Rapid Knowledge Work Visualization for Organizations

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Abstract

Purpose: The purpose of this contribution is to motivate a new, rapid approach to modeling knowledge work in organizational settings and to introduce a software tool that demonstrates the viability of the envisioned concept.

Approach: Based on existing modeling structures, the KnowFlow® Toolset that aids knowledge analysts in rapidly conducting interviews and in conducting multi-perspective analysis of organizational knowledge work is introduced.

Findings: It is demonstrated how rapid knowledge work visualization can be conducted largely without human modelers by developing an interview structure that allows for self-service interviews. Two application scenarios illustrate the pressing need for and the potentials of rapid knowledge work visualizations in organizational settings.

Research Implications: The efforts necessary for traditional modeling approaches in the area of knowledge management are often prohibitive. This contribution argues that future research needs to take economical constraints of organizational settings into account in order to be able to realize the full potential of knowledge work management.

Practical Implications: This work picks up a problem identified in practice and proposes the novel concept of rapid knowledge work visualization for making

knowledge work modeling in organizations more feasible.

Value: This work develops a vision of rapid knowledge work visualization and introduces a tool-supported approach that addresses some of the identified challenges.

Keywords: Knowledge Management, Knowledge Work Management, Knowledge Work Visualization, Business Process Oriented Knowledge Management, Modeling Techniques

Contribution Type: Research Paper

Motivation

Today, work in organizations becomes increasingly complex and knowledge intensive (Eppler et al., 1999). The notion of *knowledge work* aims to frame and conceptualize this phenomenon. In order to understand knowledge work in greater detail, models of the world need to be developed that aid in structuring the problem domain. A series of diverse approaches emerged to address this challenge including for example B-KIDE (Strohmaier, 2004, Strohmaier and Tochtermann, 2005), KMDL (Gronau et al., 2003, Gronau and Weber, 2004), extensions to ARIS (Allweyer, 1998), the concept of knowledge stance (Maier, 2005), knowledge audits (Choy et al., 2004) or CommonKADS (Schreiber et al., 2002). However, existing approaches pose some serious problems: Applying them is often very *resource intensive*, involving the execution of workshops, structured and unstructured interviews and explicit modeling activities using modeling tools and software. Because of that, these approaches *hardly scale*. This means that instead of investigating the whole problem domain, modelers need to select a more or less representative sample for their modeling activities, thereby potentially *threatening the significance of their results* (in terms of e.g. completeness and quality (Dean et al., 1994)). Subsequently, after the models have been developed, analysis options of existing approaches often are *limited* and their expressiveness is *vague and unclear*. This can be attributed to the *high influence* modelers have on the modeling process, which is also resulting

in a *reduced degree of objectivity*, a *lack of traceability* and thus, *a lack of empirical foundation* of the resulting models.

This contribution aims to address these challenges and introduces a novel approach that tackles some of the identified drawbacks of existing work. After introducing the concept of Rapid Knowledge Work Visualization and the research background, it presents two software tools, the *KnowFlow*® Interview Tool and the *KnowFlow*® Report Tool, that provide support in making knowledge work in organizations visible in a traceable and efficient way. A set of application scenarios is presented that illustrates how KnowFlow can be applied in a range of situations and subsequently the main benefits that come with following a Rapid Knowledge Work Visualization approach are presented. The contribution concludes with a critical discussion of its achievements and an outlook.

Principle Approach and Research Background

Rapid Knowledge Work Visualization

The novel concept of Rapid Knowledge Work Visualization proposes a radically different approach to traditional knowledge modeling. Figure 1 contrasts the basic characteristics: In traditional approaches, a modeler is in charge of perceiving an object system through the execution of workshops and structured or unstructured interviews. By utilizing modeling techniques and -structures, he constructs models of the object system (Tolvanen, 1998) and thereby transforms the object- into a model system (Ferstl and Sinz, 2001). In stark contrast, Rapid Knowledge Work Visualization largely eliminates the need for modelers and directly investigates knowledge workers that are considered to be *part of the object system* through an automated interview system. The interview system raises questions and documents answers according to an underlying modeling technique and -structure. Based on these underlying concepts, the interview

system is able to transform the answers given into a formal model of the object system under investigation. The new approach is especially appealing because it follows a constructivist view (Foerster et al., 1992) on knowledge work management: Instead of relying on modelers that aim to model "the real world", rapid knowledge work visualization strengthens the perspective of knowledge workers that are part of "the real world". Thereby, a more constructivist model of the system under investigation can be developed.

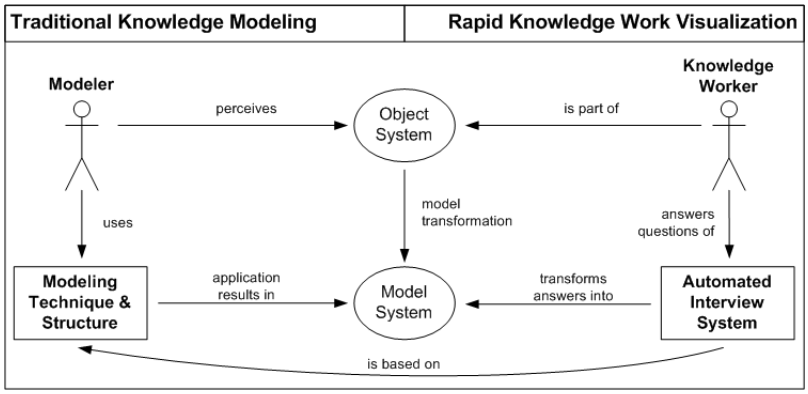

Figure 1: Traditional Knowledge Modeling vs. Rapid Knowledge Work Visualization

The notion of Rapid Knowledge Work Visualization promises a series of advantages over traditional approaches: It suggests automatic model generation based on automated, tool-supported interview techniques and thereby largely eliminates the need for human modelers. Therefore, it has the potential to *objectify* resulting models, *reduce human errors* and *biases*, *speed up and partly automate* the modeling process, *elicit and visualize inconsistencies* of different stakeholders' perspectives, and *introduce traceability* to model development. While these characteristics are interesting for modeling in general, they are of especial interest in the context of modeling in organizations because in such settings modeling is typically conducted in projects that are 1) goal oriented and 2) subject to constrained resources where 3) *economic efficiency* (Schuette and Rotthowe, 1998) is crucial.

The most pressing question that emerges from this new concept is: "How can such an automated interview tool be envisioned?". In the following sections, KnowFlow is introduced as a demonstrator for the viability of the concept of rapid knowledge work visualization.

Research Background

KnowFlow represents a further development of B-KIDE[1] (Strohmaier, 2003, 2004, Strohmaier and Tochtermann, 2005), a theoretical framework and a software tool for the identification and support of knowledge processes in organizations. Both approaches can be related to the current research domain of business process oriented knowledge management (Maier and Remus, 2002, Remus, 2002, Maier and Remus, 2003, Maier, 2005). The goal of KnowFlow is to improve B-KIDE with respect to identified drawbacks and make the concepts "fitter for use" (Remus, 2002, page 298) or, in other words, fitter for application in organizational knowledge management projects.

B-KIDE proved itself successful in developing knowledge infrastructures that support the execution of knowledge processes within and across a set of business processes in a visible and traceable way (Strohmaier, 2004). However, drawbacks identified in three conducted case studies include 1) the time and resources needed for interviewing knowledge workers as a basis for modeling 2) the necessary geographic co-location of interviewers and interviewees 3) the influence of varying skill levels of modelers on the modeling results and 4) the limited analysis options available in the B-KIDE Tool.

From a meta-modeling perspective (Karagiannis and Kühn, 2002), both KnowFlow and B-KIDE consist of two conceptual parts: 1) the *way of modeling*, which is a formal modeling structure that introduces syntax and semantics

[1] B-KIDE...Business Process Oriented Knowledge Infrastructure Development

of modeling elements and 2) the *way of working* (Hommes and van Reijswoud, 2000), which is a process that defines how the act of modeling is conducted. On the one hand, KnowFlow is based on an advanced version of the B-KIDE Modeling Structure, which integrates multiple conceptual dimensions (such as business processes, knowledge domains, organizational roles and others) of organizations as a basis for modeling knowledge work. On the other hand, KnowFlow introduces a radical new *way of working* by *eliminating* the need for interviewers (human modelers) and aiming to enable interviews that are conducted in a self-service manner[2]. The web-based *KnowFlow Interview Tool* introduced in the following section represents the outcome of these intentions. In order to extent existing possibilities of analyzing data about knowledge work, the *KnowFlow Report Tool* that is introduced subsequently was developed. By supporting the analysis of data gathered in interviews, KnowFlow aims to increase the ability of organizations to reflect upon and improve their knowledge work.

Thus, the objectives of KnowFlow can be defined in the following way:

The **overall goal** of KnowFlow is to enable broad and rapid visualizations of knowledge work in organizations. In order to accomplish that, KnowFlow aims to 1) follow an *empirical approach* 2) *scale* 3) provide *graphical representations* that visualize knowledge work in a *formal yet accessible way* 4) provide comprehensive, multi-dimensional *analysis possibilities* and 5) provide an *overview* of knowledge work in organizations.

While acknowledging the diversity of existing definitions of knowledge, this contribution utilizes a rather pragmatic approach to this question: (Organizational) knowledge is regarded to be information that is relevant for undertaking certain (business) actions (Strohmaier, 2004). This allows for taking an approach to knowledge management that strengthens the application- and action orientation of knowledge work management. At the same time, certain aspects of knowledge work, such as necessary competencies or skills, are excluded.

[2]Note: Modeling here refers to eliciting descriptive (AS-IS) models of the world. Considering prescriptive (TO-BE) models is beyond the scope of this contribution.

However, this limitation is accepted here because the problems identified in the introduction still exist and, more than that, are highly relevant for this action-oriented approach.

An Automated Interview Tool

The *KnowFlow Interview Tool* is a web-based software tool that can be utilized to efficiently gather data about knowledge work in organizations. In the following paragraphs, the *way of working* and the *way of modeling* (Hommes and van Reijswoud, 2000) with the KnowFlow Interview Tool is introduced.

The Way of Working

In order to conduct interviews, a set of interview samples and corresponding participants needs to be defined by an interview manager. Also, a set of reference models (as introduced in (Strohmaier, 2004)) needs to be developed. Reference models pre-model specific organizational dimensions per organization and thereby provide preliminary answer categories (that are *referenced* during interviews) for the interviews. In total, six reference models exist within KnowFlow, including hierarchical models for knowledge domains, business processes, organizational roles, business locations, storage objects and transfer objects. These activities represent the only modeling activities within the KnowFlow approach that rely on the availability of a human modeler. During interviews, these reference models are connected by the answers given by the interviewees and thereby form a multi-dimensional model of knowledge work. The interviews themselves are conducted in a self-service fashion: Interviewees receive an invitation e-mail that contains a link to the interview web page. The interviewee answers the questions raised and, after completing the interview, submits the data to the server which collects all interview data.

The interview process consists of three distinct blocks that build on each other and consists of interview forms that utilize a combination of unstructured

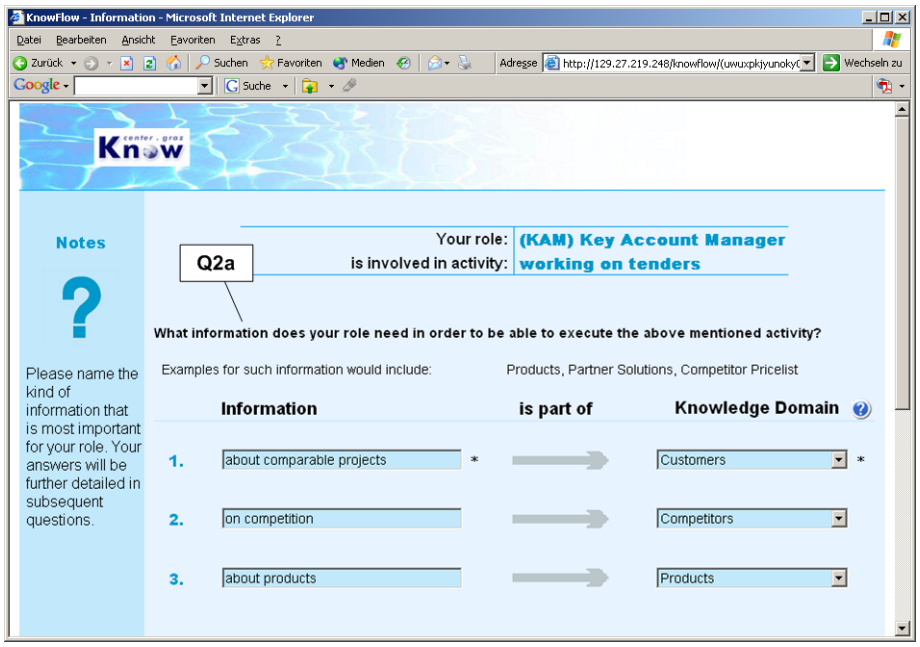

Figure 2: Screenshot of the KnowFlow Interview Tool

text and controlled vocabulary answering mechanisms. The first set of questions is related to the n most relevant activities of the interviewee. The second block elicits the most relevant information that the interviewee applies (Q2a, depicted in figure 2) and provides (Q2b) in these activities. The final block deals with specifics of the information, such as how is information transferred (Q5) or stored (Q6) and to whom is it provided (Q3) and where is it originated from (Q4)[3].

Each block is dealt with in a separate interview screen. The interview process is sequential (with the possibility for revising given answers at later points in time) and straight forward. As first tests revealed, it takes about 30 minutes per interviewee and does not need any additional competencies other than basic knowledge about internet and browser application. The KnowFlow Interview

[3]relations between these questions are depicted in figure 3

Tool can be applied iteratively (in multiple interview rounds), thereby allowing for an adaptation of the reference models and a refinement of the results achieved in earlier iterations. Evaluating the associations between *reference element* and *unstructured text* answers (that are given during interview executions) allows for gaining empirical insights on how certain reference elements (for example a certain process, a certain knowledge domain) are understood by employees and thereby allows for increasing understanding about organizational knowledge work in general[4].

The Way of Modeling

The modeling structure that underlies this interview process is introduced in figure 3 in UML[5] notation.

This diagram depicts the main structure of KnowFlow interviews and relates this structure to 1) the interview questions and 2) to the reference elements that represent answer categories in the sense of a controlled vocabulary. The interviewee is supposed to provide a set of critical activities and relate these to the pre-modeled business processes (Q1). Subsequently, information inputs and outputs are elicited for each of these activities in questions Q2a and Q2b and need to be related to the pre-modeled knowledge domains. For each information item, further details are elicited and related including organizational roles (Q3), business locations (Q4), transfer- (Q5) and storage (Q6) objects.

In addition, the KnowFlow Interview Tool elicits the degree of importance and satisfaction per information item (not depicted in figure 3). In order to give the reader a rough idea how concrete instantiations of the introduced reference elements look like, a few examples are given: A Knowledge Domain reference element might be *Knowledge about Customers*, a Business Process reference element might be *Sales*, a Business Location element might be *London*, a Transfer

[4]This kind of investigation might also be helpful in e.g. the process of developing ontologies that may need to be broadly accepted and commonly understood by knowledge workers

[5]UML...Unified Modeling Language, http://www.omg.org

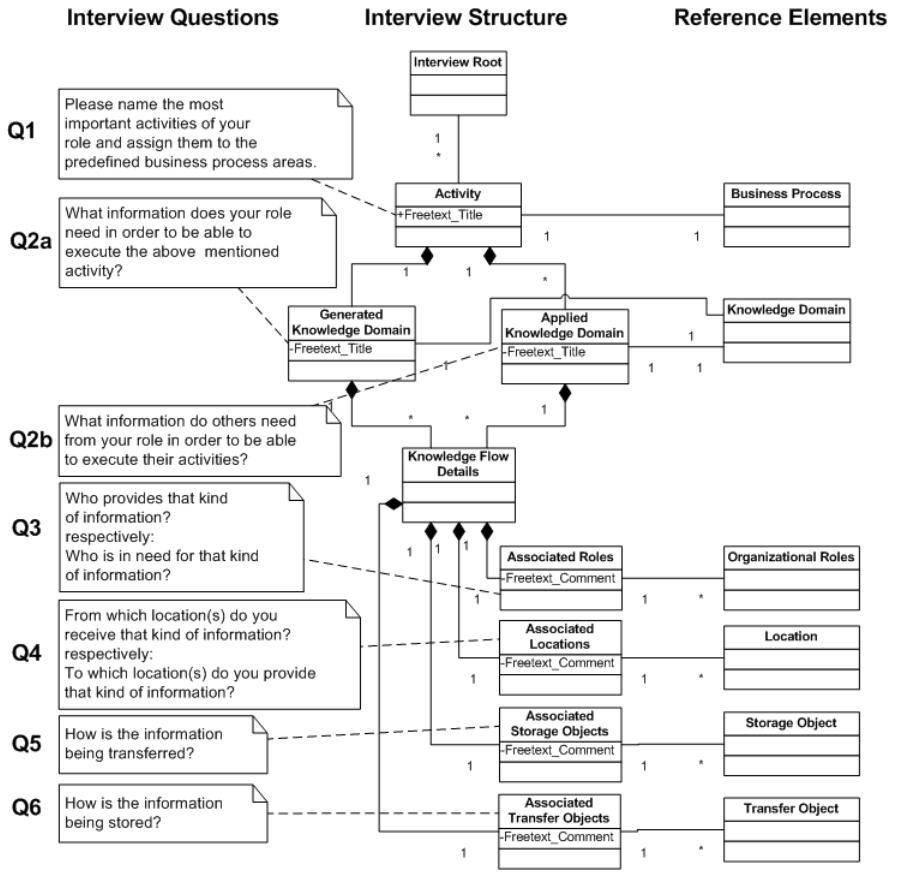

Figure 3: The structure of KnowFlow interviews

Object element might be *e-mail* or a *Meeting* and a Storage Object element might be a *Lead Document*. However, the detailed semantics of and conceptual relations between the reference elements have been introduced elsewhere (Strohmaier, 2004, Strohmaier and Tochtermann, 2005) and are not discussed in greater detail here.

Tool-Supported Visualization of Knowledge Work

The *KnowFlow Report Tool* is a graph-based software instrument[6] for visualizing knowledge work by providing a multitude of perspectives on the B-KIDE modeling architecture. In total, seven of these perspectives (called *Reports* in KnowFlow terminology) are available to make knowledge work in organizations visible, including the following types: *Role-Based Knowledge Flow Diagram, Role-Based Knowledge Profile Diagram, Process-Based Knowledge Flow Diagram, Location-Based Knowledge Flow Diagram, Knowledge Storage-, Knowledge Transfer-* and *Knowledge Community Diagram*. These reports focus on visualizing the elicited relationships between the reference elements introduced earlier. On a per-sample-basis, data can be analyzed and compared. In the following sections, some of the available reports will be introduced and their specific contribution to making knowledge work rapidly visible in organizations will be discussed.

Role-based Knowledge Flow Diagram

In this report, knowledge flows[7] between organizational roles are visualized based on the empirical data gathered during interviews. Figure 4 depicts an exemplary role-based knowledge flow diagram[8].

The syntax and semantics of this diagram are the following: Each node represents an organizational role, each directed edge represents a knowledge flow from the source to the target role, black ends of edges denote that the corresponding role has confirmed the existence of this knowledge flow,

[6] implemented on the basis of the Microsoft .NET Framework©

[7] Although a constructivist perspective on knowledge is taken that implies that knowledge is constantly (re)constructed by individuals and thus can not *flow* (Remus, 2002, page 122), this contribution uses the term knowledge flow here and in the developed reports to denote the directed nature of knowledge transfer

[8] While the KnowFlow Report Tool provides automatic layouting for generated graphs, the presented reports where manually revised to enhance readability.

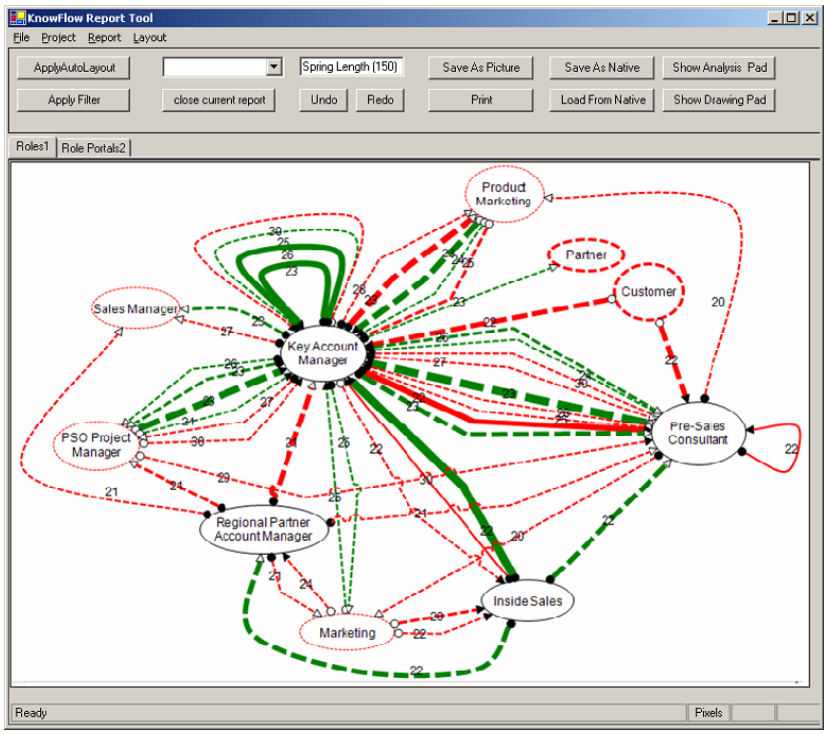

Figure 4: An exemplary Role-Based Knowledge Flow Diagram

white ends of edges denote that the corresponding role has not confirmed the existence of this knowledge flow. Knowledge flows where only one participant in the knowledge flow (either the source or the target) has confirmed the knowledge flow are represented via dotted lines, confirmed knowledge flows are represented via solid lines. The thickness of the knowledge flow lines relates to the number of interviewees that confirmed the knowledge flow. Green lines indicate a high satisfaction with the knowledge flow, while red lines indicate the contrary. Nodes with dotted lines denote organizational roles that did not take part in the interviews. This implies that knowledge flows originating from such nodes can never be confirmed. Bold node lines denote roles that are outside of the organization (such as customers, suppliers, partners,...). The labels of each knowledge flow indicate the corresponding knowledge domain. In that sense, KnowFlow can be regarded to be a value-chain oriented, knowledge

based network analysis tool.

Based on such a visualization, formal and informal communication channels within and across organizational borders can be made transparent in a way similar to existing approaches rooted in Social Network Analysis (SNA) (Paier, 2003, Mueller-Prothmann and Finke, 2004*a*, T. Mueller-Prothmann and Finke, 2005). The main difference between these approaches is the specific knowledge and business process perspective of KnowFlow. While SNA focuses on identifying *social* roles (such as brokers, gatekeepers, etc), hierarchies or functions within a network, KnowFlow goes beyond that by additionally *identifying knowledge interactions between roles that are directly related to the value generating business processes of the organization.*

Role-based Knowledge Profile Diagram

The role-based knowledge profile diagram generates detailed models of knowledge work of specific organizational roles.

Figure 5 depicts the basic concept: For each organizational role all relevant knowledge domains are visualized. Beyond that, the mechanisms by which this knowledge is transferred are depicted as directed edges from/to the knowledge domains. Finally, for each knowledge domain the relevant set of storage objects (the ones that are relevant in the context of the focus role) are depicted. As in the previous report, the number of interviewees that confirmed a certain relationship as well as the satisfaction and importance of relations are visualized here also.

From a knowledge management perspective, the role-based knowledge profile is of highest interest to analysts. It reveals the most relevant knowledge domains per organizational role and the ways they are transferred within and across the organization. Not only are abstract knowledge domains depicted, but also the concrete storage objects that are related to the identified knowl-

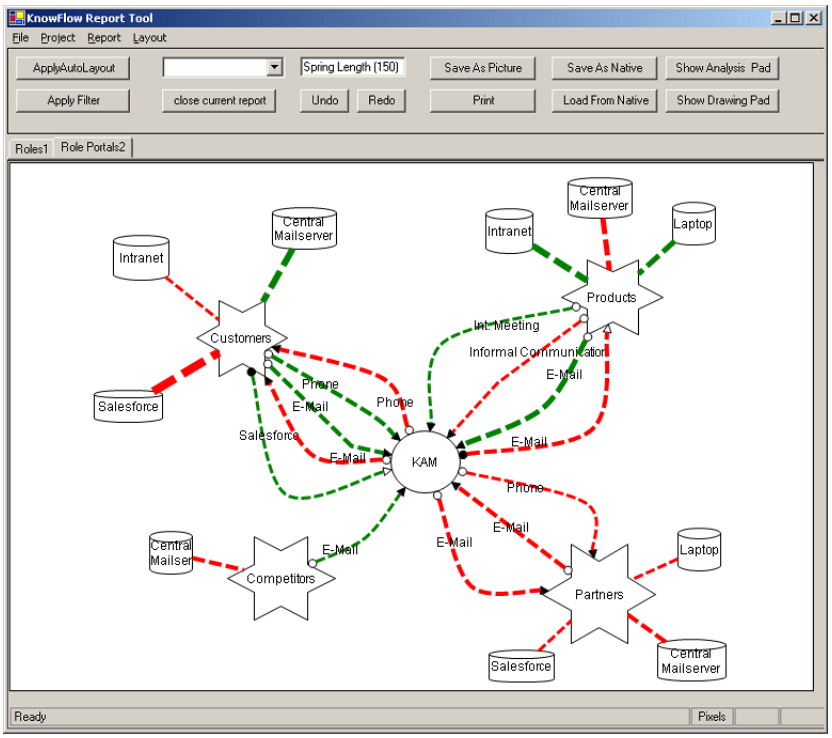

Figure 5: An exemplary Role-Based Knowledge Profile Diagram

edge domains. Furthermore, skills management initiatives may benefit from having such detailed information about the knowledge domains available that knowledge workers operate on during the execution of their business processes.

Filtering of Diagrams

The KnowFlow Report Tool comprises a set of graph filtering mechanisms. Among the most powerful ones is the tool's ability to filter knowledge flows according to the number of interviewees who confirmed their existence. With such an approach it is possible to visualize even large sets of interviews through e.g. filtering out knowledge flows that were confirmed by less than n people. This enables KnowFlow reports to scale, or in other words, to involve larger groups of people in comparison to traditional approaches. Other functionality,

such as graph based parent-child analysis, circle analysis, reasoning and others are considered to be implemented as well.

Application Scenarios

This section will now sketch out two application scenarios, that demonstrate the relevance of KnowFlow for real-world knowledge management challenges.

Knowledge Process Redesign

(Remus, 2002) considers knowledge process redesign to be one of the most dominant goals of existing business process oriented knowledge management approaches such as (Scheer, 1996, 2000, Gronau et al., 2003, Gronau and Weber, 2004, Mueller-Prothmann and Finke, 2004*b*). Based on models of business processes, knowledge processes are typically identified, discussed and finally redesigned to improve quality criteria such as performance, reliability, serviceability or conformance (Kundermann, 2002). However, broad empirical approaches are rare in this domain and existing work focuses mainly on top-down approaches, for example aiming at the implementation of closed knowledge cycles (Remus, 2002).

The Role-Based Knowledge Flow diagram provides knowledge analysts with broad, empirically founded knowledge about knowledge flows and relationships between agents. While this can be helpful in the design of knowledge systems (e.g. for developing AS-IS agent- and communication models with CommonKADS (Schreiber et al., 2002) or for developing aspects of strategic relationship models with i* (Yu, 1995)), it is of special importance for redesigning knowledge processes on an organizational level. Because one of the basic preconditions for improving knowledge processes is gaining awareness about them (as defined by e.g. the KPQM[9] (Paulzen and Perc, 2002, Oberweis and Paulzen,

[9]Knowledge Process Quality Model

2003)), the availability of knowledge flow diagrams represents a broad empirical basis for improvement initiatives. Furthermore, the possibility of capturing data about the degrees of satisfaction and importance of knowledge flows enables knowledge analysts to focus their resources on the most important and least satisfying[10] knowledge flows and thereby optimize the employment of subsequent efforts in a knowledge process redesign project.

A usage narrative aims to illustrate the basic benefits:

> *Arthur, a knowledge management consultant, is in charge of redesigning knowledge processes at the company KnowInt. The overall goal is to improve the communication and coordination between knowledge workers. Therefore Arthur utilizes the KnowFlow Interview Tool to investigate a broad target group and to elicit existing knowledge flows between organizational roles. The interviews reveal a set of knowledge flows between Project Managers and Controlling that are considered to be of highest importance, but which are not executed satisfyingly at the moment. Therefore Arthur focusses his further analysis on these critical knowledge flows and identifies related transfer- and storage instruments by consulting the role-based knowledge profile of both roles. Thereby, Arthur gets a comprehensive picture about the knowledge domains, participating roles, information items, storage- and transfer objects involved in this critical area. Based on this information, he calls in a meeting with project managers and controllers to conceptualize redesigns of the identified knowledge flows in order to raise the organization's KPQM maturity level and increase satisfaction among participants. He does that by utilizing traditional approaches from the domain of business process oriented knowledge management to incrementally increase the structure and detail within the problem domain. In doing that, Arthur can narrow his focus of investigations based on broad empirical analysis*

[10] as perceived by employees

and therefore can make an informed decision concerning subsequent actions.

Design of Role-based, Process-Oriented Knowledge Portals

Process orientation already plays an important role in available concepts that focus on the development of knowledge portals (Jahn, 2000, Hartl, 2002, Jansen, 2000, Nohr, 2002, Lindstaedt et al., 2003). However, the design of process-oriented knowledge portals can be regarded to be resource intensive and includes timely process modeling efforts. The modeling efforts necessary often even prevent the realization of promised benefits. By utilizing the introduced notion of rapid knowledge work visualization, portal designers are able to efficiently identify knowledge needs of organizational roles and relate them to concrete storage- and transfer objects of the KnowFlow Modeling Structure. This information can represent a profound basis for populating and sketching up first mock-ups of knowledge portals. In addition, the role-based knowledge flow diagrams aid portal designers in finding existing knowledge relations (knowledge flows) between organizational roles. By considering these relations in the design of knowledge portals, the interaction between roles can be mapped onto a knowledge portal network. Thereby, knowledge portals can support the actual execution of knowledge work that is conducted in a collaborative way.

In a previous case study (Strohmaier, 2004, Chapter 7.2), the viability of developing knowledge portals based on B-KIDE models was demonstrated. Portal designers were able to develop knowledge portals that ensured a certain degree of support for knowledge processes. With KnowFlow, these models can be developed more rapidly and can be analyzed in a richer way through utilization of the KnowFlow Report Tool.

Achievements

This contribution introduced the novel notion of Rapid Knowledge Work Visualization and demonstrated the viability of the envisioned concept by introducing the KnowFlow Toolset. The following list summarizes distinctive characteristics of KnowFlow and discusses their contribution to the domain of business process oriented knowledge management.

Empirical Foundation: KnowFlow has a stronger empirical foundation than traditional approaches in the domain of business process oriented knowledge management because of its novel approach to modeling that relies on automated interview techniques. Human modelers are only necessary at the beginning of the process, for setting up the reference models that provide answer categories for the interviews. The resulting visualizations of knowledge work rely exclusively on the answers given by interviewees and thereby give an idea how organizational work is understood by employees in an unbiased way. Not only are the models *traceably* constructed by the automated interview system (vs. models developed by a modeler), but they also equally integrate the answers given by interviewees (vs. a subjective synthesis performed by a modeler).

Scalability: Because KnowFlow relies on modelers at the beginning of investigations only (a one-time effort, for modeling reference models), it scales better than existing approaches. Involving a greater amount of people basically means inviting more people to conduct self-service interviews. This is in stark contrast to existing approaches where modeling a broader area typically means co-locating and coordinating a larger set of employees, possibly involving multiple modelers or integrating different modeling approaches and styles. Often, such conditions are economically not feasible for obtaining an empirically founded overview of knowledge work in organizations. To break down certain areas of investigation, KnowFlow supports the organization of interviews in interview rounds, so called samples. Samples can be conducted in

a timely dispersed space, thereby introducing even more flexibility to interview process. The scalability of KnowFlow is continued in its visualization abilities that allow for analysis of large interview sets by means of sophisticated filter functionality.

Visualization: Effective visualization of interview results is necessary to deal with the amount and complexity of data gathered. The goal of KnowFlow was the introduction of a formal yet comprehensible way of visualizing knowledge work. By basing the reports on directed and undirected graph representations, both people and machines can easily relate to and operate on the structure. In addition, the introduced syntax and semantics further enrich the meaning of these visualizations. Within the KnowFlow Report Tool, the user interface employs a set of different graph auto-layouting algorithms to provide users with a preliminary layout of the graph, while it provides the possibility of rearranging and manipulating the graph layout manually also.

Analysis: By providing graph visualizations of knowledge work based on the B-KIDE Modeling Structure, comprehensive, multi-dimensional analysis of knowledge work are supported. Not only is it possible to analyze knowledge work of specific roles or business processes, the role that storage objects and transfer instruments play in organizations can be investigated too. Through the combination of unstructured text and predefined answers, it is possible to gain an understanding about the way employees see certain areas of business. By analyzing knowledge flows, communication among roles and among processes can be identified and discussed. The KnowFlow Report Tool currently provides seven different analysis reports in total, of which two have been introduced in this contribution in greater detail.

Overview: A common principle to deal with complexity is: *"Get overview first, add detail later"*. KnowFlow was designed to suit that purpose. By allowing for rapid visualization of knowledge work, it aids in getting a quick overview

of the problem domain. *It delays more detailed modeling efforts to later phases of analysis, using the insights of early KnowFlow investigations to focus subsequent efforts and thereby aid in optimizing the utilization of constrained organizational resources.*

Discussion and Outlook

While KnowFlow aims at radically decreasing the time necessary for modeling activities, one can expect a certain loss of modeling detail and accuracy because of the lack of human modelers. However, our main hypothesis is that reducing the amount of time necessary for modeling in knowledge management projects *is crucial* for achieving economically feasible results for organizations. By taking the most radical approach, through elimination of human modelers, this contribution aims to test and stress the limits of modeling approaches along the time dimension. In future case studies, it is planned to investigate the "Fitness-for-Use" of these models in the context of the two introduced application scenarios, comparing it to previous, more detailed results. In addition, these tests may include future investigations of a number of model quality criteria such as syntactic-, semantic-, social-, pragmatic- and other qualities (Krogstie and Jorgensen, 2003).

With KnowFlow it is not necessary to develop narrow assumptions and biased hypothesis about improvements (by e.g. selecting certain business areas for in-depth modeling) because knowledge analysts are enabled to *empirically investigate much broader* areas of knowledge work in organizations. By following such an approach, improvement potentials can be identified bottom-up (based on large samples of interviews and interviewees) instead of top-down (based on assumptions). This is a serious problem of available methods (such as B-KIDE (Strohmaier, 2004), ARIS (Allweyer, 1998) or KDML (Gronau et al., 2003)) because they hardly scale. In other words, *the efforts necessary for detailed investigations of broad business areas are prohibitive with available*

instruments. Therefore, the application of KnowFlow takes place at the very beginning of knowledge management projects, *before* traditional methods, and thus helps in the *empirically founded focus setting* of subsequent, more detailed investigations. This in turn supports *both*, obtaining an overview *and* engage in in-depth modeling. Because KnowFlow enables the interview process to be conducted in a self-service manner, it *objectifies* modeling results and *reduces the chance of errors* evoked by modelers.

A certain concern that comes with automated interview tools is that questions raised by such a tool might be interpreted differently from different interviewees. Human modelers can negotiate such differences by means of personal interactions and thus can reduce the chance for misunderstandings. It is planned to work on different strategies to address this issue, including for example the provision of more context information or the provision of answers given by reference interviewees.

KnowFlow adds detail to existing approaches such as KODA (Abecker et al., 2002, p123) by modeling and visualizing not only aspects of communication, but also specific information about knowledge generation, storage, transfer or application (based on (Heisig, 2001)). In addition, support for obtaining statistical data from interviews (such as number of nominations, type of confirmation) is directly integrated into KnowFlow reports. Also the time needed for conducting interviews with KODA sometimes prohibits its application in larger settings (as for example mentioned in (Remus, 2002, p265)). By supporting self-service interviews through a web application, KnowFlow is designed to deal with larger samples of interviewees. To the best of the authors' knowledge, KnowFlow represents the first concept that utilizes a graph-based approach to knowledge work visualization. Applying algorithms from graph theory to the developed graphs is something that is intended to be investigated in future work.

Conclusion

In this contribution, the need for more rapid and empirical approaches to understanding knowledge work in organizations was motivated. The novel notion of *rapid knowledge work visualization* was introduced, which raises the need for approaches that 1) follow an *empirical approach* 2) *scale* 3) provide *graphical representations* that visualize knowledge work in a *formal yet accessible way* 4) provide comprehensive, multi-dimensional *analysis possibilities* and 5) provide an *overview* of knowledge work in organizations. This contribution introduced the KnowFlow Toolset that addresses these challenges to a certain extent. The KnowFlow Interview Tool aids in the rapid gathering of interview data while the KnowFlow Report Tool provides a diverse set of perspectives on organizational knowledge work. By being applied in early project stages, rapid knowledge work visualization does not replace but *complement* traditional approaches in the domain of business process oriented knowledge management. It does that by providing *overview first*, and thereby *aids the subsequent focusing* of more detailed modeling activities. However, the effects of rapid approaches to modeling quality and -accuracy are not understood satisfyingly yet and need to be in the focus of future research work.

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