CHAPTER 2 RESEARCH METHODOLOGY

2.1 Introduction

The aim of this chapter is to describe the philosophical and methodological foundation of the chosen research plan. Since the plan entails a pluralistic approach, combining different methodologies based on different philosophies, it is necessary to describe these philosophies and methodologies in detail. Both interpretive and critical social research methodologies are involved.

This chapter will illustrate the relationship between philosophy, methodology and practice in social research according to the structure discussed in section 1.3. The development of an information system is viewed as a social activity combining social systems and technology to the benefit of the organisation and society as a whole. The emphasis therefore is on social research. Traditional positivistic views on social research are given to highlight the differences between the research strategies.

Section 2.2 begins with a discussion on different philosophies of social research; positivism is compared to interpretivism and critical social theory. The history of these approaches is briefly discussed to put research methodology in context. The section on philosophy closes with a few remarks on the influence of the different philosophies on information systems research.

Methodology develops from philosophy. Section 2.3 describes positivistic, interpretive and critical social research methodologies. Since the chosen research plan is a combination of interpretive and critical methodologies, these are discussed in detail and in the context of information systems research. Positivistic research methodology is discussed briefly to aid the continuity of the chapter.

From methodology develops practice. Section 2.4 describes positivistic, interpretive and critical research practice. Special attention is given to practices that will form part of the research plan. Once again, positivistic research practices are briefly discussed as part of this chapter.

Section 2.5 deals with specific research problems related to this study. It describes different perspectives considered to solve the problems presented by the specific research question. This is also done from a philosophical, methodological and practical perspective. The section forms the research plan for the study as described in the previous chapter.

2.2 Philosophy and social research

The purpose of research is to discover something about the world. In an epistemological sense, we may argue that all knowledge is discovered or can be tested by well-defined methods. Although new information is sometimes discovered accidentally, it can be verified by the application of methods. Hughes (1990:10) argues that it is not easy to say exactly what these methods or procedures are. One may identify procedures such as experiments, hypothesis-testing, public scrutiny and many others. When these methods are seen as a set, one can ask why one set of methods is used in preference to another. One should ask why a set of methods is superior to another. These answers are to be found in the underlying epistemological and ontological assumptions of each set of methods.

The application of a specific research method is an acquired skill that can be mastered through experience. For each problem situation or research question, the appropriate set of methods should be selected and applied. Science is dependent on the use of methods to acquire knowledge. Hughes (1990:11) states “every research tool or procedure is inextricably embedded in commitments to particular versions of the world and to knowing that world.” This implies that any method’s effectiveness is ultimately dependent on epistemological justification. Different philosophers’ epistemological views led to different stances on research models.

Positivism, interpretivism and critical social theory are henceforth viewed as different research models based on conflicting epistemological and ontological views.

2.2.1 Positivism

Positivism has been criticised so often by social scientists, that it is difficult to give an unbiased description of the model. Positivism is known as the ”natural scientists' model” of research (Lee, 1999:12).

May (1993:4) raises the following argument to illustrate positivistic thought: “We may argue that people react to their environment much as molecules which become ‘excited’ when heat is applied to a liquid. Clearly, science does not have then to ask the molecules what they think. So is it necessary that we, as social scientists ask people? We may of course, be interested in people's opinions in terms of their reactions to events that affect their lives, but only in so far as they are reacting and we wish to explain and predict their behaviour accordingly.”

The epistemological roots of positivism can be traced to the work of Bacon (1561-1626) and Descartes (1596-1650). Bacon succeeded in establishing the experiment as basis for new scientific theory. Descartes established mathematics as the fundamental instrument in scientific research.

Comte (1798-1857) extended Bacon's ideas to social sciences. He set out to develop his system of positivism, designed to revamp society for the sake of all classes, believing that his system would guarantee international peace and avoid economic dissension. Society's salvation was to be contingent upon scientific knowledge (Comte, 1896:18). Comte (1896:17) claimed that society, including values and beliefs, could be studied with the same methods used by natural science research. The basic principle of positivism is to focus on the fact, or the given, and to ignore everything else. Research is conducted firstly by accepting given facts of the phenomenon, secondly by determining laws that govern the phenomenon and finally by forecasting future phenomena according to these laws (Störig, 1959:95).

Popper (1902-1994) aimed to unify the methods used in natural and social sciences (Stokes, 1998:76). Popper (1972) assumed that facts can be gathered in the social sciences exactly the same way as in natural sciences, and that the subject matter of all sciences is essentially the same. Popper conceded that objectivity is much harder to achieve in social sciences than in natural sciences. He stated that objectivity in a social sense, means “the realising that the action was objectively appropriate to the situation” (quoted in Checkland, 1981:266).

Durkheim (1858-1917) accepted that society was a moral phenomenon and focussed his studies on groups rather than individuals. He wanted to show that society constituted a moral consciousness that was expressed in religion, in law, in the division of labour and in institutionalisation itself (Hughes, 1990:24). He attempted to prove this hypothesis, using the traditional methods of natural sciences, without reducing the moral and human nature of the social situation under investigation.

Durkheim (1985:21) stated that the social scientist must study social phenomena in the same state of mind as the physicist, chemist or physiologist when he probes into a still unexplored region of the scientific domain. He viewed a social environment in terms of cause and effect and the role of the sociologist as that of a physician. Like the physician who applies scientific findings to distinguish between sickness and health, diagnoses the cause of the sickness and develops remedial treatment for it, he uses scientific knowledge to diagnose or determine the cause of social problems and to develop solutions (Giddens, 1978:11).

Although there are many differences among positivist philosophers, such as Comte and Durkheim, Giddens (1974:2) identifies the following claims or perspectives that make up positivistic philosophy:

- Reality consists in what is available to the senses.
- Science constitutes a framework by which any form of knowledge can be determined.
- The natural and human sciences share common logical and methodological foundations, and methods of natural sciences can be applied in social sciences.
- There is a fundamental distinction between fact and value. Science deals with facts, while values belong to an entirely different order of discourse beyond the remit of science.

These philosophical assumptions led to the development of empiricism as research methodology for social research. Positivistic research methodology is discussed in section 2.3.1.

2.2.2 Interpretivism (phenomenological approaches)

People create and attach their own meanings to the world around them and to the behaviour they manifest in that world (Schutz, 1962:33). Phenomenologists call this world of created meanings and consciousness the "life world". They argue that, unlike atoms, molecules and electrons which have no meaning to each other, people do mean something to one another. These created meanings may be subjective, but they are an integral part of the subject matter of the social scientist. Lee (1999:347) argues that the study of the subjective meaning human subjects attach to behaviour, requires procedures that have no counterparts among those of the natural sciences. Interpretivism focusses on the world of meaning and methods of studying it.

The German philosopher Wilhelm Dilthey (1831-1911) moved away from a positivistic view of history towards an "irrational" understanding of life and history (Störig, 1959:197). According to Dilthey (1989a:66), it is not possible to understand the behaviour of people with reason only; it requires all our spiritual ability.

The above view was particularly important in the translation of Bible texts. One cannot apply linguistic rules only when translating Bible texts. Different parts need to be related in order to discover the original meaning of the wider social context in which they were originally produced. The translation of ancient texts requires an in-depth knowledge of the history and society of the time. The discipline, some calls it an art, of interpreting texts is known as hermeneutics (Kaiser & Silva, 1994:13). Hermeneutics is the discipline of searching for meaning.

Dilthey expanded these hermeneutic ideas to a relativistic view on history. He argued that "history was not simply the succession of events one after the another, but expressed the spirituality of social life as expressed in social institutions, law, literature, government, morality, values, and more" (Hughes, 1990:90). To study history and human behaviour, required a well-grounded method of inquiry different from positivistic methods. Hughes (1990:90) states that "The method recognises the actions, events and artefacts from *within* human life; not as the observation of some external reality". This is in sharp contrast to the positivistic method described in the previous section. According to Dilthey (1989b:80), one could only understand human behaviour through the apprehension of their inner meaning; the meaning that led to their production.

Today, hermeneutics is the interpretation of human and organisational behaviour. It is common to most interpretive approaches. The motivation behind it is that reading a text provides the model for reading human behaviour. To illustrate this, Lee (1999:17) gives an example. Consider the ten words in figure 2.1 and the sentences formed by these words.

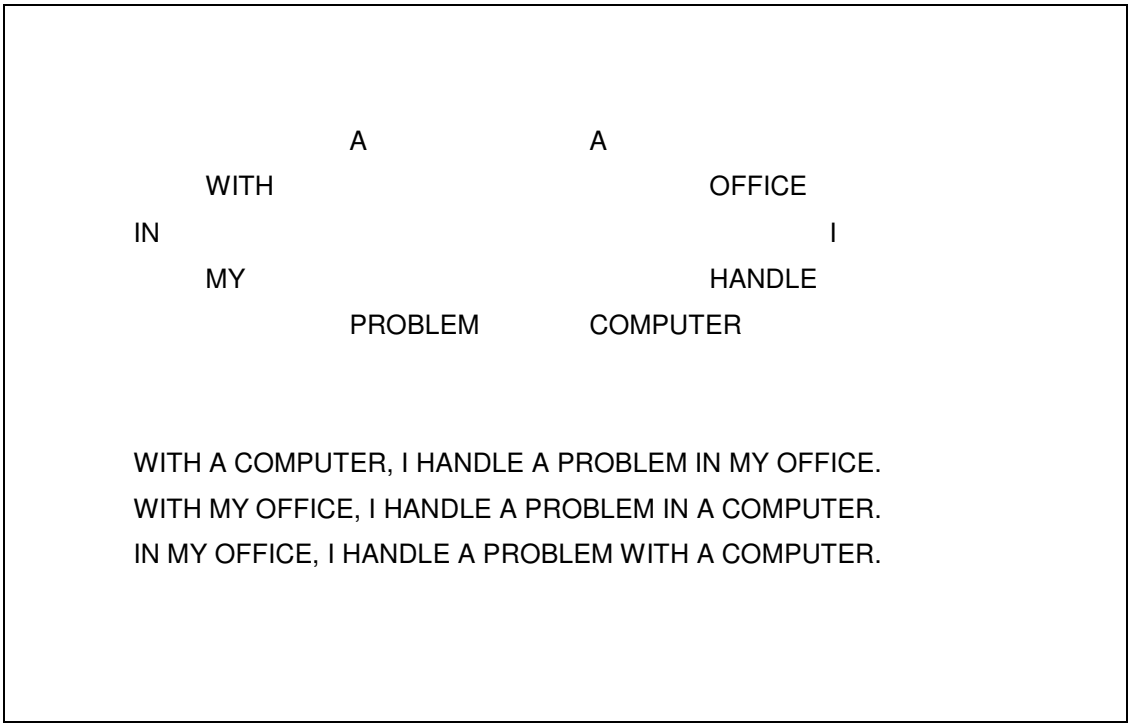

Figure 2.1 Reading a text as a model for reading human behaviour (Lee, 1999:17)

Although the same ten words are used in the three sentences in the figure, they each have a very different meaning. The meaning of an individual word and the meaning of a sentence as a whole are mutually dependent. A reader forms his/her understanding of both simultaneously. Lee applies the same method to human behaviour by arguing that the same publicly observable behaviour can have different meanings in different organisational arrangements. He states that "the meaning of an individual action and the meaning and the organisational setting as a whole are mutually dependent and, as an interpretive researcher, I form my understanding of both simultaneously".

Kuhn gives an illustration of this process (quoted in Bernstein, 1985:132). "When reading the works of an important thinker, look first for the apparent absurdities in the text and ask yourself how a sensible person could have written them. When you find an answer… when those passages make sense, then you may find that more central

passages, ones you previously thought you understood have changed their meaning." The process of switching between words and whole sentences to understand the meaning of the words in the context of the sentence, is known as the hermeneutic circle.

The same process is used to make sense of individual behaviour as part of organisational behaviour, or to make sense of an individual's single action as part of a behavioural pattern. The hermeneutic circle forms the basis of interpretive methodology used in social sciences. Interpretive methodology is discussed in section 2.3.2.

2.2.3 Critical social theory

Critical social research is underpinned by a critical–dialectical perspective, which attempts to dig beneath the surface of historically specific, oppressive, social structures (Harvey, 1990:1). Critical social theorists see knowledge as being structured by existing sets of social relations that are oppressive. This can be class, gender or race oppression. "Knowledge is critique… It is a dynamic process not a static entity…It is the process of moving towards the understanding of the world and of the knowledge which structures our perceptions of the world" (Harvey, 1990:3)

The first volume of *Capital* by Karl Heinrich Marx (1818-1883) is one of the first attempts to perform critical social research. Marx (1930) drew the attention of the world by highlighting the oppressive nature of capitalism. He identified economic processes as the underpinning of the oppression. From a philosophical point of view, Marx accepted the Hegelian dialectic, which stated that every thesis contains its own antithesis, its negation, opposite, or contradiction, and that the two conflicting forces merge to produce a synthesis, a new and greater reality (Sahakian, 1968:247). Marx applied this principle to socio-economic history and identified two conflicting classes (the bourgeoisie and the proletariat). He argued that there is a constant, irreconcilable conflict between these two classes, which can be resolved only when the proletariat revolts and overthrows the capitalist class, thereby establishing a classless society where all are equal; a dictatorship of the proletariat (Sahakian, 1968:248).

Midgley (2000:88) distinguishes between process philosophy and content philosophy: “Content philosophy presents a theory specifying exactly what counts as a knowledge generating system, while process philosophy allows for a variety of possible knowledge generating systems (with the proviso that there are sentient beings identified as part of them). Also content philosophy is mono-theoretical (proposing a single theory to account for the existence of knowledge), while process philosophy allows for theoretical pluralism in relation to many different possible first- and second-order boundary judgments that can be made”.

Midgley (2000:93) shows that Marx’s work can be seen as a process philosophy in that Marx is drawing boundaries around the economic and social bodies, effectively excluding the ecosystems of which societies are a part. Midgley (2000) also shows that Habermas and Foucault can be viewed as process philosophers. Midgley’s aim is to use systemic characteristics, such as boundary judgement, to form a methodology for critical social theory which he calls systemic intervention.

Giddens (1976:54) also identifies Habermas along with Gademer and Apel as influential in the development of critical social theory. The work of Jürgen Habermas is also discussed in chapter 3 as part of the discussion of philosophy as underpinning of critical systems thinking. Critical systems thinking can be directly linked to critical social theory.

Habermas aims to restore the value of direct and pure communication through language (Habermas, 1984:101). Language gives participants in debate the freedom to question the intelligibility, truth, rightness and/or sincerity of any statement. Habermas argues that economic forces have created a situation where pressures for instrumental reasoning are creating a distortion of local speech situations so that arguments around truth claims are still possible, but arguments about rightness have become marginalised (Midgley, 2000:95).

The work of Habermas can be seen as a reaction against the “scientisation of politics”, in which the laws of science is applied to politics. McCarthy (1978:1) states that Habermas’ “theory of society conceived with practical intent” emerges from extended reflections on the nature of cognition, the structure of social inquiry, the normative basis of social interaction, and the political, economic and socio-cultural tendencies of the age. This is done in opposition to positivistic methods that,

according to Habermas, conceals the scientist's commitment to technological rationality behind the façade of value-freedom.

Zygmund Bauman extended Habermas' ideas on critical hermeneutics in his work *Towards a Critical Sociology (1976)*. He states that emancipatory reason does not struggle with common sense but with the social reality that underlies it (Harvey, 1990:16).

In critique of Habermas, Turner (1987:161) argues that there are invariant properties in situations that Habermas and Marx cannot wish away with their utopias, referring to Habermas' utopian view of communicative action and Marx's utopia of economic equality. Giddens' structuration theory also accepts social and material constraints that any individual agent may be unable to change (Cohen, 1987:285).

Habermas' ideas are generally accepted as underpinning to current critical social research methodologies. Flood and Jackson (1991a:131) quotes Habermas (1974:32) on the relationship between theory and practice: "The mediation of theory and praxis can only be classified if to begin we distinguish three functions, which are measured in terms of different criteria; the formation and extension of critical theorems, which can stand up to scientific discourse; the organisation of processes of enlightenment, in which such theorems are applied and can be tested in an unique manner by initiation of processes of reflection carried on within certain groups towards which these processes have been directed; and the selection of appropriate strategies, the solution of tactical questions, and the conduct of political struggle."

Critical social research methodology is discussed in section 2.3.3.

2.2.4 Models applied to information systems

Before one can investigate the philosophy of information systems (IS) research, one needs to form an opinion on what IS is. In this thesis, IS is viewed as a social phenomena and the following definition is accepted: "Information systems is an inter-disciplinary field of scholarly inquiry, where information, information systems and the integration thereof with the organisation is studied in order to benefit the total system (technology, people, organisation and society)" (Du Plooy *et al.*, 1993:01). The acceptance of this definition also leads to a holistic view on Information Systems.

Information systems research is also classified as positivistic, interpretive or critical. Klein and Myers (1999:69) give guidelines for the classification of research methods. They argue that IS research is positivistic when there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population. One can classify IS research as critical if the main task is seen as one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light. Critical research seeks to be emancipatory in that it aims to help eliminate the causes of unwarranted alienation and domination and thereby enhances the opportunities for realising human potential (Klein & Myers, 1999:69). Finally, IS research can be classified as interpretive if it is assumed that our knowledge of reality is gained only through social constructions, such as language, consciousness, shared meanings, documents, tools, and other artefacts. Interpretive research does not predefine dependent and independent variables but focusses on the complexity of human sense making as the situation emerges (Klein & Myers, 1999:69).

Walsham (1995a) studied the acceptance of interpretive methods in IS research. He describes interpretive research as studies where the researcher interacts with the human subjects of the enquiry, changing the perceptions of both parties. Walsham (1995a:378) quotes the senior editor for theory and research of *MIS quarterly* (DeSanctis, 1993:vii) who wrote: "On the empirical side, we welcome research based on positivist, interpretive, or integrated methods. Traditionally, *MIS Quarterly* has emphasised positivist research methods. Though we remain strong in our commitment to hypothesis testing and quantitative data analysis, we would like to stress our interest in research that applies interpretive techniques, such as case studies, textual analysis, ethnography and participant-observation."

Ngwenyama, Truex and Davis held a panel discussion on "Assessing Critical Social Theory Research in Information Systems" at the International Federation for Information Processing (IFIP) work group 8.2 meeting in 1997 (Boudreau, 1997:1). They described critical social theory's main goal as the improvement of human condition. Where traditional social theorists contribute to the preservation of the status quo, critical social theorists seek to emancipate people. It is assumed that all social knowledge is value laden, and that all scientific knowledge is a social construction. The panel stressed that traditional methods do not challenge reigning

assumptions. The panel accepted Habermas' ideas that there is no such thing as a set of methods for critical social theory, but the panel agreed that the method used should address the researcher's underlying assumptions, as well as those of the sponsor and the organisational actors. Action research and structuration theory can be used as methods for conducting critical social research in IS. A large number of papers using action research have been published in leading information systems journals, for example, Mumby (1987, 1988), Forester (1992, 1993), and Ngwenyama and Lee (1997). The *Management Information Quarterly* recently issued a call for papers to be published in a special issue, to generate standards for the use of critical social research methods in IS research.

Myers (1997:241) states that IS research can be classified as quantitative and qualitative. According to his classification, "**Quantitative research methods** were originally developed in the natural sciences to study natural phenomena. Examples of quantitative methods now well accepted in the social sciences include survey methods, laboratory experiments, formal methods (e.g. econometrics) and numerical methods such as mathematical modelling. **Qualitative research methods** were developed in the social sciences to enable researchers to study social and cultural phenomena. Examples of qualitative methods are action research, case study research and ethnography. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions."

Qualitative research can be done from a positivistic, interpretive, or critical social perspective. According to Myers (1997:241), "Qualitative" is not a synonym for "interpretive". The fact that qualitative methods are used, does not mean that the research is interpretive. He argues that action research can be positivistic (Clark, 1972), interpretive (Elden & Chisholm, 1993), or critical (Carr & Kemmis, 1986).

2.3 Methodologies in social research

Methodology can be viewed as the interface between methodical practice, substantive theory and epistemological underpinnings (Harvey, 1990:1). Harvey argues that, although certain data collection methods lend themselves more towards positivistic, interpretive or critical epistemological perspectives, the methods are not inherently positivistic, interpretive or critical. It is therefore an oversimplification to

relate all quantitative research methods to positivistic methodology and all qualitative methods to interpretive methodology. Methodology is discussed as a foundation for research practice. It is shown that practices cannot simply be merged without considering the methodological differences between these practices. Since this study proposes such a merged strategy, it is important to show that methodological issues were investigated.

2.3.1 Positivistic social research methodology

This section begins with a short description of the most frequently used terminology in positivistic research methodology.

In a prescribed work to human sciences students called *Empirical Research Methods for the human sciences* by Behr (1983:5); research is defined as "the systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relationship among natural phenomena." In this definition, the term empirical means that which is verifiable through observation. A hypothesis is a statement about the relation between two variables, which implies that its truth can be tested and which can be accepted or rejected at a certain level of probability.

Sampling is used to reduce the size of the population to a manageable number. The size of the sample depends on the nature of the problem and the aim is to obtain the minimum sample size that will accurately represent the population being surveyed. Results obtained from the sample are valid (to a certain degree of probability) for the population as a whole if the sample is large enough.

Statistical measurements such as mode, median, mean and standard deviation are used to analyse data. Correlation and regression are used to analyse relationships in the data.

Empirical methods are most important in acquiring new knowledge in positivistic philosophies. They require observation of data that is free of judgement, interpretation or other subjective operations. Hughes (1990:36) states that "positivists argued that the basis of science lies in a theoretically neutral observation language with is both ontologically and epistemologically primary. That is, statements

made in this privileged language are directly verifiable as true or false by simply looking at the 'facts' of the world."

Logical positivism added a logical character to the empirical. Mathematics can be used to add structure to the empirical facts. Statements are true or false depending on the manipulation of symbols. The role of logical manipulation in science increased and many of the best theories can be applied across many different test situations. Popper's theory of falsification (1957) played a very important role in the development of scientific method. According to Popper, theories can only be proven to be false and good theories are those that withstand various attempts to disprove them.

Requirements for objective observation of the natural sciences had to be adapted in order to succeed in the social sciences. Some human traits, such as mental state, are impossible to observe with natural science's objective observation methods. However, a person's mental state does lead to certain outward behaviour, such as smiling, clenching of fists and wide-eyed glaring. Mental phenomena could then be observed by studying the corresponding outward behavioural display which is used as an index of different mental states. Hughes (1990:40) argues that this approach is successful for simple mental states, such as anger, pleasure and pain, but more sophisticated mental states, such as desire for wealth or status, or the belief in democracy, posed difficulties for such an approach. The observer needed other tools to report on the values of people. These tools, such as attitude scales and questionnaires, still allowed the observer to be objective in his/her observation of value-based phenomena.

Tools, such as variables and Lazarsfeld's indicators, were used to form a scientific language for social research. The language of social science observation had to consist of terms objectively defined and had to be generalisable and, if possible, quantifiable (Hughes, 1990:41).

A discussion of Behr (1983:10) on the problems and limitations peculiar to empirical research in the human sciences is quoted in totality to ensure accuracy: "It needs to be pointed out that research in the human sciences (education, criminology, psychology, social work, etc.) cannot be carried out with the same precision as in the case of the natural sciences. In the human sciences, unlike the natural sciences, the

research worker has to be content with many variables that interact with one another in subtle and diverse ways."

This is not a complete discussion on positivistic social research methodology. The study reported on in this thesis, does not involve any positivistic research methodology and the above discussion is included only to illustrate the influence of positivistic philosophy on empirical research methodology.

2.3.2 Interpretive social research methodology

The award winning paper of Klein and Myers (1999:67) on principles for conducting and evaluating interpretive field studies in information systems, became the accepted standard for interpretive research in information systems. This section on interpretive social research methodology focusses on the work of Klein and Myers (1999). Their principles are summarised in table 2.1. Klein and Myers (1999) stress that case study research is not automatically interpretive; it can be positivistic, interpretive or critical. They repeat the argument for action research, referring to Clark (1972) as positivistic, Elden and Chisholm (1993) as interpretive and Carr and Kemmis (1986) as critical. The seven principles that identify case study research as interpretive are now discussed individually.

1	**The fundamental principle of the hermeneutic circle** This principle suggests that all human understanding is achieved by iteration between the interdependent meaning of parts and the whole they form. This principle of human understanding is fundamental to all the other principles.
2	**The principle of contextualisation** Requires critical reflection on the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
3	**The principle of interaction between the researchers and the subjects** Requires a critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and the participants.

4	**The principle of abstraction and generalisation** Requires relating the idiographic detail revealed by the data interpretation through the application of principles one and two to the theoretical general concepts that describe the nature of human understanding and social action.
5	**The principle of dialogical reasoning** Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tells") with subsequent cycles of revision.
6	**The principle of multiple interpretations** Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the sequence of events under study. They are similar to multiple witness account, even if all tell it as they saw it.
7	**The principle of suspicion** Requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants.

Table 2-1 Summary of principles for interpretive field research (Klein & Myers, 1999:72)

2.3.2.1 The fundamental principle of the hermeneutic circle

Hermeneutics as philosophy was discussed in section 2.2. The hermeneutic circle depicts the interaction between the whole and its parts. It focusses on the constant movement between the individual parts and the whole. In case study research, the whole consists of the shared meanings from the interactions between the researcher's and the participants' understanding of the problem situation. The parts are the individual understanding of the researcher and the participants of the problem situation.

2.3.2.2 The principle of contextualisation

Contextualisation is the process of understanding the historical context of the current situation. The reason why the interpretive researcher studies the context differs from the positivistic search for repeating patterns, since the interpretive researcher believes that the organisation is dynamic. A better understanding of the current situation is achieved by studying the road that was taken by the organisation to reach the present state. The historical context must be reflected in the results of the case study research.

2.3.2.3 The principle of interaction between the researchers and the subjects

Data are produced as a result of the social interaction between the participants and the researcher. The participants are, just as the researcher, interpreting the events they account for. The researcher should be aware of this and compensate by using secondary sources, for example historical documentation, to verify the interpretation of specific concepts. The researcher should be aware of the fact that the interaction between himself/herself and the participant may also change the interpretation of the participant. The researcher might, just by asking a specific question, alter the participant's perception of the situation under investigation.

2.3.2.4 The principle of abstraction and generalisation

Theoretical abstractions are made from individual events. Walsham (1995b:77) refers to grounded theory, developed by Glaser and Strauss (1967), as a method to be used in the generalisation of case study data. Grounded theory is discussed in detail in section 2.4.2.3. Other methods include Latour's actor-network theory and Giddens' theory of Structuration. Giddens' theory of structuration is discussed briefly in section 2.4.2.4. The methods proposed by Yin (1994) as described in section 2.4.2.1, may also be used to achieve generalisation.

2.3.2.5 The principle of dialogical reasoning

This principle requires the researcher to confront his/her own preconceptions and prejudices that guided the original research plan. The researcher must be aware of his/her own history that led to the specific research design. This principle also requires the researcher to identify the specific form of interpretivism he/she prefers and the philosophical foundations thereof.

2.3.2.6 The principle of multiple interpretations

The researcher should identify multiple interpretations by different actors in the organisation and the reasons behind them. Although contradictions are not always present, the researcher should be sensitive to conflicting interpretations. The researcher needs to probe beneath the surface.

2.3.2.7 The principle of suspicion

This principle requires even further critical thinking in that the researcher should be aware of the socially created distortions and psychopathological delusions. The power struggle in the situation should be identified. The actors in the situation are limited by social structures and economic conditions in reaching their goals. These limitations should be exposed by the researcher.

Klein and Myers (1999:78) stress that the above principles are parts of a whole and should be viewed collectively, as well as individually. The research results affect the role of each individual principle in the research design. The realisation of these principles in the study reported in this thesis, is described in section 2.5.

2.3.3 Critical social research methodology

Critical social research methodology describes methods based on the changing of oppressive structures. It regards positivistic scientific method as unsatisfactory because it deals with surface appearances only, while critical social theory aims to cut through these surface appearances (Harvey, 1990:19). In this section, the general elements of critical social theory are discussed, followed by some notes on intervention.

Although critical social research is verified in different methods, shared elements can be identified. Harvey (1990:19) identified the following elements: abstraction, totality, essence, praxis, ideology, structure, history, and deconstruction and reconstruction. These elements should not be viewed as discrete units but rather as parts of a process that relies on all the elements. This discussion follows Harvey (1990).

2.3.3.1 Abstraction

In methods following an interpretive approach, science begins with factual interpretations and abstractions from them. Theories are based on reality. Critical social theory accepts that facts cannot exist independently from reality and works from abstract to concrete. It starts with abstract generalisations and then investigates them in reality. It involves an understanding of the general use of a concept, as well as a study into the underpinning structures which specify the nature

of the abstract concepts. It aims to reveal underlying structures that are otherwise taken for granted. These structures specify the nature of the abstract concepts which have themselves been assimilated uncritically onto the prevailing conceptualisation.

2.3.3.2 Totality

Totality refers to the view that social phenomena are interrelated to form a total whole. Social phenomena should not be investigated in isolation but always as part of a larger context. In a research environment, the researcher aims to relate the empirical detail to a structural and historical whole. This implies three things: that social relations are history specific, that there are structural relations that operate within that historical moment and finally, that the determinacy of historical specific structure and phenomenal forms are interrelated.

2.3.3.3 Essence

Essence refers to the fundamental element of the analytical process. Positivistic research views essence as bordering on the metaphysical, while interpretive research seeks the essence in the understanding of the interactive processes. Critical social researchers view essence as a fundamental concept that can be used as the key to unlocking the deconstructive process.

2.3.3.4 Praxis

According to Harvey (1990:22), praxis means practical reflective activity. It is activity that changes the world. The critical social researcher is not only interested in understanding the world; he/she aims to change the world. It is not the actions of an individual that is of interest but rather the actions that change the social formations. The individual subjects are studied for their potential for developing group action. Knowledge changes not simply as a result of reflection but as a result of action. Knowledge is not static, since we transform our knowledge through what we do; it exists in our everyday lives.

2.3.3.5 Ideology

The ideology of social structures is more than the norms and values of the individuals of the social structure. Two different views of the nature of ideology exist, i.e. a positive and a negative view. It can be seen as the *Weltanschauung* or the worldview

underlying the social structure. The positive view of ideology sees it as false consciousness which hides the interests of dominant groups from themselves. Ideology can be engaged and transcended. According to the negative view of ideology, it cannot be detached from the material conditions of their production; it is constantly reaffirmed through everyday practice. The nature of the ideology needs to be revealed by the researcher through the identification of the essence of social relations and the separation of this essence from structural forms through a process of dialectical deconstruction and reconstruction.

2.3.3.6 Structure

Structure is seen by the critical social researcher as more than the sum of the elements. It is viewed holistically as a complex set of interrelated elements which are interdependent and which can be conceived adequately only in terms of the complete structure. This implies that parts conform to intrinsic laws which determine the nature of the structure and the parts. The structure is thus capable of transformational procedures. Being self-regulating, the structure makes no appeals beyond itself to validate transformational procedures. Harvey (1990:25) uses language as an example of such a structure. It is a relational whole with grammatical rules which can transform fundamental sentences into a wide variety of forms, while retaining them within its structure and transforming them with no reference to an outside reality.

2.3.3.7 History

According to Harvey (1990:26), history refers to both the reconstructed account of past events and the process by which this reconstruction is made. The view of the nature of history influences the constructed history. Following the discussion on abstraction, critical social research involves the grounding of a generalised theory in history, as well as the exposure of the essential nature of structural relations which manifests them historically. The construction of history is seen as the result of an active interpretation of the available archaeological, documentary, or oral evidence. Critical research history is not so much interested in the historical facts as in the circumstances within which it occurred. It investigates the social and political contexts, addresses the economic constraints and engages the taken-for-granted ideological factors. It also takes the situation of the researcher into account.

2.3.3.8 Deconstruction and reconstruction

The critical researcher aims to deconstruct the situation into abstract concepts in order to study the interrelations between the concepts with the purpose of discovering the key to the structure of the situation. It is a constant process of moving backwards and forwards between abstract concept and concrete data; between social totalities and particular phenomena; between current structures and historical development; between surface appearance and essence; between reflection and practice (Harvey, 1990:31). The researcher is constantly aiming beyond surface appearances. The core concept is identified through the deconstruction of the problem situation into concepts through investigation of the different elements of the situation. The core concept is used to reconstruct the situation. If this reconstruction does not fit reality, further analysis of the core concept is needed. A study of the essence and history of the structures in the situation leads to the identification of the core concept. This is an ongoing process to expose the ideology underpinning the situation in order to identify the oppressive mechanism, which requires change.

2.3.3.9 Intervention

Although Harvey (1990) does not explicitly refer to the term intervention, it can be associated with the term of praxis. The purpose of critical research is to enable the researcher to intervene in an oppressing situation. The above discussion of the critical social theory, based on the work of Harvey (1990), is very much focussed on the emancipatory actions of the researcher in an oppressing situation (class, gender or racial oppression). Midgley (2000) uses an approach of systemic intervention which includes similar elements (although not identified as such) to bring about positive changes in situations. His work is based on the philosophy of Habermas and forms a methodology for change in problem situations.

2.4 Social research practice

From philosophy and methodology one moves to research practice. This section aims to describe typical research practices in positivistic, interpretive and critical social research. The specific problem situation of this thesis is taken into account

and serves as indicator to the level of detail given on practices from the three different perspectives.

2.4.1 Positivistic social research practice

This section contains a very brief discussion on positivistic research practice. Because the researcher accepts the social approach to information systems, the use of quantitative methods is unlikely. However, some discussion is necessary to aid the argumentative flow of the chapter.

Interviews can be used in positivistic research practice, but Behr (1983:146) points out that there is no room for debate and arguments between the interviewer and the subject. Behr (1983) argues that "one of the main disadvantages of this approach [unstructured interviews] is that it is difficult to compare the data obtained from the various respondents so as to arrive at reliable generalisations. Nevertheless, an experienced interviewer can use this approach to great advantage."

Behr (1983:150) states that the questionnaire technique is the main source of data collection in research studies in education. A questionnaire is a document distributed to the respondent and completed and returned by himself/herself in his/her own time. Questions should be carefully designed to assure statistical usability of the answers. Various statistical tools, such as Likert-type scales ("strongly agree", "agree", "undecided", "disagree", "strongly disagree"), are used to assess the respondent's attitude towards a specific statement. Statistical measures, such as mean and variance, are used to analyse the data. Good questionnaires include crosscheck questions to test the consistency of the respondent on a specific issue.

The key difference between positivistic research practice on the one hand and interpretive and critical social research practice on the other hand, is the objectivity of the researcher. Positivistic research practice requires and is designed to ensure that the researcher is objective in his research activity. This implies that the researcher does not influence the research environment in the data collection activity. Interpretive methods allow for the personal interpretations of the researcher, and the researcher is encouraged to learn as much as possible from the research environment in order to give a reliable interpretation of the environment. Critical researchers are not only interpreting the data in the environment but are also

designing and affecting change in the problem environment (typically an organisation).

Another key difference between positivistic research practice and the other two approaches is the reduction of the problem situation through sampling. Positivistic methods assume that a sample, if carefully selected, represents the population, while interpretive and critical methods study the problem situation as a whole.

2.4.2 Interpretive social research practice

This discussion of interpretive social research methodology focusses on case study research. This is mainly because the researcher has chosen case study research for the specific research problem, but also because it is the most commonly used qualitative research method in information systems (Orlikowski & Baroudi, 1991). Case study research practice is discussed with acceptance of the principles for conducting interpretive field studies (Klein & Myers, 1999) as discussed in the previous section. The section begins with a discussion on the data collection and analysis practices in case studies (mostly according to the paper by Walsham (1995b) on case studies in IS research). A short discussion of ethnography is given for argumentative purposes. Since theory generation is central to science, generalisation is a central part of interpretive research practice. Grounded theory is discussed in detail as generalisation method. An application of Giddens' structuration theory is discussed briefly.

2.4.2.1 Case study research practices

The researcher has to decide on his/her role in the organisation under study. The researcher can choose to be an outside observer, or can play an active role in the organisation through participant observation or action research. In neither of these roles should the researcher be seen as objective, since the collection of data involves the researcher's own subjectivity (Walsham, 1995b:77). Walsham further argues that the researcher, irrespective of the selected role, influences the interpretations of those being researched. In this study, the researcher chose to be an outside observer and this discussion will be focussed on this type of case study.

The role of an outside observer has advantages and disadvantages. The personnel in the field organisation view the researcher as an outsider. The researcher does not have any personal stake in the outcome of the investigation, and this opens up the communication channels. The main disadvantage of the role as outside observer, is that one is not always present in the organisation.

Data collection

In interpretive case studies, interviews are the main source of data collection. Other data sources include documentation, direct observation, and physical artefacts. The design of the interviews for the case studies of this study is discussed in section 2.5.3.1, considering practical aspects with regard to this study. Walsham (1995b:78) states that interview style varies between individuals, depending on personality, but one key issue for all interviewers is the balance to be struck between excessive passivity and over-direction. A key decision needs to be taken on the data capture methods used in the interviews. Tape recordings of the interviews are recommended, if acceptable to the management of the organisation. However, the presence of the equipment can intimidate the participants. The purpose of the recording should be made clear at the start of the interview.

The selection of interviews in the organisation and the order of the interviews are crucial to the success of the case study. Lubbe (2003:20) gives the following practical advice in terms of field procedure:

"1. Find at least three informants for each case study. This is for the purpose of validation.
2. At least two informants should be senior managers, i.e. individuals who are either a member, or reporting directly to, the board of directors or similar.
3. Obtain access to informants through a trusted intermediary wherever possible.
4. Make initial contact with the subject organisation at the highest level possible.
5. Find a friendly gatekeeper or guide as soon as possible.
6. Tape-record all interviews.
7. Support verbal information with documentary evidence where possible.
8. Attempt to secure multiple interviews per site to reduce travelling time.
9. Attempt to interview informants in their offices rather than interview rooms.
10. Engage as many members of the staff as possible, such as secretaries and support people, in general conversation about the organisation."

The next decision to be taken by the researcher is to decide what to report about each case study. Lubbe (2003:22) recommends the following:

"1. Introduction and general background of the organisation
2. The state of IT within the organisation
3. The reasons for the current decisions
4. The implementation of the IT decision"

Walsham (1995b:79) recommends the following to report on:

"1. Detail of the research sites chosen and reasons for this choice
2. The number of people that were interviewed
3. What hierarchical positions they occupied
4. What other data sources were used
5. How data was recorded
6. How the data was analysed
7. How the iterative process between data analysis and theory generation worked"

These recommendations of Walsham (1995b) are followed in the case study report presented in chapter 5.

Data analysis

After the collection of data during the case study, the researcher needs to analyse the data gathered. Yin (1994:102) argues that analysis of interpretive case study data depends on an investigator's own style of rigorous thinking, along with the sufficient presentation of evidence and careful consideration of alternative interpretations. He proposes the following techniques for the analysis of case study data:

1. Put information into different arrays.
2. Make a matrix of categories and placing the evidence within such categories.
3. Create data displays – flowcharts and other devices - for examining the data.
4. Tabulate the frequency of different events.
5. Examine the complexity of such tabulations and their relationships by calculating second-order numbers such as means and variances.
6. Put information in chronological order or using some other temporal scheme.

Yin (1994:103) advises the researcher to have a strategic plan for data analysis prior to the data collection phase. He advocates two broad strategies for the analysis of case study data. The first strategy is to rely on theoretical propositions. These propositions are the literature that motivated the researcher to investigate a specific problem environment. The propositions help to focus attention on certain data and to ignore other data. The second strategy is to develop a case description. A descriptive framework is developed to organise the case study data. Yin (1994:104) argues that the description might help to identify the causal relationships that need to be highlighted.

After selecting a strategy, one needs to select a practical method for analysing data. Such methods include pattern-matching, explanation building, time series analysis and program logic models. Only pattern-matching is described here, since the approach chosen by the researcher reflects this method.

Yin (1994:106) states: “For case study analysis, one of the most desirable strategies is to use a pattern-matching logic.” In pattern-matching, the observed data is compared with a predicted pattern (or several alternative predictions). If the patterns coincide, the results can help a case study strengthening its internal validity. Yin (1994:106) further explains pattern-matching in terms of dependent and independent variables, which are categorised as positivistic methods in this thesis. The second analysis method quoted above, namely “Making a matrix of categories and placing the evidence within such categories”, is viewed by the researcher as a method to achieve pattern-matching.

The researcher further investigated the suitability of ethnography as an alternative method of data collection in interpretive social research.

2.4.2.2 Ethnography

According to Agar (1980:79), the goal of ethnography is to reduce the gap between the researcher’s account of the situation and that of a participant in the situation. This implies that the researcher wants to understand and interpret the situation in the same way as the participant would. This can only be achieved through extended personal involvement.

The emphasis is on the role of the researcher. In traditional hypothesis-testing type research methods (called positivistic methods in this thesis), the researcher is seen as an objective observer. Most often there is very little personal contact between the researcher and the participants. This may be because the data is gathered by questionnaires, or because representatives of the researcher are conducting standard interviews. In hypothesis-testing interviews, it is important to use the same interview questions and the same interview environment for all the respondents to enable the researcher to compare the data collected. In this situation, the researcher is in a controlling relationship with the participant.

This control factor of the relationship changes dramatically in ethnographic studies, where the role of the researcher is that of a student or child. The researcher wants to learn from the participants about the situation by becoming a part of the community. Agar (1980:75) argues that the researcher aims to understand the situation as a whole. This holistic approach inspires the researcher to identify connections and relationships in the situation. The researcher is continuously improving his/her understanding of the situation by comparing events to his/her interpretation of the situation and making necessary adjustments. The relationship between the researcher and the participants grows into friendship as trust develops.

The researcher wants to understand a situation to such a degree that he/she is able to "behave appropriately in the community" or "inappropriately" if he/she chooses to do so (Agar, 1980:77). This understanding is achieved through paraphrasing the events in the situation. Agar (1980:79) expresses paraphrasing as, "We are talking about decode rather involved sequences of verbal and nonverbal behaviour, and then encode our understanding of the meanings of that sequence into some utterances to check whether we understood what just occurred. It is in this special sense that I speak of giving account."

Ethnography has been used in information systems research by Orlikowski (1991). Klein and Myers (1999:79) aimed their set of principles for conducting and evaluating interpretive field studies in information systems (IS) not only at case study research, but also at ethnography studies.

2.4.2.3 Grounded theory

The theory generation mechanism is the most important decision the interpretive researcher takes in the research design. The following three sections discuss possible methods to be used in the theory generation process.

Grounded theory is an attempt to develop a methodology (or set of methods) to organise data, gathered during an ethnographic study, into a theory.

Glaser and Strauss first described grounded theory (GT) in 1967. The aim of GT is to develop a theory from data rather than gathering data to test a theory or hypothesis. This means that qualitative methods are used to obtain data about a phenomenon and that a theory emerges from the data. Since this is qualitative research, the research problem is not stated precisely or in terms of dependent and independent variables. The first description of GT should be seen as a methodology for arriving at a grounded theory from data. The theory is grounded in the reality as represented in the data.

Since the first description of GT, Glaser and Strauss worked on separate implementations of their methodology. Strauss and Corbin (1990, 1998) developed a detailed description for the development of a grounded theory. Glaser (1992) criticises their approach as forcing a theory from the data and therefore preventing the natural emergence of the theory from the data. Strauss and Corbin (1990, 1998) give guidelines (techniques and procedures) for the inexperienced researcher to get the most from the data but stress that they are only tools and should never drive the analysis.

Every researcher who chooses to use GT as a research methodology, should investigate this divergence between the founders of GT critically (Smit, 1999:221; Goulding, 1998:56). It is the opinion of the researcher that the methods of Strauss and Corbin can be very helpful to organise one's data and to strengthen the scientific value of the emerging theory. However, coding procedures should not overshadow the influence of creativity of the original GT concept. It is clear that Strauss and Corbin (1998) took the critique of Glaser to heart in producing the second edition of their monograph on the procedures and techniques of GT in 1998. They warn their readers against the rigid application of their guidelines (for example see pp 129, 142 of Strauss & Corbin (1998)).

The procedures of Strauss and Corbin will be discussed to give the reader an understanding of the relevant issues when using GT as research method for the research of reflections on systems thinking in IS practices.

Procedures for creating a grounded theory

A theory is defined by Strauss and Corbin (1998:22) as "a set of well-developed categories (e.g. themes, concepts) that are systematically interrelated through statements of relationship to form a theoretical framework that explains some relevant social, psychological, educational, nursing or other phenomenon". Grounded Theory was also developed to aid qualitative researchers to perform "good science". Strauss and Corbin (1990:27) states that well performed GT meets all the requirements of "good science": significance, theory-observation, compatibility, generalisability, reproducibility, precision, rigor, and verification. Coding is the central method in the transformation of the data to a theory. Coding is defined as the analytic process through which data are fractured, conceptualised, and integrated to form theory (Strauss & Corbin, 1998:3). Its aim is to identify, develop and relate the concepts that are the building blocks of theory. Strauss and Corbin (1990) identify three different types of coding to transform data into a theory that is grounded in reality, i.e. open coding, axial coding, and selective coding, all of which will be discussed in the following paragraphs. The different types of coding are done simultaneously and the division between them is an artificial way of explaining the process.

Open coding

Open Coding is the analytic process through which concepts are identified and their properties and dimensions are discovered in data. To be able to identify the concepts (labelled phenomena), we have to open up the text and expose the thoughts, ideas, and meanings contained therein (Strauss & Corbin, 1998:102). A concept should be viewed as an abstract representation of an event, object, or action/interaction that a researcher identifies as being significant in the data. Concepts are compared with each other.

Categories emerge from similar concepts that have similar properties. Properties are characteristics that are common to all the concepts in the category. The properties of

the concept “flower” can be size, duration, colour, shape, etc. The categorisation of concepts into categories is an abstraction process. The researcher can give names for categories, but it can also come from the words of the respondents. However, it should be a logical descriptor of the reality (Strauss & Corbin, 1998:114). The following quote from Strauss and Corbin (1998:105) on the identification of categories is vital to later arguments presented in this chapter: “We want to see new possibilities in phenomena and classify them in ways that others might not have thought of before (or, if considered previously, were not systematically developed in terms of their properties and dimensions).”

The categories should be grounded. This implies that they are formed from evidence in the research situation. Literature may be used to add new categories, but such categories will be labelled as preliminary until they can be verified by the data and thus be grounded in reality. The interpretation of events by the researcher influences the naming of categories (Strauss & Corbin, 1998:127).

Dimensions represent the location of a property along a continuum or range. The dimensions of the size property of the flower category can be from small to large and of the colour property can be different shades or intensities. Categories give us a method for comparing different incidents. Incidents are compared in terms of properties and dimensions. Categories can be divided into subcategories that answer questions about categories like what, when, where, who, how, and with what consequences. The relationships between categories will be studied to form theories.

Axial coding

Axial coding is defined by Strauss and Corbin (1998:124) as “the process of relating categories to their subcategories, termed “axial” because coding occurs around the axis of a category, linking categories at the level of properties and dimensions”. The purpose of axial coding is to reassemble data that were fractured during open coding (Strauss & Corbin, 1998:124). This is achieved by refining information about each category and its subcategories. The conditions, actions/interactions, and consequences associated with the phenomenon (or category) are identified to describe the context (structure) and the process of a phenomenon. Since a category is a coded form of a phenomenon, it can be seen as a representation of a pattern of happenings, events, or actions/interactions which can be described by conditions, actions/interactions and consequences.

Conditions explain the situation or context in which a phenomenon occurs. Conditions can be causal, intervening, and contextual. Contextual conditions are the specific sets of conditions (causal and intervening) that intersect dimensionally at this time and place, to create the set of circumstances or problems to which a person responds through actions/interactions.

Actions/interactions are the answers to the question of how people handle the conditions. Strategic actions are actions that are purposeful in solving a problem and thereby shape the phenomenon. Routine actions represent every day responses to situations. Both these types of actions need to be investigated to gain full understanding of how people maintain the social order (Strauss & Corbin, 1998:133).

Irrespective of whether action is taken in response to a problem situation or not, there are always consequences. Some of these consequences are intended and others not. The consequences and their changing of the phenomenon need to be described in order to understand a phenomenon completely. Consequences have properties such as duration, visibility, impact, predictability, and scope.

Axial coding is about finding relationships between categories and subcategories. These represent links between concepts in the research situations. Hunches or "hypotheses" of the researchers about how concepts are linked, are stated. These relations should now be validated against the data from the actual incidents to determine if they can be grounded in reality. Contradictions between reality and the hypothesis help us to refine our description of the category by refining the conditions, actions/interactions, and consequences of phenomena.

Selective coding

Selective coding is the process of intergrating and refining the theory (Strauss & Corbin, 1998:145). Categories are only descriptions of data and are not yet a theory. Various categories need to be integrated to form a theory. The first step is to decide on a central category that represents the main theme of the research. One needs to find an intersection between all the important categories in the research. Strauss and Corbin (1998:147) give the following criteria for choosing a central category:

"1. It must be central; that is, all other major categories can be related to it.
2. It must appear frequently in the data. This means that within all or almost all cases, there are indicators pointing to that concept.
3. The explanation that evolves by relating the categories is logical and consistent. There is no forcing of data.
4. The name or phrase used to describe the central category should be sufficiently abstract that it can be used to do research in other substantive areas, leading to the development of a more general theory.
5. As the concept is refined analytically through the integration with other concepts, the theory grows in depth and explanatory power.
6. The concept is able to explain variation as well as the main point made by the data; that is, when conditions vary, the explanation still holds, although the way in which a phenomenon is expressed might look somewhat different. One also should be able to explain contradictory or alternative cases in terms of that central idea."

There are several techniques to determine the central category. These include writing the storyline, making use of diagrams, and reviewing and sorting memos, either by hand, or by computer program. When the central category is described, for example by writing a storyline, the gaps in the theory are exposed. Refining the coding of major categories should fill these gaps. The aim is to write a story to which incidents in the data can be fitted. The story can only become a grounded theory when data representing incidents in reality, can be fitted to the story. Cases that do not fit the storyline should be explained in terms of intervening conditions. Discovering outlying cases and building explanations for them into the theory, increase its generalisability and explanatory power.

Sampling

The discussion on grounded theory is closed with a short discussion on sampling procedures. Theoretical sampling is defined by Strauss and Corbin (1998:210) as "data gathering driven by concepts derived from the evolving theory and based on the concept of 'making comparisons,' whose purpose is to go to places, people, or events that will maximise opportunities to discover variations among concepts and to densify categories in terms of their properties and dimensions".

During open coding, sampling should be done as wide as possible to enable researchers to be open to discover concepts in the situation. Although sampling should be done systematically, the researcher must be flexible enough to code any event that he/she finds relevant to the study. During the study, the researcher should question and compare the data continuously. The answers to the researcher's questions will lead to further sampling and the coding of more incidents. During axial coding, sampling is done to define the dimensions and properties of the categories, as well as to define the subcategories and their relationships to the categories. During selective coding, sampling is used to strengthen the theory. Incidents are tested to fit the theory, and the theory is refined until the categories are saturated. This means that more coding does not alter the description of the categories.

It should be noted that sampling could not be planned in detail before the start of the field study. It is central to GT to discover a theory in the data and not to test a prewritten hypothesis by gathering appropriate data. It is not persons or organisations that are sampled but incidents and events. Although sampling during the beginning of the project is rather unfocussed, it will become more focussed as the project progresses. Sampling will only end when all the categories are saturated.

2.4.2.4 Giddens' structuration Theory

For purposes of generalisation, Orlikowski (1992:398) describes Giddens' (1984) theory of structuration, which questions the objective-subjective dimension in social and organisational investigation. Giddens proposes a dualism between objectivism and subjectivism. The theory of structuration recognises that human actions are enabled and constrained by structures, yet that these structures are the result of previous actions. Actors are seen as knowledgeable and reflexive (observe and understand what they are doing and why they do it) but also restricted by their situation.

The actions of human actors become practices over time and are institutionalised as structures. When institutionalisation occurs, problems or difficulties with these structures are identified, perhaps by other actors in the organisation's specific situation, which will lead to alternative practices forming new structures. This creates a dualism between objective structural features of organisations and subjective knowledgeable actions of human agents.

Orlikowski (1992:412) studied a software development organisation that employed external consultants to apply Giddens' theory to software development and evaluate the results. The organisation decided to design tools according to current practices in the firm to increase productivity and quality control. These tools were not well accepted by all consultants and some of them bypassed the tools because of their so-called restrictiveness. New employees saw the tools as the way the task had to be performed, in fact as the only way to do their jobs. Eventually some of the longer serving employees rebelled against the use of the tools, and consequently the tools were changed to represent the practices of the consultant more closely. These, in time, became the structure or method to be followed in the organisation.

The applicability of these generalisation strategies to the research problem under investigation, will be discussed in section 2.5.

2.4.3 Critical social research practice

As stated earlier, different methods can be applied from different philosophical perspectives. Action research can be applied from a positivistic, interpretive or social philosophical perspective. In this section it is viewed from a critical perspective.

2.4.3.1 Action research

The historical development of action research

Kurt Lewin first developed action research in the late 1940's. He focussed his research on the natural setting of the problem situation. Lewin conceptualised social change as a three-stage method: dismantling former structures (unfreezing) changing the structures (changing) and locking them back to the permanent structure (freezing). This implies a stable state prior and after the intervention or change phase (Greenwood & Levin, 1998:17). Lewin (1948) argued that one could only understand the inner structure of a social system by trying to change it. Lewin's work assisted the Norwegian efforts to improve working conditions.

During the same time, similar work was done in the Tavistock Institute of Human Relations in London. Trist and Bamforth did a study in 1951 on the relationship between technology and productivity at British coal mines. Lewin joined the

Tavistock group and inspired many research projects aimed at social change in the workplace.

What is action research?

Blum (1955:1) identified two stages in action research. During the diagnostic stage, the researcher and the subjects of the research study the social situation together. The diagnostic phase is followed by the therapeutic phase that involves collaborative change experiments. Changes are designed and introduced, and the results are studied to introduce more changes to improve the situation.

Baskerville (1999:6) describes four major characteristics of IS action research:

"1. Action research aims at an increased understanding of an immediate social situation, with emphasis on the complex and multivariate nature of the social setting in the IS domain.
2. Action research simultaneously assists in practical problem solving and expands scientific knowledge. This goal extends into two important process characteristics: First, there are highly interpretive assumptions being made about observation; second, the researcher intervenes in the problem setting.
3. Action research is performed collaboratively and enhances the competencies of the respective actors. A process of participatory observation is implied by this goal. Enhanced competencies (an inevitable result of collaboration) are relative to the previous competencies of the researchers and subjects, and the degree to which this is a goal, and its balance between the actors, will depend upon the setting.
4. Action research is primarily applicable for the understanding of change processes in social systems."

Baskerville and Pries-Heje (1999:3) identified five stages in the cyclic IS action research process: (1) diagnosing, (2) action planning, (3) action taking, (4) evaluating, and (5) specifying learning, as depicted in figure 2.2.

Baskerville (1999:14) gives as explanation of these components. The client structure, also known as the client-system infrastructure, is the specification and agreement that constitutes the research environment. It provides the conditions under which change may be specified. It also defines the responsibilities of the client and the researcher and is by nature a collaborative undertaking.

Diagnosing refers to a collaborative effort by the researcher and the client to analyse the primary problems of the current situation that form the underlying causes of the desire for change in the organisation.

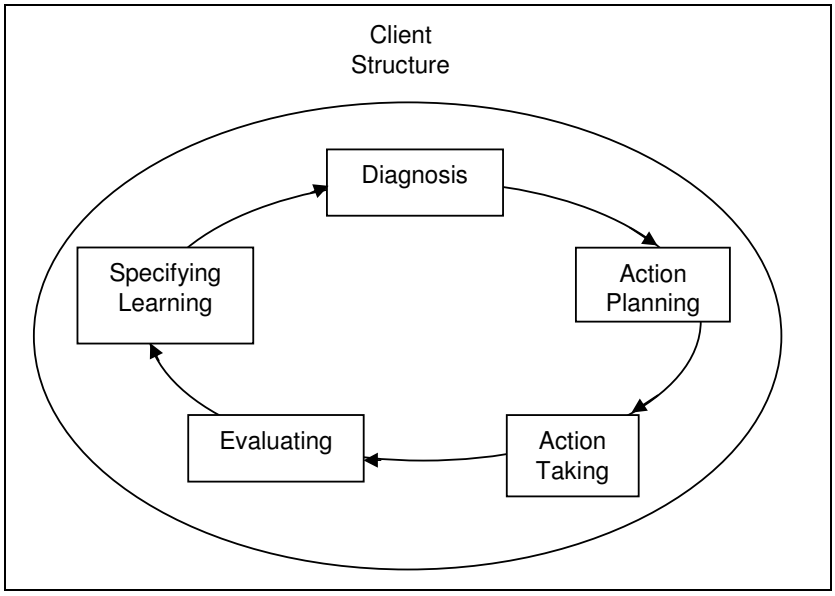

Figure 2.2 The action research cycle (Baskerville & Pries-Heje, 1999:4)

Action planning is a collaborative effort to specify actions to relief or to improve the specified problems. The plan should also include a description of the target state or desired future state of the organisation.

Action taking refers to the collaborate effort of intervention in the organisation. Changes can be made directly or indirectly. Lewin's (1948) model of unfreezing, changing and freezing can be followed.

A collaborative evaluation of the resulted state of the organisation is done to determine if the changes had the desired affect. This implies that the current state is compared with the desired future state described during action planning. Where the action was successful, the evaluation should determine whether the success could be attributed solely to the planned action. Where the action was unsuccessful, the reasons should be analysed, and the action plan for the next iteration needs to be designed.

The research team needs to specify and document the learning that took place during the specific iteration of the action research cycle. The organisational norms should be changed to reflect the new knowledge gained. Where the change was unsuccessful, the additional knowledge should be added to the original research design, altering the research plan as required. Where the change was positive, the specific situation and the successful action need to be carefully documented to aid future research, not only in the specific situation, but also in similar situations.

The diagnosis leads to a hypothesis, and the specifying learning phase leads to theory generation on the resulting change.

Theory generation and grounded action research

Checkland (1981) used action research in the research that led to the development of the soft systems methodology (discussed in chapter 3). He points out that the action researcher does not control the direction of the research; he has to follow wherever the situation leads him, or he needs to stop his research. Action research is suitable for ill-defined social problems and according to Checkland (1981:153), cannot be used to study physical phenomena such as magnetism.

Baskerville and Pries-Heje (1999:4) highlight the theory generation process of action research, as well of the shortcomings thereof. They argue that at the beginning of the research, researchers draw upon existing theory as foundations upon which to plan and take action. This theoretical framework is reinforced, withdrawn or modified to reflect the realities of action-taking according to the outcomes of each cycle. It is this evolution of theory that constitutes the scientific contribution of action research. Baskerville and Pries-Heje (1999:4) states that little attention is given to the exact processes by which such theories are cyclically developed during the course of action research.

Baskerville and Pries-Heje (1999) propose the use of grounded theory techniques to strengthen the scientific nature of the theory generation process. However, they do mention a major philosophical contradiction in this approach: “This may mean that every action research project begins, from a grounded theory perspective, with certain predefined categories and perhaps even a predefined core category. Since this contradicts a grounded theory tenet that a theory must be allowed to wholly emerge from the open coding, this “grounded action research” method does not

purely retain the "grounding" for its theory. This contradiction suggests that, since grounded theory is a complete research method in its own right, action research must use grounded theory components selectively. The resulting hybrid is action research, but does not constitute a canonical grounded theory." (Baskerville & Pries-Heje, 1999:17).

This argument represents one of the difficulties presented in the following section on the applicability of grounded theory for the proposed study. Baskerville and Pries-Heje (1999) do not relate this issue back to the philosophical and methodological foundations of grounded theory and action research respectively. In the discussion of abstraction according to Harvey's (1990) elements of critical social research methodology, it is clear that critical social research begins with a theory for which evidence is sought in the problem situation, as is the case in action research. Similarly, in the generalisation principle of Klein and Myers (1999) for interpretive field studies, it is argued that theory is generated as a result of observation, as is the case in grounded theory.

The difference in abstraction, from theory to evidence (in the case of action research) and from observation to theory (in the case of grounded theory), is a methodological difference, and it is the main motivation behind the philosophy, methodology and practice organisation of this chapter. When one attempts to merge these practical methods, it is necessary to take the methodological and therefore the philosophical foundations of these methods into account.

2.5 Research considerations with regard to this study

After the detailed discussion of the philosophy, methodology and practice of social research, it needs to be applied to the specific research question of this thesis. The research question as stated in chapter 1 evolves around the use of systems thinking techniques by data warehousing practitioners. The study first aims to explore the manner in which data warehousing practitioners use systems thinking techniques intuitively (unknowingly) and secondly, if that is the case, to set up a framework for the explicit use of systems thinking techniques in data warehouse design methodology. The assumption is made that the data warehousing practitioners under study are not aware or trained in the detail of systems thinking methodologies.

The case study data (reported in chapter 5) indicates that this assumption is reasonable in the South African context.

Considerations of philosophy, methodology and research practice are given in the next paragraphs and form a research plan for the proposed study:

2.5.1 Philosophical considerations with regard to this study

When this research problem is viewed from the philosophical foundation, the following observations can be made:

1. The first part of the research to understand the motivation behind current data warehousing practices has a strong interpretive nature.
2. The focus on the strategies or thoughts of the practitioners rules out the use of positivistic methods.
3. The researcher conducting this research does not have an emancipatory motivation for the first part of the research, therefore the research does not fit into critical social theory.

The aim of the first phase of the research is to understand the motivation behind the practices of the data warehouse developers. One does feel intuitively that the use of hermeneutics can be very fruitful in this process. The actions of individuals need to be understood in order to understand the practices of the data warehousing team and vice versa. The individual phases of the data warehouse development lifecycle aid in the understanding of the data warehouse as a whole and visa versa. One can therefore argue that this part of the research process has a strong interpretive nature.

The aim of the second part of the research is to develop a framework for the explicit use of systems thinking techniques in data warehouse design methodology. This part, which provides more of a philosophical challenge, can be seen as a second phase of the research process after the data collection has been completed and therefore represents the theory generation part of the study. Positivistic methods rely heavily on statistical tools in the analysis of data, and one senses that they are not applicable to this study. Analysis and generalisation in interpretive and critical social theory are methodological issues which will be debated further from a methodological level.

Finally, the purpose of the research from a philosophical view begs discussion. Why do we need a framework for the explicit use of systems thinking techniques in data warehousing practices? The researcher believes that the answer is ultimately to improve quality of data warehouse design. This implies that the researcher wants to change the practices of the data warehousing practitioners in the long run, except in those cases where practitioners are already using appropriate systems thinking techniques in all of their data warehousing practices. However, this is most unlikely, since data warehousing practitioners are not familiar with systems thinking ideas. One might argue that this part of the research is critical in nature, since intervention is implied. The intervention is however not part of the research process but rather a result of the completed study.

As a result of the arguments presented in this section, one may argue that the research problem has a strong interpretive nature, but intervention and therefore critical social theory is implied.

2.5.2 Methodological considerations with regard to this study

Since positivistic methodology is not applicable to this study, the debate should focus on interpretive and critical social theory methodology. At first glance, it seems that the proposed case study based research on data warehousing practices is a typical example of interpretive field studies in IS, and that the methodological principles of Klein and Myers (1999) are most suitable for this research problem. If this is true, a decision on the generalisation method is the most difficult decision to be made, and grounded theory seems to be applicable for this purpose.

Closer inspection of the methodology and the specific nature of this problem highlight the problems of a purely interpretive approach to this study. The theory generation process in interpretive methodology is based on the fact that theory is generated from the observational data. The theory is not stated at the beginning of the research and data is not collected to support the theory. The idea is that the theory will emerge from the data.

The assumption made in this study about the knowledge of the data warehousing practitioners of systems thinking techniques, complicates the generalisation process.

The detail of this argument is presented in the section on practical considerations but can be summarised as follows: Since the data warehousing practitioners do not know the terminology or principles of systems thinking techniques, it is the responsibility of the researcher to map their actions towards systems thinking techniques. In order to do this, the researcher needs to start off with some kind of mapping, linking the data on warehousing practices to systems thinking methodologies. This is in conflict with interpretive methodology.

Critical social theory methodology on the other hand seems to be more suited, since the element of abstraction presented by Harvey (1990) enables the researcher to start with a concept theory and to use the case study to seek evidence to prove or disprove the theory. In this case, the researcher can start by creating a preliminary framework for the use of systems thinking and use the data collected during the case study to find evidence in support or in opposition to the framework.

Critical social methodology focusses on the structures in the organisation. This focus is not present in interpretive methodology. Critical social methodology ultimately aims to change oppressing structures in the problem environment. The researcher should decide whether this research problem fits this situation. To make an informed decision, one needs to understand the use of the term “structure”. The philosophers in the critical social tradition view structure from different perspectives. Habermas viewed the use of language as communication medium as structural and argued that communication can be restricted by certain structures in language. Marx viewed economic hierarchies as structures oppressing the workers class.

The decision to be made here is whether practices of data warehousing professionals are structures, whether these structures are oppressive and therefore need to be changed and finally, whether it is the aim of the researcher to change these structures. First then, the question whether common practices can be viewed as structures. From Orlikowski’s (1992) work on Giddens’ structuration theory, it is clear that methodological practices of IS professionals can be viewed as structures. Furthermore, one needs to make a decision on the oppressive nature of these structures. The oppressive nature of data warehousing practices was not the initial motivation for the study. The original motivation was the mapping of data warehousing practices on systems thinking techniques. However, it can be argued that certain data warehousing practices (structures) lead to poor quality projects, and that they are oppressing high quality projects. If the researcher in the study reported

in this thesis, confronts herself with the question whether she wants to improve data warehouse quality, the answer is in the affirmative. One can therefore argue that this study aims to improve data warehouse quality through the altering of data warehousing practices (structures). A major difference between this study and typical critical social theory studies lies in the element of praxis. The researcher will not attempt to change the practices of the data warehousing professionals during the data gathering or analysis phase of the research. The research strategy is not comparable with the change cycle of action research but rather with the diagnostic phase. This is mainly due to the high costs involved in data warehousing projects. However, the research will lead to a framework for the improvement of data warehousing practices through the explicit use of systems thinking techniques.

The above argument shows that the focus on structural change of critical social theory methodology is not inappropriate for this study. The practical research design presented in the following section, will take both interpretive and critical social methodology into account.

2.5.2.1 Linking methodological aspects of this study to interpretive and critical social methodology

As a summary to this section on methodological considerations of this study, two tables are given to link the chosen methodology to the methodological principles discussed in section 2.3. Table 2.2 gives perspectives on the problem situation from an interpretive methodological perspective according to the principles of Klein and Myers (1999). Table 2.3 describes the link between the critical social theory principles described by Harvey (1990) and the methodological considerations of this study. A short description of each principle is repeated in these tables to aid the reader.

1	**The fundamental principle of the hermeneutic circle** suggests that all human understanding is achieved by iteration between the interdependent meaning of parts and the whole they form. This principle of human understanding is fundamental to all the other principles. *The researcher aims to understand data warehousing practices by understanding the practices of the data warehousing team and that of the individual team members in a hermeneutic context. A hermeneutic approach is also followed to understand the individual phases of a data warehousing project in the context of the project as a whole.*

2	**The principle of contextualisation** requires critical reflection on the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged. *The historical contexts of the different organisations used in the case studies need to be investigated. Economic constraints and social and political contexts in each organisation are viewed as enriching the understanding of data warehousing practices.*
3	**The principle of interaction between the researchers and the subjects** requires a critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and the participants. *It is accepted that research material is influenced by the interaction between the researcher and the participants. The researcher will be careful not to influence the respondent by her reactions to responses given. It is also important not to take on a consulting role. To manage this, the researcher aims to revisit the organisations after the completion of the research study to answer questions put to the researcher during the data collection phase.*
4	**The principle of abstraction and generalisation** requires relating the idiographic detail revealed by the data interpretation through the application of principles one and two to the theoretical general concepts that describe the nature of human understanding and social action. *A method based on pattern matching is used in chapter 5 to analyse the responses of the data warehousing professionals in terms of system thinking concepts. Questions covering data warehousing concepts are explored from different systems thinking methodological approaches to guide the researcher in understanding the given responses from a specific systems thinking methodology's point of view. However it should be noted that the developed framework (given in chapter 6) do not represent current data warehousing practices, but rather suggested practices in terms of systems thinking concepts. This aspect is atypical of interpretive research.*
5	**The principle of dialogical reasoning** requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tells") with subsequent cycles of revision. *The researcher conducted follow-up interviews with role players in the organisations to explore the relationship between the interpreted data, the resulting framework and reality.*

6	**The principle of multiple interpretations** requires sensitivity to possible differences in interpretations among the participants as typically expressed in multiple narratives or stories of the sequence of events under study. They are similar to multiple witness accounts, even if all participants tell it as they saw it. *The interpretive data given in chapter 5 represent the responses of individuals. It is very interesting to study the different interpretations of factual events from a systems thinking point of view. The researcher hopes to expose these differences in order to achieve a better understanding of the problem situation, but also to benefit the role players in the organisation.*
7	**The principle of suspicion** requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants. *The number of respondents to be interviewed in each organisation is not determined prior to the case study. More respondents will be interviewed when signs of such distortions are detected to clarify the understanding of the distortions and the organisation of the researcher.*

Table 2-2 Interpretive methodological considerations of this study

1	Through **abstraction**, critical social research aims to reveal underlying structures that are otherwise taken for granted. These structures specify the nature of the abstract concepts which have themselves been assimilated uncritically onto the prevailing conceptualisation. *This research study explores the underlying structures of data warehousing practices and success. These structures are explored from a philosophical and methodological point of view in terms of systems thinking. Systems thinking principles such as boundary judgement and ownership are examples of abstract concepts that are yet to be critically explored by data warehousing professionals.*
2	**Totality** refers to the view that social phenomena are interrelated to form a total whole. Social phenomena should not be investigated in isolation but always as part of a larger context. *This research study focusses on the role of data warehousing in the total organisation. It explores different motivations for the initiation of the data warehousing project. The resulting framework aims to give a broadened view of data warehousing in the context of the organisation as a whole.*

3	**Essence** refers to the fundamental element of the analytical process. Critical social researchers view essence as a fundamental concept that can be used as the key to unlocking the deconstructive process. *Systems thinking concepts, as described in chapter 3, are used as the key to unlocking the deconstructive process. Data warehousing practices are deconstructed by means of analytical questions (given in chapter 5) formulated to explore the underlying structure of data warehousing practices.*
4	According to Harvey (1990:22), **praxis** means practical reflective activity. It is activity that changes the world. The critical social researcher is not only interested in understanding the world; he/she aims to change the world. It is not the actions of an individual that is of interest but rather the actions that change the social formations. *From a critical perspective, the aim of this research is to improve data warehousing practice by understanding the underlying structures of current practices before proposing a framework for change in current data warehousing practices. The framework for improved data warehousing practices is given in chapter 6.*
5	The positive view of **ideology** sees it as false consciousness which hides the interests of dominant groups from themselves. According to the negative view of ideology, it cannot be detached from the material conditions of their production; it is constantly reaffirmed through everyday practice. The nature of the ideology needs to be revealed by the researcher through the identification of the essence of social relations and the separation of this essence from structural forms through a process of dialectical deconstruction and reconstruction. *Pattern matching is used in chapter 5 to map current practices and ideas of data warehousing professionals to systems thinking methodologies. The ontological and epistemological foundations of these systems thinking methodologies are explored in chapter 3 to identify their ideological nature.*
6	**Structure** is seen by the critical social researcher as more than the sum of the elements. It is viewed holistically as a complex set of interrelated elements which are interdependent and which can be conceived adequately only in terms of the complete structure. *The aim is not only to break data warehousing practices down to specific development lifecycle phases, but rather to understand the underlying boundary judgements (and other systems thinking concepts) made by data warehousing professionals in their everyday activities.*

7	Critical research **history** is not so much interested in the historical facts as in the circumstances within which it occurred. It investigates the social and political contexts, addresses the economic constraints and engages the taken-for-granted ideological factors. It also takes the situation of the researcher into account. *The historical contexts of the different organisations used in the case studies need to be investigated. Previous attempts to change current practices and the reasons for such changes need to be explored. Economic constraints and social and political contexts in each organisation are viewed as enriching the understanding of data warehousing practices.*
8	The critical researcher aims to **deconstruct** the situation into abstract concepts in order to study the interrelations between the concepts with the purpose of discovering the key to the structure of the situation. The core concept is used to **reconstruct** the situation. This is an ongoing process to expose the ideology underpinning the situation in order to identify the oppressive mechanism, which requires change. *Data warehousing practices are deconstructed through asking specific analytical questions. These questions (given in chapter 5) are formulated to identify different systems thinking perspectives of respondents. Individual responses to these questions (that represents the deconstruction) are also given in chapter 5. Reconstruction of the data warehousing practices is done according to systems thinking concepts and presented as a framework in chapter 6. Chapter 6 is specifically organised to illustrate the reconstruction of practices according to systems thinking concepts. The researcher conducted follow-up interviews with role players in the organisations to explore the relationship between the framework and reality. However the framework has not been used explicitly to guide data warehousing practices in any organisation. This aspect is atypical of critical research.*

Table 2-3 Critical social methodological considerations of this study

The methodological considerations with regard to this study identify differences between this study and typical interpretive as well as critical social research methodology. This underlines the pluralistic nature of the research activity reported in this thesis.

2.5.3 Practical considerations with regard to this study

This section presents the practical research plan for the study. A combination of interpretive and critical social methodologies is applied in this research. Case studies will be used as data collection method. The aim of this research is to explore

current data warehousing practices from a systems thinking perspective, in order to design a framework for the explicit use of system thinking techniques in data warehousing activities. The researcher believes that the framework would be more acceptable to the practitioners if it relates to current data warehousing practices.

The first part of the practical research plan describes how the case studies will be conducted. This discussion is followed by a discussion on the applicability of grounded theory for the development of a theory. This section concludes with a discussion on the theory generation process that will be followed to create a framework for the explicit use of systems thinking techniques in data warehousing practices.

2.5.3.1 Data collection

The researcher in this study had to choose between interpretive case studies and ethnography as data source. The use of ethnography has advantages in this situation, in that the researcher has enough time in the research environment to develop a true understanding of the motivation behind the research practices of the data warehousing practitioners. However, two problems with ethnography as data collection method for this study surfaced. Firstly, the researcher believes that from a systems thinking methodology perspective (discussed in chapter 3), data warehousing practices are dependent on the orientation of management and structures (procedures) in a specific organisation. This implies that the researcher would have to study more than one, perhaps as many as four organisations to gain understanding of the underlying systems thinking ideas in data warehousing practices. Although this is possible in ethnography, it would be very time consuming. A second concern with the use of ethnography for data collection is the role of the researcher in the organisation during the data collection period. The researcher believes that an organisation would expect financial gain from the presence of the researcher. This implies that the researcher should add some value to the development of the data warehouse. Since the researcher is trained in data warehouse development practices, the researcher might turn into a consultant, thereby influencing the very aspect that needs to be researched. It would be difficult to gain the trust and respect of the development team if the researcher constantly tries to conceal or withhold knowledge.

At least three interpretive case studies will be conducted to collect data for the research. The data collected, will be used to explore current data warehousing practices from a systems thinking point of view. Since chapter 5 covers the detail of each case study, this section will deal with the research design that was done prior to conducting the case studies.

The first question was to determine where the case studies should be done. What should be the similarities between the different organisations, if any? Should all the organisations be in the same economic sector, or should an effort be made to represent more that one economic sector? The researcher decided that data size determines the design practices in data warehouse development. Sound design practices are more important when large data warehouses are being designed, therefore the researcher decided to focus on organisations with large data warehouses. A large data warehouse is one with a large number of records in the base fact tables of the data marts. (Data warehousing terminology is discussed in chapter 4.)

Since the researcher needed to bridge a gap between studying the current practices of data warehousing practitioners and proposing methods to be used by data warehousing practitioners from a systems thinking point of view, a data warehousing consulting organisation was chosen for one of the case studies. The respondents of a consultation organisation would be more likely to report on ideal practices, since they have experience in both successful and unsuccessful projects in a variety of organisations.

The second question was to determine whom to interview in the organisation. Since different phases of the development lifecycle of a data warehouse will be researched, it is important to interview employees responsible for each of the stages in the data warehouse development lifecycle (this lifecycle is discussed in chapter 4). It will also be necessary to interview employees in the lower levels of the organisational hierarchy, since systems thinking ideas require, among other things, that all employees involved in the development lifecycle should keep the organisation's objectives in mind. Interviews with top management will serve to interpret conflicting responses from section heads in lower levels of management.

The order, in which the interviews are conducted, is of significance. It will be important not to waste the time of top management with questions that could have

been answered to the researcher's satisfaction by lower level employees. Top management on the other hand, might want to be interviewed first to set certain ground rules in terms of confidentiality and so forth. Consequently, the case study will start with a short interview with the manager and end with an extensive interview with the same manager. The researcher is of the opinion that starting the case study with a short interview with the manager has the distinct advantage of providing the researcher with an overview of the business. Detailed interviews with section heads will then follow, succeeded by interviews with employees responsible for the physical implementation of each of the data warehouse life cycle phases. The case study will be concluded with an extensive interview with top management.

The researcher foresees that the organisations involved in the case studies reported in this thesis, will require the signing of confidentiality agreements. It will be made abundantly clear to all respondents that information obtained from them will not be discussed explicitly with their colleagues or superiors. The organisations will be requested to make documentation about their practices available in terms of the confidentiality agreement.

Semi-structured interviews will be conducted. It is important to keep a conversational mood during the interview, since the researcher accepts that useful information is gathered from informal remarks rather than answers to specific questions. The structured questions are intended to keep the interview moving forward. The questions will not necessarily be asked in the planned order, but may be rearranged to aid the natural flow of the conversation. These questions are presented in the first part of chapter 5, as a mapping that was used in a pattern-matching analysis approach. These questions were carefully designed to be open–ended questions that aid the natural flow of the conversation. The researcher will ensure that, at the end of each interview, all questions were asked and answered.

Each interview will start with an introduction explaining the background of the researcher, the purpose of the case study and a short explanation of how the specific interview fits into the case study. The researcher will also give an explanation of the extent of the confidentiality agreement. Having explained the purpose of recording the interview, permission will be asked to do so. The researcher will also ask permission to attend routine project meetings. The attendance of these meetings will give insight into the internal social structure and the group dynamics of the organisation in question.

The interviews and the meetings are to be recorded with a notebook computer and a small microphone, which might prove to be less intrusive than traditional tape recordings since the respondents are used to having computers in their environment. Recording on a computer has the added advantage of simple backup operations.

2.5.3.2 Applicability of grounded theory (GT) for this study

This section investigates the applicability of GT as theory generation methodology for this study. The aim is to explore whether GT can be used to achieve the initial goal of the study, namely to understand the practices of data warehousing practitioners from a systems thinking methodology point of view. In the view of the researcher in this study, certain aspects of GT methodology as described in section 2.4.2.3, complicates its usage for the stated purpose. The point to be considered is that the data warehousing practitioners generally do not know the detail of systems thinking methodologies. The research is specifically done to explore their practices according to systems thinking methodologies, or stated differently, to ascertain whether they use systems methodologies unknowingly?

The emergence of concepts and categories

In GT the concepts that result in categories emerge from the data. It is abstractions of patterns of events or incidents in the problem situation. Although it is conceptualised by a researcher, there is a strong relationship between the names of the categories and behaviour in the research situation.

In the proposed study, GT should link the practices of data warehousing practitioners to concepts of systems thinking methodologies. This means that the categories resulting from open and axial coding, should reflect both systems thinking methodologies and data warehousing practices. This would require co-operation between inductive and deductive methods to determine categories. On the one hand, categories representing data warehousing practices would emerge from the data inductively, while on the other hand, the researcher would introduce preliminary categories representing system thinking deductively. The second group of categories would only be grounded, once incidents in the data can relate to them. The central category determined in selective coding will relate the two groups of categories.

Strauss and Corbin (1998:161) state that "finally, the theory is validated by comparing it to raw data or by presenting it to respondents for their reactions. A theory that is grounded in data should be recognisable to participants, and although it might not fit every aspect of their cases the larger concepts should apply." This implies that either the IS practitioners will not be able to verify the theory, or that they would have to be informed about the detail of systems thinking methodologies after the coding is finished.

The sampling process

In true GT tradition, the researcher looked at a similar research problem in a totally different environment to assist in identifying the pitfalls of sampling. Consider a study about adjustment problems pre-school children are experiencing. The study is similar in that the children do not know the terminology concerning adjustment problems. The problems of the children should at some point be compared with what is known from literature as adjustment problems, just as the practices of data warehousing professionals should be compared with different systems thinking methodologies. Now consider the children's actions.

When sampling is done, the researcher will focus on events that he/she thinks represent either adjustment problems, or specifically no such problems. The children will be observed for any action that may or may specifically not reflect adjustment problems. One problematic example comes to mind. A child falls over while playing and starts to cry. The crying child immediately draws the attention of the researcher. Is this an incident indicating adjustment problems? Certainly the fact that the child was playing, indicates the opposite. However, the intensity of the crying might just as well indicate adjustment problems. Was the fall only a spark for an emotional outburst? It seems that the researcher should evaluate the intensity of the emotions to link the incident to adjustment problems, or to conclude that the child got a fright from the fall or was perhaps just overly tired. The point made is that the researcher wears adjustment problem spectacles while observing the children. The researcher should wear these spectacles with great responsibility and consistency.

Another problem situation can illustrate similar difficulties. A researcher may want to investigate the degree to which parents utilise pedagogical theories in the upbringing of their children without knowledge of pedagogical principles. The parents would not

be able to articulate their actions in terms of pedagogical terminology, and the researcher would need to do a mapping between the actions of parents and pedagogical terminology. The researcher has to decide to which degree a specific action corresponds to a specific pedagogical principle.

Clearly, the researcher looking for indications of systems thinking in IS practices has a similar problem. Which practices should be investigated? Only those that clearly reflect systems thinking? In that case, can it still be called OPEN coding? Rather, how can one still achieve open coding? Is it feasible to code all the practices (a tiresome process)? How do we determine whether a certain action represents a specific type of systems thinking methodology, or not? Once again, one is concerned that too much of the theory generation process is dependent on the perceptions of the researcher.

A solution to the problem for the researcher is to be aware of his/her perceptions. These perceptions need to be stipulated and the categorisation of data should not be done intuitively but systematically against the stated perceptions or qualifications of each category.

Possibilities for the use of GT in the proposed study

In order to make a decision regarding the applicability of GT to the proposed study, five possible perspectives of the problem situation have been identified. Each perspective will be discussed and evaluated critically.

Perspective 1: A three-phase method of comparison using GT

It is possible to divide the problem into three different phases. During the first phase, the data warehousing professionals will be studied and a grounded theory will be developed to describe their actions. Their actions are not studied through the spectacles of systems thinking. The aim is to discover how data warehousing professionals do their work. The result of this study will be a grounded theory (or network of ideas) describing the practices of data warehousing professionals. The second phase is to develop a similar network of ideas for systems thinking. This network of ideas will be set up mainly from literature. The result of this phase will be a set of principles that constitutes the use of systems thinking ideas in general. The third phase is to compare the two frameworks developed in the first two phases. The

aim is then to explore in what way the actions of the data warehousing professionals represent systems thinking.

The advantage of this approach is that GT is used in the way it was designed for, namely to let a theory emerge from observational data. The bias of the researcher towards systems thinking ideas is eliminated. The complexity of this perspective lies in developing two comparable frameworks or networks of ideas and to determine a method of comparing these frameworks. One possibility is to do a GT study on systems thinking literature and compare the different categories of the two phases. However, the different sets of categories will differ considerably, and this does not mean that there is no relation between the practices of the IS professionals and system thinking ideas. Other methods to set up a comparable framework for systems thinking need to be investigated before this approach will be successful.

Perspective 2: Two phases: From literature to practice

Another idea is to develop categories from systems thinking literature and attempt to ground them in data warehousing reality. During the first phase, the researcher studies systems thinking from a data warehousing perspective and develop categories (following GT coding techniques) that represent typical systems thinking ideas in data warehousing practices. These categories are not yet grounded in reality but represent actions of data warehousing professionals that would indicate the use of systems thinking ideas. During the second phase, the researcher will attempt to ground these categories in reality by testing the observational data against these categories. Observations that fit the theory will indicate practices that reflect systems thinking ideas and vice versa.

Although this approach seems practically possible, it is against the very spirit of grounded theory. GT was designed to allow a theory to emerge from the data without the detailed formulation of a hypothesis. The first phase can be seen as a hypothesis and the second phase as a test for the hypothesis. If this approach is followed, one cannot claim a true grounded theory describing the influence of systems thinking on data warehousing practices.

Perspective 3: Narrow the scope of the study

One might limit the scope of the study to only phase one of perspective 1 above. This would change the research question to: "Can the practices of IS professionals (in this case data-driven DSS designers) be generalised into a descriptive narrative using GT?" Although this is a workable solution, it does not mean that the study will improve the quality of the work done by data warehousing professionals. One is tempted to question the overall value of such a study.

Perspective 4: Do we need a theory to describe our observations?

From this perspective one might query the argument that led to the consideration of grounded theory in the first place. The stated research question was of an interpretive nature, and the fourth principle for interpretive case studies advocates generalisation. The researcher chose to explore GT as the most appropriate method to satisfy this requirement. The question may be asked whether a theory to describe the researcher's observations is really needed. Is this not complicating the issue? Can one simply make observations of the practices of data warehousing professionals and give a valued judgement on whether these actions reflect systems thinking ideas? The generalisation then comes from repeating the process in different data warehousing environments through multiple case studies.

The above approach simplifies the proposed research, but one has to investigate the scientific value of the method followed. One way of improving the scientific value, is to divide the process into two stages; first identify data warehousing practices that reflect systems thinking before the first case study is conducted, and then follow a strict coding process to prove that the observations fit the typical systems thinking behaviour described in stage one.

This option does not use GT directly as a research methodology, but the coding processes described in the discussion of GT may be used to organise the field observations.

Perspective 5: What about action research?

One may question another assumption that led to the consideration of GT for this study, namely that of interpretive research. It was argued that the researcher does

not want to change the practices of data warehousing professionals and therefore research methods proposing that intervention is not applicable to this study. Perhaps there is a different way of viewing the situation. One might argue that the main purpose of the study should be to develop a framework for the use of system thinking in data warehousing practices. The first stage involves investigating whether the practices reflect systems thinking ideas, thus constituting the diagnostic phase of an action research project. The next stage is to set up a framework for the use of systems thinking ideas in data warehousing practices. The acceptance of this framework in industry needs to be tested. If the practitioners accept the framework, it does represent an intervention in the practices of data warehousing professionals. This approach differs from the typical action research project, where the researcher advocates a course of action and then tests the success of that action. Grounded theory coding methods may be used to organise the data, an option that certainly has a lot of merit. It should not be seen as a way to avoid generalisation, since the generalisation will come from the acceptance of the framework by the data warehousing industry.

Conclusion regarding the applicability of GT for this study

The first three perspectives directly use GT as research methodology for the proposed study. The last two perspectives explore different ways of achieving generalisation in the study. GT can be used as a method of data organisation in the last two options. After examination of these perspectives, it is clear that the nature of this research problem complicates the use of GT.

The researcher of this study gained valuable insights after identifying these perspectives of the problem situation. It became clear that a pure grounded theory is very difficult to achieve, if not unsuitable, in this situation. This is mainly due to two aspects:

1. The practitioners are not knowledgeable on system thinking methodologies, which would result in concepts and categories that will not reflect systems thinking methodologies.
2. The aim of the researcher is not only to describe current data warehousing practices from a systems thinking methodology point of view, but more importantly to design a framework for the explicit use of systems thinking methodologies in data warehousing practices. The case study part of the

study is to ensure that the resulting framework relates to current data warehousing practices.

After evaluating the problem from the different perspectives mentioned above, the researcher decided not to use grounded theory in this problem situation. This evaluation also led to an understanding of the pluralistic nature of the chosen methodology.

2.5.3.3 Theory generation and generalisation

It proved to be impossible to design questions to be asked during the interviews without an in-depth knowledge of systems thinking and an initial idea of the mapping of systems thinking techniques and data warehousing practices. The researcher therefore decided to follow the abstraction methodology of critical social research. This means that a literature study on systems thinking was followed by a literature study on data warehousing. A mapping between systems thinking ideas and data warehousing was developed from literature and is presented in chapter 5. This mapping is presented in table format, which forms the basis of a pattern-matching method used for case study data analysis. From the analysis of the case study data, a framework will be developed to make the mapping between systems thinking ideas and data warehousing practices explicit. The framework is presented in chapter 6 as a conclusion to this study.

This method of abstraction is contrary to the typical theory building methods used in interpretive research and represents the critical component of the study. The following argument explains this contrast. It is important to divide the study into two parts. The first part is to understand, by doing case study research, to which degree practices of data warehousing practitioners represent systems thinking ideas, and the second part is to set up a framework for the explicit use of systems thinking ideas to improve quality in data warehousing practices. If this was an interpretive field study, the resulting theory would have described current data warehousing practices in terms of systems thinking ideas. In grounded theory terms, the theory would be a narrative describing the relationship between current data warehousing practices and systems thinking ideas. In this study however, the final framework (part 2 of the study) for the use of systems thinking ideas in data warehousing practices, should be viewed as the theory component of the study. The initial study to explore current data warehousing practices from a systems thinking perspective (part 1 of the study),

is done to assure that the resulting framework relates to current data warehousing practices in order to foster the acceptance of the framework (part 2) by data warehousing professionals.

One might argue that the first phase of this study is similar to the diagnostic phase of action research, but the difference lies in the fact that the researcher does not use an organisational setting to test and improve the framework, because of the cost and duration of a typical data warehousing project. Data warehousing projects are developed in large companies over long periods of time and at very high costs. It is therefore impossible to implement a typical action research cycle for implementing and improving the framework.

2.6 Summary

The aim of this chapter is to give a philosophical and methodological foundation for a pluralistic research plan. This was done by describing positivistic, interpretive and critical social research philosophies. It was shown that in positivistic methods, the researcher is objective, while subjectively engaged in the research environment of interpretive and critical methods. Unlike the critical social researcher, the interpretive researcher does not seek to emancipate oppressed parties in the research situation. These different models were applied to IS research.

Research methodology was also discussed from a positivistic, interpretive and critical social viewpoint. It was shown that, apart from the emancipatory nature of critical social theory, it also differs from interpretive methodology with regard to abstraction or theory generation. In interpretive methods, theory is generated from data gathered through observation, while critical social theory starts off with a preliminary theory and uses observation to either prove, or disprove, or refine the theory.

Research practice was discussed from a positivistic, interpretive and critical social viewpoint, followed by case study data collection and generalisation through the use of pattern-matching, grounded theory and Giddens' structuration theory. Action research was discussed from a critical social theory point of view.

This discussion on philosophy, methodology and practice of social research was followed by research considerations of this study on a philosophical, methodological

and practical level. It is concluded that, although the proposed study has many interpretive qualities, the required research methodology resembles critical social theory methodology with one major difference, namely that the problem situation is changed through the resulting theory (in this case a framework), rather than through the research process.

The proposed research methodology requires that literature studies are done on systems thinking, as well as on data warehouse development practices. The researcher needs to develop a mapping between systems thinking ideas and data warehousing practices. The case study data, analysed with pattern-matching, will be used to understand which systems thinking ideas are already used by data warehousing professionals unknowingly. This knowledge, presented in chapter 5, will enable the researcher to develop a framework, which enhances current data warehousing literature relating to success factors. The resulting framework gives an explicit mapping between data warehousing practices and systems thinking ideas. The framework, presented in chapter 6, will be distributed to data warehousing practitioners. This represents intervention in data warehousing practices.