Chapter 6
The Conceptual Model

6.1 Introduction

The previous four chapters explored the theoretical background to the research questions posed in the introductory chapter. They will now function to provide a theoretical framework for a more precise research focus. We [re]formulate our research questions, construct a conceptual model and deduct hypotheses from this model.

6.2 Research questions

1. What happens to the knowledge [types] of planners during an organizational innovation such as the implementation of planning support software?

Furthermore, we formulate the following related questions

2. What kinds of knowledge will change in the introduction of a new way of working, such as the implementation of planning support software? And what differences can we discern in the presence and dominance of knowledge in terms of content and type?

3. With respect to the innovation and the expected change, in what way do the subtasks of planning differ in terms of knowledge types?

4. What is the effect of personal characteristics of the planners on knowledge change in general and specifically on the knowledge dynamics of the planners during the implementation of planning support software?

6.3 Integrated theoretical framework

6.3.1 Introduction

The conceptual model in the most basic form thus captures the effect of innovation on the knowledge dynamics of the individual end-users [see figure 6.1a].
The innovation process will cause a shift in the configuration of these three knowledge types at the level of the end-user and indirectly at the organizational level. Hence, the newly created situation, after the innovation has taken place asks for a new configuration of knowledge of the end-user in order to function within this new situation; this implies that the knowledge of the end-user will change.

The innovation triggers the process of knowledge [dynamics] in terms of knowledge types. Essential is perception, and in particular the perception of difference as this triggers the process of knowledge dynamics. And in order to perceive a discrepancy between our perception of what was and our perception of what is, our cognitive-semiotic model is leading as a theoretical model.

Figure 6.1a: Conceptual model in the most basic form

Figure 6.1b: The innovation process influences the three individual knowledge types and leads to conversions and changes

Extending our basic conceptual model we assume that the innovation process causes the three individual knowledge types to change [see figure 6.1b]. Furthermore, two specific combinations in knowledge type change can be characterized as knowledge conversion [see above]. Thus, in extending and specifying the influence of innovation on knowledge types we see five different influences [see figure 6.1b].
6.3.2 Personal characteristics

We expect that knowledge of individual planners is related to some of their personal characteristics. We focus on education, job experience, contractual hours per week and age [see figure 6.1c below].

Education

Education offers the use of a framework to perceive the world. In other words, it helps one to structure. This is the essence of theoretical knowledge. Thus, we expect education to be of influence on the quality of theoretical knowledge of the planners. The framework, in turn, is also essential for perceiving and processing new information. That is, to acquire knowledge. Thus, we expect education to influence the relationship between innovation and knowledge types, as education is one of the main tools to perceive. That is, education hands us models to process and interpret information. And these models determine what we perceive and thus what influences our thinking and knowledge.
Job experience

We also expect job experience to influence the relationship between innovation and knowledge. A planner with greater job experience will have encountered more different situations and will thus have more to compare to. In a sense, the knowledge of planners with greater job experience as well as older planners, is deeper imbedded in other knowledge.

Age

Then, we are also interested in the effects of age on the relation between knowledge dynamics and innovation, as younger planners often have a more restricted knowledge. Therefore, younger planners are expected to experience more change than older planners.

Contractual hours per week

Finally we expect the number of contractual hours per week to influence the relationship between knowledge and innovation. We argue that more contractual hours per week leads to easier build up of routines. On the other hand, fewer contractual hours necessitates communication.

6.3.3 Subtasks

Our conceptual model is almost complete. The last refinement forms the distinction between three subtasks based on their different characteristics as chapter 5 showed. Although we have no specific expectations on the differences in knowledge dynamics between the subtasks, we do expect that these differences in characteristics will differentiate the knowledge types and the knowledge type dynamics caused by innovation [see figure 6.1d]. So gathering information will show a different change pattern than either negotiating or scheduling. But also, knowledge type patterns before the implementation will differ between the subtasks.

Gathering information

Important to the execution of the gathering information task is the coded type of knowledge. We therefore expect this subtask to more heavily rely on coded knowledge than the other two types of knowledge, sensory and theoretical. Furthermore, we expect this subtask to rely more heavily on coded knowledge in comparison two the other two subtasks, negotiating and scheduling.
Figure 6.1d: The 15 dependent variables of our conceptual model in groupings of the subtasks

**Negotiating**

Important to the execution of the negotiating task is the sensory type of knowledge. We therefore expect this subtask to more heavily rely on sensory knowledge than on the other two types of knowledge, coded and theoretical.

**Scheduling**

Important to the execution of the scheduling task is the theoretical type of knowledge. We therefore expect this subtask to more heavily rely on theoretical knowledge than on the other two types of knowledge, sensory and coded. Furthermore, we expect this subtask to also rely more heavily on theoretical knowledge in comparison to the other two subtasks, gathering information and negotiating.

### 6.4 Conceptual model

Now that we have reviewed all the variables of which our conceptual model consists we can construct our total model [see figure 6.1e]. In the following we will formulate the hypotheses drawn from this conceptual model.
6.5 Hypotheses

We expect that the implementation of ZKR will lead to an increased need for communication as the making of the duty roster is no longer restricted to individual planners. Rather, the implementation of ZKR implies a need for consensus on making the duty roster. We therefore expect the coded knowledge to increase. Note that, as we explicitly expect the greatest changes to occur for coded knowledge, most of our hypotheses focus on this particular knowledge type.

The emergence of codes and consensus implies a great potential time gain and more effective communication. This effective way of communication will have an additional effect in that the sensory knowledge will be exercised less and less.

Therefore, we formulate hypothesis 1a and hypothesis 1b as follows:

**Hypothesis 1a**

The implementation process of ZKR will lead to a decrease of sensory knowledge for all subtasks.

**Hypothesis 1b**

The implementation process of ZKR will lead to an increase of coded knowledge for all subtasks.
The use of ZKR will also lead to a better understanding of the planning task and its individual subtasks. We therefore formulate **hypothesis 1c** as follows

**Hypothesis 1c**

*The implementation process of ZKR will lead to an increase of theoretical knowledge for all subtasks*

Then, our second expectation concerns the conversion of knowledge. Combining **hypothesis 1a** and **hypothesis 1b** we expect a conversion of sensory knowledge into coded knowledge; we expect sensory knowledge to decrease during the innovation and we expect coded knowledge to increase. We therefore formulate **hypothesis 2** as follows

**Hypothesis 2**

*The implementation process of ZKR will lead to a conversion of knowledge from sensory knowledge into coded knowledge*

Personal characteristics are expected to moderate the influence of the implementation of ZKR on knowledge. The first personal characteristic that we want to focus on is education, as education is a learning process; one learns to consider alternative perspectives and approaches to certain situations. Education can be described as the learning that one has already experienced; and ones learning experiences influences the learning experiences that will take place in the future. That is, ways to go about situations, in a practical sense as well as in a more abstracted sense. It might be that the higher the education, the crystallized the way to perceive has become. Therefore, we expect that planners with a higher education will have more theoretical knowledge than planners with a lower level of education. And we argue, the more theoretical knowledge the more susceptible to change and learning. Furthermore, the more theoretical knowledge a planner has the easier they can perceive differences. And perceiving differences is the critical factor for developing sensory knowledge. Now, our expectation regarding the moderating effect of education can be formulated as follows.

**Hypothesis 3a**

*During the implementation process of ZKR planners with higher professional vocational education [in the Netherlands: HBO] will show a stronger increase*
Hypothesis 3b

During the implementation process of ZKR senior vocationally educated planners (MBO) will show a stronger increase of coded knowledge in comparison to higher professional vocationally educated planners (HBO).

A second personal characteristic, which we expect to moderate the influence of the implementation of ZKR on knowledge types of the individual users, is job experience. We argue that experienced planners have strong coded knowledge embedded in detailed sensory knowledge. Furthermore, we argue that the stronger the coded knowledge is, the more difficult it will be to change these codes. In this line of arguing we reason that less experienced planners will show a greater increase of coded knowledge than will more experienced planners who start to work with the DSS. In other words, novice planners will code their knowledge more quickly based on less sensory knowledge [rougher sensory knowledge] in comparison to more experienced planners.

Hypothesis 4

During the implementation of ZKR novice planners will show a bigger increase of coded knowledge than experienced planners.

Using a similar line of reasoning for the personal characteristic of age as we have done for job experience we formulate

Hypothesis 5

During the implementation of ZKR younger planners will show more increase of coded knowledge than older planners.

A fourth personal characteristic that we expect to moderate the influence of the implementation of ZKR on knowledge types of individual users is the amount of hours per week that an individual planner works. We argue that the amount of contractual hours per week is a strong indicator for the use of sensory knowledge and coded knowledge [in opposite directions]. That is, the fewer hours per week an individual works the stronger this individual relies on the use of codes, as the amount of personal contact is restricted [this personal contact is a foundation for the development of detailed sensory knowledge]. However, these used codes are
not strongly embedded in firm, detailed sensory knowledge. Therefore, these
codes are strongly related to particular situations. We argue that the use of these
codes in different and changing context will be more difficult for individuals who
work fewer hours per week. Thus, whereas they rely more heavily on codes, the
codes they rely on are weaker. Consequently, we expect that during the
implementation of ZKR the fewer hours per week an individual works the easier it
will be to adopt the new way of working, but only in the narrow sense. That is, a
vulnerable use of new codes. We formulate our last hypothesis as follows

**Hypothesis 6**

*During the implementation of ZKR part time planners show less dynamics in
their coded knowledge than do full time planners*

The hypotheses formulated above will be tested in chapter 9, the data analysis chapter. The following chapter [7] will stage the empirical setting of the present research in the Bartiméus organization after which, in chapter 8, we discuss the methodology to justify our choices made on the operational issues.
The Knowledge Dynamics of Organizational Innovation