ISSN 1507-3858
e-ISSN 2450-0003

Małgorzata Pańkowska
University of Economics in Katowice
e-mail: malgorzata.pankowska@ue.katowice.pl
ORCID: 0000-0001-8660-606X

KNOWLEDGE WORKER TASKS IN SYSTEM ARCHITECTURE

ZADANIA PRACOWNIKA WIEDZY W ARCHITEKTURZE SYSTEMOWEJ

DOI: 10.15611/ie.2019.1.05
JEL Classification: C83, D23, I23, O30

Summary: In this paper, knowledge workers are assumed to actively realize knowledge management tasks. They are involved in the gathering, analysis, storage and dissemination of knowledge in a way that is focused on its improvement. Therefore main goal is to present system architecture models for knowledge management in information science domain. In that domain, Design Science Research (DSR) is discussed as being very useful and adopted in this paper for knowledge management. The author applied the ArchiMate modelling language and supplemented it with the process approach and Business Process Model & Notation (BPMN) for knowledge management process presentation, as well as by the case management approach and Case Management Model & Notation (CMMN). These notations are consistent and complementary, although they have different objectives of usage.

Keywords: system architecture, cyber-ethnography, ArchiMate, Design Science Research, BPMN, CMMN.

Streszczenie: W artykule przyjęto, że pracownicy wiedzy aktywnie realizują zadania zarządzania wiedzą. Są oni zaangażowani w gromadzenie, analizę, przechowywanie i dystrybucję wiedzy w sposób zorientowany na ustawiczne jej doskonalenie. Głównym celem artykułu było przedstawienie architektury systemowej dla wspomagania zarządzania wiedzą w dziedzinie systemów informacyjnych. W tej dziedzinie paradygmat *Design Science Research* traktowany jest jako wysoce użyteczny. W artykule wykorzystano ten paradygmat oraz język ArchiMate, a także notację *Business Process Model and Notation* (BPMN) i notację *Case Management Model and Notation* (CMMN) do modelowania architektury. Wymienione notacje są zgodne i komplementarne, ale mają różne cele zastosowania.

Słowa kluczowe: architektura korporacyjna, architektura systemowa, cyberetnografia, ArchiMate, *Design Science Research*, BPMN, CMMN.

1. Introduction

In general, in an information society, the norms and principles are constantly updated to keep control of information and knowledge under conditions of changing technology. Norms and rules reveal values which are understood not only as majority opinions. While norms arise out of the cultural realm of values, they are expressed in the social structures and politics. In the paper, knowledge management is assumed to be based on social norms, regulations, principles and values. Information and communication technology (ICT) influences knowledge management in the development of its infrastructure and supporting practices. These advances are visible in many initiatives, ranging from the core ICT system required to run the knowledge management activities to websites, which promote knowledge dissemination services and knowledge brokering centers, and further, to the development and full implementation of knowledge repositories.

The structure of the paper is proposed as follows. First, knowledge management is suggested to be developed according to the Design Science Research (DSR) approach. Next, knowledge management enterprise architecture is proposed in the ArchiMate language and it is based on the TOGAF framework. In this paper, knowledge workers are assumed to act in open business model organizations. The third part of the paper includes a presentation and discussion on the process-oriented approach to knowledge management. That process is modelled in BPMN notation. Finally, for knowledge management in cyberspace, qualitative research methods are discussed and their application in information science research is presented. Cyber-ethnography is considered by the author as a valuable method for knowledge development in cyberspace, therefore its tasks are modelled in CMMN notation. The conclusions include a discussion on the applicability of the mentioned above notations as well as suggestions concerning the future works.

At the base of knowledge management there are people, knowledge assets and processes. Knowledge assets can be defined as domain-specific resources that are indispensable to create values for any business organization. These assets are the inputs, outputs and moderating factors of the knowledge creation process. Although knowledge is considered to be one of the most important assets for a business to create a sustainable competitive advantage today, people still do not have effective systems and tools for managing knowledge assets. As Dalkir (2017) argues, nowadays the ability to manage knowledge is becoming increasingly crucial in a contemporary knowledge economy, which is focusing on knowledge creation and diffusion. Here knowledge is perceived as a commodity or intellectual asset, although knowledge characteristics are radically different than other valuable commodities.

According to Nonaka et al. (2000), knowledge assets must be built and used internally in order to have their full value realized. People need to build a system to evaluate and manage knowledge assets more and more effectively. Another difficulty in measuring and managing knowledge assets is that they are dynamic.

Knowledge assets are both inputs and outputs of the organization's knowledge creating activities, and hence they are constantly evolving. Beyond that, openness and open systems' development should also be taken into account. Organizations are beginning to develop interactive business models, termed the open business model, where the absorption of external knowledge resources for value creation is permitted. In the open business model, organization can receive for free or purchase knowledge from their customers or even competitors, merge with or acquire other organizations, cooperate with partners within research projects at universities, and engage users of IT products and services. The open business model occurs when individual knowledge users and user communities produce and consume value from and for each other through knowledge contributions that create mutual benefits. Social media and open source tools create opportunities for knowledge users to be producers of their own content and Web 2.0 applications. In the open business model, the boundary acts as the interaction point between users and the organization. This model facilitates the development of user experience. The users are seeking personalized knowledge practices that are derived from external social relationships rather than products or services. The essential elements of the user culture in open source based projects appear to be sharing of the activity tools by the socio-technical system and the further development of activity tools by the users, while activity tools cover technology and guidelines for users (Kokkonen, 2009).

2. Design Science Research for business organizations and Information System Research

The paper aims to present the applicability of Design Science Research (DSR) for business organization knowledge assets controlling and management. According to Hevner and Chatterjee (2010), design is an arrangement of artefacts in such a way as to best accomplish a particular purpose. In general, the design of an information system is both an iterative process and a resulting product, so design means building software artefacts which solve a human problem. Hevner and Chatterjee (2010) define research as an activity that contributes to the understanding of phenomena. Phenomenon is a set of behaviour of some entity that is found interesting by the researcher or by a group, i.e. a research community. They formulated the DSR paradigm, in which a designer answers questions appropriate to human problems via the development of artefacts, and simultaneously they contribute new knowledge to the scientific repository, therefore the created artefacts are useful in practice and fundamental for further knowledge development.

Design Science Research is not a research methodology, but it is a research work organization approach. It was originally proposed as a material suitable for graduate courses in information systems, computer science, software engineering, engineering design, and other design-oriented fields. Hence there are certain barriers of DSR applicability, because the approach is not suitable for research processes

in natural sciences. Natural science research methods are appropriate for the study of existing and emerging phenomena. However, they are insufficient for the study of problems that require creative, novel and innovative solutions. Such problems are more effectively addressed using a paradigm shift offered by design science or action research.

In their publication, Hevner and Chatterjee (2010), firstly focus on what design is, and they define it as instructions based on knowledge which turn things into value that people use. In the second basic question, the authors answer what is research and they define it as any activity that contributes to the understanding of a phenomenon. This contribution seems to be important in all aspects of the proposed DSR approach. Next, Hevner and Chatterjee consider understanding as knowledge, which is created, stored and further developed. They argue that the role of research is to provide methods for obtaining answers to questions, the resolution of problems, or the greater understanding of the phenomena. Figure 1 covers an extension of DSR to emphasize knowledge worker's tasks. In the DSR paradigm, Hevner and Chatterjee consider three obligatory cycles (see also Figure 1). These three cycles are needed to encourage researchers to rethink and deliberate as well as to apply a systematic approach to learn from their past experiences and errors and not to reinvent the same solution many times. In the Relevance Cycle, knowledge sharing with present-day stakeholders is termed as knowledge use, while preserving knowledge in repositories to have it shared with future knowledge workers is called reuse. Both use and reuse are oriented towards the improvement of organizational efficiency and the increase of the researcher's capacity to innovate. The Relevance Cycle bridges the contextual environment of the research project with the design science activities. Social constructivists (Berger and Luckmann, 1966; Lave and Wenger, 1991) argue that knowledge is created through shared understanding in social interactions. They assume that knowledge is social-context dependent and this approach is also visible in the DSR paradigm. The context is inspiring to research as well as allowing verification of the research results. Carlile and Rebentisch (2003) proposed the Knowledge Transformation Cycle just to emphasize that knowledge is created in the social process through the integration of knowledge from different sources as well as through its movement from one organizational unit to another, from knowledge researcher to its beneficiary.

The Rigor Cycle connects the design science activities with knowledge repositories. The considered rigor is achieved by the appropriate application of existing frameworks, methodologies, principles, and artefacts. According to Dalkir (2017), knowledge management draws upon many different fields such as organizational science, cognitive science, computer science, linguistics, information technologies, artificial intelligence, information science, sociology, education, and collaborative technologies of Internet. The central Design Cycle iterates between the core activities of building and evaluating the design artefacts and processes of the research. In this cycle the knowledge system research is carried out with the

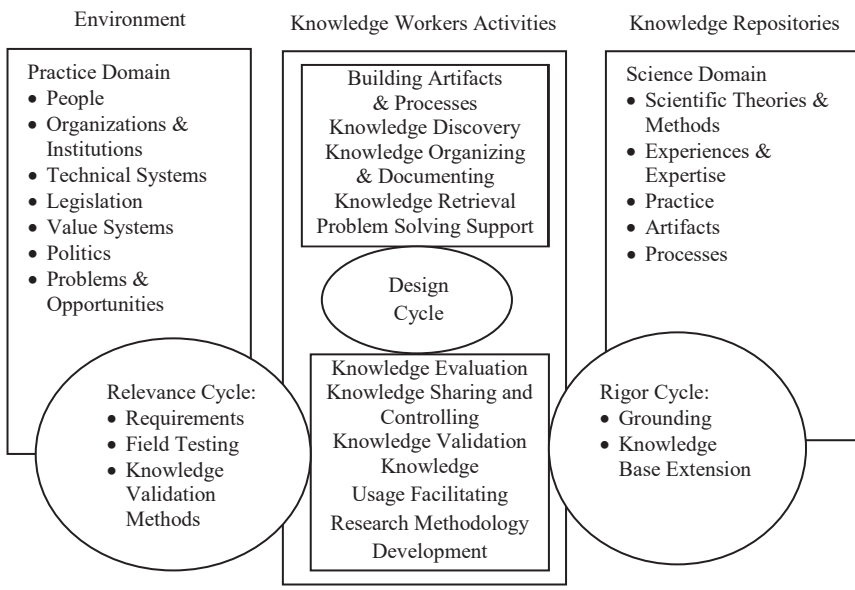

Fig. 1. Framework of knowledge worker participation in Design Science Research

Source: own based on (Hevner and Chatterjee, 2004).

co-influence of people, organization, and technology. The artefacts important here include constructs of vocabulary, symbols, models as abstractions and representations, methods, algorithms, practices, and instantiations and prototype systems. Hevner and Chatterjee allow in the DSR approach for the application of different research methods as well as different knowledge creation tools, e.g. templates, data mining, expertise profiling, mashups, knowledge visualization, and knowledge maps. In the aspects of innovation development as well as knowledge discovery, DSR's proponents emphasize that each research project is realized for the provision of beyond-of-the-art knowledge, and the researchers starting the project are to define their state-of-the art knowledge. This specification is really helpful for establishing what innovations are provided by that project.

Therefore this paper proposes that knowledge system design studies are embedded in pragmatism and the practice theory. The general design methodology is applied here and it is structured in three phases:

- empirical pre-study, including empirical analysis and documenting of existing practices and cultures as it is in an ethnography research in sociology, but beyond that there is a problem-oriented description of the existing relations between practice and information technologies;
- information technology artefact design, covering the application of design methods, the impact of relevant stakeholders in the design process and the negotiation of conflicts with them;

- evaluation and customization of the proposed information system solution, and quality management regarding user experience and usability.

The Design Cycle covers questioning, analyzing, conceptualization, experimentation, examining the situation, development of ad-hoc solutions, modelling the new solution, examining, testing and implementation, and finally evaluation is an opportunity of reasoning by developing relations between artifacts, ideas, suggestions and experiments. Beyond that, the Design Cycle can include testing hypotheses, consolidating solutions and generalizing new practices. However, this generalization is not the same as it is in nature science research, in which quantitative research methods are applied. Betz and Wulf (2018) proposed to use the following criteria, which are also suitable for knowledge system design evaluation:

- credibility, evaluated from the perspective of the research project participants and in the research context. Therefore the particular project results are believable if the phenomena of interest are described from the perspective of the participants;
- transferability, which determines the degree to which the results of qualitative research are relevant for other organizational context or settings. Transferability can be supported by the documentation of the circumstances under which the results are generated. These include the research context, the applied methods and basic assumptions;
- dependability, which means the impact of the project on further research. Dependability is not identified with replicability, but it is regarded as understandability and applicability for further research;
- confirmability, which requires sharing the documentation of the analysis of qualitative research data.

Hevner and Chatterjee (2004) emphasize that analogous to the discovery process in natural science, the artifacts construction process in design science is a creative process of generating alternative solutions. However, in contrast to the justification process in natural science, the evaluation process in design science is task and context specific. The evaluation of an artifact is related to its intended use with a prescribed environment, as well as to the a priori user knowledge. Beyond that, also the evaluation criteria are relative and they are determined for the artifact in a particular environment. However the design in an organizational context differs from the design of physical artifacts. Business organizations are social constructions that depend on human behavior and collective intentions for their success.

In the proposed DSR framework, the knowledge workers' roles and activities should be strongly supported by tacit and explicit knowledge assets from both the analyzed environment as well as from knowledge repositories. The environment contains tacit knowledge, which is shared through common experiences as well as the routine knowledge hidden in the know-how of daily operations, organizational procedures and corporate cultures. On the other side, conceptual and systemic knowledge is stored in repositories (Figure 1). Therefore, explicit knowledge is articulated through images, symbols and language, and stored in documents, manuals, databases and vocabularies.

3. Knowledge Management Architecture Modelling

As presented in Figure 2, the knowledge management architecture model was created according to the guidelines for Enterprise Architecture Modelling included in the TOGAF 9.1 framework. The authors of the Open Group Architecture Framework (TOGAF) consider enterprise as any collection of organizations that has a common set of goals (Desfray and Raymond, 2014). Therefore, each business unit (e.g. knowledge worker) can be considered as a part of an enterprise which needs to be supported by ICT and knowledge management tools. For example, the enterprise could be a government agency, a whole corporation, a division of a corporation, university, hospital, a single department, or a chain of geographically dispersed business units linked together by common ownership.

According to TOGAF, enterprise architecture is modelled in four domains:

- business architecture covering business strategy, goals, business processes, functions and business units;
- data architecture dedicated to the organization and management of information;
- application architecture presenting applications, application components and their interfaces;
- technology architecture covering the technologies and components deployed, as well as networks and the physical infrastructure upon which the applications run.

Beyond that, proponents of TOGAF include the Motivation layer in the enterprise architecture model. This layer comprises a series of elements that are important to explain the premise of enterprise architecture development. The Motivation layer is also emphasized in the ArchiMate language and software tool, which is supported by the TOGAF community (Archi, 2012; Blom, 2009). The most important elements of this layer are as follows:

- goals, which describe general business orientations;
- drivers, which often justify decisions regarding architecture changes;
- requirements, which specify what particularly ought to be implemented to achieve the goals;
- constraints, which are external elements that influence the enterprise organization, sometimes reducing its capacities;
- stakeholders;
- assessments for some areas of interests;
- outcomes representing the final results of architecture development;
- values, identified with utility or the importance of a core element of enterprise architecture.

Knowledge management architecture is assumed to include knowledge workers as the basic stakeholders, who are interested in liberty, equality and solidarity in knowledge access (Figure 2). Their activities in the knowledge management domain are to be regulated by the norms, rules, politics, and enterprise architecture principles. The business layer in the ArchiMate model in Figure 2 covers the specification of:

- business roles, i.e. researcher, knowledge user, knowledge broker;
- business services, i.e. knowledge management, knowledge seeking, research problem conceptualization, knowledge distribution conceptualization, research problem classification, research problem solution compensation, knowledge asset providing, and consultancy service security;
- business process, i.e. research activities for knowledge development;
- business event, i.e. research problem;
- business actor, i.e. knowledge user;
- business object, i.e. research problem solved.

The application layer in the ArchiMate language model in Figure 2 includes the knowledge management support system comprising some other application components. Finally, the technology architecture model in Figure 2 covers knowledge workers' devices, access to the Internet, knowledge repositories and applications supporting the knowledge management. The model in Figure 2 complies completely with the TOGAF Architecture Development Method (ADM) which is critical for enterprise architecture transformation. The method defines eight sequential phases and two other special phases, i.e. the preliminary phase and the requirement management phase. The eight essential phases are as follows:

- A.Vision;
- B. Business architecture;
- C. Information systems architecture;
- D. Technology architecture;
- E. Opportunities and solutions;
- F. Migration planning;
- G. Implementation governance;
- H. Architecture change management.

For modelling in the sequential manner, the ArchiMate language is appropriate to present the first four phases, although the main output document of the A. Vision phase is only validated during the F. Migration planning phase. It is necessary to recall that in TOGAF (Desfray, Raymond, 2014):

- preliminary phase and phase A cover scope definition, and key stakeholders' involvement;
- phases B, C, and D include descriptions of existing and target architectures as well as gap and impact analysis;
- phases E and F are responsible for architecture roadmap defining as well as for project and schedule definitions;
- phases G and H concern enterprise architecture implementation governance.

The model presented in Figure 2 is a generic version of a knowledge management support system, because the ArchiMate language allows for generating such holistic and abstract view. The TOGAF framework permits the holistic analysis of enterprise architecture, as well as modelling the structure of enterprise architecture components, their inter-relationships, and the specification of the principles

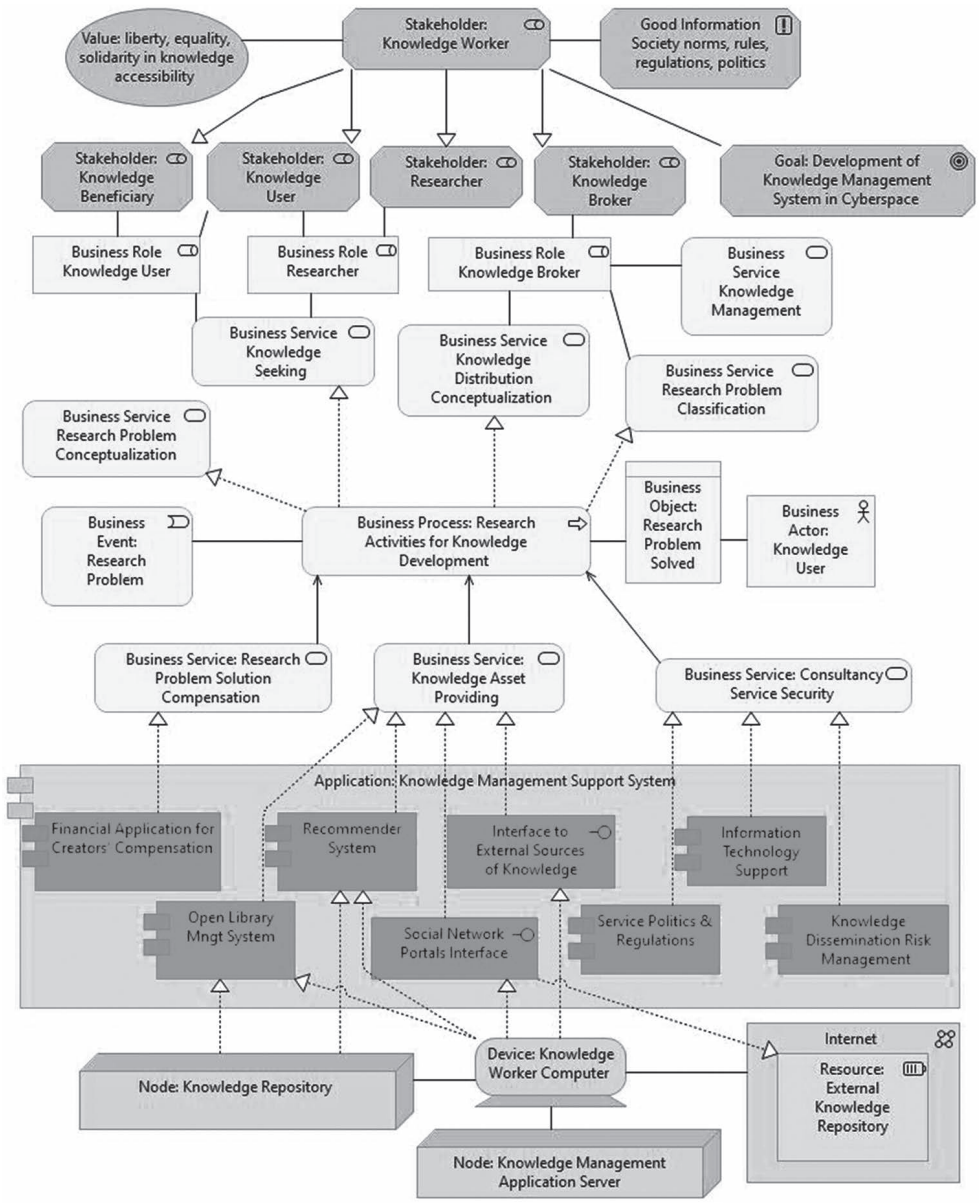

Fig. 2. Knowledge Management Architecture Model

Source: own elaboration.

and guidelines governing their designs and evolution over time. The ArchiMate language and software tool are the most suitable for the visualization of strategic issues and analysis (Archi, 2012; Blom, 2009). Thus the specification of knowledge

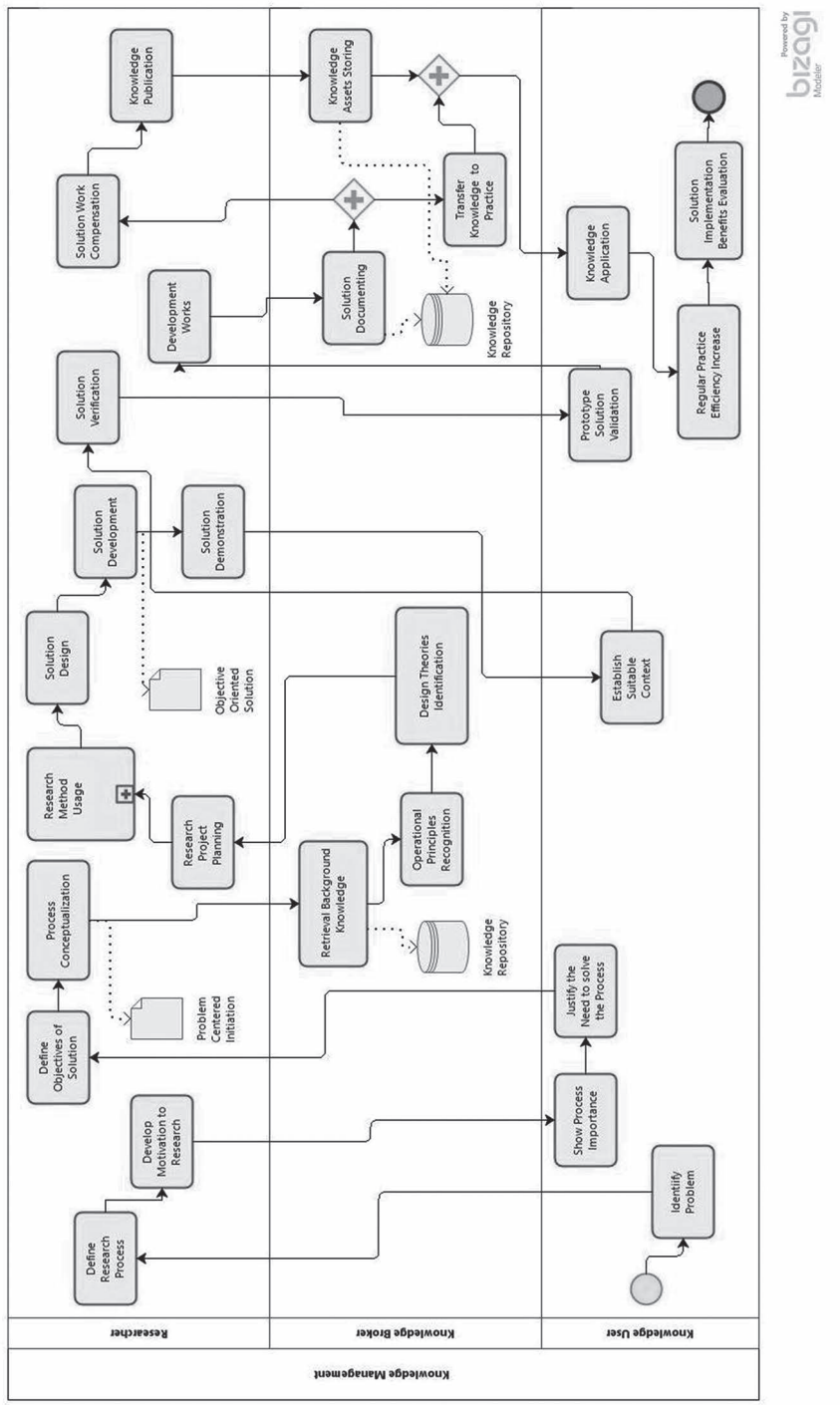

Fig. 3. Knowledge Based Research Process

Source: own elaboration.

workers' tasks can be modelled in ArchiMate and usually starts from establishing the businesses strategic goals, principles, drivers, stakeholders, their requirements and values. These considerations allow for the further development of the research process, which includes knowledge tasks.

Taking into account the strategic role of the ArchiMate language and tool, the operationalization of an enterprise architecture strategy could be further supported by other tools and notations. Therefore, assuming business process-orientation as dominant for business analytics, a more detailed analysis of knowledge workers' tasks can be supported by BPMN notation (BPMN, 2016; Leymann, 2010; Desfray and Raymond, 2014). Therefore Figure 3 covers the specification of activities, roles and repositories in BPMN notation. The knowledge development and management activities in Figure 3 can be further profiled according to particular research methodologies applied. However, taking into account Hevner's and Chatterjee's suggestion included in the DSR approach, it should be noted that they do not assume any particular research method application for knowledge management. They only proposed a very general approach for knowledge management organizing, which can be further combined with any qualitative or quantitative methodology.

4. Modeling of Qualitative Research Methods

Information science research addresses a wide range of issues concerning the technology, development and management of information, as well as their organization and social impact (Lyytinen, 1987). As a key component of the research and development process of implementing DSR products, technology has played a vital role in providing solutions to new and existing problems, and achieving the goal of improving the quality of human life. Easterby-Smith et al. (1991) discuss three forms of research:

- pure research, leading to theoretical developments;
- applied research, intended to lead to the solution of specific problems, and usually involving clients who identify their problems;
- action research as a new research paradigm to establish collaboration between researcher and knowledge user.

Traditionally research work covers activities intended to solve an immediate problem (i.e. applied research) to assess the performance or impact of an action or policy of a person, group or organization, or to develop theory (basic research or pure research). However, action research is a recently popular method in information science research among practitioners. The real value of the approach is in improving information service provision, as well as in encouraging reflective practice, structuring, and disseminating experience to the wider community.

Action research is suggested to be used to investigate organizational functions such as the role of knowledge broker or library custodian in the provision of knowledge to learners (Pickard, 2007). The approach combines theoretical considerations and

practical work. Through action research, the practitioners are encouraged to take over the habits and behaviour of researchers in their workplace and to improve the evaluations of their practices. In the action research approach, practice and research proceed in parallel.

Action research is based on a collaborative problem solving relationship between the researcher and the client with the aim of both solving the problem and generating new knowledge, hence this research approach is similar to the DSR approach. Action research can be termed as an interventionist approach to research taken with the explicit intention of improving the practice and understanding both that practice and the knowledge background. Action research can be realized as a process covering the following phases:

- identification of the research problems;
- action planning;
- implementation of the proposed solution into practice;
- evaluation of research activity, presentation of findings, conclusions, and recommendations;
- reflection as a result of the analysis.

Action research is similar to ethnographic research, because it also requires the researcher to obtain an accurate and comprehensive understanding of the situation being addressed before taking any action to solve problems. Participant observation is suggested as a preliminary to action research.

In the literature, Action Design Research is developed as a combination of the Action Research qualitative method and the DSR paradigm for generating prescriptive design knowledge through the building, implementation and evaluation of IT artifacts in a business organization (Babik, Iyer, and Ford, 2012). In the ADR approach, IT artifacts are shaped by the organizational context during their development and usage. The research process is inseparable and inherently interwoven into the activities of building the IT artifacts (Randall, 2018).

In general, information science research work covers the application of qualitative and quantitative methods. Quantitative research methods are concerned with acquiring and analyzing relatively small amounts of data from a large number of subjects. They are oriented towards the generalization of research results (Willcocks, Sauer, Lacity, 2016). Qualitative research methods are concerned with acquiring and analyzing relatively large amounts of data from a small number of subjects to investigate experiences and attitudes (Hennink, Hutter, and Bailey, 2011). The tools useful for qualitative research include in-depth interviewing, case studies, analytic interpretations, critical analysis, literature reviewing, content analysis and participant observation. Case study research is by Yin (Pickard, 2007), developed as a research method designed to study the particularities within an organizational context. The procedural approach in case study research is as follows:

- orientation and overview, formulation of the research questions;
- focused exploration;

- confirmation of the credibility of the case story and examining cross-case themes as interpreted by the researcher.

Action research and case study are realized according to the process-oriented research guidelines. However, the ethnography is different and as such is particularly suitable for research where the problem is complex and not clear, and where the research phenomenon is embedded in a social system, which is poorly understood or even unknown. In ethnography, the researcher is entering the organization context and becomes part of it, in action research the researcher is already inside the context and has considerable knowledge about the situation. In the case study approach, researchers are outside the organization context but they are able to describe it. According to Wilcox (Pickard, 2007; Hennink, Hutter, and Bailey, 2011), the goal of ethnography is to combine the view of an insider with that of an outsider to describe a social setting. The focus of ethnography is to describe and interpret a cultural and social group, whereas the focus of a case study is to develop an in-depth analysis of a single case. Although the researcher is an outsider, the emphasis is on the entry to the community and even on the creation of a context. Going into the community of users of information, the researcher wants to take over the subjective experiences of the community participants as well as their interpretation of the concepts and other processed information. In ethnographic research, the researcher is considered as the primary instrument of the research among other research participants (Pickard, 2007). Therefore, the researcher should be able to capture the complexity and nuances, as well as constantly changing situations and human experiences. They have to reveal hidden knowledge and apply appropriate tacit knowledge. Researchers should respond to situations as they arise, collect data from multiple sources at the same time, monitor the whole business environment, process data, and constantly analyze, evaluate and validate the collected evidence. Cyber-ethnography is a research act realized in cyberspace. This does not only mean that the study is conducted in virtual communities, this also means opportunities to compare different cultural approaches, as well as compare different attitudes, methods and principles concerning the same problems. The researcher is no longer located in a specific place. In cyberspace, researchers can be members of different communities, looking everywhere for the new knowledge 'findings'. The cyber-ethnographic research results can cover:

- identification of documented and undocumented transfer of information and knowledge within and among communities;
- identification of true division of labour, since it is often organized dynamically and it does not necessarily follow a prescribed form.

Assuming non-procedural activities in ethnography research, the application of the case management model and notation is proposed as more suitable solution for modelling. In general, the application of the case management model and notation (CMMN) is appropriate for government institutions' modelling, as well as for claim processing in insurance, patient care and medical diagnosis in healthcare, problem resolution in call centers, and engineering of made-to-order products (CMMN, 2016).

The CMMN notation is suitable for modelling any activities which occur occasionally and in changeable orders, and which are unique and unrepeatable. CMMN modelling provides some essential values to business architecture modelling. Sometimes, in the domain of business process modelling, a certain flexibility is required. Processes can change or need to be adjusted because of many different situations. Flexibility means the ability to deal with process task changes.

According to OMG (CMMN, 2016), the case is a collection of tasks and the case manager is the knowledge worker who realizes these tasks. The case managers (e.g. cyber-ethnography researchers) are responsible for the tasks and they can directly make decisions as to will be realized. They can handle the case in any way that is the best for them as long as it respects the constraints imposed. Figure 4 includes a descriptive analysis of a cyber-ethnography research case in CMMN notation. For

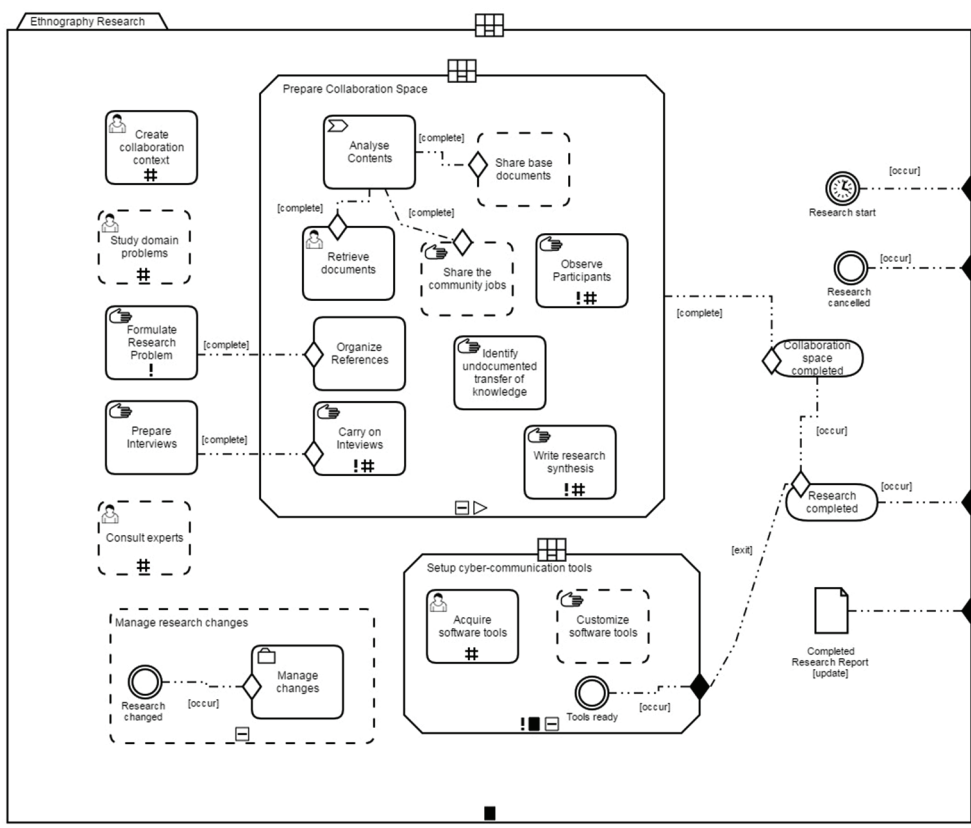

Fig. 4. Cyber-Ethnography Research Case Management Model

Source: own elaboration.

diagramming purposes, the Camunda software tool has been applied. In CMMN notation, the human task performed by the case manager can be:

- blocking – the task is waiting until the work associated with the task is completed, e.g. in Figure 4 the tasks "create collaboration context", "retrieve documents", "acquire software tools";
- non-blocking – the task is not waiting for the work to complete and completes immediately upon instantiation, e.g. in Figure 4 the task "manage change".

In CMMN notation, there are tasks and discretionary tasks. The latter are available to the case worker and their applicability depends on her/his discretion. For example, in Figure 4 "study domain problem" is proposed as a discretionary task. The tasks "consult experts" and "share base documents" are also considered as discretionary tasks. In CMMN notation, a milestone (e.g. "research completed" in Figure 4) represents an achievable target to enable the evaluation of the case progress. Although the CMMN language supports the flexibility of the tasks specified in the case, there are some weaknesses of this modelling. The BPMN modelling language better presents information and knowledge resources allocation. This notation also precisely expresses who the task executor is. In CMMN notation, only a case file item is proposed and there is no opportunity to define the available resources, besides there is no way to present a hierarchy of knowledge works. The strength of CMMM notation is that it provides a representation of discretionary items which may become concrete at runtime. The case manager can choose the order of tasks at runtime. Any order is possible since it does not violate any constraints of the ethnographic method.

5. Conclusions

The design research covers the studying, research, and investigation of artifacts as well as the activities in the research project life cycle. Designers and researchers are constantly involved in the improvement and rationalization of their practices. Stevens et al. (2018), emphasize that system design practices are constructed around methods and tools, utility functions and the defining of constraints of applications. They argue that design is an optimization process of artifact production.

Knowledge management encourages knowledge workers to elaborate the holistic approaches which allow to successfully cope with the complexity of knowledge. This holistic approach is made possible by the application of any enterprise architecture framework, i.e. TOGAF, and of a suitable language, e.g. ArchiMate for enterprise architecture modelling. However, because of the ArchiMate language weaknesses for business process modelling, there is a need to apply other notations. BPMN notation is appropriate for modelling process-oriented business architecture, but it is not flexible enough to cope with non-procedural tasks. Therefore, CMMN notation was developed by OMG and this paper presents how the notation can be applied

for modelling ethnographic research works. However, there are still some open questions for future work. It would be necessary to answer how to integrate the available modelling languages as well as how to model resource-oriented business organizations.

References

Archi – ArchiMate Modelling. (2012). Retrieved 8.04.2017 from http://archi.cetis.ac.uk/download/latest/Archi%20User %20Guide.pdf

Babik, D., Iyer, L. S., and Ford, E. W. (2012). Towards a comprehensive online peer assessment system. In K. Peffers, M. Rothenberger, and B. Kuechler (Eds.), *Design science research in information systems* (pp. 1-8). Berlin: Springer.

Berger, P. L., and Luckmann, T. (1966). *The Social Construction of Reality*, New York: Doubleday and Company, Inc.

Betz, M., and Wulf, V. (2018). Toward transferability in grounded design, comparing two design case studies in firefighting. In V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens (Eds.), *Socio-informatics, a practice-based perspective on the design and use of IT artifacts* (pp. 459-488). Oxford: Oxford University Press.

Blom, R. (2009). *ArchiMate Tutorial. The open standard language for modelling and visualizing enterprise architecture*. Retrieved 8.04.2017 from http://archive.opengroup.org/ public/ member/proceedings/q209/q209a/Presentations/blom_2.pdf

BPMN. (2016). *Business Process Model and Notation.* Object Management Group. Retrieved 5.04.2017 from http://www.bpmn.org

Carlile, P., and Rebentisch, E. (2003). Into the black box: The knowledge transformation cycle*. Management Science*, *49*(9), 1180-1195.

CMMN. (2016). *Case Management Model and Notation.* Object Management Group. Retrieved 1.01.2018 from http://www.omg.org/spec/CMMN/1.1

Dalkir, K. (2017). *Knowledge Management in Theory and Practice*, Cambridge Massachusetts: The MIT Press.

Desfray, P., and Raymond, G. (2014). *Modeling enterprise architecture with TOGAF. A practical guide using UML and BPMN.* Amsterdam: Elsevier.

Easterby-Smith, M., Thorpe, R., and Lowe, A. (1991). *Management Research. An Introduction*. London: SAGE Publications.

Hennink, M., Hutter, I., and Bailey, A. (2011). *Qualitative Research Methods*. Los Angeles: SAGE Publications.

Hevner, A. R., Ram, S., March, S. T., and Park, J. (2004). Design science in information systems research. *MIS Quarterly*, *28*(1), 75-105.

Hevner, A. R., and Chatterjee, S. (2010). *Design research in information systems, theory and practice*. New York: Springer.

Kokkonen, J. (2009). User culture, user-system relation and trust: The case of Finnish Wikipedia. In S. Niiranen, J. Yli-Hietanen, and A. Lugmayr (Eds.), *Open information management, applications of interconnectivity and collaboration* (pp. 326-243). Hershey, New York: Information Science Reference.

Lave, J., and Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Leymann, F. (2010). BPEL vs. BPMN 2.0: Should you care? In J. Mendling, M. Weidlich, and M. Weske (Eds.), *Business process modeling notation* (pp. 8-14). Berlin: Springer.

Lyytinen, K. (1987). A taxonomic perspective of information systems development: Theoretical constructs and recommendations. In R. J. Boland, and R. A. Hirschheim (Eds.), *Critical issues in information systems research* (pp. 3-42). Chichester: John Wiley & Sons.

Nonaka, I., Toyama, R., and Konno, N. (2000). SECI, BA and leadership: Aunified model of dynamic knowledge creation. *Long Range Planning*, *33*(1), 5-34.

Pickard, A. J. (2007). *Research methods in information*. London: Facet Publishing.

Randall, D. (2018). Investigation and design, in socio-informatics. In V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens (Eds.), *Socio-Informatics. A practice-based perspective on the design and use of it artifacts* (pp. 221-242). Oxford: Oxford University Press.

Stevens, G., Rohde M., Korn M., and Wulf V. (2018). Grounded design. A research paradigm in practice-based computing. In V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens (Eds.), *Socio-informatics. A practice-based perspective on the design and use of IT artifacts* (pp. 23-46). Oxford: Oxford University Press.

Willcocks, L. P., Sauer, Ch., and Lacity, M.C. (2016). *Formulating research methods for information systems*, Vol. 1. New York: Palgrave Macmillan.