Socio-technical Revelation of Knowledge Transfer Potentials

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Abstract

Research-intensive organizations struggle to get an actionable overview of their research activities. We report on a preliminary architecture of a socio-technical system that aims to uncover the potential for internal transfer of knowledge and to facilitate this transfer in research-intensive organizations. We discuss two important roles in this human-powered system and its benefits in the context of a research museum.

Introduction

Today, we can see the "trend towards 'knowledge work' and the Information Age" (Spender and Grant 1996) has come to fruition. But the resulting data deluge comes with its own set of challenges. The transfer of knowledge within organizations is a critical success factor (Barney 1986; Argote and Ingram 2000).

In research-intensive organizations, research projects are often developed in departments which are akin to information silos. The departments and projects may even compete with each other for resources. The research is documented in disparate information systems, such as project websites and wikis maintained by subject matter experts. For the researchers, it is difficult to get an overview of the competences and knowledge of their own organization to better collaborate with other researchers.

Research organizations are missing 1) an integrative overview of the internal research activities, 2) a knowledge sharing community that spans across departmental borders, and 3) support in the identification of the potential for internal knowledge transfer. Figure 1 gives an example of such a latent potential for knowledge transfer between two researchers. The two researchers and associated projects could profit from a bilateral exchange of information.

Our solution is to make the implicit information in the context of research projects visible. We aim to provide actionable insights into the potentials for internal knowledge transfers between three types of actors at research-intensive organizations: researchers, projects and departments. Our over-arching aim is to facilitate the organizational shift towards an open knowledge community.

To this end, our ontology-driven system combines semantic web technologies with the crowd-sourced contribution and curation of data. We will provide a semantically integrated knowledge base and visualization of the research activities at a research-intensive organization. In particular, we apply rule reasoning to the domain of research project information to uncover the implicit potential for knowledge transfer between the actors in the organization.

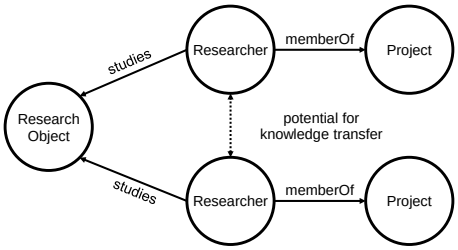

Figure 1: Example of an implicit potential for knowledge transfer between two researchers

We view the organization as a socio-technical system, a "social machine". Contrary to the definition given by Smart, Simperl, and Shadbolt (2014), our system will not be entirely web-based. The system will also have elements of offline interaction in the form of a Community Manager. Our main user group are the researchers working at the research organization.

In this paper, we present the preliminary architecture of the proposed socio-technical system (figure 2). We briefly discuss two important roles in the system and the benefits of our approach in the context of a research museum.

Proposed Architecture

Data is acquired from two sources. Firstly, research project information is elicited from the researchers via interviews and voluntary contributions. Secondly, a data processing pipeline integrates data from sources that are internal and external to the organization.

The user-contributed data is stored in a semantic wiki. The underlying ontology acts as an extendable framework for the discourse among researchers in the wiki (Wagner 2004) and as a schema for the data entry. The ontology will be iteratively developed in several workshops, starting with a seed ontology inspired by the "core dataset research" (Biesenbender and Hornbostel 2016). We envision the knowledge base and the underlying ontology to co-evolve. The ontology

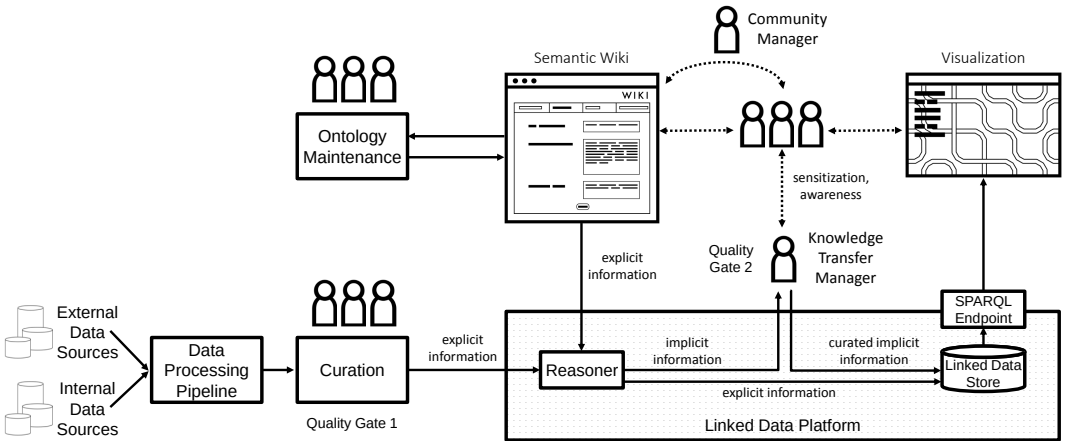

Figure 2: Proposed architecture of the socio-technical system

will be collaboratively maintained by the users in the wiki, supported by an ontology engineering methodology. Simperl and Luczak-Rösch (2013) give an overview of collaborative ontology engineering methodologies. The argument-based DILIGENT approach has proven to be a promising candidate for the wiki-based maintenance of the ontology (Tempich et al. 2007).

The semantic wiki is mirrored in a Linked Data store and enriched with internal and external data. Using automated rule reasoning, we will uncover implicit potentials for knowledge transfer between the actors in the organization. Both explicit and implicit information is made available to the visualization in a SPARQL query endpoint.

The visualization is an important step towards an open knowledge community. Research has shown that adding yet another information system to an organization is no guarantee that the employees will integrate the system into their work practices (Kiniti and Standing 2013). The purpose of the visualization is to drive the employees to the wiki. The visualization will be available online, but also on a 65-inch multi-touch display at a location accessible by all researchers in the organization. The touch-screen will raise the awareness among the researchers and motivate them to explore the data and contribute to the wiki.

Roles in the System. The researchers have the option to contribute to the wiki and to participate in the maintenance of the ontology and the curation of the integrated data.

The system is supported by two additional roles. The Community Manager elicits an initial set of information from the researchers and enters it into the wiki. The Knowledge Transfer Manager (KTM) takes a special role. The KTM acts as a curator of the identified knowledge transfer potentials. Both the Community Manager and the KTM sensitize the researchers for the system and create awareness.

Human-powered Quality Gates. Besides the collaborative maintenance of the ontology and the knowledge base, the system features two quality gates. In the first gate, the data coming from the data processing pipeline is validated and curated by a group of researchers. The purpose of this step is to prevent the aggregation of unnecessary information in the visualization and the Linked Data store. The expertise of human experts is needed in this gate to decide on the relevance of the data.

The second quality gate is a human editor in the role of the Knowledge Transfer Manager. Acting as a gatekeeper, the KTM reviews and validates the implicit relationships in the data. Only the validated potentials for knowledge transfer are made available in the visualization.

Use Case: Research Museum

We will apply our approach to a research museum as a paradigm of a research-intensive organization. Research museums are concerned with heterogeneous data from disciplines such as zoology, geology, palaeontology and mineralogy, with research being conducted in disparate departments. Knowledge transfer is however one of the main pillars of the strategy of research museums.

The benefits of uncovering the potential for knowledge transfer for the research museum are manifold. A knowledge sharing community must extend across the organizational departments. The multi-touch display and web visualization will raise the awareness of the researchers and foster cross-departmental collaboration. The crowd-sourced validation of the aggregated data is an incentive for the researchers to learn more about the research field and the organization.

The role of the Knowledge Transfer Manager benefits from the machine-supported insight into the research organization. This will facilitate the KTM's communication and negotiation with the stakeholders of the organization.

Conclusion

We presented the preliminary architecture of a socio-technical system in the context of a research organization. Community design decisions (Kraut and Resnick 2012) are an important step towards an open knowledge community. But above all, the implementation of the proposed architecture is a social challenge. The approach nevertheless promises to bring benefits to organizations, such as research museums, in building a collaborative knowledge sharing community.

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