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## **Knowledge creation in an R&D project. A multiple case study in the context of clean energy markets in Finland**

**Maija-Leena Huotari, Anna Suorsa, Kaisa Ikonen and Kaisu Innanen**

### Abstract

**Introduction.** This study examines organisational information behaviour in a multi-disciplinary, multi-professional and multi-organisational context. This environment is provided by a project on clean energy and a cloud computing-based market place for electricity trading. The focus is on the interaction and communication involved in creating new, interdisciplinary knowledge. The ultimate aim of our study is to contribute to theoretical understanding of knowledge creation as an aspect of organisational information behaviour, including public engagement in a research and development project, and to present a model of it. In this paper we aim at providing a concise description of our study. The study was commenced in late 2015 and is planned to run until 2021.

**Method.** A descriptive method is applied to outline our multiple case study. The study is based on an interpretative paradigm of organisational studies.

**Analysis.** The research in progress is described. The description further develops the research plan and elaborates on a practice oriented interaction plan and communication agenda of the project as a whole.

**Results.** The context along with the four case studies are outlined, and the methods are described including the ethical concerns. This is to present a model of organisational knowledge creation in a research and development project. Our model may prove to be an alternative to Japanese models on knowledge creation presented in the multidisciplinary field of knowledge management.

**Conclusion.** This study is a part of the BCDC Energy project. The preliminary findings of the study will be reported by the mid-term evaluation in 2017.

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## Introduction, aim and objectives of this paper

Research on human information behaviour in organisational settings has focused on information needs, information seeking and the use of information by different professions and in different tasks. The research has also examined outcomes or effects that have occurred based on the use of information (Case and O'Connor, 2016; Huotari and Suorsa, 2016). However, studies on organisational information behaviour are more limited (Choo, 1996, 2016; Allen et al., 2011; Huotari and Wilson, 2001). This limitation area of research concerns knowledge creation in particular. Knowledge creation has been studied more extensively in the multidisciplinary field of knowledge management, in studies on organization theory and management.

This paper introduces a study of organisational knowledge creation based on interaction. Our interest lies in the interaction at a group level and also at wider organisational, multi-organisational and multi-professional levels. We will also examine the interaction between individuals, as well as the interaction that occurs through information and communication technology (ICT). We aim at contributing to research on organisational information behaviour by increasing the theoretical understanding of human, social, technological and other factors related to knowledge creation in real-life settings. Our ultimate aim is to present a model of these phenomena to challenge Japanese models of knowledge creation in the field of knowledge management, because these models have been criticized, for instance, as reflecting Asian organisational behaviour. The aim of this paper is to describe how we will enhance our understanding of knowledge creation and how we intend to examine knowledge creation empirically. The objectives related to the case studies focus on the following aspects:

- identifying the knowledge-base of this research and development project as a foundation for new interdisciplinary conceptions;
- ethnographically examining the phenomena related to knowledge creation within a research and development community and the means of interaction that are applied for sharing and disseminating information;
- examining public engagement with science; and,
- contributing to our initial model of knowledge creation in this context.

In our study we understand knowledge creation as a process in which new knowledge is created by seeing new connections and meanings during interaction between human beings (see, e.g., Tsoukas, 2009) at different organizational levels and with internal and external information resources (Huotari and Iivonen, 2005). Knowledge creation can happen, for instance, as a result of research activities (Travaille and Hendriks, 2010) and in organisational processes of enterprises (Mehta, 2007).

## Method

A descriptive method is applied to present how we aim to achieve our study. Firstly, we will describe the context of our study. This is followed by a concise outline of our four case studies and a description of the research methods that will be used.

## Background for our multiple case study

The context of our study, namely, a research and development project 'BCDC Energy' aims at introducing a new type of a digital market place for clean energy trading in Finland (see

[www.bcdcenergy.engl](http://www.bcdcenergy.engl)). The project contributes to Europe's and Finland's target of achieving a carbon-neutral society by 2050. This context is timely because the energy markets are facing global challenges due to liberalisation, the potential of solar and wind power as reliable sources of energy, digital technology ([Kopsakangas-Savolainen and Svento, 2012](#)), and the recent unexpected reduction in oil prices.

The BCDC Energy project is planned to run from 2015 until 2021. The key to benefitting from the markets' transformation is to increase the flexibility of the system, which will be based on new interdisciplinary knowledge. The key actors involved in the project are the five research groups from the fields of Energy Economics, Computer Science and Engineering, Information Systems Sciences, Meteorology, and Information Studies. These groups aim at creating a new type of service for the electricity markets. The work in the project is based on a deep understanding of market mechanisms and pricing policy in the field of energy provision and consumption. The project also utilises the development of new digital technology for energy production, and integrates high quality short term weather forecasting, and new, innovative cloud computing services. Other key players are the project's strategic partners, namely the Carbon Neutral Municipality Forum and Finnish Clean Energy Association, and the Advisory Board consisting of private firms. Together all these actors will form the BCDC Energy community.

In our study the emphasis is placed on the interaction between the key parties in the process of knowledge creation. Our interaction plan and communication agenda was critical for a positive funding decision from the Strategic Research Council in Finland. Interaction and communication will be enhanced by different methods and tools including ICT. The access to the selected information and communication systems will be provided for the researchers and the Advisory Board.

Extensive interaction and communication between academic researchers and wider communities, including politicians and decision makers, is a recent trend which aims to improve the effective utilisation of newly acquired scientific knowledge. It is based on dialogical models of science communication where knowledge co-production has been introduced ([Bucchi, 2008](#)).

## Outline of the case studies

Our first case study aims at setting up an integrative knowledge-base for the BCDC Energy project. First, we will examine the knowledge domains by looking at the quality of the scientific publications and mapping the intellectual property rights. This bibliometric analyses will focus on the key features of the publications representing the project's multi-disciplinary body of research. A co-word analysis of the author keywords and the index terms in the Scopus database for the selected articles will be conducted for identifying the core terminology used by the BCDC Energy community. This analysis will indicate the most critical terms used by the community. Through a participatory approach the researchers themselves will be involved in selecting the terms and defining them. The created core terminology will be included in the national research infrastructure 'Bank of Finnish Terminology in Arts and Sciences'. This belongs to the European *Common Language Resources and Technology Infrastructure (CLARIN)* and through the FIN-CLARIN consortium, i.e. the [Finnish national roadmap](#), it is part of the roadmap specified by the European Strategy Forum on Research Infrastructures (ESFRI).

By examining communication and interaction patterns in social networks embedded in the BCDC Energy community ([Allen, 1977](#); [Burt, 1992](#); [Granovetter, 1973](#); [Wellman et al., 2015](#); [Johnson, 2012](#)) the first case study will also support developing further appropriate means of interaction between people at the group, organisational and multi-organisational levels for new interdisciplinary conceptions to emerge.

In the second case study our interest will focus on interaction that will be conceptualised by applying the theoretical framework by Suorsa and Huotari (2014a), Suorsa (2015) and related methodology (Suorsa and Huotari, 2016). The methodology has been partly tested in an empirical setting in the Joy of Reading programme in Finland (Suorsa and Huotari, 2014b). The framework consists of levels of interaction events and of the organisational circumstances of this event. This will allow a conceptually consistent examination of knowledge creation and information use in the BCDC Energy community. Interaction will be studied both face-to-face and via ICT-applications both as an event and an experience and analysed through a phenomenological, qualitative approach. In this framework interaction is understood as a communal and shared experience, and views a human being as a historical being connected inseparably with his context (Suorsa and Huotari, 2014a; Suorsa, 2015). In this framework communication refers to a historical, experience-based event, that is understood as a form of play formed with rules and which has a presence in a course of actions (Suorsa, 2015; Gadamer, 2004).

The third case study will focus on examining the researchers' readiness to communicate about their own research to a wider audience as well as their attitudes and experiences of this type of professional activity. It will also study the communications regarding the BCDC Energy project's science and public engagement actions to up-date the project's interaction plan and communication agenda. These will include, for example:

- preliminary scientific communications, such as building commitment to blogging and tweeting, by stating and scheduling responsibilities that will involve the researchers, the strategic partners, and the Advisory Board in turns;
- setting up a team of communication professionals representing the researchers' and the strategic partners' home institutions; and
- collaborating with related projects funded by the Finnish Academy's Strategic Research Council.

This is justified, as it has been shown that diversity supports innovativeness and different backgrounds, knowledge and experiences form a nursery for novel ideas and outcomes, and vice versa. It is also accepted that major differences in backgrounds may enhance anxiety and insecurity. A dialogical communication approach will emphasize aspects such as the importance of listening to others, choosing language that resonates with what individuals are already thinking about, or highlighting common ground between scientists and non-scientists (Dudo and Besley, 2016).

The fourth case study will present a model integrating the outcomes of the three previous case studies. Our model may prove to be an alternative to the Japanese models of organisational knowledge creation by Nonaka (1994) and his colleagues (Nonaka and Takeuchi, 1995; Nonaka *et al.*, 2000; von Krogh, 2009).

Our approach is a multiple case study (Yin, 2009). It is based on the interpretative paradigm of organisational research (Burrell and Morgan, 1985), which is close to the interpretative discourse of research into knowledge management (Schultze and Leidner, 2002). A practice-based view of knowledge management is dominant in our study (Hislop, 2013; von Krogh, 2009).

We will utilise methods typical for action research involving triangulation. The data representing the knowledge domains of the project will consist of the research group leaders' core articles on the Scopus database, published from 1995 to 2015. We are aware of the limited coverage of Scopus in many fields of science. However, it does cover the majority of the articles of the BCDC Energy project to be analysed. Ethnographic qualitative and quantitative data on interaction will consist of surveys of the social contacts between the key actors of the community and of the content of the information and communication systems utilised in the project. Data on participant

observation of the work of the community will be collected face-to-face from meetings and workshops and by utilising portable video cameras and the Learning and Interaction Observation Forum (Leaf) at the University of Oulu, which is equipped with various advanced audio-visual services and a multimodal observation and recording system. Interview and survey data of attitudes towards public engagement in science will be gathered, and also relevant documents produced by the community.

The data will be analysed utilizing a variety of qualitative and quantitative methods. Informetrics on publications and citations, and co-word analysis of author and index terms will be applied, and Google Analytics will additionally be utilised. Social networks will be analysed by using UCINET (see <https://sites.google.com/site/ucinetsoftware/home>). Indicative qualitative content analysis will be applied for observational and interview data.

The guidelines for research ethics in empirical research in the humanities and social sciences will be followed, and the permission procedures of the Ethics Committee of Human Sciences at the University of Oulu, Finland. The principles of open science will be followed, and the data will be made available for reuse when possible. Open publishing channels will be selected when reporting the findings.

The study was started in late 2015 to be run until 2021. Some preliminary findings will be reported by the first mid-term evaluation by the Strategic Research Council, Finland, in 2017.

## Conclusion

This multiple case study will contribute to research on organisational information behaviour including public engagement and will elaborate on conceptions of knowledge management. Our study will increase understanding of the complexity of knowledge creation in multidisciplinary communities. Thus, in future studies our study's potential will also be examined to integrate the theoretical and methodological viewpoint of hermeneutical phenomenology with the ideas of the activity theory related to interaction and communication in practice.

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