The knowledge dynamics of organizational innovation
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Chapter 8
Methodology

8.1 Introduction

Discussing the methodology of a research involves discussing the empirical issues; in other words, describing and explaining the ‘actions that we undertook for the empirical research’ [de Groot 1961]. The present chapter therefore respectively discusses the design of the present research [8.1], the group that participated [8.2], the instruments used to operationalize our theoretical concepts [8.3] and how we went about conducting our research, discussing the procedure [8.4].

8.2 Design

Our research is based on the one-group pre-test – post-test design, a quasi-experimental design [see figure 8.1a]. This design is based on within-individual treatment comparison in which one group of individuals undergoes treatment as opposed to between-individuals, in which two or more different groups each get a different treatment. So in our study, 18 planners participated in all three measurements. In a within-individual design, one group of individuals will be subject of a pre-test [T0], then undergo the treatment [E] after which a post-test [T1] follows [see figure 8a]. The effect of the treatment will simply be established by examining the [average] difference between T1 and T0 [Judd, Smith, & Kidder 1991].

<table>
<thead>
<tr>
<th>T0</th>
<th>E</th>
<th>T1</th>
</tr>
</thead>
</table>

Figure 8.1a: One group pre-test – post-test design
T0: pre-test, T1: post-test, E: event

The design of the present study is a variation on the one-group pre-test – post-test design; it involves two consecutive events. We therefore introduce a second post-test, one for each event. The first ‘event’ was the training on the new planning software ZKR [T1] and the second ‘event’ was the actual working with
the planning software ZKR, so the experience that the planners gained \([T_2, \text{see figure 8.1b}]\). We did not include a control group for this study. A control group functions as a comparison, to evaluate the effect of the treatment. The main aim of our study is to understand the knowledge dynamics within a field setting. Therefore, our first interest is one of longitudinal concern rather than comparing a ‘treatment’ situation to a ‘non-treatment’ situation.

![Figure 8.1b: Design present study: A variation on one group pre-test – post-test design](image)

**Figure 8.1b: Design present study: A variation on one group pre-test – post-test design**

<table>
<thead>
<tr>
<th>T0</th>
<th>training</th>
<th>T1</th>
<th>experience</th>
<th>T2</th>
</tr>
</thead>
</table>

We expanded our variation on the one group pre-test – post-test design by using three sub tasks of planning, namely gathering information, negotiating and [the actual] scheduling [see also chapter 5 on planning]. This resulted in a 3 [activity: gathering information, negotiating, scheduling] \(\times\) 3 [measurement: 1, 2 and 3] within-subject design, consisting of eight cells, as the first measurement did not involve the subtask of scheduling, [see figure 8.1c].

![Figure 8.1c: Research design](image)

**Figure 8.1c: Research design**

We chose this design [figure 8.1c] for the following reasons. First of all, the three different measure points in time provide the opportunity to establish possible knowledge changes during the innovation process. Furthermore, the first measurement functions as a base, which enables comparison of a non-innovational situation to an innovational situation. Secondly, the second
measurement was chosen to measure the effect of the training of ZKR. And the third measurement in time was chosen to measure the effect of actually working with ZKR. Then, to understand the effect of task domain we differentiated between three subtasks. Finally, a consideration to choose this design was a result of the organizational constraints to conduct empirical research.

8.3 Participants

The participants all worked at the care institution of Bartiméus. As the change in personnel was substantial over the one and a half years that we gathered the data for this study, it was not possible to have one and the same group of planners. Figure 8.2 shows an overview of all the participating planners and their ‘distribution’ over the three measurements. Before the implementation of ZKR 35 planners participated, 31 planners after the training with ZKR and 24 planners in the third measurement. In total, 18 planners participated in all three measurements.

Figure 8.2: Overview of participating planners over three measurements

8.4 Operationalization

8.4.1 Innovation

The independent variable of this study is innovation in the sense that we measured the effect of the innovation process at different points in time; we did not oppose an innovative situation to a non-innovative situation.
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We studied this variable at three values: 1] no innovation of the new planning software, the first measurement, 2] at the beginning of the innovation, the second measurement, at this time the planners had had training in ZKR, and 3] the innovation was operational, the planners had gained experience with ZKR over a period of six months, the third measurement.

The first measurement
During the first measurement there was no innovation and application of the planning software ZKR. Although some planners were aware of the coming implementation of ZKR, the planners had no specific idea of what was going to happen. Some planners were a bit skeptical as they suspected a great time investment would be needed to work with ZKR, which would be a waste of time as they were satisfied with the way things were [see also chapter 5]. However, some were eager to start working with ZKR. Thus the planners at this time were not confronted with the innovation and they made the duty roster by hand as they had always done. Therefore, their knowledge of planning had not been influenced by the innovation of the new planning support software ZKR.

The second measurement
At the time of the second measurement the implementation of ZKR had started. The planners had had their training on the new planning support software ZKR. The effect of this training was that the planners became more aware of the way that they [used to] plan and the consequences that the implementation of ZKR could have on the way that they made the duty roster. Therefore, their knowledge of [the subtasks of] planning started to be influenced by the implementation of ZKR.

The third measurement
During the third measurement the planning support software of ZKR was operational. The planners had worked with ZKR for half a year, which changed their way of planning from making the duty roster by hand to making the duty roster with planning support software. In effect this meant that the planners had made at least three duty rosters with the new planning software ZKR. In studying the relationship between knowledge and innovation this measurement shows the impact of the applied innovation.
8.4.2 The three knowledge types

Chapter 4 discussed the three knowledge types, emphasizing sensory knowledge to emerge when difference is perceived, coded knowledge when communication is needed and theoretical knowledge as the essence of a concept is revealed. These three starting points form the foundation of our operationalization.

Sensory knowledge

Sensory knowledge is essentially knowledge through the senses, without the intervention of a code. This entails applied knowledge. Therefore, a key characteristic of this type of knowledge is that it needs demonstration in a face-to-face situation to communicate. In order to make a construct of sensory knowledge we derive other characteristics from this key characteristic [see the Appendix for details].

- Personal transfer of knowledge
- Learned through experience
- Communication through use of metaphors and analogies

Coded knowledge

Coded knowledge is essentially knowledge that frames; it is represented in a sign. This entails verbalization or another kind of sign to capture this knowledge. Therefore, a key characteristic of this type of knowledge is that it can be captured in words. In order to make a construct of coded knowledge we derive other characteristics from this key characteristic [see the Appendix for details].

- Can be verbalized
- Learned from handbooks
- Use of impersonal communication media, such as e-mail or other information systems.

Theoretical knowledge

Theoretical knowledge is essentially knowledge about the meaning of a concept. This entails reason and structure, taking different sides and putting the concept into perspective. Therefore, a key characteristic of this type of knowledge is that it can be reasoned about or with. In order to make a construct of coded knowledge we derive other characteristics from this key characteristic [see the Appendix for details].
8.4.3 Moderating variables: Personal characteristics

Education was operationalized as the highest level of education that the planners had completed. Job experience was operationalized as number of years that the planners had had experience in their present job. Age was operationalized as number of years and contractual hours were operationalized as the amount of hours that the planners worked per week.

8.4.4 Questionnaire

The Castor-research group of the University of Groningen developed the questionnaire that was used in this study. This research group included specialists on semiotics, cognitive psychology and communication studies. Furthermore, the questionnaire was also co-developed by experts in the field of nursing as well as planning. The questionnaire was piloted on planners in the field [hospital planners - Leeuwarden].

The questionnaire for the first measurement contained three parts 1] a general part, about the planner [e.g. about education, experience, age etc.], the organization and questions about the implementation of ZKR, 2] a specific part about gathering information, 3] a specific part about negotiating. For part 2 and 3 the same cluster of questions was used in our questionnaire concerning the subtasks. These questions included questions on knowledge types, learning, information sources, expectation and communication. The Appendix shows the questionnaire used in the first measurement.

For all three measurements the same questionnaire was used. However, during the first measurement it turned out that filling out the questionnaire was very time consuming. As this did not improve the motivation of the planner for filling out the questionnaire the questionnaire for the second measurement was carefully narrowed down – we omitted the open questions – maintaining the possibility for comparison; so the questions in the questionnaire for the second measurement were the same as for the first measurement.
The second and third questionnaire included an additional set of questions on a third subtask, scheduling. Thus, the sub task of scheduling was not included in the first questionnaire.

### 8.4.5 Validity and reliability

Carmines and Zeller (1994: 4) distinguish validity and reliability as follows:

*… while reliability focuses on a particular property of empirical indicators – the extent to which they provide consistent results across repeated measurements – validity concerns the crucial relationship between concept and indicator.*

The previous section described the operationalization of our three theoretical concepts. In terms of validity we state that this operationalization was based on content validity and face validity. That is, the operationalization was based directly on the theoretical framework, after which we consulted experts for a face validity check on this operationalization. We will elaborate on the reliability in the following chapter.

### 8.5 Procedure

Three questionnaires were sent out to the planners during the implementation process, 1] before the implementation of the planning software ZKR [January / February 2001], 2] after the training for the planning software [July / August 2001] and 3] approximately one and a half years after the first measurement, when the software program ZKR had been operational for about half a year – this comes down to making about three duty rosters using ZKR [July / August 2002].

Before the questionnaire was sent out the participants received a letter in which the aim of the research was explained [before the first questionnaire the planners also received a letter from the organization]. After that the questionnaire was sent out. When the participants received the questionnaire, the ones that did not return it were approached and kindly requested to fill in the questionnaire. When there were any difficulties with the filling in of the questionnaire the participants could contact us. The third questionnaire was personally handed to the planners, which had the advantage of being able to directly communicate with the planners.
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