

Conclusions and evaluation of the research

The C4 protocol for expert-apprentice relations was designed in the previous chapters, using theories regarding different aspects of expert-apprentice relations and a number of case studies where the protocol was further developed. This chapter evaluates and concludes the research. The chapter is constructed as follows: in the first paragraph the research's line of reasoning is briefly recapitulated and its main findings are evaluated. Secondly, the contributions of this research to science and practice are described after which is explained how the protocol can be applied in practice. The fourth paragraph contains reflections on the research approach. The final paragraph suggests several directions for further research.

9.1. Line of reasoning and evaluation of main findings

The starting-point for this research was the observation that expert-apprentice relations can serve as a method for knowledge sharing in organisations. The question that was identified was how can contemporary organisations establish and operate master-apprentice relations within their organisations in order to improve knowledge sharing. This research attempted to answer this question and therefore the objective of this research was formulated as follows:

to create a protocol for establishing and operating expert-apprentice relations in contemporary organisations

In order to develop a protocol for introducing expert-apprentice relations in contemporary organisations, DSR was chosen as the research approach because of its aim to find solutions for specific field problems. This research aimed to find specific requirements for expert-apprentice relations. The requirements were divided into 5 categories:

1. Functional requirements
2. User requirements
3. Boundary conditions
4. Design restrictions
5. Attention points

This research was then split into three parts. Firstly, the theoretical background of expert-apprentice relations was studied. As the goal of introducing expert-apprentice relations was

to improve knowledge sharing between an expert and his apprentice, knowledge and knowledge sharing in general was studied first. Theories on learning were studied next, because learning is both the source and outcome of knowledge sharing and the expert-apprentice relation is about informal and social learning. Experts and expertise are a vital part of the expert-apprentice relation, however expertise is not a common subject of knowledge sharing theories. That is why in the third part of the theoretical background the development and construction of expertise was studied. The second part of the research consisted of a discussion of the use of expert-apprentice relations in other times and cultures. In order to extract complementary mechanisms for the contemporary use of the expert-apprentice relation, two examples were studied, the medieval master-apprentice relation and the Japanese sempai-kohai relation. Thirdly, an exploratory case study research was conducted. These six case studies served as a source for additional findings, which together with the findings of the study of literature served to determine the requirements for the design of expert-apprentice relations. The design of the protocol went through several phases and stages ultimately resulting in the C4 protocol for expert-apprentice relations. The components of the protocol reflect the different parts of the research: the theoretical mechanisms, the complementary findings of the two studied examples of expert-apprentice relations, and the findings from the exploratory cases studies. After the twenty developing case studies, the protocol was tested in four cases, justifying the protocol using pragmatic validity. The test cases supported the effectiveness of the protocol.

The outcomes study of literature in chapter two and chapter three, together with the results of the exploratory case studies in chapter four resulted in chapter five in the requirements for the design. The C4 protocol was further developed in twenty cases. An important aspect of the protocol is the identification of three primary types of expert-apprentice relations. These three types of relations follow the knowledge characteristics of the expert within the expert-apprentice relation. The three identified types are primary types: different secondary types can exist in which two or more primary types are combined. The three identified types of expert-apprentice relations are:

1. The I-dominant relation in which the *Information*-component of the expert's knowledge to be shared, is dominant;
2. The S-dominant relation in which the *Skills*-component of the expert's knowledge is dominant;
3. The A-dominant relation in which the *Attitude*-component of the expert's knowledge is dominant.

The C4 protocol for expert-apprentice relations was constructed including the three primary types of expert-apprentice relations. The base of the C4 protocol consists of four parts, each composed of several steps. The four elements that form the basis of the protocol are Composing, Connecting, Culminating, and Completing.

COMPOSING → CONNECTING → CULMINATING → COMPLETING

A total of 22 steps form the C4 protocol for expert-apprentice relations. From testing the protocol in four test cases (differentiating between alpha and beta testing) it can be concluded that the C4 protocol is an effective instrument for establishing expert-apprentice relations in organisations. The different parts of the protocol are identified in the test results and the outcomes are in line with the intentions of the protocol. The protocol resulted in functioning expert-apprentice relations where knowledge was shared between expert and apprentice. Thus, the C4 protocol seems an applicable instrument for professionals in the field. As the protocol is a solution concept and not complete solution, the protocol can only function if it is executed by a professional with knowledge of knowledge sharing and social relations. Also, because the protocol is designed to be used in a wide range of contexts, an important task for the user is being able to translate its use to fit a specific situation.

As a result of the research, the protocol has been designed from the viewpoint of an expert-apprentice relation facilitator. However, when acting in an expert-apprentice relation parts of the protocol can still be of use in the absence of a facilitator. The advantage of focussing on the facilitator of the expert-apprentice relation, is that the relation can be more controlled and monitored with respect to the organisation's goals.

To summarise, it can be concluded that the C4 protocol for expert-apprentice relations that is the result of this research, has been positively evaluated. The different elements of the protocol seem to encompass the different aspects of the expert-apprentice relation resulting in knowledge sharing between an expert and an apprentice. The general contributions of this research for science and practice are described in the next paragraph.

9.2. Research contributions

This research contributes to theory building as well as to real life knowledge management in organisations. The contributions of this research are therefore divided into two parts: first the scientific contributions of this research are described, followed by the specifying of contributions to practice.

9.2.1. Contributions to science

This research contributes to science in several ways. The first contribution to science is the creation of the C4 protocol for expert-apprentice relations: such a scientific protocol for expert-apprentice relations did not previously exist. Within knowledge management literature the expert-apprentice relation is mentioned as being part of the knowledge management toolkit. For example as a tool to induce 'socialisation' (Nonaka & Takeuchi, 1995) or situated learning in social practice (Lave & Wenger, 1991). However, the expert-

apprentice has not been analysed or 'unravelling', nor have there been studies on how to create optimal expert-apprentice relations. This research contributes to science in general, and more specifically to literature on knowledge management and informal learning in organisations. It is a first step in the process of analysing the underlying mechanisms of the expert-apprentice relation as a method in knowledge management. Important aspects are the identification of the elements of expert-apprentice relation and the primary types of expert knowledge in expert-apprentice relations. Besides the elements of the protocol itself, this research shows that within knowledge management psychological aspects are an important aspect in working with tacit knowledge. The current knowledge management literature is often concerned with technical knowledge management through information technology or by implementing top-down decisions. For example, introducing intranet to enhance knowledge sharing or trying to capture an expert's knowledge in an expert system. This research indicates once more (see for example Book & Gruhn, 2003 and Von Krogh & Roos, 1996) that knowledge management can-not exist in a purely technical dimension, but that in knowledge management non-technical or psychological factors are a key part and should therefore receive more attention. A last contribution to science is the use of Design Science Research as the research design. DSR is not (yet) a widely practiced research strategy in the science of management and organisation. This research contributes to the knowledge of DSR application in this type of research.

9.2.2. Contributions to practice

The contribution to practice follows from the characteristics that define DSR. DSR is concerned with field problems and is solution-focussed. This research contributes to practice by having created a protocol to facilitate expert-apprentice relations in organisations. The protocol is practical and concrete. Professionals in organisations can use the protocol to create expert-apprentice relations within their organisation in order to achieve different goals. For example, the goal can be to preserve the knowledge of an expert, or to stimulate the learning of a junior employee. The protocol can be used by the organisation because it is concrete and created from the viewpoint of the relation facilitator. The protocol can be used as a 'route map' in stimulating knowledge sharing within the organisation. In general, the research contributes to practice by indicating that in knowledge management the knowledge manager should focus on the knowledge domains of the participants as well as on the personal factors: i.e. the social relation that is a vital part of knowledge sharing. The following paragraph examines how management can use the C4 protocol in practice.

9.3. Applying the C4 protocol in practice

This scientific research is aimed at solving a practical problem. The problem that this research tries to solve is how to improve knowledge sharing between an expert and his

apprentice. The result of the research is the C4 protocol for expert-apprentice relations. This protocol is quite practical: the different steps that are part of the protocol are concrete and identifiable in practice. However, the protocol is a general solution: it is *de-contextualised*, that is, disconnected from context. This makes the protocol general, it is applicable in, and relevant for various contexts and situations. Managers who want to use the C4 protocol within their organisation, have to translate the protocol to their specific situation. Each situation in practice has specific and unique characteristics. In applying the protocol, the manager should take these characteristics into account. In translating the protocol from the general to the specific, the manager can use the indications and contraindications of the design which were presented in chapter 5. The indications and contraindications can serve as a guide in *contextualising* the C4 protocol. In most cases it takes a professional and experienced manager to translate the protocol to a specific context and to apply it in that specific situation.

The expert-apprentice relation can appear in various situations and compositions within organisations. The protocol can be used in the training of new employees, as well as in management development programmes and in relation to employee retirements or transfers. The manager can recognise an appropriate situation for the protocol's use, or can create a situation himself. For managers it is important to realise that the C4 protocol for expert-apprentice relations is intended to be applicable in multiple relevant contexts. The indications provide a list of knowledge problems where the protocol can be of use. What these knowledge problems have in common is that the existence and use of tacit knowledge is an important factor in these situations. The knowledge problems involve people. An important indication for the use of C4 protocol is the presence of an expert or expertise within the organisation. If the knowledge problem is concerned with expertise or the development of expertise, then C4 protocol can be of great use.

9.4. Reflection on the research design

In this research a protocol for expert-apprentice relations was created through developing case studies grounded in theory. A limitation of the research is that all cases appeared in the same context, namely the Talent Project. Although the protocol is intended to be applied in a wide range of contexts, it can be argued that the outcomes of this research only relate to contexts that correspond with the context of the case studies. However, the protocol was developed in a wide range of cases, which took place in a wide range of organisations and with a wide range of participants, and therefore the outcomes are relevant to many situations and characteristics. Further testing and applying the protocol in different contexts can justify the protocol justified for all contexts.

A second limitation that can appear in this type of research is interventionist involvement – or researcher involvement. In designing the protocol the researcher can become part of the

solution. The researcher intervenes and observes and therefore he is present in the design. If the researcher becomes part of the solution, the outcomes of the research cannot be generalised. In this research the pitfall of the researcher becoming part of the solution is avoided by having other persons applying the protocol in two test cases. This can be considered a form of Beta-testing. The outcomes here are expected to be general because the researcher was not the first interventionist (here: facilitator), the outcomes are expected to be general. However, although the researcher was absent in these last cases where the ultimate design was field-tested, the researcher did observe and analyse the cases. Therefore unintended effects cannot be ruled out. Secondly, the protocol was applied in the same environment as the researcher designed it in. Therefore a limitation to this research is that although no indications were found, the researcher involvement in the solution cannot be completely ruled out. Testing and applying the protocol in different contexts and with different facilitators can rule out researcher involvement.

The research tried to include the mechanisms that form the foundation of expert-apprentice relations. The objective was to create a map for the expert-apprentice relation. As a consequence, this map shows the route and the landmarks, but not every detail is filled in. This is because different mechanisms define expert-apprentice relations, and this research does not fully discuss or analyse all aspects of expert-apprentice relations. For example, the long-term effects of expert-apprentice relations are not included, and the effects of combinations of different knowledge domains is not thoroughly analysed. These limitations partly indicate directions for further research, which is the subject of the next paragraph.

9.5. Directions for further research

The outcomes of this research can be used as a hypothesis in further research. A hypothesis to detect if the created protocol has the intended positive effects on knowledge sharing in expert-apprentice relations. The protocol includes a broad spectrum of mechanisms, which in further research could be either studied individually, or in combination, to show their impact and specific demands in expert-apprentice relations. For example, the development from novice to expert is part of the protocol, but is not analysed to its full extent. In further research this aspect could be studied to see which, in the development to expertise, different aspects of the relation are important in order to optimise the protocol for expert-apprentice relations. The matching of experts with apprentices is another aspect of the protocol that needs further study: what are effective personality matches and what are the effects of the participants' learning styles? This research identified the underlying mechanisms of expert-apprentice relations. Further research could provide better insight into these different aspects and their effects on the expert-apprentice relation.

For the C4 protocol itself, further research is needed to test its effectiveness. When the protocol goes through extensive beta testing by different facilitators in different contexts,

more conclusions can be drawn on its functioning and effectiveness. Further testing and improving the C4 protocol for expert-apprentice relations will make it possible for professionals to install functioning expert-apprentice relations within their organisations and solve specific knowledge problems. The above suggestions for further research are concerned with deepening the protocol, improving the protocol itself. A last possible path for future research is studying how the protocol can be broadened: which situations and contexts are relevant for the protocol? A possible result may be that the C4 protocol for expert-apprentice relations proves to be applicable in a broader range of knowledge problems than is identified in this research.

