & Saei, 2020). Everyone noticed the need to integrate suppliers and customers to make a SC successful (Vereecke & Muylle, 2006). Companies are building collaborative relationships with their SC partners in order to achieve efficiencies, flexibility, and sustainable competitive advantage (Nyaga et al., 2010). The increase in their levels in the SC ensures quick access to required information, increases sensitivity to customer needs, and shortens the response time compared to competitors (Sezen, 2008), which creates value for shareholders by reducing costs and increasing market share (H. Lee, 2000). Integration helps reduce production costs, shorten cycle time, improve product quality, increase response rates, and improve customer satisfaction (Flynn et al., 2010; Baofeng Huo et al., 2016).

Three dimensions of SCI important for this research may be distinguished, among others: internal integration (Germain & Iyer, 2006; Pagell, 2004), external forward (upstream, customer) integration (Devaraj et al., 2007; Homburg & Stock, 2004; Westbrook & Frohlich, 2001), external backward (downstream, supplier) integration (Devaraj et al., 2007; Germain & Iyer, 2006; Handfield et al., 2009; Koufteros et al., 2007; Westbrook & Frohlich, 2001). Internal integration is the first step for the external one (Hillebrand & Biemans, 2003). Both internal and external integration have a different role in SCI. The internal

one focuses on integrated processes, while the external one concentrates on broad relationships with customers and suppliers (Flynn et al., 2010). SCM's successful implementation requires integrating the company's internal functions and linking them with its partner companies' external operations in SC (Holmberg, 2000). Furthermore, internal integration is strictly associated with physical flows of materials, while external integration refers to the data flows, which means using information systems (Westbrook & Frohlich, 2001). But some results of studies (cf. Kumar et al., 2017; Dyer et al., 2018) indicate that relations and particularly the inter-organizational relations are the basis for the activities of enterprises currently operating on the market. Both in economic practice and the subject literature, more attention has been paid to the fact that not individual organizations, but systems of several or even a dozen of interconnected, internally integrated, coordinated and implementing tasks within strategic cooperation of supply and sales chain links (supply chains) have greater chances for a market victory.

The literature points to examples of Japanese SCs as those that achieve the highest degree of integration and build partnerships between individual enterprises. For example, Liker and Choi (2004) describe the Japanese SCs – Toyota and Honda – as a "partnership model" where a network of suppliers learns and improves processes in cooperation with producers. Similarly, Iyer et al. (2009) describe Toyota's SC in terms of close and long-term relationships with a high level of information exchange and cooperation to solve common problems.

In the relevant literature, there is a widely recognized consensus of understanding SCI in terms of the informational (Devaraj et al., 2007; Feldmann & Müller, 2003; Prajogo & Olhager, 2012; Themistocleous et al., 2004), material (Childhouse & Towill, 2003; Min & Zhou, 2002; Westbrook & Frohlich, 2001) or financial flows (Flynn et al., 2010). A lot of the papers focus on the field of operations, information systems, and information technology. The main focus is associated with enterprise application integration (EAI) through information systems, such as electronic data interchange (EDI) (Alvarado & Kotzab, 2001; Themistocleous et al., 2004), enterprise resource planning (ERP) (Themistocleous et al., 2004), warehouse management systems (WMS), transport management systems (TMS), material requirement planning (MRP), collaborative planning and forecasting replenishment (CPFR) or distribution resource planning (DRP) (Min & Zhou, 2002).

In turn, there are few researches and studies in the literature which focus on various human resources (HR) – related issues in SCI, even though they may have a high level of influence on SCI (Ellinger & Ellinger, 2014; Pandey et al., 2012; Sweeney, 2013). Some researchers suggest that information systems or technology are not enough for integration. Key success factors consist of relationships, cultures, organizational structures, and people (Beth et al., 2003). In connection with human capital, SCI enables enterprises to change their strategies to more partnership-oriented ones and enterprises with a high level of employee commitment to the organization are more likely to integrate within the understanding of SCI (Baofeng Huo et al., 2016).

1.3. The role of staff exchange activities in supply chain integration

As stated above, most empirical research on SCI focuses mainly on operational management, the use of information systems, and information technologies. However, the cooperation of SC links, leading to the integration of its participants, can also be implemented through selected practices in HRM (Menon, 2012; Pandey et al., 2012). Importantly, it is worth emphasizing at this point that among the criteria indicated for deepening ties between business entities are, among others, staff exchange activities (Menon, 2012). Moreover, research shows that communication and teamwork were the most important competencies for successful SCI (Prajago & Sochal, 2013). The research conducted by Huo et al. (2015) examines the effect of high-involvement HRM practices on three dimensions of SCI. It concludes that different aspects of HRM practices have different effects on SCI. Employee skills and incentives do not influence supplier integration despite their positive relation to internal integration and negative relation to customer integration. However, all three dimensions of SCI are related by employee participation.

In turn, Wang et al. (2016) examined the effects of manufacturers' HR capabilities and IT resources on internal integration capabilities and their influence on supplier integration. The research shows that employee capabilities had positive effects on internal and external integration. Also, Shub and Stonebraker (2009) showed a relationship between selected HRM practices and SCI. Their study showed a theoretical integrative model of human and organization variables with SCI and performance. Among human variables, there are such activities as relationship-based staffing, training, evaluation, and compensation. Sweeney (2013) also sees the need to investigate human resources' role in shaping relational capital as a factor of SCI. He suggests that integration (either intra or inter-firm) is predicated on relationships between individuals, teams, functions, and divisions and relationships between upstream and downstream organizations and relationships. For many firms, adopting the holistic SCM approach requires a reappraisal of how internal and external customer/supplier relationships are created and managed. Research conducted by Menon (2012) is also worth noting. He used the Delphi method (13 experts – scientists and practitioners) to determine the role of HR in SCI and performance. As part of internal integration factors, the experts indicated departmental teams to coordinate with other department and cross-functional teams and matrix management while pointing out that the smooth integration of different departments' work was considered a prerequisite for external integration across organizations. Among the factors of external

integration, there were teams to coordinate activities with SCs partners network teams with people partner companies working on network goals, share resources (personnel, technology, R&D) with partners, partner involvement in new product development, and using external resources such consultants for educating staff and putting new systems in place. The Delphi research conducted by Menon shows extremely important conclusions for deepening integration in SC – HR can look to SC partners as a source of the workforce. Partners can provide employees, and the organization can send its employees on assignment to partner organizations. This conclusion relates directly to the topic of staff exchange activities in the SC.

2. Research methodology

The adopted research approach was intended to answer research questions presented in the introduction section. Therefore, the consecutive parts of the empirical results analysis addresses those questions. The three-stage research process based on the prepared survey whose goal was to identify staff exchange activities in the SC in the enterprises that are SC leaders has been adopted to obtain the empirical results. Such a solution, based on the nomothetic approach, has already been successfully implemented by Jagoda et al. (2020). The survey consists of 16 questions who were divide into three interrelated sections. The first section refers to the general information about the examined company in terms of the number of people employed or branch identification. The second section consists of the questions referring to the staff exchange activities (when? how long? what rules? who is delegated? who is an initiator?). The third section consists of sub-sections and more in-depth questions depending on the situations in which staff exchange activities take place. Thus, the three-stage process adopted by the authors of this paper is as follows:

1. The identification of the literature gap and the research sample. The relevant literature from the Web of Science and Scopus databases have been thoroughly investigated.
2. The selection of types of enterprises for the analysis and situations for human flows in the SC based on stage one and industry and branch reports from Poland. The following branches have been distinguished: home appliances, construction, chemical, wood industry, electrical machinery industry, metal industry, mining industry, electrotechnical, energy, retail, wholesale trade, medical/pharmaceutical, oil and gas, clothing/textile, food, telecommunications, transport/rail/logistics, armaments, and other enterprises. Considering various situations in which personnel is exchanged between enterprises in the SC, in the pilot studies, the authors identified: quality control, IT systems integration, audit, training, supplying the supplier's workforce in case of insufficient production capacity, replacement, accident, and joint tasks/projects.
3. The analysis of the research data obtained from the survey, including the criteria presented in stage two, and finally propositions for further research.

The research was conducted in Poland, EU, among SCs leaders that are the coordinators of activities and whose economic strength and position are decisive in the SC. The survey mentioned above was used in the structured interview tool with the computer-assisted telephone interviewing (CATI) method, where the respondent was always an HR manager. The research sample contains 2469 enterprises. In the research process, 1232 enterprises were included; 500 declared staff exchange activities in the SC; 732 enterprises denied such a situation.

3. Empirical results

3.1. RQ 1: Do the staff exchange activities in the SC contribute to the integration of its links?

Cross-tables, a statistical test, and the variables' correlation were used to analyse the variables' relationship. The selection of the appropriate statistical test and the correlation coefficient depends on measuring the variables, the number of their values, or their distribution. The study used correlation coefficients for nominal variables: C – contingency, Yula (phi), V Cramer, directional measures: lambda, uncertainty coefficient, and chi-square test of independence. The null and alternative hypotheses of the chi-square test assume that:

H0a: the variables do not depend on each other.

H1a: the variables depend on each other.

Empirical results have been presented in Tables 1, 2 and 3.

The distribution of observations in the cross-table shows a similar percentage of affirmative responses in companies with a workforce of 100–249 and over 500 employees. Thus, both in large and very large enterprises, it is believed to a very similar degree that the staff exchange activities between individual links in the SC contribute to its integration. Gender does not differentiate the attitude of the respondent. It should be noted that there is a large majority of affirmative answers – over 80%.

Directional measures and symmetric measures are statistically insignificant, so no conclusions can be drawn about the dependence of the attitude regarding the staff exchange activities towards the size of employment. The chi-square test is also statistically insignificant, which means that there is no reason to reject the null hypothesis (H0a) – the claim that staff exchange activities contribute to SCI and the volume of employment are independent of each other.

Table 1. Staff exchange activities in SCI and employment volume results (source: own elaboration with SPSS)

Cross table					
Category		Staff exchange activities contribute to the SC integration	Staff exchange activities do not contribute to the SC integration	Total	Percentage share of positive answers
Employment volume	100–249 employees	324	42	366	88.5%
	over 250 employees	113	21	134	84.3%
Total		437	63	500	87.4%

Directional measures			
Category		Value	Approximate significance
Nominal by Nominal	Lambda	0.000	b
Uncertainty factor		0.003	0.219e

Symmetrical measures			
Category		Value	Approximate significance
Nominal by Nominal	Contingency coefficient	0.056	0.210
V Kramer		0.056	0.210
Phi		0.056	0.210
N important observations		500	

Chi-square test		
Value	df	Approximate significance
1.568	1	0.210

Table 2. Staff exchange activities in SCI and sector (source: own elaboration with SPSS)

Cross table					
Category		Staff exchange activities contribute to the SC integration	Staff exchange activities do not contribute to the SC integration	Total	Percentage share of positive answers
Sector	Agriculture, forestry, fishing	40	5	45	88.9%
	Industry, heavy equipment	209	34	243	86.0%
	Services	188	24	212	88.7%
Total		437	63	500	87.4%

Directional measures			
Category		Value	Approximate significance
Nominal by Nominal	Lambda	0.000	–
Uncertainty factor		0.001	0.659

Symmetrical measures			
Category		Value	Approximate significance
Nominal by Nominal	Contingency coefficient	0.041	0.660
N important observations		500	–

Chi-square test		
Value	df	Approximate significance
0.833	2	0.659

Table 3. Staff exchange activities in SCI and sector (source: own elaboration with SPSS)

Cross table					
Category		Staff exchange activities contribute to the SC integration	Staff exchange activities do not contribute to the SC integration	Total	Percentage share of positive answers
Branch	Home appliances	4	1	5	80.0%
	Construction	26	3	29	89.7%
	Chemical	24	3	27	88.9%
	Wood industry	23	6	29	79.3%
	Electrical machinery industry	19	2	21	90.5%
	Metal industry	37	4	41	90.2%
	Mining industry	4	0	4	100.0%
	Electrotechnical	20	3	23	87.0%
	Energy	17	0	17	100.0%
	Retail	93	10	103	90.3%
	Wholesale trade	38	7	45	84.4%
	Medical / pharmaceutical	36	3	39	92.3%
	Oil and gas	1	0	1	100.0%
	Clothing / textile	10	1	11	90.9%
	Food	47	14	61	77.0%
	Telecommunications	9	2	11	81.8%
	Transport / rail / logistics	27	3	30	90.0%
	Armaments	2	1	3	66.7%
Total		437	63	500	87.4%

Directional measures			
Category		Value	Approximate significance
Nominal by Nominal	Lambda	0.009	0.414
Uncertainty factor		0.012	0.461

Symmetrical measures			
Category		Value	Approximate significance
Nominal by Nominal	Contingency coefficient	0.176	0.557

Chi-square test		
Value	df	Approximate significance
15.533	17	0.557

3.2. RQ 2: Does the size of the enterprise and the sector (or branch) in which it operates affect SC's integration through staff exchange activities?

The distribution of observations in the cross table shows a very similar percentage of affirmative responses in companies from different sectors. Thus, the sector does not change the attitude towards the staff exchange activities contribution to its integration. There are over 86% affirmative responses in each sector.

Directional measures and symmetric measures are statistically insignificant. Likewise, the chi-square test is statistically insignificant; therefore, there is no reason to reject the null hypothesis (H0a) – the claim that staff exchange activities contribute to SCI and the enterprise sector are independent of each other.

The company has the greatest dispersion of affirmative responses in the cross table containing the breakdown by branches (67–100%). However, in every branch, most enterprises believe that the staff exchange activities between individual links in the SC contribute to its integration. The smallest percentage of positive answers is in armaments, the highest in the mining, energy, and oil and gas industries.

Directional measures and symmetric measures are statistically insignificant. The chi-square test is also statistically insignificant, which means that there is no reason to reject the null hypothesis (H0a) – the claims that staff exchange activities contribute to SCI and the enterprise sector do not influence one another.

3.3. RQ 3: What types of staff exchange activities in the SC contribute, in particular, to SC integration?

Furthermore, at the beginning of the research, the authors tested the assumption that the distribution of the study variables was normal. For this purpose, the Kolmogorov-Smirnow and Shapiro-Wilk tests were used. These tests are based on the following null (H0b) and alternative (H1b) hypotheses:

H0b: the distribution of the examined feature in the population is normal.

H1b: the distribution of the studied trait in the population differs from the normal distribution.

The significance of each variable's tests is less than 0.05; i.e., we reject the null hypothesis (H0b) – the distributions of the examined variables are different from the normal distribution. For this reason, non-parametric tests were included in the analysis for the comparison of variables. The McNemar test is the test used for comparing two paired samples and is used for dichotomous variables. Wilcoxon's test compares dependent samples and is used to test variables measured at the ordinal level and nominal and interval level. The following hypotheses were assumed in the tests:

H0c: states that "staff exchange activities between individual links in the SC contribute to its integration" does not depend on situations in which the staff exchange activities between the company and the supplier and/or recipient take place.

H1c: states that "staff exchange activities between individual links in the SC contribute to its integration" depends on situations in which the staff exchange activities between the company and the supplier and/or recipient take place.

If the significance level is greater than or equal to α = 0.05, there is no reason to reject H0c; when this value is lower than 0.05, the null hypothesis (H0c) should be rejected in favour of the alternative hypothesis (H1c). The test results are presented in Table 4. All statistics are significant at a significance level lower than 0.05; thus, the claim that "staff exchange activities between individual links in the SC contribute to its integration" depends on situations in which the staff exchange activities between the company and the supplier and/or recipient take place appeared to be true. As was stated before, the authors of the article equate staff exchange activities in the SC with sending or delegating the company's employees to work in partner organizations.

In the case of staff exchange activities regarding quality control, IT systems integration, the audit of activities, training, supplying the supplier's workforce in the event of insufficient production capacity, replacement and accident, in most (from 329 to 488) of the surveyed companies there were no staff exchange activities between the surveyed company and the supplier, and in a significant minority, (from 12 to 171) of companies there existed such activities.

Few (from 1 to 26) respondents stated that staff exchange activities between individual links in the SC did not contribute to its integration, even though there were such activities in the company. On the other hand, the majority (from 292 to 426) of the respondents believe that staff exchange activities contribute to its integration, even though there were no such activities in the

Table 4. Staff exchange activities in SCI and sector (source: own elaboration with SPSS)

Staff exchange activities situation	McNemer test			
Quality control			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		49	361
	Staff exchange activities occur		14	76
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	14	188.00	2632.00
	Positive ranks	361	188.00	67868.00
	Connections	125	–	
	Total	500		
IT systems integration			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		48	361
	Staff exchange activities occur		15	76
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	15	188.50	2827.50
	Positive ranks	361	188.50	68048.50
	Connections	124	–	
	Total	500		

End of Table 4

Audit			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		37	292
	Staff exchange activities occur		26	145
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	26	159.50	4147.00
	Positive ranks	292	159.50	46574.00
	Connections	182	–	
	Total	500		
Training			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		39	291
	Staff exchange activities occur		24	146
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	24	158.00	3792.00
	Positive ranks	291	158.00	45978.00
	Connections	185	–	
	Total	500		
Supplying the supplier's workforce in case of insufficient production capacity			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		60	402
	Staff exchange activities occur		3	35
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	3	203.00	609.00
	Positive ranks	402	203.00	81606.00
	Connections	95	–	
	Total	500		
Replacement			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		62	426
	Staff exchange activities occur		1	11
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	1	214.00	214.00
	Positive ranks	426	214.00	91164.00
	Connections	73	–	
	Total	500		
Accident			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		52	380
	Staff exchange activities occur		11	57
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	11	196.00	2156.00
	Positive ranks	380	196.00	74480.00
	Connections	109	–	
	Total	500		
Joint tasks/projects			Staff exchange activities do not contribute to the SC integration	Staff exchange activities contribute to the SC integration
	Staff exchange activities do not occur		3	12
	Staff exchange activities occur		60	425
	Wilcoxon signed-rank test	N	Average rank	Total ranks
	Negative ranks	60	36.50	2190.00
	Positive ranks	12	36.50	438.00
	Connections	428	–	
	Total	500		

company. Thus, more respondents had a positive attitude towards the SCI than the actual number of companies where such activities existed. It is worth noting that this part of the respondents' answers is declarative. There are no specific situations related to the staff exchange activities in their SCs. Nevertheless, in their opinion, the situations in which personnel is exchanged between enterprises (sent or delegated to quality control, IT systems integration, the audit of activities, training, supplying the supplier's workforce in the event of insufficient production capacity, replacement, accident) contribute to SCI.

It is different in the case of the implementation of joint tasks/projects. There were no staff exchange activities in 15 surveyed companies, and in as many as 485 companies, there were such activities. 60 respondents stated that staff exchange activities between individual links in the SC did not contribute to its integration, even though there were such activities in the company to implement joint tasks/projects.

On the other hand, 12 respondents believe that staff exchange activities contribute to SCI, although there were no such activities in the company. Therefore, in this case, we are dealing with a declarative answer. However, most of the respondents (428) had a positive attitude toward staff exchange activities in the company and SCI.

Authors of the paper would like to also analyse the transfer and implementation of the results in the companies of suppliers or recipients through staff exchange activities situations. Therefore, regardless of whether there are staff exchange activities in the SC, companies agree with the opinion that these activities between individual links of the SC contribute to its integration. Such situation confirms that they are one of the essential aspects for SCI. Staff exchange activities are the most often in the following situations: implementation of joint tasks / projects, training and audits. In the first situation, the results of the work of the teams are transferred and implemented in 40% of enterprises, in the second – 1%, in the third – as many as 60%. If we take a look on the in-depth results of the above-mentioned situations, the following conclusions may be formulated:

- implementation of joint tasks / projects – companies agree with the opinion that staff exchange between the individual links of the supply chain contributes to its integration, both in the case of companies in which there are staff exchange activities (88%) and in the case of companies without such activities (80%). The staff exchange occur between the company and the supplier or recipient in as many as 485 companies. Accordingly, the results of the work of these teams are transferred and implemented in the companies of suppliers or recipients (193 companies – 40%).
- training – companies agree that staff exchange contribute to the integration of the supply chain (86% of companies with staff exchange activities and 88% without such activities). In the research sample, 170 companies declared the staff exchange activities between the company and supplier or recipient but in only 1% of them the results of work are transferred and implemented in those enterprises.
- audit – the results in terms of audits are quite similar as in the case of trainings – staff exchange activities contribute to the supply chain integration (85% of companies with such activities and 89% of companies without such activities). In 171 companies audit involved staff exchange between the company and the supplier or recipient. Moreover, in 103 companies the vast majority of the results of the work of the teams are transferred and implemented in the companies of suppliers and recipients (60%).

Discussion and conclusions

The considerations in our study on the role of staff exchange activities in SCI's context indicate the need to recognize the fact that it is an essential factor of integration. The basis for conducting research in this area was the relatively insufficient subject literature. Its review indicated that HRM and the staff exchange activities between the links of the SC are vital factors in SCM and foster its integration. That claim was also confirmed by the research conducted by the authors. They show that situations in which personnel is exchanged between enterprises in the SC contribute to the integration of the SC. Staff exchange activities lead to building organizational proximity, what favors the creation of knowledge and learning and the transfer of developed knowledge among the participants in the SC. Inter-organizational proximity is considered as the explanatory variable of the efficiency of cooperation and collaboration. It involves the similarity of features, properties, attributes of the organization (more broadly, these issues are discussed, among others in Boschma (2005), Boschma and Frenken (2010)), resulting from the convergence of physical space, psychological and social relations, and shared cultural values or institutional conditions of operation.

The research has shown that the SC leader company size and sector and industry in which it operates are insignificant in terms of SCI through staff exchange activities in the SC. Irrespective of the size, sector, and industry, most companies believe that the situations allowing for personnel exchanges between enterprises in the SC contribute to its integration. Nevertheless, it should be emphasized that some of the respondents' answers were declarative, as staff exchange activities do not always occur in their SCs with regard to quality control, IT systems integration, the audit of activities, training, supplying the supplier's workforce in the event of insufficient production capacity, replacement, and accident. They express the belief that such situations are a factor in SCI.

The presented research shows that such type of staff exchange activities as the implementation of joint tasks/projects is a crucial factor of SCI. Such interfirm joint teamwork is defined as the integration of interfirm human resources from bilateral partners to act as boundary spanners of the firms and cowork together as SC

taskforce in executing routine operations, specifically in the business process integration (Oliver, 1990; Shi & Liao, 2013). Similar conclusions that refer to the teamwork has been presented by (Bennet et al., 2008). An important issue related to cross-organizational teams in the SC is creating and distributing information and knowledge by members of these teams. Integrating team management with knowledge and information sharing in the SC is very important (Madani & Rungsrisawt, 2019). There are some instrumental activities that enable task performance, such as exchanging information with key external actors to improve team decision making (Cummings, 2004; Hansen, 1999) and learning (Bresman, 2010). Intra-organizational connectivity creates built-in boundary spanning capabilities across teams and improves information sharing in the organization (Ancona & Caldwell, 1992; Hansen, 1999; Lazer & Friedman, 2007). Boundary-spanning includes both individual and organisational level actions, where individual actors play an important role in maintaining micro and macro linkages (Schotter et al., 2017). It seems that in relation to the obtained research results, it can be concluded that most of the identified staff exchange activities constitute boundary spanning capabilities across SC entities. Employees of individual SC companies who work in other SC entities are boundary spanners in the SC. A review of the literature, covering more than 100 sources (Haas, 2015), concludes that boundary spanners are interfaces between a unit and its environment, and play several different functions, including information exchange and access to markets and resources. A common function of boundary spanners is to achieve effective communication between firms involved in an exchange relationship. The boundary spanning practices include negotiating with clients, or contracting with external suppliers (Chakkol et al., 2018). As such, they are organizational actors who are involved in managing relationships with external partners and transferring, selecting, and interpreting knowledge from the external environment to the firm (Zhang et al., 2015; Soundararajan & Brammer, 2018). These workers crossing organizational boundaries contribute to SC integration and performance by supporting diffusion and integration of knowledge. The functions of boundary spanners in SC are not simply communicating product and price features, but working, strategic communication, and consultation in cross- organizational teams, education – in the staff exchange activities situations of implementation of joint tasks/projects, training, and audits, there are different levels of knowledge diffusion. The transfer and implementation of the results are the highest in joint tasks/projects (40% of enterprises) and audits (60%). Accordingly, in terms of the trainings only 1% of enterprises are focused on the knowledge diffusion. However, the identified staff exchange activities can be classed as managerial capabilities that facilitate inter-organizational relationships in SC.

This study has certain limitations that can be addressed in future research. There was a challenge in obtaining statistical significance level during results analysis. However, the results directly confirmed that staff exchange activities may be a part of the SCI. Nevertheless, further research with a bigger research sample and more accurate questions should be conducted among enterprises that constitute SCs. It should be noted that some part of the respondents' answers was declarative and insufficient for the complex analysis of the results. In the question regarding whether staff exchange activities foster SCI, including the Likert scale might differentiate answers and present the levels of that integration. It is therefore recommended to widen the research and include that perspective into analysis. Besides, more international perspective could bring more in-depth conclusions on how different cultures impose SCI through staff exchange activities.

Based on the considerations made in the article, it can be concluded that the state of knowledge regarding staff exchange activities in the SC is not sufficiently recognized. The undertaken empirical research in this area and an attempt to theoretically synthetize this issue is a stage in the further development of this knowledge. This process undoubtedly requires further research.

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