CHAPTER 3

Role of Knowledge Brokers as Facilitators of Organizational Development in Era of Industry 4.0

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Summary. Since it is commonly claimed that the so-called 3rd industrial revolution involving advanced digitalization within enterprises is to be followed by the vision of a future in which products will be produced by people working in modular manufacturing systems, the question that arises is related to who could support managers experiencing this paradigm shift in industrial production. The study aims at establishing possible directions of how competence profiles of knowledge brokers should be built to provide their customers with solutions that may turn out to be worth implementing in the light of challenges related to efficient knowledge sharing faced by a modern enterprise. The research method that has been implemented involves a survey supplement partially with interviews, which is why the questionnaire distributed among groups of managers amounting to 250 people. Results show that their level of engagement followed by their necessary competences is different. They actually allow claiming that to be successful managers need to look for different sources of up-to-date knowledge which needs to be codified and spread quickly. The study contributed to the field of research concentrated on the innovativeness of enterprises as well as knowledge sharing that results in it.

Keywords: knowledge brokers, knowledge transfer, sustainable development

1. Introduction

One of the most important features of knowledge brokers (intermediary organizations) is the one related to the fact that they can provide different organizations with specialized services as well as with access to equipment and other resources which otherwise cannot be used by those organizations due to different reasons. For example, these can often relate to financial limitations. Taking it into account it appears to be at least intuitively apparent that following the main principles of Industry 4.0 among which there can be mentioned such as interconnection, information transparency, decentralized decisions as well as technical assistance (Hermann et al., 2016; Nosalska et al., 2019, p. 9) cannot occur without the impact

on how knowledge brokers operate. At the same time, it is argued that it is still unclear actually how do collaborative partnerships between KIBS firms (that is knowledge-intensive business services, they can be regarded as intermediary organizations or simply knowledge brokers, Malecki, 2010) and product companies emerge and next evolve (Liu et al., 2019). It appears to be reasonable to assume that this lack of knowledge related to the collaborative process entails a lack of knowledge related to the roles of knowledge brokers. Because the importance of tasks that require companies to integrate knowledge from not only external but also internal sources emerges, the term "systems integration" was coined (Malecki, 2010, p. 1034). Hence, it needs to be emphasized that facilitating knowledge flows knowledge brokers impact on how organizations decide on a developmental path.

To conduct a complex analysis of their activities and necessary competences that requires a survey as a research method supplemented with interviews is used, it can be helpful to assume that nowadays knowledge brokers are faced with the challenge to operate within ecosystem boundaries. The ecosystem can be understood as "a set of interconnected entrepreneurial actors, entrepreneurial organizations, institutions, and entrepreneurial processes which formally and informally coalesce to connect, mediate and govern the performance within the entrepreneurial environment" (Mason & Brown, 2014, p. 5). This definition allows preparing the ground for analysis of intermediaries such as nonprofit, private, and public organizations and universities. We agree as to the core of activities of knowledge brokers that covers the advancement of commercialization by providing different services. However, we aim to shed light on these problems less from the point of view of the context of scientific entrepreneurship but more by analysis of problems of the emerging era of Industry 4.0. That is why the next sections of the chapter are structured in the way that the section discussing knowledge brokers, in general, is followed by the one focused on Industry 4.0. Finally, the chapter matches the postulated competences of knowledge brokers with the most pronounced challenges of Industry 4.0 and it tries to point out indispensable elements of the competence profiles of knowledge brokers that would like to operate effectively within specific conditions of the environment. The understanding of how knowledge brokers operate appears to be essential for the more effective implementation of this knowledge transfer mechanism as the role of knowledge brokers can be limited by the lack of evidence about their potential effectiveness (Bornbaum et al., 2015, p. 9). It cannot be forgotten that knowledge brokers represent a costly knowledge transfer mechanism as they can also be considered as a human component of knowledge transfer. What can be perceived as especially intriguing when analyzing the problem of activities of knowledge brokers in the era of Industry 4.0 is whether and (if need be) how the premise on which the role of knowledge brokers is based should be changed. Put it differently, the issue of how important the enhancement of the likelihood of behavior change by the interpersonal contact is (Thompson et al., 2006) appears to be the open one. As Malecki stated in order for knowledge brokers to be able to understand both tacit knowledge and its numerous signals, job descriptions for knowledge brokers "must permit seemingly frivolous socializing". That is why one can see that the behavior of knowledge brokers is essential as well as its reconciliation with other ("normal") company activities can be difficult (Malecki, 2010, p. 1043). The challenge is to support enterprises with building business models that allow for the introduction of innovations as well as for flexible adaptation and rapid reorganizations of processes (Grabowska, 2019). It involves capturing the essence of interaction (Grabowska, 2018; Grabowska, 2019) while at the same time necessitate being focused on pillars of modern industry enabling technologies.

2. Knowledge brokers – tasks and competences

Following Lomas' view, Cvitanovic et al. (Lomas, 2007 as cited in: Cvitanovic et al., 2017, p. 264) defines knowledge brokerage as "the full suite of activities required to link decision-makers with researchers, facilitating their interaction so that they are better able to understand each other's goals and professional cultures, influence each other's work, forge new partnerships and promote evidence-based decision-making." According to the authors, this definition corresponds well with the one previously quoted that related to the ecosystem (Mason & Brown, 2014). Here, it appears to be worthwhile to mention that roles of brokers are defined as involving facilitating transactions and flows of information between people or groups separated or hindered by some gap or barrier, where a barrier can have physical (geographic), cognitive or cultural dimensions (Long et al., 2013, p. 2; see also Pyka & Janiszewski, 2016). Noticing that theory of these types of roles was on its early stage developed in Burts' books Long et al. (2013, p. 2) claim that brokers can be said to reach across structural holes between actors that not being connected possess unique information. They may effectively facilitate access to novel information or resources, facilitate the transfer of knowledge, and co-ordinate effort across the network (Long et al., 2013, p. 2). In fact, being focused more on aspects related to the innovation process it is possible to point out the second stream of theoretical antecedents for works on an intermediary function which covers works e.g. Tushman or Allen (Long et al., 2013, p. 3). In the literature, there also are direct claims for matching these two approaches (Fleming & Waguespack, 2007). Moreover, there are other such popular terms used to describe knowledge brokers like gatekeepers that are to bridge the structural hole between its cluster and an outside cluster or boundary spanners that are to bridge the structural hole between two clusters conceptualized as being separated by a boundary of some sort (Long et al., 2013, p. 3). Moreover, Cvitanovic et al. (2015) emphasize that apart from knowledge brokers (and other entities of this kind) the importance of other approaches to improving knowledge exchange. Hence, a scientist can be embedded in decision making agencies (and vice versa) or under the most widely advocated approach of knowledge co-production the strong understanding of the research content among decision-makers can be developed as a result of managers' active participation in scientific research programs (Cvitanovic et al., 2015, p. 29). Interestingly, it should be still taken into consideration that analyzing data on utility patents in the careers of more than 35 000 collaborative inventors over almost thirty years, Fleming et al. (2007) identify three mechanisms (that is a social brokerage, social cohesion, domain straddling) that may make it possible for boundary spanner to be more creative. Fleming et al. (2007) pay attention to the fact that in general, the brokerage can occur when collaborators operate in similar domains and actually possess a lot of redundant information (Fleming et al., 2007, p. 468). The question that arises concerns competences needed to operate within such environments because knowledge and creativity may turn out to be crucial when for example when collaborating within a cohesive network boundary spanner is expected to diffuse ideas more effectively but at the same time to generate or broker fewer ideas.

Following Ward et al. (2009) and Oldham and McLean (1997) Bornbaum et al. (2015) point out three kinds of knowledge brokers' roles. Firstly, they claim that the task of facilitating or managing the creation, translation, diffusion, and application of knowledge causes knowledge brokers to become knowledge managers. Secondly, to stimulate

new information, collaborative knowledge exchange, as well as evidence-informed approaches knowledge brokers, should engage in linkage and exchange activities that are to be focused on the development of positive relationships between knowledge creators and knowledge users. In addition to this, thirdly, activities of knowledge brokers in the field of enabling evidence-informed decision-making (Dobbins et al., 2007 as cited in: Bornbaum et al., 2015, p. 2) together with those focused on both developing knowledge users' understanding and skills (Ward et al., 2009; Bornbaum et al., 2015, p. 2) and on enhancing capacity to access and apply knowledge (Morley, 2006 as cited in: Bornbaum et al., 2015, p. 2) are placed under the category of capacity building activities. They all being demanding can also contain common elements and overlap to some extent (Bornbaum et al., 2015, p. 2, 9).

Looking for the answer to what types of activities of intermediary organizations can be especially useful in the context of Industry 4.0 it appears to be a good idea to revise what are the main features of knowledge brokers as well as of similar to them entities that can also engage in information and knowledge sharing. Haas noticed that in the case of boundary spanners it is possible to indicate many factors that can have an impact on their work (Haas, 2015, p. 1034). Among them there are such as organization context (e.g., the level of acceptance from the manager who cannot control boundary-spanning activities – Davenport & Prusak, 1998 as cited in: Haas, 2015), the current performance of the company, perceived environmental uncertainty or even perception of justice or stress (Wachner & Arthurs, 2007 as cited in: Haas, 2015, p. 1034). That is why there are quite a lot of competences that need to be developed before boundary spanner can act effectively. From the point of view of emerging trends, it can be worth mentioning that there are streams of research that study the impact of new technologies on knowledge broker, and even the term "virtual knowledge broker" has appeared to emphasize the growing role attached to the use of the Internet when supporting innovative activities (Verona et al., 2006).

When analyzing knowledge brokers (i. e. intermediary organizations like university technology transfer and licensing offices; incubators, accelerators, and co-working spaces; professional services providers; networking, connecting, and assisting organizations as well as finance providers) Clayton et al. (2018) they are posing issues which may be especially worth when investigating the changes in the current economy that occur as the Industry 4.0 becomes a more and more recognizable phenomenon. They emphasize that background support should result in greater chances for sustaining innovative activities within a regional economy (Clayton et al., 2018, p. 104; Cooke et al., 1997). It should be realized that as Clayton et al. (2018, p. 106) claims the challenge for intermediaries is not only to address innovation gaps at the firm individual level, but they also are expected to influence positively agglomeration economies, which is why authors claim that attitudes of knowledge brokers toward local communities should be really open. Actually, it can be reminded here that Cooke et al. claiming in favor of the preparation of special programs that can support learning processes taking place in a region by governments emphasize the importance of regional level because of such features of a modern economy like growing significance attached to cooperation, recognizable advantages of agglomeration economies for exchange of tacit knowledge (Cooke et al., 1997, pp. 478–479, 487). The issue to be considered is by use of which means and resources knowledge brokers can shape relational dynamics (Berger, 2013 as cited in: Clayton et al., 2018, p. 106) and forge different kinds of partnerships

among participants of communities that start to use to a greater extent many new technologies which require the implementation of new business models.

For example, Stezano (2018) discussing the intermediary roles played by technology centers emphasize that not only does this kind of entity need to choose a suitable strategy toward scientific research and technological development, but also activities of these centers involve establishing liaisons with firms. Consequently, to support other organizations in transferring knowledge and technology these centers have to adopt specific organizational governance schemes (Stezano, 2018, p. 643). But the first issue is to establish how knowledge brokers try to make use of their knowledge of key factors for innovations, especially how they are prepared to ensure their customers that as Stezano emphasizes learning through interactions is crucial (Stezano, 2018, p. 643). Similarly to at least some extent like in Poland efforts put in supporting links between policy and academia do not entail greater joint attention in Mexico. Not only should commercialization mechanisms like patenting, innovation licensing, or the creation of so-called technology-based enterprises be considered, but other mechanisms that build a collaborative environment should be considered as well. Among these possibilities, there are such as publishing, consulting for researchers, and postgraduate student training. Then it becomes quite visible that the main task for knowledge brokers is to mediate relationships among different kinds of actors which require that knowledge brokers possess suitable competences.

According to the authors it can be claimed that in general one of the main tasks of a knowledge broker is to link other organizations and provide them with resources that should enable them to solve problems. Due to the fact that the part of these resources inflow from the environment that is actually co-created by intermediary organizations and their partners (Janiszewski & Szmal, 2018) for researchers to be able to discuss components of competence profiles of knowledge brokers it is necessary to be fully aware of what kind of trends are to dominate in the worldwide economy and societies. It appears to be reasonable to claim that if hitherto knowledge brokers were expected to find acceptable responses to diverse stakeholders needs on time as well as to actually to "navigate contextually sensitive environments" (Bornbaum et al., 2015, p. 10) the emergence of Industry 4.0 can only strengthen these demands.

3. Challenges of era of Industry 4.0 and possible knowledge brokers responses

Lasi et al. (2014) relates the term of Industry 4.0 to the vision of future production according to which there will be modular and efficient manufacturing systems within which "products control their own manufacturing process" (Lasi et al., 2014, p. 239). Among driving forces for the fourth industrial revolution, they recognize the application-pull group as well as the technology-push group. In general, a completely digitalized environment is to emerge as a result of the co-occurrence of digital processes, increased networking of technical components, and the increase of the digitalization of goods and services (Lasi et al., 2014, pp. 239–240). These aspects undoubtedly will force knowledge brokers to build suitable communication skills to be capable of translating knowledge.

What is especially important is that Industry 4.0 makes big demands as to cooperation and it is claimed that for companies it is more difficult to innovate in isolation (Powell, 1990). This problem becomes more visible when considering the transmission of especially really complex knowledge across company boundaries (Camuffo & Grandinetti, 2011). Lacking capabilities can be supplemented just by cooperation, also with regional intermediaries (McEvily & Zaheer, 1999) but then the problem arises of ensuring sufficient resources that may make it possible for knowledge brokers to avoid being overburdened by too much amount of information flow (Zhao & Anand, 2013; see also Janiszewski, 2016). The growing importance of technologies and cooperation occurring among physical objects like sensors, machines, cars, buildings do not mean that people who are direct beneficiaries of goals achieved in industrial environments by the use of technologies do not need to develop trust or take care of ethical issues related to their businesses (Zheng et al., 2019, p. 5). Even though at the beginning emerging trends related to Industry 4.0 are rather perceived as technological revolution and to a smaller extent as organizational one, it is quite reasonable to claim that as time goes by and the problems related to the coordination of different technologies arise, then the need for more managerial roles will become more visible. Apparently, we are allowed to say about increasing digitalization and interconnection not only with regard to products or manufacturing systems but also with regard to value chains and business models (Camarinha-Matos et al., 2017, p. 4). Then the central role for business is considered as being directly linked to the way in which positive impacts to the environment and society are generated (as well as negative ones reduced) (Stock & Seliger, 2016 as cited in: Cezarino et al., 2019, p. 2) by new sustainable business models so that Industry 4.0 and sustainability can be regarded as trends in production systems (Cezarino et al., 2019, p. 2; Jabbour et al., 2018). The question that arises here relates again to the kind of competences that knowledge brokers should possess to prove their effectiveness when engaging in building new business models in which technological, social, as well as purely environmental aspects, are considered as being equally important.

Büchi et al. (2020) postulate for carrying out analysis how the pillars of Industry 4.0 technologies (like, e.g., Internet of things, big data analytics) that can be implemented individually or through various combinations impact on companies and their relationships (Büchi et al., 2020 p. 2). Following Pan et al. (2015) and both Reynolds and Uygun (2018) as well as Kovács and Kot (2016), Büchi et al. (2020, pp. 1–2) consider both developing communications between people, industrial components like machinery and equipment and products as well as extending internal and external networks among the primary topics related to Industry 4.0. As we see the space for the presence and for activities of knowledge brokers is open. It has already been claimed (Fleming & Waguespack, 2007) that combining challenges in the social and technological field is very demanding but Industry 4.0 causes the issue to be even more difficult. This is because due to the way in which we consider the ecosystem, modern technologies may make the issue of communications more important than ever before.

Further, the one important and interesting point to which the attention is paid by Clayton et al. (2018, p. 117) relates also to the importance of idea sharing and consumer feedback. At the time when customers are more and more willing to take part in product creation from the beginning (design stage) and as a result of this the relationships which they build with manufacturers become stronger (Nosalska et al., 2019, p. 2), the pressure put on knowledge brokers to operate more effectively becomes greater. As a result, it may turn out to be really

difficult because of constraints resulting from limited resources that are put on the activities which knowledge broker can perform (Janiszewski, 2019). Then how to built a proper competence profile that should allow knowledge brokers to optimize their results one more time appears to be especially important. Here, one aspect more can be brought forth. Knowledge brokers may also contribute to some extent to institutional diversity that is considered as of great significance by Clayton et al. (2018, pp. 105–106). Referring to some trials of uncovering the specific challenges of brokerage among partners possessing different goals, they emphasize the need to go beyond a singular focus on the university-industry-governments link. According to them one of the ways to be followed is the one pointed out by the new growth theory which emphasizes the role of knowledge creation (Clayton et al., 2018, p. 105). Ibe et al. (2018, pp. 1–2) conclude that the constellation of processes associated with co-development causes multiple stakeholders to become knowledge brokers (Ibe et al., 2018, p. 4). The growing engagement in knowledge co-creation appears to be one of the features of modern knowledge brokers (Janiszewski & Szmal, 2018). Actually, co-creation may mean that organizations integrate external ideas that stem from customers or users, or based on these ideas they try to build common platforms with universities or other companies. Although these activities do not require that brokers extend the range of their activities beyond traditional workshops, meetings, and projects (Debackere, 2014, pp. 23–25) it is difficult to imagine that brokers try to achieve their goals without suitably developed competence to build relationships.

Outline of the research process

The research object was the configuration of roles or competences that the network of brokers of knowledge (innovation as it was called in AGH UST official documents) operating within the innovation eco-system of AGH University of Science and Technology in Cracov should perform or possess. The research was undertaken because of the evaluation of a concept of technological scouting that was implemented by the Centre for Transfer of Technologies that is a unit supporting science and research conducted by AGH UST. The idea of technological scouting assumes that by focusing efforts on acquiring useful pieces of information about activities of research teams in faculties (Wiśniewska et al., 2015) university can improve the effectiveness of the process of commercialization of knowledge. It results in the need of defining tasks, roles, and competences of knowledge brokers. On the one hand, brokers should be a kind of liaison between research teams and the economic environment. On the other hand, they are expected to take inter-organizational cooperation aimed at knowledge commercialization in universities. The goal of the research was to define both roles and activities that are necessary for knowledge brokers regarding the challenges of the era of Industry 4.0.

The scope of the research was wide as they referred to a competence profile of knowledge brokers as well as to tools enabling members of the network of knowledge brokers to develop their competences. The process of creation of a competence profile for the position of a knowledge broker required that elements like formal/legal context and organizational context within which entities responsible for technology transfer operate, conditions, practices, challenges, and constraints related to performing the role of a knowledge broker in given organizational settings were considered when gathering and analyzing information and data.

For the reason of consideration of the multiplicity of approaches the research process was divided into few stages:

1) Accessible publications and documents that regulate formal and organizational issues related to the operating of units dealing with knowledge transfer and commercialization in universities in Poland were analyzed. Three key levels were considered: national level (analysis of acts and orders), university-level (analysis of AGH UST statute, resolutions of Senate of AGH UST, work regulations), and level of Centre for Transfer of Technologies operating within AGH UST structure (strategy, mission, and vision, organizational structure, jobs description, archival job offers).
2) By the use of a survey questionnaire supplemented with interviews with selected actors of the ecosystem of innovation of AGH UST scope of responsibilities as well as duties and tasks realized by members of a network of innovation.
3) Strategic workshop was conducted, which was when verification and confrontation of data gained from two main sources that is query of documents and studies as well as analysis of actual work process were done. It allowed for hierarchization previously identified indispensable knowledge resources, skills and competences that should be possessed by knowledge brokers. As a result competences profile for head of technology transfer department, knowledge broker, manager of network of innovation, technological business development officer as well as animator of academic entrepreneurship were created. Table 1 contains the description of knowledge broker that is to operate within the AGH UST structure.

Table 1. General competence profile applied for position of knowledge broker to be employed by AGH UST

General competences	task orientation	Ability to effectively and independently prioritize and realize tasks with which broker who needs to make efficient use of working time is charged
	communication	Ability to be clear and precise in speaking and writing, to understand statements of other people, to actively listen to others, to adapt language and argumentation to an interlocutor, to efficiently conduct meetings
General competences	building relationships	Ability to build a good image of Centre for Transfer of Technologies as a partner in commercialization, to take care of good relations with internal as well as an external client, to develop own networks of contacts in as well as outside the organization, to connect science with business and to share knowledge with others
	entrepreneurship	Aspiration for improving own competences as well as for extending own impact and responsibilities in this way, openness to new approaches and methods of work, ability to adapt themselves to changing situations as well as working conditions, ability to think creatively

Table 1 cont.

Competences related to a position held	analytical thinking	Ability to search and acquire valuable pieces of information, to recognize dependencies, and to draw conclusions based on possessed data
	negotiations	Ability to efficiently be in negotiations and to carry them into effect that would be beneficial for the represented side
Professional competences	commercia-liz-ation	Ability to conduct the commercialization process, to undertake activities aimed at working out and promoting technological offer based on research conducted in AGH UST that should correspond with market needs

Source: own study based on (Klimkiewicz et al., 2019, p. 14)

4. Conclusions

Although activities undertaken by knowledge brokers are widely described in the literature, in practice these activities are conducted in quite different ways. Those units that try to implement this conception do it by defining the roles and activities of knowledge brokers with regard to conditions present in a given entity. It means that it is possible to notice that these roles can overlap because they all often contain some common elements that can be ascribed to the following activities: to identify, to engage and to join with stakeholders, to facilitate cooperation, to identify and to acquire suitable information, to create knowledge products adapted to customers' needs, to support communication and information exchange, to develop networks, to facilitate and assess changes. The growing importance attached to the role of the Internet in supporting innovative activities should be indicated as well. All the above mentioned activities can be understood as brokerage mechanisms that are aimed at improving the coordination between science and industry. From this point of view, the main task for knowledge brokers is to go between different kinds of entities that require that not only do knowledge brokers explain results, but knowledge brokers should also actively consider their potential economic exploitation. For knowledge brokers to be able to implement suitable strategies, they undoubtedly need to possess sufficient resources. Otherwise, it may finally turn out that knowledge brokers cannot undertake more ambitious projects.

The key issue relates to what kind of activities and ideas can be especially useful when being considered with regard to Industry 4.0. It appears to be a good idea to reconsider the main needs or extra features of knowledge brokers that should enable them to work effectively in the era of Industry 4.0. Referring to the frames of general competence profile applied for the position of AGH UST knowledge brokers that are described in Table 1 in the context of attributes ascribed to the era of Industry 4.0 it is possible to recognize the following competences.

Commercialization competence

It is required a high level of this competence due to a high level of knowledge complexity as well as its innovativeness. It makes attempts of its implementation more difficult.

Different partial solutions that stem from different fields of research must be combined resulting in complex technologies. As an important ability, the one to propose activities leading to the capability of commercialization of research results can be considered. It is necessary to search for information and to efficiently make use of them when assessing the commercial potential of intellectual goods, assessing the readiness level of this good to be implemented in the face of key risk factors. It is required both to define advantages precisely and to communicate them in a diverse environment. Brokers need to know the level that must enable them to understand commercialized technology, market laws as well as to understand needs that the receiver of the technology could have. To develop this competence, it is important to deepen continuously knowledge related to the industry in which a given broker is specialized. It should make it possible to discuss the core features of the technology with a scientist as well as knowledge broker should be able to recognize properly the context in which value is to be created. It is very important to monitor and analyze other cases as well as to read technological trends.

Communication competence

Here two issues are key ones. The first is to listen to actively and empathetically as well as to reason easily and precisely even when discussing complex issues. A broker needs to understand the message by listening actively and empathetically to an interlocutor as well as to ask questions that should enable a broker to understand the issue more deeply. The art of communication and argumentation is made more difficult by the fact that messages are conveyed between environments that have a different organizational culture.

Competence to build relationships

Building relationships can be understood as initiating, shaping, and maintaining positive and satisfying relationships with other people for all sides. They are key with regard to effective cooperation. Broker tries to be helpful, and it should not avoid being contacted even in case of more difficult matters. Brokers should initiate contact on their own, search for new business partners and contacts with important employers' associations, propose new interdisciplinary solutions dedicated to Industry 4.0.

Entrepreneurial competence

Entrepreneurship here is understood as the ability to recognize possibilities and next to exploit them as well as to incorporate ideas into the Economy 4.0, to plan a process of the idea realization, and to manage this process. A broker that possesses this competence should be proactive, show initiative as well as have creative ideas. In addition, a broker should be eager to learn new issues, to self-improve permanently by searching for novelties and innovative solutions. Also, a broker should not be afraid of experimenting and not be discouraged by failures. Brokers must listen to others, need to be open to discussion and new ideas, absorbs feedbacks, and next to make use of it to develop themselves and to improve their effectiveness.

The conducted analysis did not show other, distinct from classical, attributes of knowledge brokers that are indispensable for them to work effectively in the era of Industry 4.0.

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