

OPERATIONALIZING THEORY

Moving from Insight to Action in a SME

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Keywords: Learning organization, visualization, usability, action research, method, operationalizing.

Abstract: This paper presents a method for operationalizing theory. The method has its basis in the empirical findings arising from collaboration between the researchers and a research partner, Flower Systems Ltd. The research partner is a software company characterized as a SME. The presented method is exemplified with theories from learning organizations, usability, and visualization – which are all connected to the problem articulated by our partner. The method is an iterative process characterized by a systemic and holistic long-term view that incorporates feedback. The method takes as its point of departure the problematic area described by Flower Systems Ltd; the researchers both intervene and interpret in this problematic area, so the method is both described and verified. The paper combines the case study and action research methods in what is sometimes referred to as a “hybrid” method, the action case method. The view of innovation presented in this paper is that innovation entails supporting change processes in order to create purposeful and focused change. The underlying research question has been: How usable is our method for operationalizing theory in solving the problem of adapting to changes in an SME?

1 INTRODUCTION

The departure point of this paper is the intersection between the desires of researchers to operationalize theory and the desires of small- or medium-sized enterprises (SMEs) in order to adapt to changes.

The desire of researchers is that the knowledge created in their scientific field should serve to guide practitioners. The information systems (IS) field is sometimes referred to as an “applied science” (Rose, 1998) or “applied field” (Dubin, 1983) in which the knowledge created should also provide practical guidance. Questions regarding the relevance of information systems research to practice have been addressed (Benbasat & Zmud, 1999) and discussed (Appelgate & King, 1999; Huang et al., 1999; Lyytinen, 1999). Academics must be cautious of only addressing the scientific community regarding issues defined solely by academia. Benbasat and Zmud (1999) identify the need for IS researchers to be exposed to practical contexts in which IS-related usage and management behaviours unfold; one recommendation they put forward is that we should

first look to practice to identify research topics, looking to the IS literature only after a commitment has been made to a specific topic.

The desire of a SMEs has its basis in a need to adapt to changes in the marketplace to retain their competitive advantage (Street & Meister, 2004). An SME is typically characterized by a flat organizational hierarchy, with informal communication channels, in which the owner and the manager are involved in daily business operations. The daily routines of an SME are characterized by short-term development cycles, for example, all problems needing to be solved are urgent ones connected to the production process according to managers and staff members. But the SME must still adapt to changes in the market in order to survive, though these changes could not be characterized as urgent problems connected to the production process. The literature proposes various solutions to the problem of adapting to organizational change, all of which share at least two factors, namely, attention to activities performed in the organization and the state of mind of the staff and management (Senge, 1994).

1.1 CILO

Communication in learning organizations-CILO-is a research project funded by the Swedish Knowledge Foundation. The project started in January 2006 and will last to the beginning of 2009. The mandate of the Swedish Knowledge Foundation is to enhance Sweden's competitiveness by supporting research and competence development in industry.

Four researchers and five research partners (all characterized as SMEs) are involved in the research project. This paper focuses on the empirical findings arising from collaboration between the researchers and one of the SMEs, Flower Systems Ltd. The collaboration focuses on the two different desires of the SME and the researchers.

Flower Systems Ltd. (FSL) is a software development company. The company was established in 1986 and is 100% owned by two partners who also are operationally active. The company has 11 employees. Their basic product is a development tool called Nectar 4GL, used for developing and running applications for database handlers in multi-user systems. With this generic tool, FSL has constructed an application, ISOX 2000, which is a system for handling case documentation in local government social services. Since their customers are largely government departments, they must comply with a highly formalized routine, i.e., the governmental purchase agreement (*statligt upphandlingsavtal*), in order to win contracts. Over the past three to four years the concepts of user-friendliness and usability have been highlighted in governmental purchase agreements, and employees of various governmental social services have also requested changes in ISOX 2000 to make it more user friendly. FSL has had to deal with the concept of user-friendliness and usability in changing both ISOX 2000 and how it does business. This is an example of the desire to adapt to changes in a SME which could be supported by the knowledge within the usability area of the researchers.

1.2 Research Question and Aim

This paper describes and verifies our method, the CILO method, for operationalizing theory. The proposed method is presented in section three and the theories to be operationalized are in section four. The underlying research question has been: How usable is our method for operationalizing theory in solving the problem of adapting to changes in an SME?

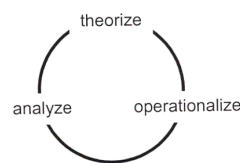


Figure 1: Model of conceptualizing theories (Rose, 1998).

Researchers use theories for three different purposes (Rose, 1998):

To analyze

To theorize

To operationalize

The third purpose, to operationalize (see Figure 1), concerns how well a theory offers operational guidance to practitioners

The process of creating knowledge comprises four basic elements and the relationships between them (Braa & Vidgen, 2000; Vidgen & Braa, 1997):

Theory:

Research question

Conclusion

Empirical data

In any applied field/science the theory used must confront reality. If we regard theory as a process in which the researcher is the master of an iterative process of induction and deduction, induction is a process starting with sound observations and descriptions that generate theory, while deduction involves explorations of the theory's implications. This deductive process provides us with hypotheses that become the basis for further empirical testing based on observations and description (Dubin 1983).

2 RESEARCH PROCESS

The research conducted in the CILO project could be characterized as qualitative research with an underlying interpretative philosophy (Myers, 1997). The main research method used is action research (Baskerville, 1999; Baskerville & Myers, 2004) as defined in the MISQ special issue on action research.

The present paper combines the case study and action research methods and has its basis in the action case method (Braa & Vidgen, 1997; Braa & Vidgen, 2000; Braa & Vidgen, 1995; Vidgen & Braa, 1997). The main motivation for this method, the "action case" method, as applied in the present study, is that we selected data from one specific case, the FSL case, and both interpreted this case in

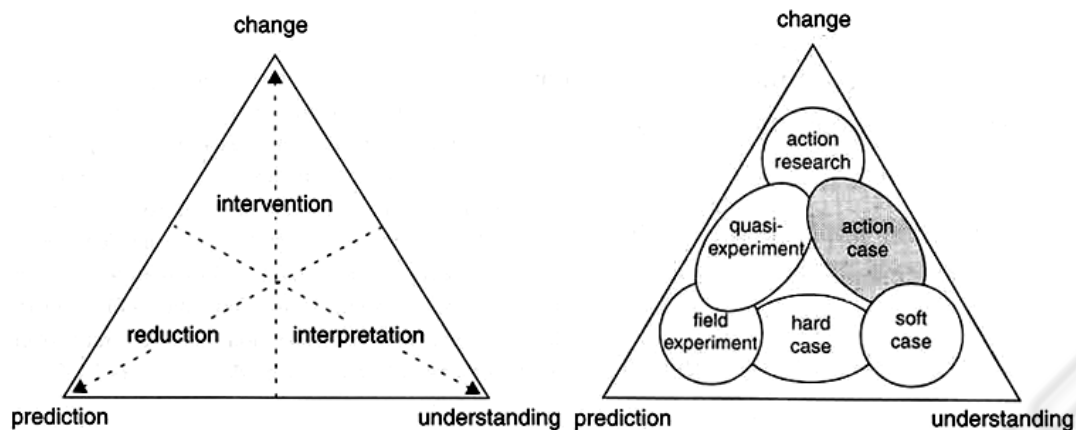


Figure 2: Positioning the action case method (bra and vidgen, 1995).

depth and made interventions in the company (Figure 2).

Braa and Vidgen (1995) present three main arguments justifying the use of the action case method: 1) in practice, most research projects involve aspects of both the action and case methods, 2) it allows the testing of both theory and IS techniques, and 3) it can reduce the scope of a larger project.

According to Braa and Vidgen (1995), the action case method is characterized by:

Potential to change the organization (AR), with a focus on small-scale changes

Inclusion of case study elements, supporting an understanding of the domain

Intervention (in real time) and interpretation

Output comprises two level of results, i.e., concrete and conceptual

These four characteristics are clearly evident in the present case. The action case method highlights two not exclusive skills of the researcher (Mumford, 2001). First, the ability to create relationships with the staff and managers at the organization where the intervention takes place; this skill is crucial, as the staff and managers should never question the researcher's trustworthiness when it comes to the interests of the organization. The second skill comprises what are sometimes collectively referred to as "social skills," i.e., the researcher must be able to deal with the interests of various people (from different groups, with different tasks, etc.), interests that may sometimes be hidden in early stages of research. It takes great social skills on the part of the researcher to make the interviewee comfortable enough to reveal the hidden agendas that inform daily practices.

3 THE PROPOSED CILO METHOD

The CILO method is an iterative research process characterized by a systemic and holistic long-term view that incorporates feedback. The CILO method takes as its point of departure the problematic area described by a partner; the researchers intervene in this area based on their interpretation of the data collected. We use three different methods to collect data: seminars, interviews, and visualization (Figure 3); the ensuing analysis is based on the chosen theoretical framework and on benchmarking activities.

The general principles applied when interviewing are as follows:

Preliminary interviews aim to create a relationship with the interviewee to secure a free and flexible flow of information

The interviewee is always right.

We impose no view on the interviewee. This is the most important principle and it is based on our experience that when it comes to dialogues concerning why a company has not implemented innovations, it is of the utmost importance that the interviewee not get the impression that s/he has missed an opportunity.

We make a suggestion based on the analysis of previous interviews. The suggestion is always presented as a question, to guide the interviewee to ask for information concerning solutions.

The goal is for the interviewee to become aware of the current situation and of various possible ways to improve it.

All interviews are recorded and visualization is performed in the interviews.

At least two researchers are present at every interview.

Seminars are held with the researchers who took part in the interviews in order to share impressions.

Visualizations of models and processes are based on the interviewees' experience of the current situation in the organization.

The core of the method consists of interviews with knowledge workers in the organizations

3.1 The First Phase: Gaining and Defining Insight

The first iteration has one goal and that is to find out what should be improved at the SME, i.e., to define the problematic area. The first goal is to arrive at a situation in which the interviewees at the organization gain insight into a shortcoming of the organization. For example, perhaps a process is not efficient or a product does not met customer

The second goal is to reach consensus that the shortcoming is important, after which we describe it in detail. In the interviews we use the following tools:

Brainstorming seminars

Simulated interactions between the company and its customers or between a system and the end users of the company's system

Visualizations of conceptual relationships

Visualizations of processes (based on interviews with customers/clients of the organization)

To achieve these two goals we iterate until we have a map of all the problems/needs that are crucial for the long-term survival and growth of the organization.

3.2 The Second Phase: From Insight to Action

Be aware that we never directly suggest how problems should be solved; instead, all suggestions are put forward as questions. We do this since we have empirical evidence that promoting any type of solutions could spoil the free flow of dialogue. The researchers and staff discuss the history underlying each shortcoming/opportunity and engage in free dialogue about how similar processes are usually handled in other organizations. In these discussions we use the following tactics:

Internal benchmarking over time: What various approaches have been tested? What were the results? Why did these results occur?

Benchmarking with organizations in similar or related branches: How can similar problems be solved in other companies?

Matching the situation with analogous problem solving methods from the theoretical framework

Using the interpretation to discover the similarities, differences, and outstanding features that become evident in the benchmarking or analogical matching

Responding to the various solutions to which the interviewee assigns priority.

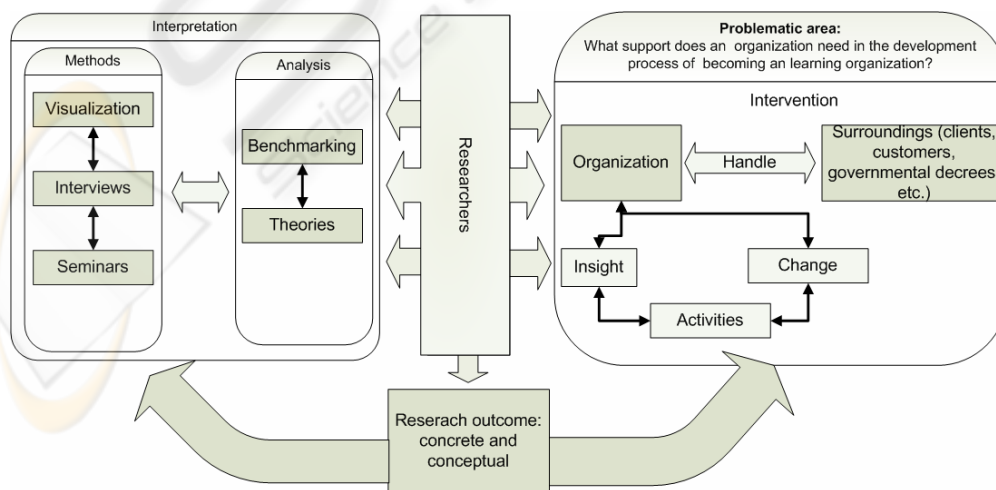


Figure 3: Overview of the CILO method expectations.

3.3 Third Phase: From Action to Learning

The aim of such efforts is not simply to support companies in implementing innovations, but rather to support them in becoming learning organizations. The idea is that the organization should not have to be dependent on the type of work described above in the first and second phases. To help these companies becoming learning organizations, we promote the creation of double feedback routines; this is done via the following activities: 1) Analyzing and creating standard descriptions of processes that can be classified as organizational learning, 2) Determining numerical measures of performance in the processes.

4 THEORIES

The theories applied in this paper are rooted in three different fields – learning organizations, usability, and visualization – which are connected to the problem articulated by FSL. The organization in which the researchers intervene are on the right hand in figure 3 and the theories the researchers use to interpret is in the left hand. Staff of FSL has often complained that they are blind to the defects in their work, in this particular case, problems relating to the concepts of usability and user-friendliness as demanded by the staff of various governmental social services.

4.1 Learning Organizations and the Concept of Innovation

Organizations must change in order to survive (Aldrich, 1999; Argyris & Schön, 1996; Christensen, 1997; Davenport & Beck, 2001; Huber, 2004). This fact has been a focus of both learning organization researchers (LOR) and innovation researchers (IR). The view of innovation research presented in this paper is that innovation entails supporting change processes in order to create purposeful and focused change. Though these two research fields share many concepts, there are two major differences: first is the concept of reflection presented in LOR, and the second is the focus on strategy evident in IR.

The first difference has its basis in the work of Donald Schön, which has in turn been expanded on by Pete Senge (Schön, 1983; Senge, 1994). The practitioner's ability to reflect in and on action by turning the mirror inwards in order to bring the internal pictures of the world to the surface is an

important issue. People are viewed as agents able to act upon the structures and systems of which they are a part. Learning has its starting point in people and their ability to reflect, organizations learn only through individuals who learn, but individual learning does not guarantee organizational learning. The second difference, the focus on strategy, has its basis in a focus on managers and their decisions. Communication should be built on strategies formulated by the managers (Koput, 1997). The focus to some extent is on knowledge management, where the knowledge adds value when applied to improve, change, or develop specific tasks and activities (Scozzi & Garavelli, 2005). A systemic view is shared by both types of research, in that both emphasize that there should be a focus on the whole instead of the parts. The view of organizations as dynamic processes containing feedback is also shared.

4.2 Usability

Usability has been a concern of both practitioners and researchers. The International Organization for Standardization (ISO), for example, attempted to define usability in ISO 9126 as, a set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users (ISO9126, 1991). A later ISO definition is set forth in ISO 9241-11 where usability is defined as, the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO9241-11, 1998). So usability itself is always defined by the users, a fact that has directed attention to the usability process (Norman, 1988), i.e., user-centered design, instead of to the product *per se*. During this process we need to consider:

Who are the users, what do they know, and what can they learn?

What do users want or need to do?

What is the general background of the users?

What is the context in which the user is working?

What has to be left to the machine? What to the user?

ISO has set forth the human-centered lifecycle process descriptions (ISO/TR18529, 2000):

HCD.1 Ensure HCD content in system strategy

HCD.2 Plan and manage the HCD process

HCD.3 Specify the user and organizational requirements

HCD.4 Understand and specify the context of use

HCD.5 Produce design solutions

HCD.6 Evaluate designs against requirements

HCD.7 Introduce and operate the system

They apply this HCD process in what they call a “usability maturity model,” which is used to evaluate the ability of an organization to work with HCD. The evaluation is done by ranking every HCD process on the following scale: incomplete, performed, managed, established, predicted, and optimized.

Some researchers (Shneiderman, 1998) consider usability as part of “usefulness” and as composed of: Learnability (e.g., intuitive navigation): How much training do users need?

Efficiency of use: Can users easily accomplish their intended tasks? For example, can users accomplish intended tasks at their intended speed?

Memorability: What documentation or other supporting materials are available to help the users? Can users find the solutions they seek in these materials?

Few and non-catastrophic errors: What and how many errors do users make when interacting with the product? Can the user recover from these errors? What do users have to do to recover from errors?

Does the product help users recover from errors?

Subjective satisfaction

4.3 Visualization

Two streams of use can be identified when it comes to applying visualization techniques in the IS field:

Visualizing data or information for the design of a GUI or service in an information system

Visualizing business processes in organizations

In both streams the aim of using visualization techniques is to enhance mutual understanding and communication. For example, task analysis and needs analysis in the user-centered approach to designing IS both involve visualization for the actors involved in the process, to ensure that they all understand the nature of the service being developed (Löwgren, 2004a). The two streams are not exclusive; for example, a business process model could be used to improve, or at least attempt to improve, a GUI.

As mentioned earlier, FSL has had problems with the concept of usability/user-friendliness, and this prompted the researchers to employ both streams of visualization techniques. The first stream has been used in discussing the GUI of the ISOX 2000, while the second has been used in analyzing how the civil servants actually work on their tasks during the course of their daily routines.

4.3.1 Visualizing Data or Information

Many different visualization techniques can be used in information system development processes to visualize/sketch the services under development; this paper will examine several of them, as follows:

Storyboards (Löwgren, 2004b) offer one way of visualizing the findings of the task analysis.

Paper prototypes enable developers to try out different parts of a system at low cost and with great time efficiency (McCracken & Wolfe, 2004).

Flowchart/nodemaps are also useful in visualizing the system for the various actors; a possible disadvantage is that interpreting nodemaps requires training that some end users lack (Shneiderman, 1998).

Unified modeling language (UML) has become standard when developers visualize, specify, and document the structure and behavior of a service. UML is used in communication between designers and developers.

4.3.2 Visualization of Processes

Many different visualization techniques can be used in business process modelling activities. Two of the most popular nowadays are event-driven process chains (EPC) and business process modelling notation (BPMN). The main reason for the popularity of EPC is that it is a component of the enterprise resource planning system, SAP.

EPC consists of the following elements (Aalst, 1999.):

Functions: These basic building blocks correspond to an activity (i.e., task, process, or step) that needs to be executed (see Figure 4).

Events: These describe the situation before and/or after a function are executed. Functions are linked by events; an event may correspond to the post-condition of one function and the precondition of another (see Figure 4).

Logical connectors: These can be used to connect activities and events to specify the control flow. There are three types of connectors: \wedge (and), XOR (exclusive or), and \vee (or) :

BPMN has attracted considerable attention in the IS research field as an easy to use description technique for documenting and re-engineering processes (Recker et al., 2006). BPMN consists of the following objects ((White, 2004):

Flow objects: These basic building blocks are events (circles), activities (rectangles with rounded corners), and gateways (diamonds).

Connecting objects: These basic building blocks (mostly arrows) indicate sequence flow (filled

arrows), message flow (dashed arrows), and associations (points).

Swimlanes: These basic building blocks comprise pools (graphical container) and lanes (sub-partition of the pool).

Artifacts: These basic building blocks consist of data objects, groups, and annotations.

In the CILO project we do not intend to fully apply any formal visualization notation system. We do, however, acknowledge the influence of the descriptions of the abovementioned techniques, but we aim to develop, in an iterative and evolving process, a simple and, for the project, appropriate notation system supported by Microsoft Visio. As mentioned earlier, a visualization technique is a powerful way to establish mutual understanding and communication between the researchers and company representatives, and a powerful tool to use to raise awareness of the usefulness of implementing the systemic measuring of business processes in an organization.

5 RESULTS

The results will be structured according to the proposed CILO method. The main research question was “How usable is our method for operationalizing theory in solving the problem of adapting to changes in an SME?” and this question was matched to a problematic area described by the partner, FSL.

5.1 The First Phase: Gaining and Defining Insight

Revealing the experienced shortcoming of the organization provided the insight that FSL did not know how to deal with the concepts of usability and user-friendliness. These two concepts are critical in the government purchase agreement; as well, various employees from various governmental social services have requested changes in the product to make it more user-friendly. To describe the problem in detail we conducted seminars, brainstorming, and interviews with staff members at a governmental social service department. After all, it is the end-user who always defines usability. For the visualization of data we used flowcharts, paper prototypes and storyboards for the visualization of processes we used a mix of BPMN and EPC. The users’ complaints about the system’s usability fell into four general categories:

First impressions/the starting screen

Too much information (approximately 80 different data fields appear on screen)

Users lose track of where they are

The software should be more “web like”

5.2 The Second Phase: From Insight to Action

These four categories were followed up in the second phase. The visualizations of processes and data were transcribed between the meetings and were continuously improved; they served as starting points for interviews and seminars.

The starting screen was changed to make it more personal; the five most recent tasks on which the social services secretary had worked should be reachable by hypertext linking, and it should be possible to search by task number or social security number.

The solutions proposed to the problem of too much information were hypertext linking, clustering interrelated data, and aligning data with borders.

The last category is still under discussion. The idea of integrating processes in the GUI has been proposed, but how this should be connected to the database and how to handle the need for metadata have not yet been resolved.

It turned out that the software could be made more “web like” by adding a main menu on the left side of the screen.

5.3 Third Phase: From Action to Learning

The idea is that the organization should not be dependent on the type of work described above in the first and second phases. Considerable time was spent discussing the needs of the users and their changes of opinion over time. In several years usability will not mean the same thing as it does now. The proposed solution is a process comprising weekly meetings at which participants should discuss what they learned from the end-users in the previous week.

6 CONCLUSION

This paper focuses on the proposed CILO method and how usable it is for operationalizing theory in the context of implementing innovations in an SME. In this particular case the method turned out to be very successful, and there were strong indications of

the method's usability. Validation of this proposed method has been done by the staff members of FSL. The research process used was the action case method, in which one of the fundamental components is intervention; we should not disregard the intervention and how this has affected the staff members of FSL.

We intend to use the CILO method with our other research partners in order to gain a broader understanding of the strengths and weaknesses of the method

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