Electronic 'Knowledge Factories' versus Micro-environment of Innovation: Who Will Win?

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Abstract

The end of the 20th century was marked by several studies that revealed the collective mechanisms of the knowledge development as a joint activity in working teams. Thus, the idea that acquiring knowledge was an unproblematic transfer of what is already available and can be unilaterally transferred and assimilated was rejected [*Lave, Wenger,* 1991]. The aim of this paper is to study the opportunities persented by electronic network platforms for using the collective nature of knowledge in the interests of further developing knowledge and innovation through online communication of professionals.

Based on a literature review on the development of knowledge, the paper compares the basic principles of knowledge application in formulating new decisions during real joint activity and during online communication within specialized platforms for 'knowledge exchange'. The author argues that electronic networking platforms contribute to the fragmentation of knowledge representation of participants, eluding a common sense and purpose. Thus, such platforms blur the boundary between knowledge and information. The article indicates that the desire to increase the effectiveness of collective creativity via online communication risks not developing competencies, discretion, and exploration of others' experiences. Instead, this desire leads to strengthening external control and separation of functions into primary routine operations when an individual participant is valued not for his/ her knowledge and previous experience, but for his/ her communicative capabilities. The produced effect is akin to the industrial revolution of the machine era; when this effect is widespread, there are risks that knowledge workers will be turned into easily replaceable, piecemeal workers. To avoid this, electronic platforms should either learn to recreate the conditions of offline micro-environments of innovation, or not claim to fulfil the role of knowledge production.

Innovation as a Process of Social Interaction

Researchers in the field of science and innovation have focused mainly on questions of science and technology policy for a long time, with social interaction in groups of workers being left 'on the back burner.' As a result, many scholars argue that innovations, as a joint activity, are something of a 'black box' [*Brown, Duguid,* 2001; *Howaldt, Schwartz,* 2010], and that 'after Schumpeter innovations were reduced to technical innovations' [*Howalt, Schwartz,* 2010; *Rammert,* 1997].

In many ways, the difficulties faced by innovation researchers can be explained by the lack of clarity surrounding knowledge, the latent nature of the collective mechanism for knowledge assimilation and development, and the close connection between innovation and the specific conditions in which it takes place. The situation is further complicated by the simplistic and rationalist identification of knowledge with academic books, guidelines, and data. The end of the 20th century was marked by a number of studies leading to a change in views on the collective nature of knowledge and its practical orientation. This was dubbed the 'practice turn' in social sciences [*Schatzki et al.,* 2001]. Theories such as Jean Lave and Etienne Wenger's 'communities of practice' [*Lave, Wenger,* 1991], actor-network theory [*Latour,* 2005] and organizational knowledge started to gain popularity. The notion of organizational knowledge was developed by Ikujiro Nonaka and Hirotaka Takeuchi based on their experience of Japanese corporations [*Nonaka, Takeuchi,* 1995]. Despite these differences of approach, the notion that knowledge development is an 'unproblematic process of transferring what is already available' – able to be unilaterally transferred from person to person and automatically assimilated – has been firmly refuted [*Lave, Wenger,* 1991]. Researchers have described this shift in social theory as a 'silent revolution' [*Gherardi, Nicolini,* 2000]. However, the spread of technologies allowing network-based electronic interaction between specialists, which has been recognized as giving fresh impetus to the development of collective knowledge, does not entirely justify these expectations and even at times leads to the results of previous studies on knowledge being rejected. The wide dispersion of participants, ease of initiating and ending virtual communications, textual form of expression, advantages of short communications and their dilution with hyperlinks and visual effects effectively promote the fragmentation of knowledge, the illusion of common sense, and the blurring of boundaries between knowledge and information. The question arises as to 'What can this lead to?' and 'How are we to overcome the 'growing pains' so that electronic knowledge development platforms can reproduce and increase the value of the social micro-environment of innovation?'

Many factors reflecting the social micro-environment of innovation can explain the development of collective knowledge theories in the 1990s. First, knowledge, its diffusion in a group and development within an individual can be latent [*Polanyi,* 1967; *Teece,* 1998; *Nonaka, Takeuchi,* 1995]. According to some empirical studies, knowledge is particularly important in the acquisition of new skills and development of innovations in organizations [*Nonaka, Takeuchi,* 1995].

Second, knowledge can be viewed as a 'dynamic human process of justifying personal belief toward the truth' [*Nonaka, Takeuchi,* 1995, p. 58]. This entails some effort on the part of the individual to set goals and engage in mental or real interaction with other people or the environment to guarantee the truth of a judgment. We can, therefore, view knowledge in a similar way to capital in Marx's theory as a self-expanding value, to counterbalance information, which is inert in nature. However, justifying the truth of knowledge takes place in combination with 'social learning systems' [*Wenger,* 2000], which enables non-specialist individuals in neighbouring fields to act in line with their achievements, thereby developing their knowledge as opposed to 're-inventing the wheel.'

Third, knowledge is 'situated,' that is, shaped by the empirical or experimental situation. Therefore, the notion of 'situated knowledge' or 'communities of practice' can be applied to any instance of knowledge development [*Lave, Wenger,* 1991; *Wenger,* 1998]. Regional innovation clusters have now exemplified the special conditionality of knowledge, particularly in relation to local or regional specifics [*Brown, Duguid,* 2000; *Porter,* 1998; *Batheld et al.,* 2004]. At the same time, the conditionality associated with a specific place is a special case of the properties and specificity of knowledge.

Fourth, knowledge is collective. According to J. Lave and E. Wenger, any assimilation and development of knowledge can be viewed as a joint activity between the initiator and more experienced specialists in the corresponding field. This applies equally to physical and intellectual activity, including science [*Brown, Duguid,* 2001; *Ryle,* 1949]. J. Lave and E. Wenger provided the simplest outline of the bilateral knowledge assimilation process – the newcomer is an active party in this process and therefore, the knowledge of all participants is refined and reformulated.[1]

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[1] At the same time, viewing knowledge from the position of group dynamics is important not only in sociology, but also in science, technology and innovation research, where the static approach is extremely widespread. For example, it can be seen through the undervaluation of the innovative potential of technological borrowing in developing countries. In this case, the fact that assimilation of any new technology assumes a simultaneous assimilation of knowledge and a change in the system within which the new technology is integrated is ignored.

Fifth, the collective nature of knowledge assumes 'engaged participation' rather than individuals with appropriate experience or general specialization [*Lave, Wenger*, 1991]. For there to be insight, participants need to be involved in solving a problem collaboratively [*Brown, Duguid,* 2001; *von Hippel*, 2009]. This is different to specific social connectedness (fleeting or more stable – which depends on the problem-solving conditions), which can be likened to an electrical circuit in physics, or to special attachment in social science. In fact, researchers use a different metaphor – 'prudent' or 'mindful participation', which combines joint efforts and a common focus on searching for solutions [*Hargadon, Bechky,* 2006].[2]

The Micro-Process of Knowledge Creation: The Story of Machinery Repairs

To illustrate this position, we will use the example described by Julian Orr [*Orr*, 1990] and analysed by John Brown and Paul Duguid [*Brown, Duguid*, 1991]. If there is an unexpected breakdown in an important piece of equipment, a worker will turn to a technical repairs specialist to repair it. The specialist does not have a ready-made solution; the solution emerges as a result of the interaction consisting primarily of an exchange of 'stories' of similar repairs and solutions in the past [*Brown, Duguid*, 1991; *Orr*, 1990].

The interaction between two workers with differing experience, one of whom cannot solve a new problem independently or is not aware of their problem-solving aptitude, can arguably be viewed as the unit or 'cell' of knowledge development. In this example, knowledge development and problem-solving actually emerges from dialogue between two people, which is comparable with the situation of professional communications on an electronic network[3]. How does this take place?

Narratives – the stories told by participants – occupy a central position in the dialogue. They serve as both a graphic and verbal form of making sense of the situation. At first glance, these are discrete examples from the past, but they are 'flexible universals', allowing a certain common sequence to be formulated from the components of the stories. Storytelling is simpler than looking at the situation analytically; but, of course, for this you would need to select an approach and the cause of the fault is unclear to the participants. In addition, a narrative provides holistic 'pieces' of experience which are richer than any analytical 'fall-out' could be, as a narrative is inscribed with subconscious elements of latent knowledge. The process of searching for a solution is akin to Freud's theory, where recalling past episodes and identifying hidden connections under the guidance of a psychoanalyst will reveal a patient's unconscious [*Freud*, 1920]. Similarly, in our example, by using imagination and latent knowledge of the two participants, stories of past breakdowns and repairs are 'patched together' into a new solution.

In theory, each participant could recall stories independently as a means to bring latent knowledge to bear on a new situation. But interaction speeds up the search for a solution. Contact with an experienced colleague:
- causes a partial *verbalization of the latent knowledge* held by each participant through narration;
- expands the variety of examples subtly *linked* to the current breakdown;[4]
- increases the intensity and emotional impact of memories;
- ensures the *continuity* of memories through mutual additions to the narrative and *gap-filling* in each other's experience.

An important condition of productive interaction between previously unacquainted workers with different specialisms is *a separate general sense* of what is going on (each participant has their own experience of repairing machinery breakdowns, which frame the scope of their interaction). Even less competent repair workers have their own unique experience, which allows for mutual understanding and dialogue. This would not have been the case in the other example presented by Orr, where the technician was the only professional among unskilled onlookers [*Orr*, 1998]. According to Orr the specialist's understanding of repairs is 'tacit,' since he is working alone. When a sociologist, as an uninformed outsider, asks the specialist questions, the responses will seem awkward. The technician would be forced to choose words which characterize his knowledge as 'tacit understanding.' The existence of a boundary object combining the experience of two participants, rather than the actual presence of people engaged in the work of the machinery, serves as the necessary precondition for joint progress towards a new solution [*Tsoukas*, 2009; *Bruni et al.*, 2007; *Bechky*, 2003].

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[2] Failure to comprehend the importance of connection in this context can lead to misinterpretation and misidentification of communities of practice from the presence of group attachment, personal relationships, etc. to the point of resembling a community [*Lindqvist,* 2005]. The gap between newcomers and experienced practitioners is perceived as a threat to the stability of the community [*Handley et al.,* 2006]. A group of innovators is a social group, but the relations between members are not the result of a community of self-identification and personal relations, but rather a common cause and joint knowledge.

[3] The ethnographic work of J. Orr and his best known book 'Talking About Machines' [*Orr*, 1996] highlights the importance of talking about work to develop knowledge. The forms these conversations take is the subject of this paragraph.

[4] The first two features tie in with I. Nonaka and H. Takeuchi's processes of knowledge 'externalization' (moving from tacit to explicit knowledge) and knowledge 'socialization' (moving from the tacit knowledge of one person to the tacit knowledge of another) [*Nonaka, Takeuchi*, 1995].

Networked Electronic Mediation for Knowledge Development

We will now turn to the current situation of electronic professional networks. Numerous justifications in social sciences as well as in innovation research have recognized the collective nature of knowledge and innovation.[5] In contrast, the value of collective interaction to develop knowledge and innovation in collaboration involving information and communication technologies (ICT) is almost undisputed. This is due to the aforementioned 20th century studies and, in part, the visible presence of multiple people on a single platform serving as documented proof of communications: blogs, chats, photographs, links, visitor statistics, 'friends' lists, 'followers', and page visitors. Such platforms are often larger than many conferences in terms of participant and contact numbers; further, the textual form of communications makes it possible to document the contribution of each participant.

In this respect, can we speak of a new stage in the successful assimilation of knowledge resources and the acceleration of innovation? To answer this, we need to understand what happens during professional dialogues using electronic resources and then compare the results with observations regarding face-to-face interaction.

Recent literature abounds in materials on virtual 'knowledge exchange and sharing' platforms. But the blemishes and failures can be explained by the fact that this experience is new, carrying natural defects in design or formulation of tasks by customers.

In discussions of the workings of electronic platforms, several key subjects tend to be examined:

- the creation of professional or thematic platforms bringing together professionals with a particular profile irrespective of their affiliation with organizations [*Pan et al.,* 2015; *de Kraker et al.,* 2013; *Phang et al.,* 2009; *Chen,* 2007; *Chiu et al.,* 2006];
- the use of corporate electronic resources for professional exchange between employees of a company [*Murphy, Salomon,* 2013; *Salminen-Karlsson,* 2014; *Gray et al.,* 2011, *Tiwana, Bush,* 2005];
- the use of social media for 'open user-driven innovation,' where non-professional consumers play a role in the development of new products initiated by companies [*Mount, Martinez,* 2014; *Füller et al.,* 2014; *Martinez-Torres,* 2014].

The variety of subjects partly reflects the myriad uses of electronic platforms. Thematic platforms are geared towards the integration of professionals and are almost closer to the idea of developing professional knowledge in and of itself. This mainly applies to corporate platforms, especially, in the way they are tied to the working conditions of a specific organization and the continuity of working processes in real life. Ultimately, the advantage of open innovation platforms is that innovation based on the contributions of users is both the primary aim and end result; and where there is innovation, there is knowledge development. We will now look at each variant in more detail.

Thematic Platforms

These platforms bring together professionals with a particular profile or specialty who are not connected through an organization. The literature identifies several common traits of these platforms.

First, platforms are categorized in terms of satisfying an individual's need for knowledge and their willingness to share this knowledge. The situation is often described as being similar to market supply and demand: at one end, there are individual demands for certain knowledge, and at the other, there are those who have the corresponding knowledge and are willing to share it. To describe this situation, we use terms characteristic of commodity markets, where the platform stands in place of the circulation of money. The most common word combinations are knowledge exchange, knowledge sharing, knowledge transfer, knowledge flows, knowledge providers, and knowledge contribution. Researchers see the task of developers as balancing these opposing movements: between knowledge seeking and knowledge contribution, knowledge demand and knowledge supply, knowledge sharing and knowledge seeking behaviour.

To establish a social quasi-market for knowledge, where everyone offers what they have and takes what they need, we need a larger number of participants on board and arrive at a platform of competent specialists. The development of knowledge management systems is considered essential to this process as they allow knowledge to be collected, accumulated and exchanged [*Pan et al.,* 2015].

There is a general consensus that for electronic knowledge exchange platforms to work successfully, we need to encourage the space for inquiries and opinions on such platforms. This confirms the fact that an electronic platform is not always used to develop knowledge or obtain information on a specific topic, even when the platform is thematic and the participants belong to a particular professional group. We

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[5] Innovation studies tend to study social process through the prism of the technical characteristics of the social capital.

also need external controls to check the match between inquiries received on the platform and industry specialization. It may have a content structure and team of experts and moderators who encourage creative content and reject irrelevant themes [*Pan et al.*, 2015].

As early as the late 1990s it was noted that searching for information is not the only or primary aim of participants in networked communities. Living in an information environment has become the natural form of passing time for people today. The literature uses various metaphors for this: 'information neighbourhood' [*Savolainen*, 1995; *Burnett*, 2000] and 'berrypicking' [*Bates*, 1989]. As a form of life and leisure, such activities can hardly be considered work or creative and have little in common with consulting a reference book. Characteristic forms of such activities include neutral behaviour (exchanging compliments and gossip), playful behaviour (jokes, word games) and emotional support. In turn, the search for information can also take on various forms: posting announcements, information inquiries, requests for business consultations, and work by managed project groups [*Burnett*, 2000].

The fact that the closest interaction in 'virtual communities of practice' is in pairs, where participants maintain each other's attention on common tasks, attracts particular attention. Moreover, the connection is stronger when the virtual communication is reinforced with contact in real life [*Pan et al.*, 2015], which points to the limitations of online communications. The capabilities of video links do not disprove this observation, but also serve as a necessary stand-in for face-to-face communication. Even group video links between working groups are mostly based on dialogues between two participants [*Salminen-Karlsson*, 2014].

According to developers of professional logistics networks [*Pan et al.*, 2015], giving an electronic platform all the properties of a social network (the ability to manage profiles and lists of friends, which is absent in forums) forms 'transactive memory' and social capital in participants [*Pan et al.*, 2015]. However, accumulating social capital is not the same as knowledge development. Some might point to the case of new virtual acquaintances whom we consult for information, help or even invite to solve a creative task, but this only implies that the main interaction does not take place on the platform. This is in fact more an example of service functions such as posting announcements and information inquiries. With a large number of participants, we can add candidate screening to this list, when searching for partners or consumers for offered services. In this way, new ideas can be tested, although this would primarily involve first impression assessments. More thorough testing and especially joint development of ideas through electronic discussions is unlikely due to the inability to check mutual engagement, participant competence, and a number of other conditions that will be examined in the following section.

Corporate Platforms

The natural precondition for the creation of corporate electronic platforms is a common subject-matter and common interests among the participants. Theoretically, it could provide the foundation for greater integration between participants than in thematic platforms, where contributors have no organizational ties to one another. Some of the most successful examples explored in the literature come from major corporations: Lockheed Martin (an aerospace company) and Pfizer (a pharmaceutical company) [*Murphy, Salomon*, 2013]. In the first case, platforms were developed in a top-down manner, and in the second, from the bottom-up. Researchers agree that both cases have recorded positive results from developing tools to externalize tacit knowledge. To achieve these results, an internal social network was set up that allowed specialized blogs, organized thematic discussions, and e-broadcasting. In addition, there was also the opportunity to directly share tacit knowledge through joint use of electronic bookmarks and collaborative development of specialized wiktionaries [*Murphy, Salomon*, 2013].

In both cases, the successes are linked to the fairly complex design of the platform. At Lockheed Martin, the platform was initially developed to solve corporate problems, and some of the internal platforms had access restrictions and anonymity was forbidden. The task was to overcome the problem of probable loss of knowledge once the groups of specialists working in geographically disconnected subdivisions retired. The inability to form such an archive would cause the company to lose all the experience it had accumulated over the years [*Murphy, Salomon,* 2013].

In turn, Pfizer solved the problem from the bottom-up: its platform was developed in several stages, implementing changes to its design and technical characteristics. Thus, the company gradually struck a balance between its staff's demand to share and integrate experience, and the managers' interest in improving worker and customer loyalty. Eventually, some of the content was made accessible to external participants. An 'exo-environment' was set up between company employees and stakeholders upholding professional concern for clients that increased client confidence. Thus, employees' knowledge development was tied in with stakeholder management.

These examples open up a new chapter in marketing, personnel management, and the strategic development of business organization as a whole. The experience of platforms can also be used at

multi-national corporations to uphold common standards and working conditions in divisions located in different regions, particularly when businesses are based in countries with a different work and management culture.

At the same time, even these examples of best corporate practices raise a number of questions from the perspective of direct contribution to knowledge development. It is well-known that pricing specialists have turned to electronic platforms and have started to write blogs. However, what remains unclear is what knowledge has been exchanged, by whom, and how it has been learned. The corporate platforms themselves are innovations undoubtedly, but these innovations fall more within the realm of management than employees' knowledge development. The development of corporate wiktionaries does not appear to be a significant innovative contribution to employees' knowledge development at a micro-level. We can however be more certain of the increased level of awareness of the workings of different divisions or employees. At the same time, other researchers have shown that indirect contact and spatial dispersion between participants complicates active professional collaboration, even if the latter is a requirement of the work process [*Salminen-Karlsson*, 2014; *Batheld et al.*, 2004].

These examples suggest that mutual motivation on the part of workers to participate in professional exchanges of experience is important for corporate and non-corporate platforms in equal measure. However, companies have their own problems that need to be solved before the problem of employees' knowledge development is raised. If a company does not recognize the interests of its employees and underestimates the potential commonality between those interests in real life, developing platforms as a means to exchange experience and enhance communication between personnel can prove futile [*Venters, Wood*, 2007]. In addition, companies are interested in staff integration only to the extent that it satisfies their economic interests. They have little motivation to encourage the integration of employees and their knowledge, since this may pose a threat to the degree of control it has over both staff and knowledge [*Burton-Jones*, 2014; *Zuboff*, 1988]. In this regard, some researchers believe that diffusing the discourse of knowledge development can help to intensify the impact of managers and extract knowledge from employees 'carrying' the knowledge [*Adelstein*, 2007]. In view of these reservations, corporate electronic platforms can be a double-edged sword in knowledge management and, depending on the management's aims, be used to integrate and disintegrate workers' knowledge.

Platforms for Open User-Driven Innovations

Compared with the forms of electronic platform examined above, the workings of platforms for open innovations developed by users are more coherent, focusing on one subject and emphasizing effectiveness in terms of the platform's contribution to innovation. As opposed to abstract 'knowledge exchange,' innovation is the end goal and finite result of platform participants in the form of a developed product. Thus, researchers describe the interaction among participants in user-driven innovation as a 'powerful source of knowledge', 'knowledge synergy', 'crowd collaboration', 'collective intelligence' [*Mount, Martinez*, 2014] and 'aggregate knowledge' [*Füller et al.*, 2014]. At the same time, the recent experience of collective product development shows that it can be a vulnerable pursuit, unlike the collaboration of specialists both in real life and online.

Above all else, it is important to note that the participants involved in the collaboration are not professionals. Therefore, the effectiveness of user-driven innovations is highly dependent on the number of participants, the representativeness of the target groups of consumers, and their level of activity. The 'collective intelligence' of user-driven innovations is in a certain sense opposed to the professional approach. An individual's contribution has little value, and in fact is an example of 'e-tribalism' [*Kozinets*, 1999]. According to this view, the functional roles of participants increase: with 'tourists', 'socialites' or 'followers'; 'newcomers' – 'denizens' – 'elders'; 'lurkers', 'opponents', and 'developers'. [*Füller et al.*, 2014; *Kim*, 2000; *Kozinets*, 1999].

Another difference is that means of communication are the main attraction of consumer electronic platforms. 'Creativity' as such is demanded of some 'developers,' while the task of the end-user is simply to be a member of the group, to review, support or choose from different variants. The differentiation in functional roles muddies the picture somewhat, but the demands of the platform are not fundamentally different. Other studies on the workings of innovative teams using electronic resources also point to the higher importance of communication skills and greater number of contacts compared to the qualitative characteristics of partners [*Gloor et al.*, 2008].

Yet there are serious doubts as to whether such platforms increase the knowledge of participants since each participant is only a 'cog' in the collective process, and the end result is estranged from the participant in the same way as it is in one of Marx's capitalist factories. But the point is not whether this activity is without remuneration, but rather that each participant performs elementary actions that requires neither professional experience nor great intellectual effort, which is extremely removed from the vision of the

overall development process for a new product. Therefore, we can hardly expect any qualitative increase in a participant's knowledge.[6] The increase in knowledge and the resulting innovation, as in the case with electronic corporate platforms, are in fact the management's: the management's knowledge and innovation [*Paton*, 2012]. Even an ardent propagandist of crowdsourcing such as Jeff Howe recognizes that given the poor ability of a 'crowd' to organize itself and apply its energy, knowledge, or economic resources, in user-driven innovations it is only effective if it is managed from the outside, as a crowd is unable to organize itself in crowdsourcing [*Howe*, 2008].

This does not reduce the value of user-driven innovation in any way. On the contrary, it allows companies to save resources, helps to increase labour productivity and satisfy client needs. The question is more of how this relates to knowledge. In crowdsourcing, users stand in place of professionals, as the carriers of specialist knowledge. In fact, this is another example of the common situation arising when the introduction of a new technology leads to reduced demand for qualified specialists in a particular field (say, marketing specialists or sociologists) and increases their demand in another field (e.g. managers or programmers). The roles of marketing specialists and sociologists converge or become routine, and consequently the demand for their knowledge falls.[7]

Despite the differences in the three types of electronic resources examined above, there are some common traits inherent in them all:

- Increasing the number of participants and the number of interactions between them are a common goal of electronic platforms and a criterion for their success (although perhaps not the only ones);

- Managers play a deciding role in ensuring that the platform operates effectively;

- External controls by the management are often tacit and anonymous in nature, and are implemented through the structure, design and variety of capabilities. For the user, in contrast, it appears as if they are given the freedom and tools to aid their creativity. More noticeable forms of control, including direct moderation and rejecting irrelevant content, become more necessary when external conditions interfere with managerial authority;

- In most cases, potential participants of platforms have no direct need for electronic or regular cooperation. As a result, updating and using the interests and real needs of people (for example, overcoming social and work-related isolation, a need for recognition of work achievements, satisfying consumer preferences, seeking out helpful acquaintances, or keeping in touch with colleagues and acquaintances offline) usually guarantee the success of electronic platforms;

- Joining a network and being a member is a primarily individualistic act, based on personal interests and individual choice. The subsequent creation of groups is mediated by the platform, and any integrated involvement is restricted by the conditions imposed by the platform;

- Textual communications tend to dominate the social interaction between participants.

Differences Between Professional Discussions Online and Offline: The Contribution to Understanding Knowledge

Examples from studies so far on electronic platforms only enable us to analyse comparable situations to a certain extent. The initiators behind the creation of platforms are pursuing differing aims; their declared and actual intentions may differ; and finally, we do not have all of the empirical evidence on the workings of electronic platforms. In this section, therefore, we will analyse the more common properties of professionals' interaction online and offline (provided that both situations have the ultimate goal of knowledge development). Needless to say, this analysis is not exhaustive.

Comparing stories of machine repairs (face-to-face interaction from within a work situation) with discussions of professional problems on specialized electronic platforms reveals a number of differences (Table 1).

While they are similar in many respects, strictly speaking, real and virtual communications differ greatly. The key differences in virtual communications are linked to the ease of switching to another commentator, hyperlinks, changing the subject and participant, time gaps, and the high role of chance, including the chance of being involved in the discussion itself. This often makes the communication and

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[6] Winners of competitions which demand serious creativity and extremely active communicators are exceptions to this rule. But any new knowledge held by these is linked not to the substance of any innovations developed through concerted efforts, but is attributed instead to the development of personal communications and team-working skills [*Martinez-Torres*, 2014].

[7] The displacement and/or deskilling of workers as a result of technological shifts is a serious topic for discussion, relating both to the machine era [*Braverman*, 1974] and modern conditions [*Paton*, 2012; *Bakhshi, Windsor*, 2015]. An example of possible displaced professions is given here for clarity. To understand precisely which types of profession can be displaced or affected in terms of their rights and to forecast professional shifts, we need to look at specific examples of technological substitution.

	Table 1. **Main elements of professional communication: differences between online and offline forms**	
Characteristic	**Type of communication**	
	Offline	**Online**
Externalization of tacit knowledge	Takes place directly through sharing stories that are directly linked to the work process	Some of the author's tacit knowledge may be revealed in the wording of a professional blog. Asymmetry in sharing knowledge between the blogger and commenters, reduce the mutual potential for knowledge development. Success depends on the purpose and design of the platform and the professional level of visitors. Bloggers and commentators are not connected by a common work process
Continuity over time	Yes	Possible, but not guaranteed. Barriers to continuity include pauses in between responses; discrepancies over time in the involvement of the necessary and competent specialists; the need to be on the platform at the right time and low chances of the blog being read on time.
Focus on a common subject	Strong, as participants are absorbed in the context of what is going on, which is easily controlled by all participants	Unstable and unequal for different participants, as they are outside the context of the subject being discussed[I], may not have experience in the field in question, even if they share the specialization. Without direct contact and the shared context, it is difficult to control attention
Mutual understanding	Visual, emotional, and verbal affirmation	Predominantly textual affirmation. It may be deferred over time, which can limit control of the participants' content by the blogger and reduce the level of devotion to the group's work. The presence of special symbols, graphic and sound effects to express emotions confirms the lack of emotional contact
Assessing the competence of a partner	Complex – based on practical actions, including joint activity, based on verbal contact and visual signs (outward attributes of the profession, reputation, indirect confirmation from third parties, artefacts)	Based on textual evidence: formal self-presentation of platform participants, content of blogs, involvement in discussions. Takes longer than offline. Depending on the extent to which the authenticity of the information provided by participants and competence and specialization of said participants is controlled by the platform, assessing the competence of a partner can be more or less reliable than offline. In the absence of strict controls by the platform, it is difficult to control or check the competence upon 'entrance'[II]. The most accessible methods of control by participants – friendships and closed groups – are relatively reliable.
Common goal of participants	Takes on a certain nature – to do, to solve, to repair, etc. Set specific work conditions, time constraints, and criteria for the result	Unclear or absent. Even overlapping common goals do not have to be linked to joint activities. Motivation is varied, and may go beyond the scope of professional activities, as well as significantly differ between the blogger's and commentator.
Involvement in joint activity	Clear in real conditions, with the possibility of exchanging tacit knowledge	Weak or absent. Specialist instruments (videos demonstrating skills and knowledge in real conditions, joint drafting of documents) make up for this shortcoming only partly, as this is not full-fledged work, but rather a demonstration of what has been done or could be done offline[III]
Nature of participation	'Engaged' [*Lave, Wenger, 1991*] or 'mindful' [*Hargadon, Bechky*, 2006]	Dispersed, characterized by a lack of engagement and attention. Discussants may not intend to profit from the experience under consideration, subsequently developing it online or offline
Participant make-up	Complete and known, which reinforces mutual help and responsibility	Not always known and can change, and the level of responsibility and mutual help is unpredictable

[I] This is true if the blog author and commentators do not work together offline. But we are looking at the standard case of online communication, when participants are generally not acquainted and interact remotely.

[II] In the Lockheed Martin example, for certain thematic areas, there are restrictions on participants accessing the discussions, as they are controlled by the platform conditions. The selection of relevant commentators increases the effectiveness of online communication, which is a rare practice as it requires special forms of control. The key reason for the restrictions imposed by Lockheed Martin is information secrecy [*Murphy, Salomon*, 2013].

[III] This is not related to the types of work that are initially carried out online or require remote work. These include, for example, website development and administration, electronic database processing and exchange, network analytics, preparing and running remote learning courses and hacking.

Source: compiled by the author.

the knowledge arising discontinuous and fragmented. As a result, online dialogues can bring benefits to business, while interim results – in the form of changing the direction of discussions or uncovering previously unknown properties – do not take the form of new knowledge and innovations. When it comes to the best professional practices online, such as developing knowledge and innovations, this is a significant drawback of electronic platforms.

Many researchers, including those who believe that this problem will be resolved in future, have remarked upon the important role played by contextual absorption and a continuous discourse. Key differences and problems lie in the fact that the unity of participants in online interaction is imposed from outside by the conditions of and conditions over the platform. Offline unity, in contrast, is set from within the

work process – by the business or context shared by the participants in which they are situated as well as by physical objects, standards of work relations, and many other tacit circumstances. This is a component of the 'tacit knowledge' described by J. Orr.

There are two consequences of this. First, there is a contradiction between creative freedom and external control. Research on communities of practice has shown that rigid structuring from outside harms the development of knowledge in real life. To be successful there needs to be professional autonomy and discretion [*Thompson*, 2005; *Brown, Duguid*, 1991]. In online discussions, the external controls offset the lack of internal connection, meaning that they cannot be ruled out. Second, the general context of an online discussion is not a prerequisite but rather a result of said discussion, which calls into question the possibility of obtaining a full-fledged creative product from it.

The main distinction between online communications (in 'isolation' from the work situation) and direct offline dialogue that is 'immersed' in the context, lies in the loss of common sense and common goals. The exceptions are cases when people who work together use the same virtual platform: in which case they simply bring their work online. To discuss a complex work situation on a virtual platform, all of the circumstances surrounding the work need to be 'carried over', which in many cases is either not possible or not advisable.[8]

The move to a virtual environment partly causes a gap in natural relations between facts, events, and objects. These relations are present in artificial speech and narratives, so it is possible to share them online. However, on a blog or chat – the most widespread forms of online discussion – reproducing whole stories, let alone exchanging them, could be problematic. Disjointed comments can only poorly replicate real relations for others; the chain of discussion forms relations, but they do not fully reflect the experience of each of the participants. These are chance relations between commentators, which arise spontaneously during the course of the discussion. They are linked only by the theme of the blog, and are at times only linked to the utterances of certain participants who have 'digressed' onto new topics. Together they may have no sense of unity and are entirely abstract in nature.

Giving virtual platforms set up to exchange professional information the role of a 'knowledge exchange' instrument arguably constitutes a step backwards compared with 20th century groundbreaking studies on knowledge development done by Polanyi, Lave and Wenger, and Nonaka and Takeuchi. In essence, we are now seeing a repeat of the misunderstandings of the earlier period of social research on knowledge: no distinction is being made between information and knowledge. Knowledge transfer is equated with textual communications and the amount of knowledge received with the quantity of participants in a discussion or simply recipients of communications sent through the 'share' function.

When we study electronic platforms to understand knowledge, what stands out is an abstract rationalist side and the depersonalization of the personal contribution that was noted at the beginning of the mass computerization era [*Burton-Jones*, 2014; *Zuboff*, 1988; *Orr*, 2006]. With the emergence of electronic platforms, the collectivity and interpersonal connection between people are starting to take on a formal and abstract form. An electronic platform can perform the role of a quasi-market for knowledge, but knowledge itself is an easily broken down, alienable substance which can be 'transferred' or 'exchanged.'

If we follow the vector of this development into the future, we see the intellectual worker as a producer of creative eclecticism derived from unconnected fragments of other people's knowledge. Sources of knowledge can be likened to a 'second-hand goods market' for information, while electronic platforms are akin to 'knowledge factories.' Similar to the 'part-time worker' at a factory, a part-time knowledge worker in this imaginary world will produce memes and choose between developers offered by a computer. This 'knowledge work' is a call for the individual mastery and conversion power of innovative micro-groups. Small innovative groups are hardly likely to disappear even if circumstances develop in this way; however, they will start to behave like elite laboratories employing a small fraction of the skilled population. Whether this prospect will become reality, or whether small creative laboratories will serve as a micro-environment for innovation for an ever growing number of people deserting mass production, only the future will tell. Nevertheless, to increase the likelihood of this second scenario, electronic platforms should learn to recreate the conditions of innovative micro-environments existing offline, or they should not lay claim to the role of producing knowledge.

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[8] Lockheed Martin's corporate platform was intended to solve similar problems - the disclosure of knowledge by experienced engineers whose were locked in narrow working groups – 'silos' – due to the way in which work was divided or for the sake of secrecy. They assessed the effectiveness of the platform based on the number of workers over 40 years of age who had been invited to keep blogs [*Murphy, Salomon*, 2013]. At the same time, knowledge development assumes interaction, a return from listeners or blog readers, which should form a part of a blogger's virtual communities of practice, i.e. be able to reproduce what he or she has shared on the blog. This aspect of knowledge work has still not been studied.

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