

A Research Methodology for Supporting the Development of a Personal Digital Workspace for Knowledge Workers

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Abstract. Present day knowledge workers interact with a digital world which is full of digital services intended to support these workers in their knowledge intensive tasks. Digital services include the use of applications in general, tools that support knowledge generation, or knowledge transfer, but may also support the proliferation of knowledge in order to improve organizational decision making and value addition. However, it often occurs that contemporary digital services are not user-friendly, impersonal, and ambiguous in use. Therefore, my Ph.D. research focuses on the notion of ‘Sophia’: a reference model and a development framework for a personal digital workspace for knowledge workers. A personal digital workspace for knowledge workers aims to integrate and personalize all digital services, digital information items, and digital knowledge items, so that an individual knowledge worker can carry out his work related activities pleasantly, effectively, and efficiently in every physical, social and digital context.

1 Introduction

Our society is changing under the influence of advanced information technologies [1]. Various authors who try to assess the influence of computer and information technology on humans, society, and organizations use metaphors such as: Being Digital [2], Digital Economy [3], and Digital Places [4]. It shall need no further arguing that information technology has an increasing influence on the way we work and live [2, 5, 6]. In 2003, the world produced about 800MB of information for each man, woman, and child on earth [7]. Well over 90% of information currently produced is created in a digital format, and this percentage will increase substantially in the future. At the same time, much of the existing content which is currently only available in a physical format will be digitized soon as well [7]. Contemporary businesses demonstrate significant concerns on how all this available information can be converted into knowledge [8]. With the growth of clerical occupations at the turn of the

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century, the ascendancy of knowledge-producing occupations has been an uninterrupted process. A movement from manual to mental, and from less to more highly trained labor has occurred [9]. Several studies, including Porat [10], Rubin and Huber [11], and Reich [12] have documented the growth in the relative size of people working in the information economy. In the past, the concept of ‘knowledge worker’ has often been equated with being an ‘information worker’, someone who is producing and processing information but may not be responsible for any actions taken based on that information [13]. While an information worker is busy producing, processing, storing, transferring, and comparing information, a knowledge worker crafts and tunes the available information to create, distribute, and apply knowledge. Information is an enabler of these actions, so the work of an information worker is closely related with the work of a knowledge worker. Knowledge workers have high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge [14].

The contribution we would like to make with this research is to provide more theoretical support and practical guidance when creating a personal digital workspace for knowledge workers. This particular doctoral consortium paper discusses the focus of this research (section 2), explains the research problem and the research questions (section 3), contains a description of the underlying research methodology (section 4) and lists topics for further research (section 5). Finally, section 6 concludes this paper.

2 A Hierarchy of Digital Spaces

Present day knowledge workers interact with a digital world which is full of digital services. Digital services can be defined as any computer based tool which supports the performance of applications, activities, or actions such as knowledge generation and knowledge transfer, and may also support the proliferation of the knowledge produced by knowledge workers in order to improve organizational decision making and value addition [15]. All these services are intended to support these workers in their knowledge intensive tasks. However, it often occurs that these digital services are not user-friendly, impersonal, and ambiguous in use.

In order to anticipate more rapidly and adequately to these concerns in the swiftly changing digital environment of a knowledge worker, his workspace should be digitized in a way so that digital services properly assist the knowledge worker in his work [16, 17]. Both academia and industry gradually anticipate on these developments. Malhotra and Majchrzak [17] introduced the virtual workspace, Forrester [18] the concept of an adaptive workspace, Gartner the e-workplace [19], Bafoutsou and Mentzas [20] the electronic workspace, while Rijsenbrij [21] coined the concept of a digital workspace. Industry figures show that an increasing number of companies have decided that digital services required to anticipate on the swiftly changing digital environment of a knowledge worker are classified as core investments, and as a

result more money is spent on data warehousing¹ and portals² [22]. A survey at 83 firms with more than \$100 million in revenue shows that the largest segment of companies expects to spend between \$1 million and \$5 million to roll out portals and to employ a staff of three to manage a portal during the first three years [23]. Portal enthusiasm continues despite tighter budgets and post-dot-com scepticism. The largest number of companies which were part of the survey counted between 1,000 and 10,000 portal users today, and respondents at \$1 billion-plus companies expect to drive this number into the tens of thousands one year from now [22].

Figure 1 helps to clarify on which type of digital space (in which the aforementioned digital services like data warehousing and portals play an important role) the focus lies in this research and to position the various digital spaces in a hierarchy.

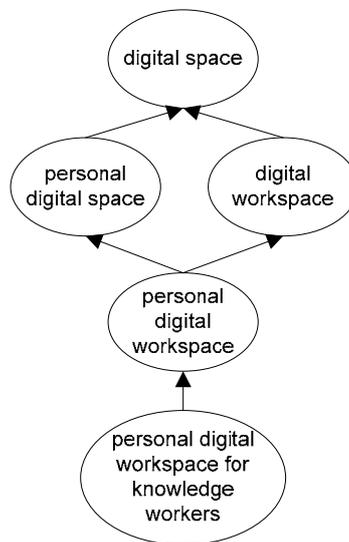


Fig. 1. A digital space hierarchy

As a first step, we might say that a digital space integrates all digital services and digital information items, so that people can carry out their private and work related activities pleasantly, effectively, and efficiently in every physical, social and digital context. When considering the hierarchy in figure 1, it is clear that a digital space can be personalized (a personal digital space) and that a digital space can be work-related (a digital workspace). When these two variants of the digital space are combined we

¹ A data warehouse is a central store of data common to the organization [15]. It is a central repository of information drawn from disparate and physically distributed operational source systems of an enterprise, as well as external data.

² Portals can be seen from several perspectives. ‘Portal’ means ‘large door’ or ‘gateway’, indicating that the portal itself is not the final destination but a way to reach many other places [15]. A portal integrates and personalizes digital services, information items, and knowledge items in one environment, so that the individual knowledge worker is facilitated in his work.

will achieve the personal digital workspace. In this research, we will initially focus on the personal digital workspace for knowledge workers, which is actually a bottom-up approach in the proposed digital space hierarchy. This enables us to define initial theoretical groundwork and to scope the research. Thus, ‘Sophia’ can be defined as a reference model of and a development framework for a personal digital workspace for knowledge workers. Such an environment aims to integrate and personalize all digital services, digital information items, and digital knowledge items, so that an individual knowledge worker can carry out his work related activities pleasantly, effectively, and efficiently in every physical, social and digital context.

3 Ensuing Research Questions

Taking the definition of Sophia provided in the previous section as a starting point, we now identify the research questions which we aim to answer in our future research activities. Current research on user-centric development methodologies [24, 25, 26, 27] is not based specifically on a personal digital workspace for knowledge workers (which integrates digital services, digital information items, and digital knowledge items), so this is addressed in the following research questions.

Given the basic research problem:

How to create a reference model of and a development framework for a personal digital workspace for knowledge workers, so that more theoretical support and practical guidance can be provided when creating such personal digital workspaces?

Three basic research questions can be formulated:

- Q1** Which reference model enables us to describe how a personal digital workspace for knowledge workers integrates and personalizes digital services, digital information items, and digital knowledge items so that these workers can carry out their work related activities pleasantly, effectively, and efficiently in every physical, social and digital context?
- Q2** Which development framework enables us to describe and analyze the environment and the concepts of a personal digital workspace for knowledge workers? This includes the selection and / or the creation of modeling techniques that clearly take the objectives of knowledge workers as a starting point.
- Q3** What is an operational form of this reference model and the development framework which we can use as a working-method in order to create personal digital workspaces for knowledge workers?

What is especially important in this research are the concepts necessary to design a personal digital workspace for knowledge workers from a demand side perspective. The knowledge worker is the centre of attention in this research, not the technology. Thus, this Ph.D. research has a close relationship with the fields of information science, sociology, psychology, and business administration. Actually, we scope this research so that the correlation between technology and the interacting knowledge worker is emphasized. This means in fact that concrete adjacent fields are (but not limited to): computer-supported cooperative work (CSCW), human-computer interac-

tion (HCI), user interface design, knowledge management, and cognition. These fields also take the knowledge worker as a starting point.

4 Research Methodology

A good scientific theory is a *model of cause-and-effect* to explain some *phenomenon of interest* [28]. In order to create Sophia, the ‘action research’ method [29] will be used. The action research method is a qualitative research method which associates research and practice, so that research informs practice and practice informs research synergistically. Action research combines theory and practice (and researchers and practitioners) through change and reflection in an immediate problematic situation within a mutually acceptable ethical framework. Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning. In action research, the researcher tries out a theory with practitioners in real situations, gain feedback from this experience, modifies the theory as a result of this feedback, and tries it again. Each iteration of the action research process adds to the theory, in this case the reference model and the development framework. As an external Ph.D. student, I work closely with practitioners on a daily basis and thus gain feedback from these experiences which can be used for the research. Now the ideal domain of the action research method is characterized by a social setting where the researcher is actively involved, with expected benefit for both researcher and organization. The knowledge obtained can be immediately applied [30]. The Sophia research project is thus a typically cyclical process of linking theory and practice together [31].

An action research description adopted from [32, 33] details a five phase, cyclical process. The approach first requires the establishment of a research environment. Figure 2 illustrates this action research structural cycle.

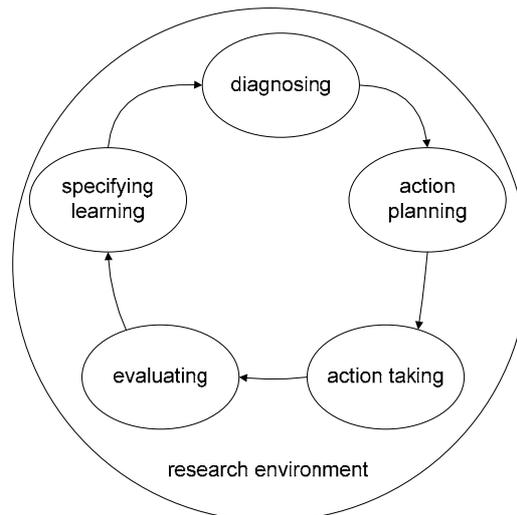


Fig. 2. The action research cycle, adopted from [32, 33]

The interpretations of the five phases for the Sophia research project are as follows:
the diagnosing phase consists of the development of theoretical assumptions (i.e., a working hypothesis). A contribution to this phase is made by this doctoral consortium paper;
researchers and practitioners then collaborate in the next activity: action planning. The discovery of the planned actions is guided by the reference model and the development framework, which indicate both a desired future state (when organizations have implemented a personal digital workspace using the Sophia theoretical model) and the changes that would achieve such a state. For the Sophia project, this consists of the development of the reference model (research question 1) as well as the development framework (research question 2);
action taking then implements the planned action. The researchers and practitioners collaborate in the active intervention into the organization, causing certain changes to be made. This phase consists of implementing an operational form of Sophia (research question 3);
after the actions are completed, the collaborative researchers and practitioners evaluate the outcomes;
in the ‘specifying learning’ phase, knowledge can be provided for diagnosing future action research interventions. The success or failure of the theoretical groundwork also provides important knowledge to the scientific community for dealing with future research settings. Furthermore, new knowledge gained by the research can be used for organizations involved in the research.

The action research team formation is depicted in figure 3.

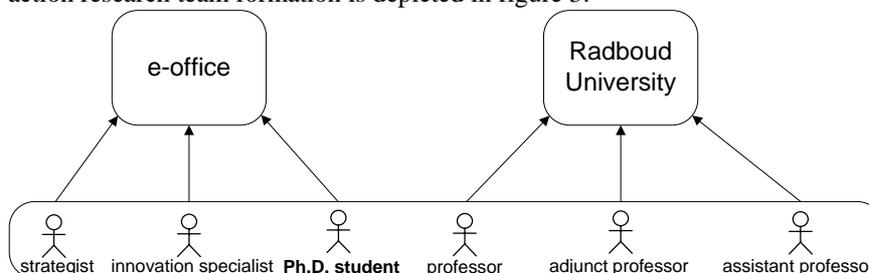


Fig. 3. The action research team formation

The action research team formation consists of academics as well as practitioners. As an external Ph.D. student, I am employed at ‘e-office’ in The Netherlands, where the lion’s share of the research takes place. From its start back in 1991 e-office has helped organizations in optimizing the work environment of workers by utilizing information and communication technologies and thus e-office serves as a proper practical environment for the research. e-office provides client organizations personal digital workspaces by implementing portal solutions based on IBM and Microsoft technology. Two professors (also the supervisors of the thesis) and one assistant pro-

fessor provide methodological as well as theoretical assistance from a scientific point of view. The professors are employed at the Radboud University in Nijmegen, The Netherlands. Two employees at e-office also provide assistance during the research. One colleague is a strategist and provides assistance mainly with respect to the research content from a practical point of view. A huge advantage of this approach is that the strategist is able to try out (parts of) the developed theoretical groundwork in practice before it is even officially published to the scientific world and the business world. This feedback can be used to improve the theoretical groundwork due to practical experiences. An innovation specialist at e-office assists with organizational issues during the research project, such as planning, evaluation of the research process and self-reflection.

5 Further Work

In any case I plan to *iteratively* carry out the activities depicted below in the upcoming years of the Ph.D. project. The phases below are related to the action research cycle shown in figure 2.

Diagnosing phase:

- critical comparison of articles that show similarities with the aforementioned research questions and identification of advantages and disadvantages of the various approaches;
- identification and comparison of various solutions present in the market which already provide a first draft of what a personal digital workspace for knowledge workers should look like.

Action planning phase:

- gathering and categorization of a complete list of digital services (with references to existing services of the kind mentioned) as part of the conceptualization process. The knowledge conversion model of Nonaka and Takeuchi can be used as a meta model for the categorization of the services [34];
- further development and conceptualization (including conceptualization of the physical, social and digital contexts of the knowledge worker) of the reference model and the development framework using (a) relevant modelling language(s) like ORM [35].

Action taking phase:

- providing empirical evidence (e.g. by conducting a case study) to clarify the needs of a knowledge worker as will be explained by the development framework to thoroughly validate the theoretical groundwork;

providing an operational form of the reference model and the development framework which can be used as a working-method in order to create personal digital workspaces for knowledge workers.

Evaluating phase:

critical comparison of the theoretical groundwork with the ensued research questions to find out if there is any discrepancy between the theoretical results and the research questions;
reflection and evaluation of the implementation of a working-method for the creation of personal digital workspaces in an organization. This can provide new insights for the theoretical groundwork.

Specifying learning phase:

comparison with other action research interventions in the scientific community and identification of advantages and disadvantages of the various approaches;
transfer of knowledge to organizations involved in the research so that the organizations can make use of the produced research results.

6 Conclusion

I have proposed an approach (called Sophia) to develop a reference model of and a development framework for a personal digital workspace for knowledge workers, so that eventually a design of such environment can be guided. This approach includes a basic problem statement with three research questions, the 'action research' methodology and an outline of further work. In the CAiSE Doctoral Consortium I would at the least like to identify other potential research methodologies and techniques which are suitable in the process of developing and conceptualizing a reference model of and a development framework for a personal digital workspace for knowledge workers. Additionally, I would like to gain knowledge about various modelling languages already used by other researchers in the process of conceptualizing a theory.

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