

# Optimisation of Knowledge Work in the Public Sector by Means of Digital Metaphors

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**Abstract:** Although most enterprises nowadays increasingly employ digital information management in all areas, there are still many organisations – e.g. in the Public Sector – where much of formal and informal information is documented on paper only. This work lays out the concept of a set of digital *metaphors* for entities in the “paper world” and argues that they will ease the adoption and acceptance of digital information and knowledge management solutions.

We furthermore describe how the metaphors are linked with each other. We place a special focus on the relationship between informal, unstructured information and formally structured one, as well as on collaboration and knowledge sharing enabled by the metaphors. These aspects have been combined into a prototype that is described and illustrated in some detail.

**Key Words:** knowledge management, collaboration, knowledge sharing

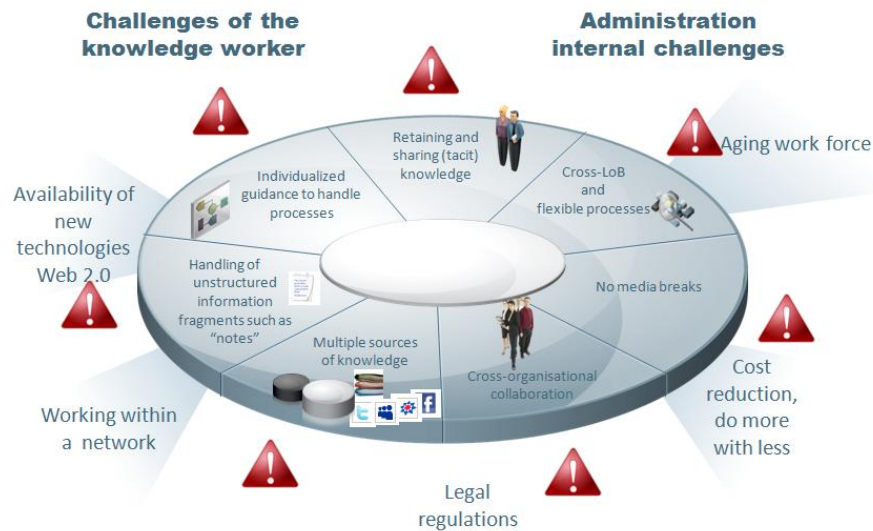
**Category:** M.6, M.8, H.3, H.4

## 1 Introduction

In many of today’s work environments – despite rapid digitisation and emergence of Web (or Enterprise) 2.0 solutions – rather “traditional” practices still hinder effective collaboration and knowledge sharing and management.

In such environments – of which many organisations in the Public Sector are good examples – most knowledge sharing still happens in an informal, face-to-face manner (e.g. in coffee breaks or over the desk) without knowledge being captured in any way. Even if experience is being recorded, this often happens in a paper-based way, where the means of recording range from notes on post-its over personal reference files containing work-related experience to official paper files. Figure 1 shows some of the challenges for knowledge workers that are addressed here.

It is desirable to better retain the valuable knowledge of an organisation’s workforce and to have an environment allowing internal and external participants to collaborate easily. In particular, information resulting from collaboration and personal work should be easily exploitable later on. In order to achieve that, the discrepancy between unstructured and structured information needs to be overcome and the means to capture information have to be advanced.



**Figure 1:** Summary of challenges a knowledge worker is faced with.

In this paper, we argue that a transition from the “traditional” style of work to the advantageous digitised world should be supported by creating *metaphors* that allow knowledge workers to recognise objects from their old (paper-based) working environment, e.g. notes or paper files. Thus one can expect an increase in the acceptance of a digital solution.

In addition, we suggest that these metaphors should be enhanced with light-weight ways to contribute and share information. Finally, the metaphors must enable knowledge workers to connect informal and unstructured information pieces (e.g. notes) or results of informal collaboration with formal information objects in the structured world (e.g. a record in a case management system).

More precisely, we aim to show that the following can be achieved:

- Digital equivalents and metaphors for paper-based entities appropriately model and improve business processes, e.g. in the Public Sector.
- Handy means for digitising and structuring of operational and other informal information enable both flexibility and formal knowledge management.
- An integrated environment for sharing and management of informal knowledge provides for better information reuse.

- Lightweight integration of business applications such as CRM with the informal knowledge management environment for personalised use of business applications.
- Lightweight integration of web resources enables “crowd sourcing” and leads to better collaboration and decision-support processes.
- Useful features such as contextual recommendation of information items fit very well in the scope of the same integrated environment.

We thus aim to improve the complete lifecycle of information, from informal notes to well-structured information objects, where all pieces – whether formal or informal – can be easily connected to yield a single access point to all information needed in a given work situation.

## 2 Concepts

In a paper-based workplace, we find several well-established ways of handling and recording information and collaboration. Before we constructed our digital metaphors, we did some investigation into these routines by visiting several people in small German municipalities and finding out about their daily work procedures.

In the following, we will describe shortly the routines of handling and recording information that we observed along with the digital metaphors that we propose for each of them. In addition, we will describe how a connection can be made between informal, unstructured information and formally structured one.

- **Notes:** Notes are usually made while receiving information, e.g. on the phone. In such a situation, the information cannot be recorded formally for various reasons – because of lack of time, lack of details or sometimes because not even the exact target location for the information is known (e.g. which paper file it should go to). Therefore, quick notes are often jotted down on scrap paper or post-its. Later, these notes are manually transferred into the right (paper) file. It may also happen that rather comprehensive information on a certain case is collected on single pieces of paper prior to (formal) filing.

The metaphor that we propose for capturing unstructured information digitally consists of two parts: a *sidebar* for making quick notes that are comparable to post-it snippets and a *notebook* with sections for filing of (informal) notes. The sidebar is put alongside the current work context of a user (see section 3 for details) and allows to make notes quickly without losing track of that context; it roughly corresponds to a post-it. The notebook, on the other hand, allows users to create categories – which correspond to section

dividers in paper files or coloured post-its stuck to paper sheets – where a rough order can be brought into more comprehensive, interconnected notes.

- **Reference files:** In many organisations, especially in the Public Sector, so-called reference files are used to collect generic work-related information that is valid across individual cases – i.e. an assembly of all the experience that is necessary to do a certain job. These files will usually contain sections covering various aspects of a job. They are often kept on a paper basis by individual employees, but may be passed on to an employee’s successor after retirement.

We propose to replace such files by another sidebar that manages digital reference files – henceforth called *context patterns* – for various generalised work contexts and enables users to create, modify and share such a context pattern with their colleagues. A context pattern may contain resources, such as contacts or documents, templates, letters, standard procedures, policies etc., as well as text-based information in the form of descriptions of problems (that may arise in a work context) and solutions.

- **Search:** The inconvenience of searching for information in a paper-based environment is one of the best arguments for introducing digital information management. Most applications offer the functionality to search the data they manage, but knowledge workers often need to search across many data repositories including internal and external, operational and archived, structured and unstructured data, from within various work situations.

We propose to integrate a federated search engine into the notebook solution, where both structured and unstructured information is indexed and made available through a unified interface. The so-called cabinet mimics the traditional filing cabinet in the office, with visual means to faster find the needed files.

- **Collaboration:** In most work environments, collaboration is rarely well documented since work-related information exchange happens through informal emails or during phone calls. Even if some documentation exists (e.g. notes being taken during a phone call), it is not connected to any formal documentation and often exists in various versions that are not consistent with each other.

We propose to introduce a collaboration tool that enables transparent collaboration and creation of business outcomes through decision support, involving a variety of participating roles. In our prototype, we chose an existing product [StreamWork] as an example of such a solution – where additional integration with the other parts of our prototype allow to re-use the results of the collaboration reached within that tool.

- **Formal files:** Finally and most importantly, paper-based work environments are usually characterised by the existence of formal information objects kept in paper files – where there is often still a legal obligation to do so. Applications that manage formal and well-structured information digitally are abundant – in this work, we will consider a case management system as an example of such an application. The problem that exists especially in the digital world is that the formal and structured information is kept separate from any unofficial and unstructured information that employees may collect (e.g. notes on a specific case being scribbled down during a phone call) and that there is no possibility to connect the former to the latter. However, in many situations it is desirable to be able to attach an informal note to a formal document within a file (as may happen through a post-it in the paper-based world) without changing the content of the formal document.

We therefore propose the introduction of an assistant that allows to link informal notes to any formal information object (such as a case in a case management application) through a single click. This link can be made visible to everyone and establishes a solid connection between the formal document and the note, without changing the content of the formal information object.

### 3 An implementation

The prototypical implementation of our ideas that we present in this section consists of various parts, the concepts of which have been laid out in the previous section. Here, we will very briefly describe the technical realisation of these concepts in our prototype, along with illustrative screenshots.

Figure 2 shows the realisation of both the quick note sidebar and the notebook. Both work in a web browser and both are based on TiddlyWeb [TiddlyWeb], a Wiki-like tool for creating and managing short pieces of text (so-called *tiddlers*). As explained above, the sidebar offers the possibility to take notes quickly while working on something in the main browser window – if people are to be convinced to capture notes digitally, it is very important to ensure that this can happen very fast and without the need of preparation, i.e. starting the note-taking must be a one-click action. This is ensured by putting the sidebar alongside the work context as a sidebar. After creating a note in the sidebar, it can then be transferred into the Notebook via drag and drop (and vice versa). In the Notebook, notes can be easily organised into sections and can be additionally tagged. In that way, quick notes from the sidebar can be easily “filed” and organised into sections in the notebooks.

In some respects, the digital metaphor is not strictly analogous to paper-based note-taking: the notes taken can be made available to other persons by inviting them to a (shared) notebook and they are of course searchable. Of

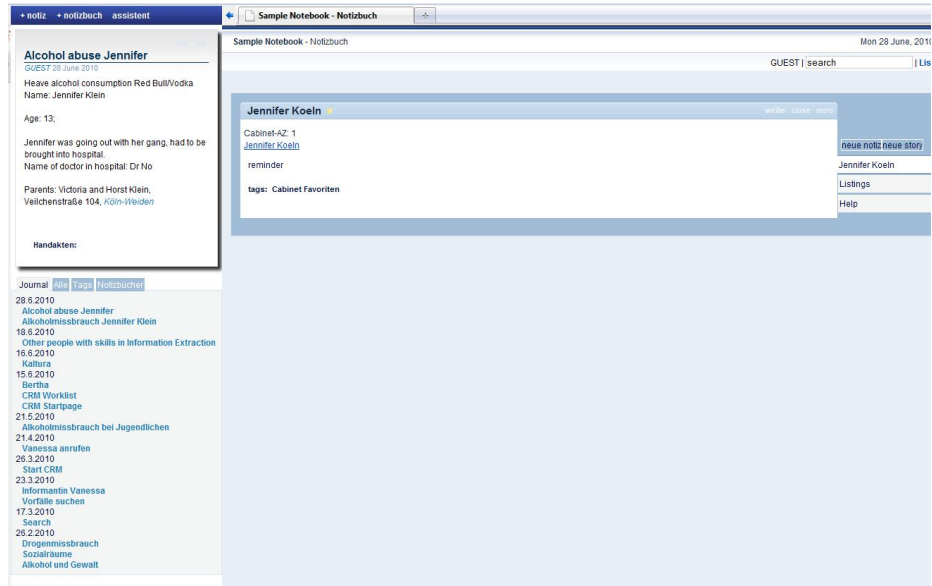


Figure 2: Realisations of note-taking metaphors: browser sidebar for quick notes (left) and notebook for organising notes into sections (main window)

course, these enhancements may – for some people – impede the perception of the analogy to the paper-based world. However, we believe that they show the actual benefit of the digitisation and that the analogy can still be made obvious by a “paper-resembling” user interface – something that may still be improved for our prototype (see section 5 below).

Figure 3 (a) shows the realisation of context patterns: it is again a browser sidebar which is organised into parts for contacts, documents and collections of problems and solutions. When translating the structure of a reference file into the paper-based world, these parts may be understood as follows: the “Contacts” category resembles an address book part of a paper-based reference file – where people often use sheets with forms containing name, phone number, address etc. The “Documents” category contains (links to) important documents – which, in a paper-based world – would be present in the form of print-outs in the reference file. Finally, the “Problems/Solutions” category offers the possibility to document experience in the form of free text.

Within each part, categories can be created and filled with resources as is shown in the picture. In order to help users to choose an appropriate pattern for their current work context, the note sidebar has an additional recommendation

feature: whenever creating or updating a note, links to relevant context patterns will be automatically displayed directly beneath the note.

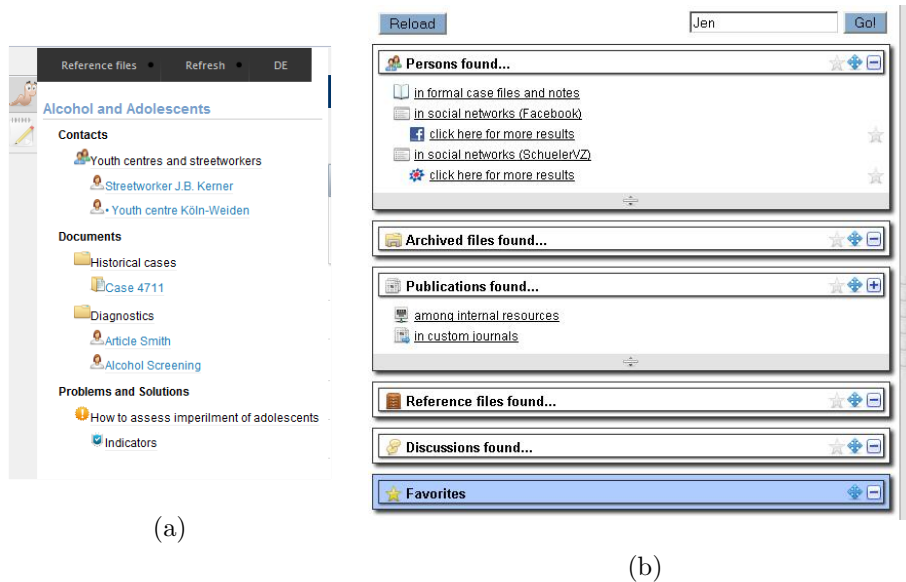
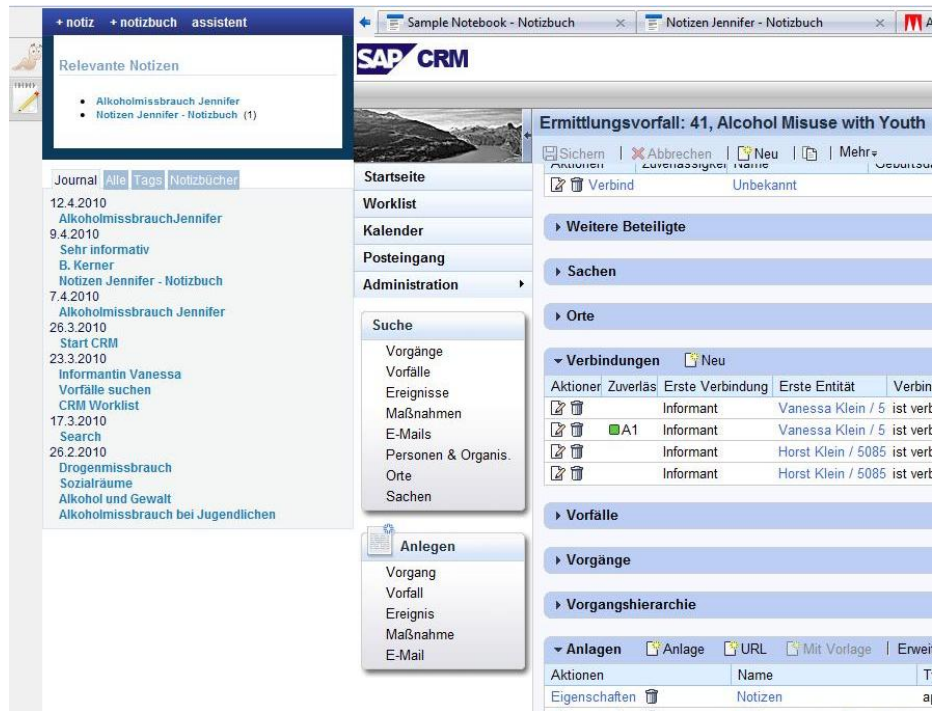


Figure 3: Realisation of (a) context patterns and (b) federated enterprise search (Cabinet)

Again, the metaphor has been enriched with some means of knowledge sharing and electronic information management: firstly, the sidebar offers a pre-defined *structure* for reference files by dividing them into sections for persons, documents and problems/solutions. It thus limits the flexibility of organising the content that may be present in paper-based reference files. It furthermore allows to share context patterns with colleagues and makes them searchable. Again, we believe that these enhancements make context patterns more valuable for knowledge sharing and retention than their paper-based counterparts.

Figure 3 (b) shows the *Cabinet*, a federated search engine integrated into the notebook. It allows to search both structured and public and third party unstructured sources, including social networks. Search results from the Cabinet can be easily transferred into either the context pattern or the quick note sidebar via drag and drop. The context pattern sidebar can interact in the same way with the notebook.

Finally, figure 4 shows a case management system (based on CRM) with a case as an example of a structured information object. On the top left, we see that



**Figure 4:** Linking structured and unstructured worlds via the link assistant.

informal notes are linked with that information object in the so-called assistant that is part of the quick note sidebar. For each information object in the CRM system (i.e. for each page) it displays the notes that have been associated to it. That association can be achieved through a single click on the “link” button next to a note when the page to be linked is open in the main window.

That means that attaching a note to a formal document works exactly as in the paper-based world: one opens the formal document at the right place and sticks a note (corresponding to a post-it) in that place. The only difference is that it may be explicitly controlled whether this note remains private (i.e. only to be seen by the person who attaches it) or becomes public to be seen by everyone who has access to the formal document.

#### 4 Related Work

Since our prototype links a number of seemingly rather diverse concepts, we can find related work in various areas: The notebook metaphor we propose visually



resembles Microsoft OneNote [OneNote] and also bears some resemblance with the web-based notebook EverNote [Evernote], but is inherently more collaborative, as are the many recent approaches to knowledge management that rely on Wiki technology [Wagner 2004], e.g. semantic wikis [Schaffert 2006] or blogs [Shakya et al. 2008].

Linking of informal notes with more structured content or formal documents has been addressed by approaches that use printouts as proxies, such that notes on paper taken with a special pen get transferred into digital annotations [Liao et al. 2005]. Others support what is called active reading (taking notes while reading something) [Schilit et al. 1998] via a pen tablet display where users annotate the scanned image of a page.

The topic of federated search addressed by the cabinet has a rather long tradition (see e.g. [Callan 2000]) and it has also been realised by many researchers that enterprise search presents new challenges that call for different approaches than those applied in web search [Hawking 2004, Fagin et al. 2003]. We particularly focused on the challenge of seamless integration of search and its results with the work environment of a knowledge worker.

As far as context patterns are concerned, relevant work has been carried out in the area of task management – we have generalised the notion of task patterns [Schmidt and Riss 2009, Du et al. 1999] into context patterns, generalising from tasks to cases or general work situations.

## 5 Conclusions and Future work

In this work we have shown how the transition from paper-based environments into a digital world of information and knowledge management can be eased by metaphors that resemble well-known entities from the “traditional” workplace. We have also illustrated how these metaphors can be designed in order to achieve a seamless integration between structured and unstructured information and allow for lightweight collaboration and knowledge sharing.

In the future, we plan to enhance our prototype with functionalities for fine-grained, but still lightweight user rights management as well as advanced search and recommendation techniques. We would also like to investigate the possibilities of integrating Linked Open Data, especially into the Cabinet. Furthermore, we consider it necessary to put more effort into making the user interface reflect the analogies to the paper-based world. Finally, we will validate our prototype with prospective end users.

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