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An Ecological Approach to Collaborative Knowledge Management in Small Professional Communities: Sustainable Information Practices for Sustainable Work

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Abstract. A research project on knowledge management in small companies specialized in green architecture is focused on the construction of a shared body of knowledge in a specific community of practice. We have conducted an inquiry, interviewed and observed the information systems of 30 professionals. We have tried to characterize their information practices according to their aim to “think locally and act globally”. Organizational information processes are related to information literacy and create sustainable information management in communities of practice. Information and communication practices as well as a need for education, management methods and innovative knowledge strategies in the community exist. Three dimensions are taken into consideration: cognitive, technological, socio-political. The overall information ecosystem includes services, structures, people and resources. Some organizational principles are necessary for a sustainable knowledge construction process: reliance, transaction, cognitive accessibility to information.

Keywords: Knowledge management, sustainable information, information ecosystem, cognitive accessibility

1 Introduction

Knowledge management is traditionally located in the context of organizations [1], large companies and public services, which have human, technical and financial sufficiency. It is based on a process of knowledge industrialization which takes into consideration information governance within the theoretical framework of communication sciences. In economic sectors, which are heavily regulated by market rules, and impose a binding apparatus, production and circulation of information are channelled and organized, but poorly distributed. Knowledge management taps into channels that remain inaccessible to small companies which networking is based on communities of practice or interest.

This economic and normative logic is not necessarily congruent with the social and political one calling for a redistribution of goods and knowledge, or with reticular technology used to share information and to create a public space. Beyond a normative definition of public space as a deliberative sphere dominated by a social group in Habermas' theory [2], John Dewey's theory of public [3] focuses on learning processes to live together and gives way to a pragmatic approach of participation and construction of citizenship. On the other hand, the approach of political activists and protest movements relate technical and ideological trends of collective action with the disappearance of the mass media monopoly of communication [4] in a "Postmedia era consisting of a single appropriation, collective and interactive use of information machines, communication, intelligence, art and culture".

The knowledge economy refers both to a new discipline in the field of economics and to an historical period that saw the emergence of an economic model based on the value of the information for the production of knowledge innovation. The capitalist model of knowledge economy, which relies heavily on the private appropriation of ideas and creation, has long been questioned by civil society and by researchers in several disciplines, information experts and geographers who observe the emergence of new territorial dynamics around the themes of open innovation, crowdfunding, collaborative management...

By combining a systemic approach of information in knowledge management and a communication approach of information practices in communities, we propose a reflexion on the feasible conditions of a participatory and open management of knowledge that would allow the emergence of dialogical spaces for learning and action, the transition from economy to ecology of information [5] and knowledge, from a closed to an open standard system. The issue of information in relation with ecology is more often questioned in a logic of engineering, in terms of use of information and communications technology targeting material saving, of environmental monitoring or implementation of public policies. Research shows that information and communication technology can encourage cross partnership and participation. But they focus mainly on the issue of communication tools and not on information practices, including diversity, according to Louise Merzeau [6], a "socio-technical ecosystem in which the user is the heart and nervous system". The communicational approach of triviality proposed by Yves Jeanneret [7], which links social logic, appropriation of cultural objects and symbolic knowledge, is an interesting track. To engage in this reflection, we first describe the particular case of a community of practice to map the areas and information networks for learning. Secondly, we design an opening on alternative spaces and strategies for knowledge transfer. Finally, we suggest some guidelines to put these proposals in operation.

2 The Economy of Knowledge in a Community of Practice

As part of research into knowledge management in learning professional contexts, the RUDII (Representations, uses, development, engineering of information) research team has observed communities of practice and analysed the emergence of

information and communication strategies and management of innovative knowledge. From the identification and modelling of information practices, we question the possibility of building support tools for knowledge construction by reversing the "top-down" dominant approach that offers key tools in an economic conception of innovation aiming to improve productivity.

2.1 A Research Question: Information Practices in Knowledge Construction

The issue of knowledge management, which is the topic of research and technological development in organizations, cannot be treated uniformly in all economic and social sectors. The choice of the research team to observe the eco-design community in the field of construction is based on the existence of huge information needs for some professionals who are gathered around a common objective related to environmental concerns, with various cultures and individual professional practices, located in small, interdependent companies. This community builds its information system from various sources, which are rarely publicized, in independent and informal practices without the mediation of information professionals. Such a dynamic begins with personal information systems. The research project focused on 10 small companies specialized in green architecture. We carried out research, interviewing and observing the information systems of 30 architects, retailers and builders. We have tried to characterize information practices regarding the professionals' aim to "think locally and act globally". Organizational information processes are related to information literacy in order to create sustainable information management for communities of practice.

From a theoretical point of view, we anchor our work on a socio-constructivist perspective, and we consider a set of elements querying the shared process of knowledge building within a professional community. This approach considers that the information formats developed and circulating among peers illustrate a professional information culture. Then we analyse knowledge from the elements of socially constructed reality by members of the community, through their own experience. This question leads us to identify the favorite information sources for the actors, the information research sharing and validation methods, the selection criteria and the forms of rewriting and broadcast / storage used. We try to understand, within the emergence of shared information environments, the ability to co-build management devices, and to share and organise knowledge. Nabil Ben Abdallah [8] shows that the studies of information practices are often focused on individuals and neglect the collaborative dimension of information activity. Engeström's theory of the activity reintroduces this dimension, taking into account the interactions between individuals within groups and between groups and artifacts, the actor in the workplace, his representation system and his personal information literacy within the work activity [9] and the overall information ecosystem [10] which includes services, structures, people and resources.

The research, from a methodological point of view, is based several approaches. A sociological approach from surveys is used to analyse professional contexts, practices (research, treatment, communication) and representations (maturity). A

semio-pragmatic approach identifies the components of the knowledge construction. A documentary approach analyses the personal information systems by connecting them with the informational material produced by communities. A communication approach of spaces and informational ecosystems seeks to identify acts of social construction of reality [11] through the themes, vocabulary, semiotic discourse structures and information arrangements. Semi-structured interviews were used to capture the informational and documentary requirements, to observe how people seek, manage and disseminate information. The first part of the research identified exactly, with business partners in the fields of observation, the central informational topics. In the second part, we analysed with professionals, during interviews, their personal information system. The research team has identified a need for education, management methods and innovative knowledge strategies in the community. Three dimensions have been taken into consideration: cognitive -information governance-, technological -learning objects and mediation-, socio-political -information architecture-.

2.2 The Identification of Active Participatory Practices but Weak Knowledge Management

Research has helped to draw up a map of searched for and used information types and modalities. Traditional media information (magazines, exhibitions, books), business information produced by building material companies, and institutional information produced by professional organizations and some technical centers, are very dominant. This first stage of the research has identified shared watch areas: energy management, sourcing and implementation of building materials (including origin, methods of production and distribution, and health impact), planning, and the issue of transport and forms of cooperation. All this information is highly institutionalized, filtered and mediated by organizations, and structured according to economic and political criteria. Some sources are underused, such as scientific information related to research, and technical information related to the experience of professionals, which is generally disseminated in training institutions. Professionals usually develop informational tinkering practices from heterogeneous sources of information such as technical documents and meetings. Legal information is very expensive. The information practices identified are essentially based on research and gathering but not as much on treatment or distribution. The socio-cognitive hybridization possibilities are low, as well as cooperation and regulatory practices in networks that are weak regarding the quantity, complexity and cost of public and private data for informational and professional activities. This description of information practices and mapping of an emerging community of practice does not reveal exceptional discovery as part of a business field where competition creates isolation and where economic disparities are important. But it remains interesting as emblematic of a closed representation of the information environment in the personal and collective ecosystem that reflects on the gap between actual practices, the information environment of reference and the shared information culture.

Field observation shows that some practices exist: thematic information monitoring, classification through the establishment of databases, indexing and information management that meet organizational and individual cognitive styles with recurring features. We also notice the use of paper and the Internet, parallel to classification implementing elaborate coding systems with hierarchical thematic indexed clusters: thematic color codes, alphanumeric codes (architecture, urbanism, consulting/design: colors, characters, environments, textures...) for digital folders and subfolders, chronologic rankings. Among all stakeholders, the information classification system corresponds to a typology of activities. Thus, for example, taking notes in conferences (scientific information is too expensive in the retail versions) can be arranged by some professionals in order to be reused for tenders. Can also be found in personal information systems, some educational bases, easy to understand documents to show to buildings' owners or to employees. Thus, rankings correspond to action objectives. In collective organizations, some professionals have also established internal networks with servers on which information is necessarily structured with precision. A person can belong to multiple networks based on its activities (planning/construction, private/public command, types of projects, etc.). Databases are structured within and between networks based on activities. These databases are free, retrieved or constructed.

3 Conditions of Participation

The collision between social network practices, a code of values based on the community and isolated information practices, produces a contradiction between two logics: a logic of movement, and a logic of storage and closure. In the first, the information is shared, in the second, it is protected. It is therefore essential to focus on the dynamics and interactions through three principles of action that determine participation: openness, accessibility and reliance.

3.1 The Principle of Openness: Public Areas of Knowledge

In the professional community that we studied, information and knowledge management in business operates through competition and closure. The professionals express the weight of acculturation in schooling and training time, during which they have been transmitted the professions' "rules of the art", based on identity, legitimacy and expertise. These rules close the information ecosystems and thereby the technical, scientific and ideological reference field. The metaphor of "enclosures" can easily be used here. The professionals from the observed group deplore the existence of closed systems which they do not always have the means to enter, they will not easily manage to leave and which do not correspond to their beliefs. The community dimension is limited to professional practices, technical devices and equipment and a system of common signs. In the process of communication with the public, this community dimension also remains marginal, because professionals do not have time

to disseminate information. The social space/time is not conducive to knowledge sharing for economic reasons (the highly competitive nature of the building sector) and for ideological reasons (the unlikelihood of sharing in the professional community of architects), although these reasons are inconsistent with the reference values of eco-design.

These comments refer to the question of knowledge that one is entitled to think in terms of community. Elinor Ostrom did so with the theory of commons, common knowledge recovery and the idea of co-construction from shared information. She [12] shows that new "enclosures" create a private appropriation of knowledge. Common knowledge, defined by Charlotte Hess [13] as "resources shared by a group of people who are vulnerable to degradation and enclosures," therefore requires new governance for protection. This theory inspires social movement as we know it: open source, open archives, creative commons, open data. Elinor Ostrom has proposed governance principles that ensure the robustness of community management systems, sustainability, through common rules of procedures and management, conflict management, mediation, adaptation.

The open data can be considered as an opportunity to offer an open and collaborative construction or participatory and "common knowledge" [14]. Open data have special characteristics in the information economy, being heterogeneous, free (even if they have a production cost for the community), open and usable, but may have no cognitive value without treatment for their integration in information activities. The provision does not guarantee reuse by organizations other than those which that have the industrial strength to handle it. The metaphor of transparency does not guarantee the absence of selectivity about which data can be opened and displayed. It is, furthermore, a political choice regarding spaces and socio-technical treatment needed -identification of objects, extraction, processing- which design the possible uses. The data liberation movement is based on the search for a form of disintermediation and "democratization" of information, but the need for mediation or informational acculturation remains a central issue for all actors, producers and data users. The open data movement is still offering the opportunity to all citizens to have access to what was non-public information or of a commercial nature, which is particularly rich and useful to professionals in the environmental field, as demonstrated by the example of the city of Montreal [15]. The state and local authorities have adopted a policy giving the opportunity to work on research for data mediation solutions, for the development of information devices likely to create knowledge and for use by professionals.

3.2 The Principle of Accessibility

Digital accessibility refers to the cognitive ability to access information available through technology. Accessibility, according to UNESCO's Information for all program, is related to the cognitive abilities of individuals to be able to use new technologies, availability, affordability and adaptability. These three dimensions are based on financial and material capabilities. The ability to access the main digital

information is not a guarantee of a better acquisition of professional knowledge. Access to information is also conditioned by the possession of powerful interoperable tools. The dimension of interoperability between information devices or systems that actors use is the main problem they face. The multiplicity of computers deployed on different work fields which are places of collection of scattered information, is one of the difficulties of access to sustainable information. A final difficulty concerns the type of information, mostly professional and business that actors cannot acquire without funds.

3.3 The principle of Reliance: Informational Transaction and Democratic Participation

Reliance means that we have to think of the network in a dynamic logic of information sharing strategies, rather than silos, circulation and discussion rather than deliberation. It thus suggests that we no longer consider the systems as static objects but rather understand the relationship of operations and systems. It requires the construction of cultural links between different worlds beyond disciplinary boundaries and some cognitive flexibility.

Manuel Zacklad, opening the debate on the transactional approach inspired by Dewey and Bentley, proposes to focus on the uses of information in various contexts, not only organizations but also communities of practice and informal groups in which there are “distributed practices” [16]. Dewey and Bentley [17] described three stages for the design of human actions in the environment: first, the primitive conception of self-action, second, interaction, and finally, transaction. Joelle Zask [18] shows that the individual transaction as a condition to the sustainability of human action system, is possible only in the context of social and political participation, as opposed to traditional expertise. John Dewey explains the pragmatic conception of participatory democracy as the continuous creation of a public engaged in action, which learns from the survey and shared experience, stressing that there is “not knowledge without the development of a community and no community without the development of shared knowledge”. For John Dewey, democracy is experimental since participation is the only means everyone has to develop existence, an existence which is based on exchange and cooperation for fear of being dominated by a self-proclaimed authority. Information is a source of “empowerment”, providing the means of collective and individual action. Information allows people to build and share perception, understanding and action on the environment on a collaborative basis.

Our research showed that the professionals, in their information practices, still prefer reading on paper or “closed” documents in solitary and vertical perspective of knowledge construction that contradicts the values held by their common project. They do not have many opportunities for searching, reading, writing or digital networking. Digital reading puts the focus on the link in the text (in hypertext) between readers. It is useful for sharing work between people and sense constructing through social ties. Social networks can thus be used for their ability to converge the intentionalities around the same project. The fragmentation of attention can change the

scale and expertise to upset hierarchies. Information literacy means empowerment in keeping with the values and the regime of authority to make choices, understand and interact. Bernard Rieder [19] also shows that the discursive web architectures make new social morphologies possible. He uses the metaphor of the foam to designate mediated proximity of isolated individuals and membrane to refer to information filtering capabilities (insulation).

Social networks are likely to play an important role in information monitoring and collaborative information sharing for knowledge and innovation, apart from centralized platforms produced by institutions or economic actors. They also promote communication about professional activity. They are however only poorly integrated with competitive uses of information that fall outside of a form of digital sociability. Beyond the personal situation of competition in the architecture profession, it seems that poor integration to social networks cannot be explained by a controlled strategy but by the socio-communicational context and acculturation.

These principles lead us to the problem of coordination. Our project draws some tracks still to invest concretely.

4 For a Knowledge Ecology

The term knowledge ecology is used by Edgar Morin [20]) but also in the managerial discourse that produces analytical models of interaction processes and knowledge distribution in companies [21]. The idea of collective creation of knowledge in an innovation goal is not new nor particularly linked to sharing objective. It was popularized in 1983 by Henry Chesbrough with the term "open innovation", which emphasizes the importance of interaction in the new knowledge creation process in companies. The expression of knowledge ecology invites to consider, beyond the socio-technical and engineering devices in the organization, the contextual dimensions, including cultural knowledge, with the procedural dimensions of information processing.

4.1 Informational Trust

The establishment of knowledge co-construction process takes a number of characteristics that Dominique Maurel and Chebbi Aida [22] called the informational confidence. It is based on quality criteria (relevance, reliability, credibility, authenticity, richness, accessibility) and symbolic value. The choice of structuring information resources often consists of configuring metadata and standardization of uses from that Brigitte Simonnot [23] refers to as the "system paradigm", a concept of access to information centered on functioning applications requiring the information seeker a rational and stable model. The "actor paradigm", in contrast, allows to imagine hybrid fittings between men, machines, networks, to make visible the invisible, but also bring the existing storage resources on collaborative or community

spaces with logical documentary tools for information sharing.

The governance of information in communities of practice poses particular problems related to the impossibility of identifying all stakeholders and to set boundaries to information systems, whereas the context of use of the information -size the group, leadership, degree of trust between the actors- is very important. Cooperative strategies depend on communication opportunities between actors.

4.2 Technical Equipment

The technical equipment of knowledge management is based on interactions and modes of regulation. Vincent Liquète proposes to call informational ecosystem the system based on people, structures, services and documents. It operates on an "operating" information system [24] for the establishment of interactions needed to manage projects and dialogue between different professional cultures through documents that are "boundary objects". This system is oriented towards activity, while the personal information system is oriented towards the actors and built according to their needs, and the overall system is oriented towards organizations by combining the spontaneous information networks to institutional networks [25]. In this system, the ranking is based on the praxeological rationality that includes the construction of knowledge in the psycho-social context, highlighting the link, and in the cultural context highlighting the meaning and technical context rewarding action.

Four main functions appear in the framework of the organization of this equipment, with respect to types of activity: training, project management, communication via a relational database, information watch. The professionals must be able to customize, in a sustainable way, the resources. The boundary objects can be defined as "an arrangement which allows different groups to work together without consensus" [26]. These artefacts (software, procedures, classifications, etc.) allow the transfer of elements of one practice to another with the characteristics of modularity, abstraction, versatility, standardization. The projects themselves are communicational objects. These boundary objects pass within a community through information networks. The handling of this tool needs a cultural substrate that allows a shared representation of the construction of knowledge.

4.3 Development of a Culture of Critical and Participatory Information

Lack of information literacy in the initial curriculum is a recurring feature and is deplored by the actors themselves, who are often self-taught and develop effective tinkering practices. Yet information literacy appears to be the prerequisite for participation, particularly when writing technical documents is at the centre of professional practices. Angèle Stalder and Eric Delamotte [27] remind us that it has a tactical dimension centered on the professional act, an action-centered dimension of intellectual technology, and a structural dimension centered on the communication device. We can add a critical dimension ("radical") that Andrew Whitworth describes, seeing in information literacy the means for a real intellectual decolonization and redistribution of power by seeking a dialogic, polyphonic, dynamic and critical

objectivity [28]. Finally, this literacy is necessarily transversal and plural, it is a transculture [29]. A training device can include several types of abilities: tracking and collection, selection and evaluation, organization and recording (personal memories and shared work), implementation, rewriting, self-evaluation, self-learning, cooperation, communication, planning.

5 Conclusion

Professionals who have been the subject of our investigation questioned the industrial, rationalist, capitalist model, from the point of view of information, industrialization of culture, attention and knowledge, to favour a logic of crafts, tinkering and companionship. They try to rely on a long time shared experience and not only shared information. However, they perceive the difficulty of sticking to this slow pace of a reenchanting world in a competitive environment where the risk of dischronicity could exclude them from the action. The search for a knowledge ecology inscribed in space, time and relations is a complex project and process to be built.

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