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Research Note

A knowledge management approach to capture organizational learning networks

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ABSTRACT

Effective knowledge management practices in organizations are focused on knowledge creation and knowledge transfer activities. Thus, intelligence and competencies matters at the organizational workplace. For most knowledge intensive organizations is fundamental the continuous availability and development of domain expertise. This paper describes an ongoing research project to develop an organizational knowledge architecture that is being specified and developed to support collaboration tasks as well as design and model predictive data analysis and insights for organizational development. The primary goal of this research is to create a suitable architecture for use, initially, in intranet (corporate portal) collaborative procedures, but also scalable for later use in more generic forms of ontology-driven knowledge management systems. The designed architecture and functionalities aim to create coherent web data layers for intranet learning and predictive analysis, defining the vocabulary and semantics for knowledge sharing and reuse projects. Regarding intellectual capital definition, this research argues that effective knowledge management are based on the dynamic nature of the organizational knowledge, and predictive data analysis and insights identification can transform and add value to an organization. This paper presents a knowledge management and engineering perspective (ontology based) for the application of predictive analysis and insights at the organizational (corporate) workplace towards the development of the organizational learning network.

1. Introduction

The development of knowledge network communities has been an aspect of the corporate intranets and knowledge portals, and it has ever since enabled the connection of human resources with corresponding interests, regardless of time and space restrictions. In spite of in the beginning the organizational intranets was known or seen as a simple repository of information and data where employees and stakeholders do not necessarily implied a strong bond among the organizational network community, that has changed with the increased availability of user-generated content mechanisms and with the growth of social networking services, as well the continuous growth of intranet (and web 2.0) management technologies.

Corporate intranets (along with the Internet) became the hub of socialization and knowledge sharing; became the logical extension of our human tendencies and learning, that have been tailored our society and our cultures. Those reflected tendencies towards an individual-centered approach whereas group-centered activities, creating context where each individual contributes to the intellectual climate and technological infrastructure of society, rather than the effects of media itself. Organizational learning communities are a phenomena usually built upon multidisciplinary and innovative collaborative stakeholders which grow within the organizational workplaces.

The following section describes the knowledge management and engineering approach, including the knowledge elicitation and acquisition techniques and an ontology design methodology. The following sections present the main knowledge management focus of this research: managing intellectual capital in organizations, and a research approach to capture the organizational learning network. The design approach being used to model the organizational network applies conceptual maps and ontologies.

2. Knowledge management and engineering approach

Knowledge management (KM) refers to identifying and leveraging the collective knowledge in an organization (Krogh, 1998). KM systems

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refer to a class of information systems applied to managing organizational knowledge, and are developed to support and enhance the organizational processes of knowledge creation, storage, retrieval, transfer, and application, mainly at organizational (corporate) workplaces.

We consider the organization definition stated as a social unit of people, which are systematically structured and managed to meet a need or to pursue collective goals. An organization has a management structure that determines relationships between functions and positions, and subdivides and delegates roles, responsibilities, and authority to carry out defined tasks. Organizations are open systems in that they affect and are affected by the environment beyond their boundaries (Business Dictionary-Organization Definition, 2017).

In the knowledge-based economy organizations are facing systematic changes. KM focuses on techniques of managing a common base of organizational knowledge that allows heterogeneous organizational groups, functions and communities to coordinate their efforts and share knowledge across time, function, discipline and task specific boundaries (Configuring software, 2016). In addition, knowledge may be geographically distributed and stored in a variety of different representations, e.g. tacit knowledge in researchers' minds and structured information in databases.

2.1. Ontology design and development

The term "ontology" has its origins in metaphysics and philosophical sciences. In its most general meaning, ontology is used to explain the nature of reality. There are at least a dozen of definitions of ontologies in computer science literature, but the most widely cited is that provided by Gruber (1993). An ontology is a high-level formal specification of a knowledge domain: it is a formal and explicit specification of a shared conceptualization.

A conceptualization is an abstract view of particular real-world entities, events and relationships between them. Formal refers to the fact that an ontology is a form of knowledge representation and has a formal software specification to represent such conceptualizations, for example, an ontology has to be machine-readable. Explicit means that all types of primitives, concepts and constraints used in the ontology specification must be explicitly defined. Finally, shared means that the knowledge embedded in ontologies is a form of consensual knowledge, that is, it is not related to an individual, but is accepted by a group.

Ontology design and development can be approached from several different perspectives: inspirational, inductive, deductive, synthetic and collaborative (Holsaple & Joshi, 2002). In recent years, there has been a move towards integration of these different styles (Edgington, Choi, Henson, Raghu, & Vinze, 2004). The underlying ontology-driven software design method (Fig. 1) also attempts to integrate these different styles by focusing on a collaborative approach and building on existing ontology research, such as the Enterprise Ontology (Uschold, King, Moralee, & Zorgios, 1997), ontology design (Swartout & Tate, 1999), and ontology development, a guide to create an ontology (Noy & McGuinness, 2001).

2.2. Context conceptual maps

This research project aims to contribute in this direction: to design an ontology-driven KM tool to support research cooperation and organizational knowledge development. The design of conceptual maps underlies a collaborative (organizational) approach. Conceptual maps are a graphical representation (Schermann, BOhmann, & Krcmar, 2009) which provides preliminary exploratory insights that lead to the development of ontologies to apply on predictive analysis and insights identification.

Conceptual models are a prerequisite for successfully planning and designing complex systems (Jeusfeld, Jarke, Nissen, & Staudt, 2006; Moody & Shanks, 2003; Pereira & Mira da Silva, 2012; Pereira, Almeida, & Mira da Silva, 2013) and have been employed to facilitate, systematize, and aid the process of information systems (IS) engineering (Pereira et al., 2013). Yet, conceptual modelling is also suitable to systematize knowledge, provide guiding research and map a portion of reality (Järvelin & Wilson, 2003).

The expected resulting ontologies are based on the social (organizational) learning domain.

Knowledge may be tacit or explicit (Nonaka, 1994). Knowledge can refer to an object, a cognitive state, or a capability and may reside in individuals, social groups, social systems, documents, processes, policies, physical settings, or computer applications and databases (Alavi & Leidner, 2001).

The intangible (or less tangible) value of the organization is generated from informal activities that help build business relationships and contribute to operational effectiveness (ValueNetworks, 2017). From these informal activities can result more intangible knowledge assets. These intangible assets can be seen as knowledge and benefits extended or delivered by an individual or group, that are informal but still have value for the organization. The combination of the less tangibles of an organization, i.e. human, structural and relational capital, is called intangible capital or intellectual capital (IC) (Adams & Oleksak, 2010).

The collaborative design process of a conceptual map is an effective approach to capture intellectual capital. It is not always possible to capture intellectual capital within the workplace of organizations because they are somehow invisible in conventional forms of information systems

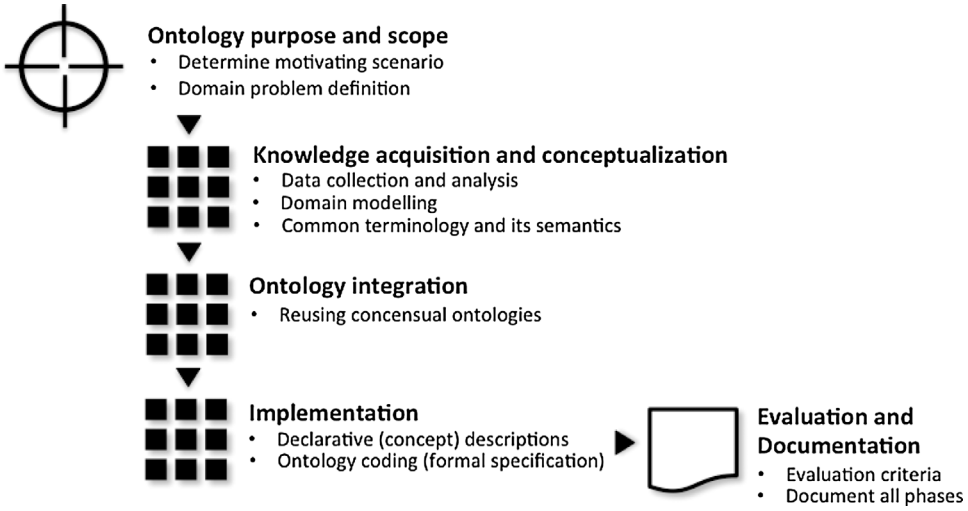

Fig. 1. Ontology development method.

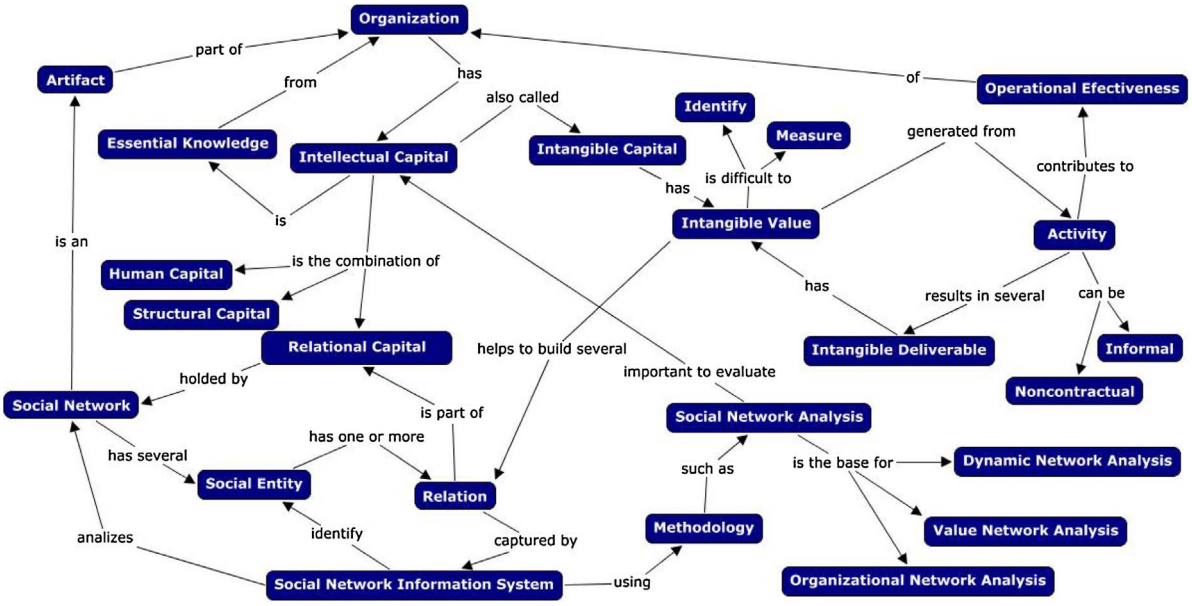

Fig. 2. Context Conceptual Map.

and intranets (Adams & Oleksak, 2010). Also, there is a lack of standard metrics for the evaluation and assessment of the relational capital within the organizations (Zadjabbari, Wongthongtham, & Hussain, 2008). Measurement can be seen as a result of observations that quantitatively reduce uncertainty. A reduction, not necessarily elimination of uncertainty will suffice for a measurement because it is an improvement on prior knowledge (Hubbard, 2010).

Fig. 2 shows a conceptual map with the key concepts and relations referred above. Social network information systems identify relations between social entities and provide a set of automatic and sometimes predictive inferences on these relations, promoting better interactions and collaborations between these entities. Social network analysis (SNA) (Faust & Faust, 1994) is the base for several areas such as: Organizational Network Analysis (ONA) (Cross & Parker, 2004), Value Network Analysis (VNA) (Alee, 2008) and Dynamic Network Analysis (DNA) (Carley, Diesner, Reminga, & Tsvetovat, 2007). For example, they provide methods for studying communication in organizations with quantitative and descriptive techniques for creating statistical and graphical models of the individuals, tasks, groups, knowledge and resources of organizational systems. In this sense, SNA methodologies are important to discover individual's roles in organizations and evaluate the value of intellectual capital.

3. Intellectual capital in organizations

The actual economy is supported by information and communication technologies. Nowadays, the processing of information and creation of knowledge are the main sources of productivity, e.g. knowledge management, intellectual capital and organizational learning. Focusing, intellectual capital is composed by human capital, structural capital and relational capital.

In order to better understand what intellectual capital is, it is necessary to know that an organization has tangible and intangible capital. Summarizing, tangible capital is what can be measured (e.g. the value of a product or service), and intangible capital is the result of the organization informal and noncontractual activities such as interpersonal relationships, which tends to be ignored in the organization accounting systems. As stated before, these intangibles can help and contribute to operational effectiveness of the organization. So, in reality they are not intangibles if they can be detectable as an amount, thus observable and measured (Hubbard, 2010).

The value of organization knowledge is greater than their tangible assets, and so, KM practices are a way to help tracking and keeping tacit knowledge inside organizations, namely human capital, relational capital and structural capital are essential knowledge within the organizations. Human capital is the knowledge, skills and experience of individuals. Structural capital is the set of procedures, processes and internal structures that contribute to the implementation of the objectives of an organization (Anklam, 2007). The relational capital is the value of social relationships within and across organizations.

The combination of the less tangible assets of an organization is intangible capital, also called intellectual capital (Adams & Oleksak, 2010). From the book The Knowledge Evolution (Allee, 1997), Anklam (2007) summarizes (Fig. 3): (1) Human capital is the knowledge, skills, and experience of the individuals required to provide solutions to customers, its core competency; (2) Structural capital can be viewed as the internal procedures, processes, and internal organizational structures that have evolved to enable the organization to function as it does, for example, standard methods or heuristics passed from person to person; and (3) Relational capital is the value of an organization's relationships with customers, suppliers, and others it engages with to accomplish its business; for example, its access to specific markets or resources.

The systematic transfer of tacit or implicit knowledge to explicit and

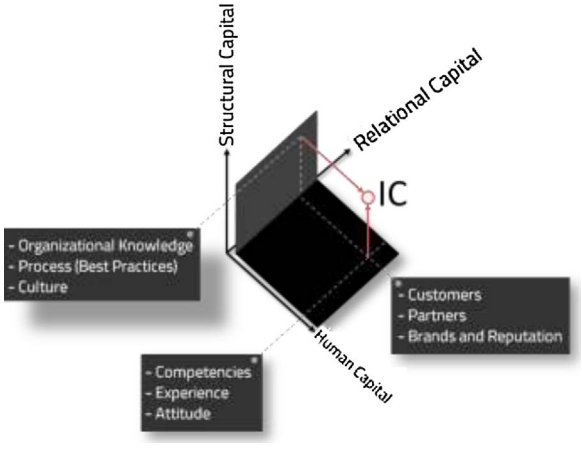

Fig. 3. Intellectual Capital Types.

accessible formats is the goal of many KM projects (McInerney, 2002). The real promise of the knowledge economy comes in the creation of structural capital as the knowledge that is captured and institutionalized in an organization (Adams & Oleksak, 2010). Less tangible assets such as human relations are not owned by organizations and it is hard to separate them from the human capital and structural capital knowledge assets.

3.1. KM as a core competence of knowledge workers

Knowledge Intensive Organizations rely on making the most effective use of the knowledge that is available to them in order to compete and survive (Vasconcelos, Miranda, Kimble, & Henriques, 2009). Knowledge based tasks such as recognising patterns in organizational behaviour and dealing with abstraction, ambiguity and uncertainty, form a large part of their corporate activity. In practice, much of this work is done through exploiting a constantly changing and evolving network of relationships between people, sources of information and organizational needs. Organizational groups in such organizations need to create mechanisms to elicit innovation, find sources of information, manage skills efficiently and gather ideas and suggestions in order to do their work. In other words, to work effectively in a knowledge intensive organization, groups need to be able to work collaboratively (Vasconcelos, Sousa, Lamas, & Shmorgun, 2011).

Knowledge is the critical resource in today's economy and is raw material. The raw materials of the knowledge era are knowledge-based intangibles (or less tangibles knowledge assets). Human capital, relational capital and structural capital are types of knowledge assets that become the raw material for innovation and value creation (Fig. 4).

KM starts to be a core process and is becoming a core competence of knowledge workers because they have to develop a better understanding of the information that they need at the work. As stated before, we summarize intangible (or less tangible) capital assets in organizations from (Adams & Oleksak, 2010): (1) Human Capital; (2) Structural Capital; and (3) Relational Capital. Thus, the value of knowledge assets in most organizations is not isolated and individually identifiable: it exists as an holistic system, which can provide efficiency, quality, process improvement, innovation and organizational learning and development (Adams & Oleksak, 2010).

3.2. Intellectual capital measurement challenges

There are three basics challenges associated with intellectual capital (Buono, 2003; Greene, 1999). In essence, how is it possible to: (1) Value (measure) intangibles better; (2) Create more value (i.e. invest and manage) from intangible capital; and (3) Retain more (conversion) of this capital? These questions are still a challenge. Adams and Oleksak (Adams & Oleksak, 2010) argue that *"In Europe and Asia, a number of tools have been created by governments as part of competitive initiatives to help training managers in small and medium-sized enterprises (SMEs) so that they can leverage their knowledge capital"*. So, when trying to solve this problem in order to create an IC assessment system, the main parameters are (Adams & Oleksak, 2010): (1) Scope; (2) Rating System; and (3) Standard of Measurement in all the kinds of assessments within the organization in order to achieve a cohesive picture. As stated before, measurement can be seen as a result of observations that quantitatively reduce uncertainty. *"A reduction, not necessarily elimination of uncertainty will suffice for a measurement because it is an improvement on prior knowledge"* (Hubbard, 2010). Toward a universal approach to measurement intangibles in business, Douglas Hubbard recommends a five step framework (Hubbard, 2010). We identify these steps: *(1) Define a decision problem and the relevant; (2) Determine what you know; (3) Compute the value of additional information; (4) Apply the relevant measurement; and (5) Make a decision and act on it.*

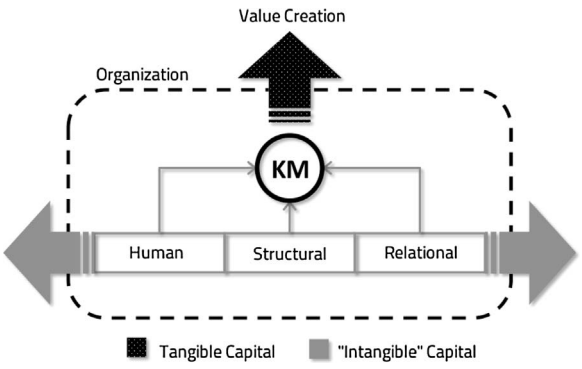

Fig. 4. Organizational Tangible vs. "Intangible" Capital.

3.3. The role of social network analysis

An organization is itself a social network that is made up of many smaller networks and organizational memories and typically the knowledge is dispersed throughout the network. There are common network properties and processes associated with networks, such as structure, development/evolution, governance, and network outcomes (Provan, Fish, & Sydow, 2007). To uncover these properties, evaluate and analyze social networks there are four major areas: Social Network Analysis, Organizational Network Analysis, Value Network Analysis and Dynamic Network Analysis.

Theorizing and understanding networks can generally be thought of as coming from two complementary perspectives: the view from the individual organization and the view from the network level of analysis (Provan et al., 2007). Interorganizational networks are also referred as "whole networks". A typology demonstrates the possibility of four different types of network research approaches (Provan et al., 2007): (1) the impact of organizations on other organizations through dyadic interactions; (2) impact of a network on individual organizations; (3) impact of individual organizations on a network; and (4) whole networks/network level interactions.

Considering an organizational environment, network-level theories use many of the behavior, process, and structure ideas and measures developed by organization-level researchers. However, as stated by Provan et al. (2007) the focus is not on the individual organization but on explaining properties and characteristics of the network as a whole.

4. Capturing an organizational network

Several software packages to support, represent, and analyze social networks are available. The packages can range from complete software to analyze and visualize social networks to systems that permit the design and execution of surveys and then use the data obtained to perform a full network analysis.

Other systems allow the automatic discovery of network information via mining a data repository or communications gateway. As depictured in Fig. 5, based on the referred models, there are different approaches for capturing an organizational social network. In Fig. 5, we present an overview of representative inputs, models, techniques and tools to support and analyze organizational social networks.

As depicted in Fig. 5, the common way to extract a social network is by instantiating it directly through SNA software packages. However, using these tools and platforms it is also possible to automatically extract social networks from information gateways or through automatic survey analysis. The KM Analyst can bring shifts in management thinking and improvements in the intellectual capital value of the organization (e.g. using IC reports). The IT Manager serves as an agent to provide access to private information systems of the organization (e.g. ERP/CRM systems or local communities knowledge bases).

As stated before, an organization has tangible and less tangible capital. In this context, it is difficult to separate the human, structural and

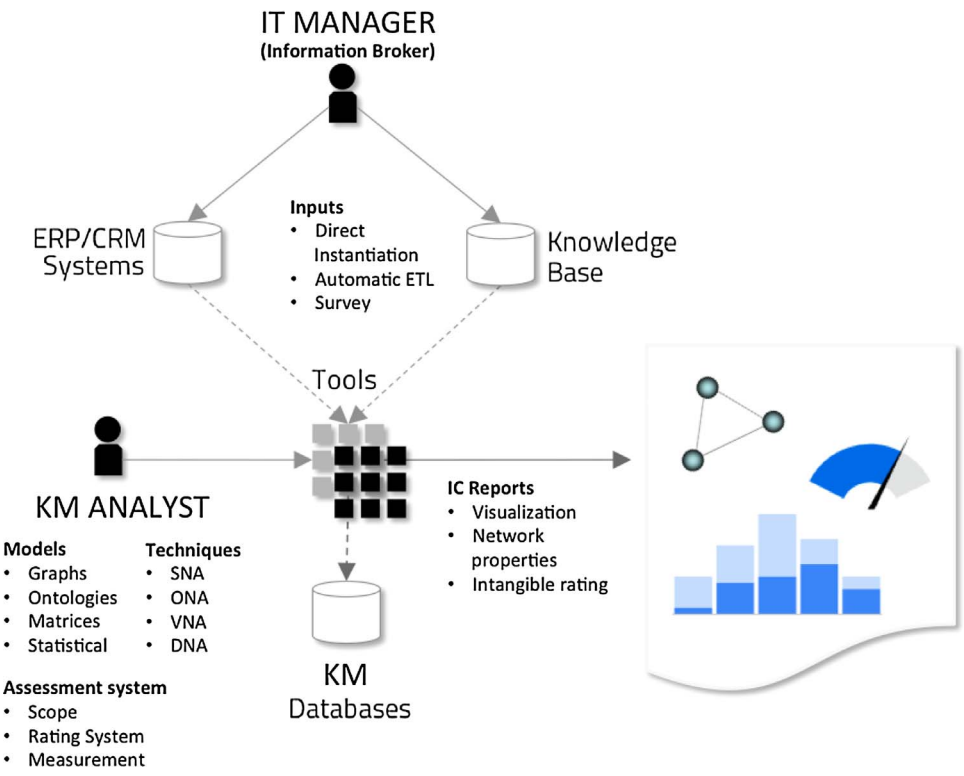

Fig. 5. Capturing and Analyzing an Organizational Social Network.

relational factors. Knowledge management captures these factors, which are the necessary for innovation and value creation processes.

5. Conclusions and future work

The main rationale of this research is built on the belief that by understanding intranet organizational communities we will be able to better foster their inherent formal and informal learning and decision making processes in a number of contexts. This paper presents the development of an ontology-driven research framework designed towards an understanding and conceptualization of what intellectual capital is within the organization and how organizational knowledge assets can be represented.

The innovative nature of this research and future KM and engineering approach and predictive data analysis tool can be characterized by this systematic recording of organizational intranet manifestations, recording that eventually will provide structural, social behavioral or morphological patterns or some other connections that eventually help eliciting ways of support of different learning and working (business processes) contexts. The relevance of this work is grounded in the idea of developing conceptual maps and related ontology for intranet learning and development. This ontology aims to facilitate a systematic management of online learning community manifestations as an effort to understand their life cycle and therefore to provide mechanisms, which improve inherent formal and informal learning processes in a number of organizational contexts.

After knowing what to observe, based on current approaches, further research and future work will describe how intellectual capital can be engineered and measured.

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