INTEGRATING ETHICAL CONSIDERATIONS IN COMPUTERIZED INFORMATION SYSTEMS

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I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has already been conferred upon me.

___________________________________________________________
Göran Larsson
To my mother and father
Abstract

This work concerns ethics applied to computer technology, emphasizing the use of this technology within organizations. Computer technology has created the possibility to do things not possible before, for good and bad. Ethical reasoning can be used as a tool to provide guidance, in order to create Computerized Information Systems (CIS) that are sustainable with respect to the ethical demands that can be put upon them.

If one wants to integrate ethical considerations into a CIS, it is reasonable that ethical issues should be taken account of in systems development. As a general methodology for developing a CIS, the Systems Development Life Cycle (SDLC) will be examined. The SDLC is the place and moment when it is possible to integrate ethical considerations into a CIS.

This work will focus on, and try to explain, what characteristics are necessary in order to be able to apply ethical considerations to a methodology. This is done by examining five methodologies adopting the SDLC. It will also be examined how the three major ethical theories utilitarianism, deontologism and rights ethics will affect the SDLC, and thus eventually a CIS being implemented.

The outcome of this work are that there are limited possibilities of integrating ethical considerations into methodologies adopting a hard system approach, compared to those adopting a soft one. The ethical standards of a CIS must be established early on in the SDLC. Integration of ethical issues requires a system approach to be applied in the SDLC. Participation becomes an important feature of systems development in order to adopt ethical reasoning. The different ethical theories will put different emphasis on the group or the individual in systems development.
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## Background

Computer technology has had a great impact on our lives, and can be expected to influence our lives even more in the future. The way information systems based on the use of computer technology are developed, implemented and used is likely to affect us all.

If one wants to direct development in a system, it will be a good point of departure to look at the systems development process, which eventually will lead to the creation of a system. The characteristics of the development process of Computerized Information Systems (CIS) are described in the Systems Development Life Cycle (SDLC). This process will lead to an implemented CIS.

Every day decisions are made based on an ability every human being seems to possess, more or less, the ability to make ethical judgements. These judgements will then influence our acts. Ethics is the area of study that describes what is right and wrong, what is good and bad, and why that is the case. Ethical issues concern all humans, with respect to their behaviour, and the tools they use to fulfil their wishes. Thus, technology in the form of CIS will also be affected by our beliefs as to ethical questions.

Computer technology has created the possibility to do things not possible before, but these possibilities do not come without a cost. As with many other technologies, such as the knife or nuclear power, it can be used as a means to bring about good or evil.

In this work, how to avoid or minimize possible consequences of the deliberate misuse of computer technology will not be discussed. Instead, the standpoint will be chosen that the CIS is a powerful tool for an organization to obtain its goals. The emphasis will be on how to develop a CIS that is sustainable with respect to the ethical demands that can be put upon it.
It is argued in this work that different ethical theories can be used as a tool to provide guidance, in order to create a CIS that rests on sustainable decisions. Ethics has been a companion to humankind for a very long time. The different schools of thought that have developed contain insight that could be beneficial to the development of CIS, even in this comparatively new area of technology. The technology itself might be new, but many of the problems it could create are not (Johnson, 1994).

Therefore, it is reasonable that ethical issues should be taken account of in the SDLC. This is the place and moment when it is possible to integrate ethical considerations into a CIS. When a CIS is already integrated into an organization, it will be most difficult to try to integrate ethical views into it, since the system should rest upon ethical values. Thus, it is necessary to emphasize the SDLC, and the CIS it will eventually lead to, and not only the CIS itself, if one wants to consider ethics.

Today, there is a void when the CIS and ethics are considered, in the sense that ethical considerations are seldom made explicit in the SDLC. It will be argued in this work that there is an absence of ethics, and the possibilities to integrate ethical considerations, in some of the major methodologies of today that adopt the SDLC.

After making an introduction about the various areas of ethics, computer technology, its effects and the SDLC, this work will focus on, and try to explain, what characteristics are necessary in order to be able to apply ethical considerations to methodologies adopting the SDLC. It will also be examined how three major ethical theories will affect the SDLC, and thus the CIS eventually implemented.
2 Introduction

The intention of this chapter is to open a window to the areas of ethics, ethics in the context of computer technology, and systems development. It should also give the reader an understanding why the subject presented is of importance.

The meaning of the word “ethics” will be examined first, followed by a separation of relative and universal ethics, the latter being the subject matter of continued study in this work. This is followed by a description of the SDLC and its phases, which forms the systems development that will eventually lead to a CIS. The term CIS will also be given a definition.

Fundamental to this work, the question “Is ethics important in the use of computer technology?” must be examined. Sufficient proof that this indeed is the case will be put forward, before the aims and objectives of this work are presented.

2.1 Ethics, morality and law

The word ethics has its roots in the Greek word ethos, “…the character and sentiment of the community.” (Shea, 1988, p. 15) Ethics is also called moral philosophy. It is the discipline concerned with what is good and bad, right and wrong. Before analysing the ethical issues surrounding CIS, there is a need to discuss ethical analysis and, to some degree, become familiar with some ethical theories and concepts.

Ethics deals with questions that cannot simply be answered with “yes” or “no”. For example, is it right to be dishonest for a good cause? Is it right to steal food when starving?

Is it right to make decisions that will benefit many, at the price of sacrificing a few? Oz (1994, p. 1) asks, “…what is right and what is wrong? (...) The answers depend on the society and the time in which we live.” What is considered right for...
one person, organization or community, does not necessarily need to be considered right by others. Often, there is no right or wrong, but different and opposing viewpoints that are considered right by their arguers.

Situations when “yes” and “no” will not suffice do also exist in the field of CIS. Consider the copying of a proprietary program. It could be argued that nothing has been stolen, in the physical sense, merely made a mirror of a set of ones and zeros. The owner of the software still possesses it, maybe even without knowing that a copy has been made. But this act infringes on the right of the author to earn a profit by copying it. Then, consider this reasoning: “If I had to buy the software to use it, I would not bother to acquire it, and therefore, no one is hurt by me copying the software.” Can anyone easily say what is right and wrong in this situation, considering the arguments of the opposing sides?

Ethics deals with this type of questions. Its subject consists of the fundamental issues of practical decision-making, and its major concern is what is the paramount value, and the standards by which human actions can be judged to be right or wrong.

According to Johnson (1994, p. 17), one’s argument, here for an ethical belief, “...has to be ‘put on the table,’ and once there, it can be evaluated in terms of its coherence and consistency...”. If, and when, we examine a claim, we get to understand not only the claim more fully, but also our own views and why we reason as we do. This process leads to either a change in belief or a strengthened conviction (Johnson, 1994).

The terms ethics and morality are closely related, and often confused. Ethics is considered the philosophy of morality. The term ethics refers not to morality itself but to the field of study, that has morality as its subject matter. Ethics is often referred to where it would have been more suitable to speak of moral judgements or moral principles. Morality is what we do, and ethics provides a philosophical
basis for why we do it. According to Severson (1997, p. 7) “...morality refers to the sense of conscience and right and wrong that we derive from our upbringing.” Severson (1997) continues by stating that morality is something that is to be considered highly personal and something that functions instinctively. It will happen automatically, almost like a reflex. Ethics, on the other hand, is something that is more structured and deliberative. It is a kind of critical thinking about morality.

Shea (1988) argues that it is easier to understand the concepts of morality and ethics, if the concept of law is added. Any moral principle becomes progressively more dense, when going from morality to ethics to law. Shea (1988, p. 20) states, “Obscure as the law sometimes is, here we find our most precise guides...”. In the rapidly developing field of CIS, a vacuum exists with respect to both moral rules and law. Should the current vacuum of rules be filled with individual reasoning or law? Johnson (1994) states that law is neither the starting place nor the end when it comes to ethics. Our moral character shapes the law, and is often a starting point for the underlying moral analysis, which forms the basis for creation of law.

Ethics has always been viewed as a branch of philosophy, but its practical nature links it with many other areas of study. Yet, ethics differs from more concrete branches of study such as politics, medicine or economics, because it does not concern factual knowledge such as the areas mentioned above. Still, there are few, if any, parts of science not affected by ethics (Shea, 1988).

In systems theory, another side of the definitions of ethics and morality might be considered. van Gigch (1991, p. 424) states that ethics is the “Code of conduct and responsibility that agents of change ought to follow when designing systems.” Thus, ethics must guide the conduct and behaviour of all the different decision-makers in a design process. A considerable burden rests upon the designers of a system; they are those whose beliefs will be put into practice, thereby affecting the whole direction of the system that is created.
A system, in this case CIS, is never in a state that is fixed. The system is at a constant change. Thus, the philosophical analysis of it also needs to be an ongoing process. According to Johnson (1994) this must be the case. We can examine an argument to see where it leads, and also to see what is needed in order to defend it and put it on a firm footing. This process will not necessarily show that the statement holds, but at least we will gain what Johnson (1994, p. 18) calls “‘negative knowledge’”. This information shows that an argument is insufficient and why.

2.2 Relative and universal ethics

This section will deal with some major ethical theories that will be used as a basis for further analysis in this work. Before doing any study of ethics, Johnson (1994) emphasizes that one should recognize the distinction between descriptive and normative ethical claims.

Descriptive claims deal with what people actually do in different situations. Descriptive claims are thus empirical, since they tell us what people actually do or think. Normative claims on the other hand, do not concern what people do, but what they ought to do. Ethical theories are normative, since they try to provide a basis to explain why an act is right or wrong.

For example, that some people ignore paying the fees on public transport on occasions when there is no danger of being caught does not make this behaviour right. That one or several individuals have a belief does not automatically make this belief morally right.

Relativism

In relativism, there are no universal, moral rights and wrongs. Right and wrong are variable and relative, depending on the environment (Oz, 1994). Relativism may
not be that easy to understand as it first seems, since it is not simply the belief that what is right depends on the circumstances. Even a convinced universalist would not deny that there are exceptions from the rule of universalism, which is that there exists a universal right, something that will hold for everyone, everywhere (Oz, 1994). For example, when breaking a rule (“you shall not steal”) to prevent something worse, maybe an accident. Ethical relativism is rather the view that what is really right depends solely upon what the individual or the society thinks is right. As the beliefs of the individual or society will vary over time and place, what is right and wrong will vary accordingly. An example of this can be the view, some 150 years ago in southern USA, that slavery (for some reason limited to coloured people) was right, a view few people would share today. This is a disturbing example of what could fit inside the scope of “right” in relativist ethics.

In ethical relativism, there is no recognition of a value-less way of justifying any principle as valid for all individuals and all societies. But, as Oz (1994, p. 8) states, “What should a Westerner do when among cannibals?” Relativism faces a dilemma when different cultures and individuals confront each other. A relativist can never judge another individual’s or society’s actions as wrong, even if one has a intuitive feeling that this is the case, since every individual and society may have their own viewpoint and moral standard.

Johnson (1994) separates relativism in claims of two types, negative and positive. Negative claims are of the type “there are no universal moral norms or standards”. A negative claim asserts that there is no universal standard by which one’s acts can be judged. This implies that negative claims deny that there are universal “rights” and “wrongs”. Positive claims state to whom the relativist claim should be valid, to the individual or to the society in which one lives.

Johnson (1994) examines the relativist claims to some extent, and concludes that there are several weaknesses in the theory, upon closer study. One of the most serious weaknesses found is that by assuming that there are no universal rights or
wrongs, the relativist makes the statement that every individual ought to follow the rules of one’s society, which is a universalist statement.

Universalism

The universalist believes that there is a universal right, a universal good, a code of conduct that should be considered right (and vice versa, wrong) by all individuals in all communities. Universalism is at the opposite end in the ethical spectrum compared to relativism, for which what is considered good and right are relative to the society in which one lives (Johnson, 1994).

There exist several sub-branches of universalist reasoning, such as consequentialism and deontologism. Based on the criticism of relativism put forth above, only universalism in the form of consequentialism and deontologism will be considered from now on.

2.3 The Systems Development Life Cycle (SDLC)

If ethical considerations are to be integrated into a system, it is reasonable that the best place to start is in the systems development process. This is the place where change takes place, and thus here it is possible to integrate the views and values that the stakeholders of the system wants it to rest upon. In the context of CIS, ethical considerations should be integrated into the SDLC.

As a general methodology, the SDLC presented in Avison and Fitzgerald (1995) has been selected. The SDLC illustrates the essential phases in the development process of a CIS, and illustrates the issues that are common in most methodologies of today. It has been considered that the SDLC process is suitable for the continued examination of the subject, based on its general characteristics.
Avison and Fitzgerald (1995) state that the SDLC is a methodology, which should not be confused with a technique or tool. A methodology is defined as “…a collection of procedures, techniques, tools, and documentation aids which will help the systems developers or business users in their efforts to implement a new information system.” (Avison and Fitzgerald, 1995, p. 13-14).

Avison and Fitzgerald (1995) continues by evaluating some of the criticism that the SDLC has faced. The term “life cycle” indicates the iterative nature of the process: when the SDLC entered its final phase, the system was frequently found to be inadequate and the process had to start from the beginning again. Yourdon (1988) criticises this as one of the major weaknesses of the SDLC. Still, Avison and Fitzgerald (1995) states that even if the SDLC is a traditional methodology, this does not imply that it is of little value. Many of the methods developed today are based on the SDLC in general, and address the potential weaknesses of the methodology by improving one or several of the phases that will be identified further on. Avison and Fitzgerald (1995) concludes that in many respects there is nothing intrinsically wrong with the SDLC. Many problems with the methodology are instead connected to the way it is used. According to Andersen (1994), the SDLC is the most successful avenue in many development tasks.

Avison and Fitzgerald (1995) urges the reader to stop and reflect on how many systems that are developed today using ad hoc methods. Hereby, they stress the importance of adopting a methodology when developing a system. According to Yourdon (1988, p. 44), there are three primary objectives of creating a project life cycle:

1. “To define the activities to be carried out in an EDP [Electronic Data Processing] project
2. To introduce consistency among many EDP projects in the same organization
3. To provide checkpoints for management control and checkpoints for ‘go/no-go’ decisions”

The remainder of this chapter is based on Avison and Fitzgerald’s (1995) identification and specification of six different major phases of the SDLC, if not stated otherwise.

The SDLC consists of the following phases (Avison and Fitzgerald, 1995):

1. Feasibility study
2. System investigation
3. Systems analysis
4. Systems design
5. Implementation
6. Review and maintenance
7. Liquidation (added in Andersen, 1994).

Together these phases are referred to as “‘the systems development life-cycle’” (Avison and Fitzgerald, 1995, p. 20) or “the classical project life cycle” (Yourdon, 1988, p. 45).

1. In the feasibility study (Avison and Fitzgerald, 1995), the point of departure is the already existing system. One studies the requirements it was intended to meet and the problems that occurred in meeting these, the new requirements that have surfaced. Alternative solutions are briefly investigated. An alternative solution must be within the boundaries of the system and adapted to those constraints put on the designer. An outcome of the analysis of the alternatives suggested might be leaving things as they are without enforcing any change, making minor adjustments, such as developing new instructions for the CIS, or larger changes, such as the redevelopment of the system or the development of a new CIS. The new system proposed must be feasible legally, organizationally
and socially, technically and economically. The demands of all stakeholders must be taken account of. Together, out of the possible alternatives, a recommended solution is proposed with a draft of the outline functional specification.

According to Andersen (1994), an important facet of the SDLC methodology is that the users should analyse their way to their objectives, and that this analysis should be carried out before the information system is designed. Large extents of the development of an information system is a work with descriptions, according to Andersen (1994).

Andersen (1994) considers the first phases of systems development to be organizational analysis and information systems analysis. Andersen (1994) calls these the what-oriented, or problem oriented, areas. Here it is decided what the information system should be able to do.

2. After the feasibility study, a system investigation (Avison and Fitzgerald, 1995) should be carried out. This is a detailed fact-finding phase. The area where the CIS is to be used should be thoroughly investigated. The basis for this investigation is collected from interviews of those affected by the CIS, from questionnaires, from direct observation of the area of interest, and by exploring the current knowledge that exists in the field.

The decision-makers need to manage these different information sources properly in order to make the right decisions. Their findings should be cross-checked by using concurrently several of the approaches stated above. If possible, the experiences of other decision-makers of the type of CIS considered for implementation should be taken into consideration, since this is a valuable information source of hands-on experience.

3. The system analyst now has enough facts from the feasibility study and system investigation to proceed to the systems analysis (Avison and Fitzgerald, 1995)
phase. The existing system is now analysed by asking questions such as (Avison and Fitzgerald, 1995):

- Why do the problems exist in the current system?
- Why, in the current system, were certain methods of work adopted?
- Do alternative methods exist?

The systems analysis phase is an attempt to obtain more profound knowledge of the aspects of the present system and why it was designed in its current way. This information should then be used to show how things should be improved in the new system.

4. Now, enough information exists to proceed to the *systems design* (Avison and Fitzgerald, 1995) phase. The outcome of this phase is the design of the new system. New facts obtained in the system investigation phases may lead the analyst to choose a different design than the one indicated to be the most suitable in the feasibility study.

Success here depends both on the thoroughness in the investigation phases and the quality of the investigation in the analysis phase. If a manual system is to be automated, the new design could be similar to the previous system, but now using the power of the CIS, thereby both avoiding the problems that existed in the old system, and potential new ones.

In Andersen’s (1994) analysis of the SDLC, organizational analysis and information systems analysis are followed by *theoretical design of the technical solution* and *development of technical solution adapted to equipment*. Andersen (1994) calls these phases the how-oriented, or solution oriented, areas. A demand specification is developed. This is the link between the analysis phase and the design phase.
5. Implementation (Avison and Fitzgerald, 1995) consists of the several and different phases that lead to an implementation of the new system. Software needs to be written or bought and adapted to the new CIS. The same is also true for hardware. Existing hardware should be adapted to the new CIS, and it might be necessary to acquire new hardware. When the software and hardware exists for the new CIS, both have to be tested to ensure that they will work properly in the system.

The design and coding of software are usually carried out by specialists in the area, computer programmers. If this approach is chosen, the analysis and programming tasks will be considered as separate parts, carried out by different people.

Quality control is a major importance at this point. The software and hardware used in the new CIS should not only be considered satisfactory by the analysts, but also by the users of the future CIS.

Before a new CIS can be fully effective, its user needs to be trained so they can take full advantage of it. This is also an important part of the implementation of the system. Without proper training, users are unlikely to work efficiently, thus the goals of the new CIS will not be fulfilled, even if the previous phases in the SDLC have been carried out properly.

In Andersen (1994), the realization phase consists of creating the code necessary to “‘build’ ” (Andersen, 1994, p. 46) the CIS by programming. This phase is followed by implementation (Andersen, 1994), the start of the new information system. This work demands reflection and planning. Both the designers of the new information system and its users should be involved in this process, where problems of motivation and of a practical nature might be encountered. When the implementation is finished, any problems should be resolved, and the information system is ready for use.

6. Once the system is operational, the systems development enters its final phase, review and maintenance (Avison and Fitzgerald, 1995). The system will
probably need fine-tuning to be kept up and running, and thus some staff will be assigned this task. Maintenance will ensure the continued effective use of the CIS.

The system will be continually reviewed. In this evaluation process, the organization will gain knowledge for the future when developing other systems.

Andersen (1994) calls Avison and Fitzgerald’s (1995) last step *administration and operation*. Routines should exist to administer the information system in order to provide smooth daily operation.

A continued review of the quality of the information system should always be carried out. This task is called administration. It includes review of the operation, with continued correction and identification of when to perform larger maintenance.

7. Compared to Avison and Fitzgerald (1995), Andersen (1994) adds a new final phase, *liquidation*. No system will exist forever. Andersen (1994) stresses that it is important to secure information in an information system that is under liquidation, in order to ensure that it does not end up in the wrong hands.

2.4 Computerized Information Systems (CIS)

This work concerns information systems that are computerized. A motivation for this choice is found in Avison and Fitzgerald (1995). They state that these systems are interesting, since (Avison and Fitzgerald, 1995, p. 2)

“…the computer can process data (the basic facts) speedily and accurately, and provide information when and where required, which is complete and at the correct level of detail, so that it is useful for some purpose.”
However, they view (as in this work) the CIS as a means to fulfil something, and not an end in itself, by comparing the importance of a typewriter or word processor to an author: it is a tool. Thus, the computer technology is not necessarily the most important aspect of an information system (Avison and Fitzgerald, 1995).

In this work, a CIS is viewed to be a powerful tool that an organization can use to obtain its goals.

### 2.5 The need to consider ethics when developing a CIS

#### 2.5.1 The technology and society

The information technology gives us great promises to improve the quality of our lives, but at the same time, it poses several threats. How should this technology be used to maximize the good and minimize the bad consequences? Johnson (1994) argues that the introduction of computers into the society has created new possibilities for individuals and institutions that have never existed before. CIS is not to be considered to have less impact on the way we live than for example inventions like the car, a technology that has created many possibilities and posed equally many problems for our society. In this respect, CIS will probably be no different.

Oz (1994) makes an analogy with the use of a knife: its use could be twofold. Either it can be used by a surgeon as at tool to save a human life, or it can be used by a murderer to end a life. “Knife” here could as well be replaced by CIS. It is up to the individual and the society to decide what to do with an invention with this dualistic power. According to Johnson (1994, p. 6), “The use of computers mirrors society.” We need to discuss why we use CIS, not merely what to use it for.
According to Oz (1994), we have changed from an industrial society to an information society. Most of the people in the western world are involved in the production and dissemination of information. Spinello (1995) argues that information is what gives the organization the competitive edge. The importance of correct information for decision-making must not be underestimated. This, the need to generate and control information, has made CIS a major resource in the corporate environment of today.

Today, the government and the lawmakers are playing a catch-up game with the rapidly developing computer technology. Both Oz (1994, p. 19) and Johnson (1994, p. 4) point out that this has created what they call a “vacuum” of both laws and ethics in this field. But, as Johnson (1994, p. 5, italics supplied) states, despite this, “...computers are not used in a vacuum.” Johnson (1994) argues that we must recognize the context in which the new technology is used. Such different factors as political, economical, social and cultural will influence our view of what rules and policies that should eventually be applied to CIS.

2.5.2 Properties and possible implications of the technology

Spinello (1995) divides the information technology into three broad categories in order to study the ethical implications of each one of them, and the issues that are created when they interact. These categories are software, networks, and hardware. Oz (1994) has identified seven areas where the information technology has great impact for society. They are data collection, data processing, storage and retrieval, communication, presentation, control and dissemination of expertise.

Data collection (Oz, 1994) can be illustrated by the use of automatic teller machines, credit cards or any other equipment connected to a computer network. All transactions can be logged and then used as a basis for audit trails, decision
support, financial analysis, and marketing. This may be done by interconnecting two or several databases to identify patterns.

*Data processing* (Oz, 1994) is the process of turning raw data into information, that is something that has a value to us. The power of modern computers is immense. Large sets of data can be processed using arithmetic and logic operations nearly instantly.

*Storage and retrieval* (Oz, 1994) are necessary to allow data processing. Storage media is no exception when it comes to the development speed of information systems. The capacity of today’s storage media equals the speed with which a modern microprocessor can manage data. The development of networks has created possibilities for retrieving data regardless of its location.

*Communication* (Oz, 1994) is what makes it possible for different computers to exchange data with each other, and for the user of the computer to exchange information with other users of the network. Connecting a computer to a network makes it possible to share the resources of an organization, thereby making better use of them.

Spinello (1995) emphasizes that computer communication using networks has made it possible for organizations to exchange large amounts of information both simply and inexpensively. Oz (1994) states that the networks are that which has created opportunities for people separated by large distances to communicate their thoughts and knowledge, thus being able to share them with many others. Oz (1994, p. 19) states “Computer networks have turned the world into a ‘global village.’ ”

*Presentation* (Oz, 1994) has been made easier and more effective using computers. The technology’s ability to use several media simultaneously, such as text, images, audio and video, creates new possibilities to present ideas and thus share
Information technology provides a basis for improving the quality of our lives. Nevertheless, Oz (1994) claims that the benefits will not come without a cost. Consider data collection. Oz (1994) asks, who owns the information? When using a credit card, does the cardholder automatically accept that the credit card company uses the holder's buying habits as a means to increase its income, by selling this information to a marketing agency? Spinello (1995) emphasizes that the creation of databases and the use of data for secondary purposes might create ethical dilemmas. There is an obvious risk that privacy might be infringed upon.

Networks and the growth of a global communications channel, the Internet, has indeed created new possibilities. Spinello (1995) discusses the effects on security when virtual corporations and virtual communities develop. Who is responsible in a networked environment where there is no central place of control when a security breach occurs? Who is responsible for maintaining control? The features of the
networks and its possibilities may at the same time be its vulnerability. The more secure a system, the less flexible. And vice versa.

The new information technology has created new issues when it comes to liability (Johnson, 1994). For example, if there is a power failure connected to problems with a CIS, who is responsible? The power company, the authors of the power control software, or the company that integrated the power control software with the power company’s present equipment? Johnson (1994) stresses this issue. The introduction of computers has changed the scale of operations in many organizations. The technology is unique in its complexity. Therefore, issues regarding liability need to be reconsidered.

New technology creates new issues. Consider software. Johnson (1994) exemplifies this by posing the question whether it should be looked upon as a product or service. Should the authors of a program be seen as providing a service or selling a product? This illustrates that we cannot simply and mechanically apply the traditional legal and moral principles without some reflection first.

CIS has created new possibilities to manage data in three different ways: it can be done faster than ever before, it can be done on a massive scale, and from more sources. Oz (1994) states that computers have changed our lives in two ways. Firstly, they allow us to do what we did in the past more efficiently. Secondly, they enable us to do things that were not possible before.

2.5.3 The need to base a CIS on ethical considerations

Before analysing the ethical issues surrounding CIS, this question should be asked: “Are the issues new ones, or reincarnations of old ones that have caused problems and concerns to the society for centuries?” Johnson (1994) has examined this question. There are two possible points of view: either one can say that there is nothing new to ethics in respect of CIS. Privacy issues, for example, have been
around for a long time. One can also choose to argue that the issues are new and unique. CIS are built on inventions and developments that simply did not exist fifty years ago, like software, microchips, and global electronic networks. The idea of processing instructions using silicon chips or the implications of a global electronic network could not be conceived of at that time (Johnson, 1994).

We should be careful when reasoning by analogy when we consider CIS. Analogies are useful, since they make it possible to characterize something that is previously unknown by referring to something that is familiar. There is, however, a risk that we focus on the similarities and fail to recognize important differences (Johnson, 1994).

Spinello (1995) argues that the fundamentals for ethical reasoning considering CIS already exist in the framework of the current ethical theories, in the shape of our traditional norms and ethical insights. The issues surrounding CIS are not completely new, Johnson (1994) argues. There is no reason to reinvent the wheel when it comes to the fundamentals of ethics. It should be possible to use, and rely on, the traditional moral principles and ethical theories. However, we have to consider the unique features of CIS. It is important to consider the environment in which a CIS is to be used. Without this understanding, proper rules and policies can never be developed.

Oz (1994, p. 26) boldly states “Yesterday’s technological achievement is today’s social problem.” There needs to be a balance between the different stakeholders of a system. This is easier said than done, since it is likely that opposing views will have to be merged.

Spinello (1995) states that decisions when implementing a CIS is often carried out by decision-makers that are ill informed and subjective. They are under pressure to implement the CIS quickly and in an expedient way. These circumstances do not create a favourable environment for decisions that are of good social durability. However, the decision-maker who is proactive in this area will be rewarded. Such behaviour will avoid “...embarrassing ethical quandaries and
expensive lawsuits, along with disgruntled employees and customers.” (Spinello, 1995, p. 12)

2.6 Aims and objectives

The aims of this work is to investigate the importance of ethical considerations in the development and use of CIS, and when and where ethical issues should be taken account of in the SDLC.

The objectives to obtain these aims will be:

- By gaining knowledge of the fundamentals of ethics and its major schools of thought, giving a background for ethical thinking in CIS
- By giving a possible foundation for the issues that should be considered in the development of CIS
- By examining the SDLC and methodologies adopting it, then applying the conclusions regarding ethics and the development process.
3 Method

This area of study has been examined by surveying existing literature in the field of ethics, concerned with computer technology, as well as literature describing the SDLC, and methodologies that adopt the SDLC. Generally, there already exists an extensive body of material written in each area respectively, and that can be used to support further study.

The survey of literature as a basis for this work was chosen because of the thorough descriptions of ethical theories that already exist, as well as considering identification and descriptions of the problems existing in the context of ethics and the use of CIS. It was also found that there already exists sufficient material regarding the SDLC, its participants and phases as well as methodologies that adopt it. This makes the choice of an examination based on literature surveys justified.

Basing this work on existing literature is also motivated by the fact that many of the ethical dilemmas and questions created by computer technology are known, and thus the knowledge regarding these dilemmas already exists. However, it was also found that less emphasis on how to approach these issues existed in the literature surveyed.

Without doubt, the choice of literature as basis for this work will give it a theoretical tendency. More practically orientated studies compared to the one presented here, will most likely benefit from the application of the theoretical knowledge that exists within the field. However, considering the non-applied nature of this work, and also weighing time and resources available, it was concluded that it would be more beneficial to use the different types of information already existing, in order to try to extend the knowledge of the subject.
METHOD

The study has been carried out in the following order:

1. An examination of the characteristics of some major ethical theories was made first. Literature by Johnson (1994), Spinello (1995), Oz (1994), Martin and Schinzinger (1989), Shea (1988) and Severson (1997) was used as a basis. The intention was to gain an overview of ethics in general, and the different theories that are most influential today. This should also provide information regarding how these theories could be put into practice in a CIS. Three theories were selected for further study: utilitarian, duty and rights ethics. The selection of these theories depended on to what extent they where recognized as important in the literature.

   When making this examination, literature concurrently covering both the areas of computer technology and ethics has been the object searched for, since ethics is considered in the context of CIS in this work. This approach has also provided an overview of the current issues concerning ethics and computer technology.

2. Out of the chosen literature, the research has focused on what the current questions are in the field of ethics in computer technology. This has provided a basis for understanding the possibilities and problems that might be encountered when developing a CIS, and in the latter case, how to solve them. This study has also provided information necessary for answering the question “Why is there a need for considering ethical issues in CIS?” This phase should also establish a “lowest common denominator” regarding the sorts of ethical questions that might arise in the development of any kind of CIS. This understanding of the subject is necessary to proceed to the phase where a search for possible solutions is initiated, that is, how these questions should be treated most effectively.

3. The SDLC has been examined with the help of literature describing its characteristics, phases, participants, and their interactions in the development
process. At this point, the SDLC was examined on a comprehensive level. Literature by Avison and Fitzgerald (1995), Andersen (1994) and Yourdon (1988) was used as a basis.

The CIS to be developed will progress through the different phases of the SDLC. Therefore, it is necessary to know the characteristics of these phases, and the roles and interactions of the participants throughout the development work.

4. In the literature covering the SDLC and methodologies adopting it, five different methodologies have been selected for further examination. The methodologies are Structured Analysis, Design and Implementation of Information Systems (STRADIS), Structured Systems Analysis and Design Methodology (SSADM), Effective Technical and Human Implementation of Computer-based Systems (ETHICS), Soft Systems Methodology (SSM) and Multiview.

They have been examined to obtain information regarding how ethics is treated in some major development methodologies. In addition, this examination should provide some insight into the question “To what extent is it possible to integrate ethical considerations into the methodologies?”

The examination has been based on a compilation of methodologies, aimed at providing an overview of several methodologies, instead of devoting all attention to a particular methodology. It has been judged more fruitful for this work to study a comprehensive overview of methodologies, rather than aiming at in-depth knowledge of a specific methodology.

5. Based on the information gathered during the examination of the ethical theories chosen, and the five methodologies, an analysis has been carried out to provide an answer to the question “What are the necessary characteristics of a methodology, adopting the SDLC, that makes it feasible to integrate ethical considerations into it?” During this analysis, it was also shown that the different methodologies, more or less, express an ethical theory.
6. Above, it was examined to what extent some current methodologies are based on an ethical standpoint, and to what extent an ethical theory could be integrated into a methodology, to serve as a supportive tool in decision-making.

It has been examined how each one of the three selected ethical theories will affect the SDLC. This has been done by first extracting the characteristics of the three ethical theories respectively, based on the literature covering ethics and computer technology. Then, based on the different phases of the SDLC and its participants, it has been examined how the characteristics of ethical theories will affect the SDLC. This part, together with the former one, is the basis for the results presented later in this work.
4 Materials

In the introduction, an overview of ethics, ethics in the context of computer technology and systems development was presented. Here, in this chapter, universal ethics in the form of consequentialism and deontologism will be presented, as well as utilitarian ethics, a subset of the former, and duty and rights ethics, a subset of the latter. These three ethical theories will be used further on in the analysis, where it is examined how they will affect the SDLC, if they are to be integrated into systems development.

In addition, a selection of five methodologies adopting the SDLC was examined, in order to gain knowledge of the characteristics necessary for applying ethical considerations to methodologies adopting the SDLC.

It was not thought necessary to present this material here, since brief descriptions of the respective phases of the methodologies can be found together with the analysis. A more thorough description of the methodologies can be found in the appendix.

4.1 Major ethical theories

4.1.1 Consequentialism

In universalism, the consequences of our behaviour, rather than the behaviour itself, is the important factor for ethical judgement (Oz, 1994). These theories can be categorized as consequentialist theories. What is important is the amount of common good an act produces. What is good? one might ask. A sub-branch of consequentialism, utilitarianism, views good as any behaviour that improves happiness (Oz, 1994).
Consequentialists can be separated into those who only consider the amount of goodness an act produces, and those who evaluate whether an act is right or wrong by looking upon whether it is based on a good rule or principle. These two distinctions are called act-utilitarianism and rule-utilitarianism, respectively (Martin and Schinzinger, 1989).

**Utilitarianism**

The classic utilitarian theory was developed by two British philosophers, Jeremy Bentham (1748-1832) and John Stuart Mill (1806-1873) (Spinello, 1995). Utilitarians believe that all people wish to improve their happiness as much as possible. The motivation for utilitarianism can be concluded by quoting Johnson (1994, p. 24): “…what is so important, so valuable to human beings that we can use it to ground a moral theory…”? The utilitarian concludes that happiness is the ultimate good, and what everyone strives for. This striving is a part of our human nature (Johnson, 1994).

Utility is defined as the overall balance of all good and bad consequences when committing an act. High utility will mean much good and little bad, or as much good and little bad as possible (Martin and Schinzinger, 1989). What is ethical is to strive for what maximizes happiness for the greatest number of people. Ethics in utilitarianism is therefore based upon outcomes of an act. The utilitarian believes that the sole end of human action is the promotion of happiness. Therefore, happiness is the test by which to judge all human conduct.

All of the good and bad produced by an act should be considered. By a mathematical analogy, the good (ethical) and the bad (unethical) is summed for each stakeholder affected by a decision. All measured values can then be treated as vectors. They are then summed, and if an act should be judged as ethical or unethical is evaluated by looking at the net good for all stakeholders (Oz, 1994). The act is ethical if the sum has a positive value, and unethical if it has a negative value. What is emphasized is the net good for society, not for the individual.
The theory, according to Spinello (1995, p. 20), is “...committed to the optimization of consequences.”

Utilitarianism can be criticized in several ways. For example, although lying generally (in the act-utilitarian view) has bad consequences, there could exist situations where lying is right (Johnson, 1994). The net good reasoning in utilitarian thinking may also have very disturbing consequences. Consider the following scenario: If net good for the society is the ultimate aim, why cannot we consider a healthy person a potential organ donor? (Johnson, 1994) By taking organs from, and thereby killing this individual, it would be possible to sustain the life of several terminally ill individuals, thus increasing their happiness, and most possibly the net good for society. Spinello (1995) asks, if it could be shown that enslaving a small part of society would maximize the overall happiness of the society, would it be a morally justifiable action?

To counter these arguments, the utilitarian might answer that, in the long run, practices as mentioned above would lead to loss of trustworthiness and security. Thus, these practices would not contribute to the net good produced.

To tackle the problems of “basic” utilitarianism, what is called rule-utilitarianism has developed. Johnson (1994) describes rule-utilitarianism as the adoption of rules that generally and in the long run will maximize happiness. If a rule is thought useful or not depends on the consequences of its general practice. Martin and Schinzinger (1989) has studied the rule-utilitarian Brandt. Brandt’s view is that rules should be considered in sets called moral codes. A moral code is considered optimal if, when put into practice, it would create more good for the public compared to other codes. Brandt believes in the rationality of the human being. The human, when supplied with all value-less information, would express rational desires when doing a judgement.

The utilitarian seeks the net good for the maximum number of people. But what is considered “good” is hard to calculate. This will depend on the situation, but also
on the preferences of different individuals. Thus, a new ethical dilemma might be created. Should we strive for physical pleasure or intellectual pleasure? According to Mill, a happy life is rich in “higher pleasures” (Martin and Schinzinger, 1989, p. 35, italics supplied). What places a certain pleasure in this category is that it is preferable to another pleasure. In order to establish whether a form of pleasure is “higher”, Mill suggested a quantifiable test: a pleasure is more preferable compared to another one, when people who have experienced both choose one before the other. Mill also considered that intellectual pleasures are of a higher value and more worth striving for compared to physical ones (Martin and Schinzinger, 1989). Some philosophers, pluralistic utilitarians, claim that happiness involves intrinsic values such as “...friendship, knowledge, courage, and health.” (Spinello, 1995, p. 20)

By stating that happiness is the ultimate good, utilitarianism creates a norm that ethics can be judged by, it provides a decision tool to consider the ethics of actions. According to Spinello (1995), the theory also puts the focus on an objective examination of the interest of all parties affected by a decision.

Johnson (1994) illustrates that utilitarian reasoning is an important theory to consider, since many of our decisions are based upon the cost-benefit or risk-benefit calculus advocated by utilitarianism. A simple example is when a government agency decides whether a company should be given permission to open an open-cast mine, by weighing the worth of the possible positive consequences (increased employment and economic growth) against the cost of the negative ones (destruction of the nature, pollution).

4.1.2 Deontologism

The word deontology comes from the Greek word deon, “‘obligation’” (Spinello, 1995, p. 19). It places special emphasis on the relationship between duty
and the morality of human actions. It can be contrasted with utilitarianism by its emphasis on the act itself, not the outcomes of it (Johnson, 1994).

In deontologism, right and wrong are based on the individual characteristics of an act, not the consequences of it (as in utilitarianism). The behaviour itself is in the centre of the basis for judging an act as ethical or unethical (Oz, 1994). A simple example: When adopting deontological reasoning, one shall not speed on a road, not because it decreases someone’s happiness (for example, it is more likely that you lose control of your car and hurt someone when speeding). Instead, one shall not speed because it, in itself, is wrong. If everyone else did the same, living in a modern society heavily dependent on cars would be unendurable.

In deontological ethics, an act is considered morally good because of some of the characteristics of the action itself, not because the result of the action is good. Oz (1994) illustrates the differences between consequentialism and deontologism by an example from the field of CIS. Consider the issue of copying of proprietary software, piracy. A consequentialist would say that piracy is wrong, since if many people copy a program without permission, the authors will either go out of business, leaving their customers no choice at all to buy their product, or they will find new ways to earn money to stay in business, for instance raising the price of the product, which will hurt their regular paying customers. The consequentialist would say “do not copy the software, since we may all be hurt by it”. The deontologist, on the other hand, would say “do not copy the software since it is unethical and wrong, regardless of the consequences”. The deontologist does not focus on the possible effects of piracy, the company going out of business or a raised price of the software. Instead, the deontologist looks at the intrinsic nature of an act to decide if it is to be judged right or wrong.

Johnson (1994) has looked at some aspects of the deontologists critique of utilitarianism. The deontologists argue that if happiness was the end of all human conduct, we could as well be driven by pure instinct, and would have no need for a
capability of higher reasoning. The fact that humans are creatures capable of rational reasoning suggests that our function must be something else than the striving for happiness only.

Duties

The German philosopher Immanuel Kant (1724-1804) focused on duties divorced from one’s will to obtain happiness or pleasure (Spinello, 1995). Kant is one of the most influential deontologists. Kant’s theory is a form of duty ethics. Duty ethics emphasizes that one ought to perform certain duties even when these duties do not necessarily produce the most good (Martin and Schinzinger, 1989). This makes Kant’s theory clearly a deontological theory. For an act to be morally right in Kantian reasoning, one must “…will one’s maxim to be a universal law...” (Oz, 1994, p. 10). This is the formal principle of Kantian ethics. That is, one must accept that others act in the same way as oneself chooses to do in a given situation.

If one subscribes to the “private” standpoint that “it is acceptable to lie”, for this standpoint to be moral, it must be possible to transform it into a universal law. This is the essence of Kant’s maxim. In this case, the private reasoning will create a logical contradiction. This is so, because if everyone chooses to break promises at will, the concept of a promise would be rendered useless (Spinello, 1995).

Kantianism (Oz, 1994) is a based on the idea of the individual’s duties. Spinello (1995) states that Kantianism is a pure moral philosophy, not based on the knowledge of human nature, but instead in a common idea of duty. According to Spinello (1995), a duty means that one ought to do the right thing in the right spirit. Kant put the emphasis on the intention to do one’s duty: “…the honest and conscientious effort to fulfill duties.” (Martin and Schinzinger, 1989, p. 37)

For an act to be considered good, not just the act but its motive must be considered ethical. For example, saving a person from a burning building, thereby risking your own life, is not necessarily considered good if your motive was not first and foremost to save the life of a fellow human, but instead personal wellbeing in
the form of attention or fame. If the latter is true in this case, by Kantian reasoning, the act would be judged as immoral. Kantian reasoning opposes the utilitarian statement that we should do what is right because that is the path to happiness.

Kant’s ethics is based on the distinction between hypothetical and categorical imperatives (Martin and Schinzinger, 1989). Any action based on desire is called a hypothetical imperative, meaning by this that it applies only if we desire the goal. For example, “do not speed on the roads, since the police may catch you and you will have to pay a fine” is an imperative that applies only if you want to avoid speeding tickets. In contrast to such approaches to ethics, Kant said that morality must be based on categorical imperatives: they must apply to all rational beings, regardless of their wants and feelings. An imperative is called categorical since it does not allow any exceptions (Spinello, 1995). Moral reasons and principles must also be what Martin and Schinzinger (1989) calls universalizable. The case with speeding above illustrates this. It could be tested by the formal principle in the following way by applying deontological reasoning: Just avoid speeding when you are at risk of getting a fine. Could this hold as a universal law? No. If everyone applied this law, it would create havoc in the traffic; thus also hurting the speeders wishing to drive (to) fast. Now, by this reasoning, it is shown that that the above statement does not hold. Spinello (1995, p. 25) calls the categorical imperative a “‘moral compass’” that gives us a way to know if we act morally or not.

Kant believed that people should never be treated merely as a means, but always as and end (Johnson, 1994). This should be interpreted so that it is acceptable to use a person, as long as it is not merely as a means. An example of this is an employer who hires people, and they are given fair pay, thereby recognizing their skills. On the other hand, paying such a small salary that the employee becomes a de facto slave would be treating them merely as a means, and thereby immoral. Without the inclusion of the word “merely” in Kant’s theory, all employers (as in the example above) would behave immorally (Johnson, 1994).
A problem with Kant’s theory is the rigid, absolute fashion in which it shall be carried out (Spinello, 1995). There are no exceptions from the categorical imperative. We are considered to act in the same way all the time. Is it right to lie to a murderer or a madman? This scenario creates a conflict between two universal rules: the rule not to tell a lie, and the rule not to kill. There must be exceptions. Spinello (1995) argues that this is a grave problem for Kantian reasoning.

**Prima facie duties**

Spinello (1995) has examined the ethical theory developed by British philosopher William D. Ross (1877-1940). The theory can be viewed as an extension of Kant’s ethics, which focuses on a single, common duty. Ethics according to Ross comes out of a sense within every individual for what is right or wrong. These rules are ultimate and irreducible. However, Ross does not accept Kant’s view that there must not exist any exceptions from the rules. Consider, again, the scenario when telling a lie to a possible murderer or madman avoids injury. Ross acknowledges that there must exist exceptions, in the form of prima facie duties, rules that hold in normal situations, but not necessarily in extreme ones, such as Kant’s categorical imperatives should do. Prima facie duties are principles of duty that has exceptions (Martin and Schinzinger, 1989). Every situation must be evaluated before one chooses not to follow a prima facie duty. A moral principle can only be sacrificed when it is necessary to prevent a greater damage, when, if it would have been followed, would occur.

Ross has identified seven duties that everyone should follow. The duties are not necessarily limited to seven. Nevertheless, Ross believes that there are duties that are self-evident and axiomatic. If they cannot be understood without arguing, Ross does not provide any further effort. It seems, like Spinello (1995, p. 27) states, that Ross thought “Anyone who doesn’t see them [the duties] must be obtuse or morally blind!”
Spinello (1995) criticizes Ross for the possible vagueness when deciding which prima facie duty takes precedence before another in situations where two or more prima facie duties conflict. Ross embraces a utilitarian net good point of view by stating that if several conflicting duties exist, the one to select is the one with more prima facie rightness than wrongness. Then the problem with what is considered right and wrong surfaces again. Despite this, Spinello (1995) states that the theory has merits. It puts the focus on one’s duties in a decision situation. It also adds flexibility to Kant’s categorical imperative, making it more easily applicable to complex problems.

Rights

In their survey of ethical theories, Martin and Schinzinger (1989) have examined some rights ethics theories, one of them being the British philosopher John Locke’s (1632-1704) human rights theories. When contrasting duty ethics (such as Kant’s) with rights ethics, there is one important similarity in that both agree that good consequences are the only moral consideration (as utilitarians do). The difference between duty ethics and rights ethics is that the latter says one has duties to other people because one has rights, whereas the former says that duties create rights (Martin and Schinzinger, 1989).

Locke argued that to be a person means that one has rights, for instance rights to property, liberty, and life. There is an important difference between the types of rights, called negative and positive rights (Spinello, 1995).

Johnson (1994) identifies negative rights as rights that require restraint from others, and positive rights as the duty of others to do something for the holder of the right. Negative rights is the right to be protected from outside intervention in certain activities, such as freedom of speech, liberty and privacy. Positive rights are the rights to pursue one’s interests, such as the right to health care or education.
Locke’s ethics can be categorized as contractarianism (Spinello, 1995). This type of ethics emphasizes the co-operation between an individual and the society. The individual recognizes the rights of other groups and individuals in the society, such as every individual’s right to freedom, life and property, whereas the society recognizes the same rights for each individual of the society. Contractarianism focuses on the need to respect each individual’s “...legal, moral and contractual rights as the basis of justice and fairness.” (Spinello, 1995, p. 31) The strong emphasis on the rights of the individual in contractarianism would not make it possible for a contractarianist to accept the utilitarian view about maximising good for all. For example, confiscating goods or property for the good of all would be a violation of individual rights.

Johnson (1994) separates rights into two groups: legal and moral. Legal rights are created by law, whereas moral rights are not necessarily law. Moral rights are independent of the law.
5 Analysis

This chapter examines what characteristics that must be fulfilled, if ethical considerations are to be integrated into a selection of methodologies adopting the SDLC. It will also be examined how utilitarian, duty and rights ethics, respectively, will affect the SDLC, if these theories are to be applied in systems development.

5.1 How ethics is adopted in five methodologies

In this section, the subject is which characteristics that are necessary in order to apply ethical considerations to a methodology that adopts the SDLC. The methodologies selected are STRADIS, SSADM, ETHICS, SSM, and Multiview, all as described in Avison and Fitzgerald (1995). The selection of these methodologies are considered to present a spectrum of methodologies that will illuminate the hard and soft system approaches, with respect to their weaknesses and strengths when it comes how to ethics can be applied.

The different phases of the methodologies have been divided into the six phases of the SDLC, as described by Avison and Fitzgerald (1995). The reason for this approach is that it will be fruitful for the examination if the different phases of the SDLC can be exemplified by each methodology. The differences between the methodologies will also become clear.

In this section, only brief descriptions of the phases of the methodologies will be presented. For a more thorough description, please consult the appendix. It has not always been possible to have the different phases of the methodologies fit into the phases of the SDLC, but the division has been carried out to as large an extent as possible.

To provide a basis for the examination of ethical issues in this section, literature by Johnson (1994), Spinello (1995), Oz (1994) and Martin and Schinzinger (1989) was used.
5.1.1 Feasibility study

*Structured Analysis, Design and Implementation of Information Systems* (STRADIS) states that the aim of the *Initial study* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) is to ensure that the system developed is the one most fit in a competing environment. What is considered a competing environment is based on economic factors, by weighing possible expenses versus incomes. The system should promote incomes, avoid costs, or improve services. It is obvious that STRADIS emphasizes economic factors.

If the economic factors were supplemented with all factors affecting the stakeholders, the STRADIS methodology would be a utilitarian view. It would be natural to extend a methodology such as STRADIS, where the measurability of beneficial factors is in focus, with the standpoint that (in the utilitarian view), ethics could be added as a cost. Ethics could be calculated in the same way as monetary costs to get an idea of the fitness of the system chosen for development. Johnson (1994) states that an important advantage of the utilitarian view is that it puts the requirement on the actor, in this case the analyst, to consider in a neutral way the interest of all parties affected by an action, in this case the system design.

However, utilitarianism has been criticized for the problems in defining what is to be considered good and thus (in the utilitarian view) would be in the interest of the parties concerned. The analyst must strive towards a consensus among stakeholders affected by the new system.

The decision-makers should approve the *Initial study* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) in STRADIS until the systems development proceeds to the following phases.

When the decision-makers approves that a project should be carried further, it is important to note that they not only have a responsibility when it comes to monetary costs, but also to costs in a wider sense: environmental, human and social, ethical and so on. To make proper decisions, the analyst must gather data creating a foundation for the continued systems development in the following phases and present this data to the decision-makers. It is of great importance that
the analyst aims at obtaining a broad view of the needs of the different stakeholders, which ensures provision of enough information for the decision-makers to make decisions based on neutral information.

The decision-makers will also have to try to reach consensus about what is considered as costs and how they should be evaluated in STRADIS, whether choosing to adopt ethical theories for support in different parts of the systems development or not. For example, if automating a part of a corporation’s information system would decrease the need for a group of loyal long-time employees that, until recently, were considered an important asset, how should the decision-makers act?

This question, which clearly will be affected by the ethical standpoint of the decision-makers, cannot be answered simply, regardless of whether an ethical analysis of the matter is carried out or not. Nevertheless, an ethical evaluation could serve as a powerful tool to identify and analyse views in the decision-making process.

In *Structured Systems Analysis and Design Methodology* (SSADM) (Weaver, 1993; in Avison and Fitzgerald, 1995), it is stated that the methodology does not cover program design. The phases that follow the design are considered installation specific, and are thus not included in the methodology.

This implies that in this view of system design, the direction of the system to be developed is established at an early stage. The following phases will be directly dependent on the preceding ones, with respect to the quality of decisions made in the early phases.

If the choices in the design are established early on, the same applies to decisions regarding ethical issues. It would be difficult to adopt an ethical standard in a system, if ethics and reasoning about it were not considered a cornerstone of the early systems development phases. Here, the decision-makers must establish ethical aims and objectives early on, and make efforts to ensure that everyone involved in the process understands these aims and objectives, and views them as sensible. If those who should put the organizations ethical objectives into practice,
that is the users, do not agree with them, success in this area would be most unlikely.

In SSADM, the aim of phase zero in the methodology, *Feasibility* (Weaver, 1993; in Avison and Fitzgerald, 1995), is to ensure that the project suggested in the planning phase is feasible.

What is considered feasible is based on economic and technical factors, a wider perspective compared to STRADIS. It is stated that the new system must outweigh its costs. This makes utilitarian ethics fit for use with SSADM.

It would be possible to use ethical analysis as a supportive tool for the examination of what should be considered feasible. Also, choosing a utilitarian view, it would be possible to evaluate to what extent ethical dilemmas in the new system could be resolved, based on the utilitarian statement “The standard of right conduct is maximization of goodness.” (Martin and Schinzinger, 1989, p. 34). That is, the decision-makers should weigh good against bad consequences. It is important to point out that this principle can conflict with other views that stakeholders in the process might have on ethical issues, but it could still be useful as a guiding tool. SSADM emphasizes economic and technical factors, but as argued in methodologies such as ETHICS and Multiview, there is more to the scope of “costs” when it comes to the design of a new system.

The analysis should start with choosing an ethical theory. It has been stated earlier that utilitarian ethics is fit to use with STRADIS, a methodology that has similarities to SSADM. However, there is no intrinsic property of duty or rights ethics that prevent them from being used together with SSADM. The theory should be consistently used when confronting ethical dilemmas. Not clearly stating that the ethical analysis will be based on a specific ethical theory would create problems, where different individuals involved in the decision-making process make judgements based on their implicit views (which can be deduced from an ethical theory) on the given topic, and no common understanding of the basis for the views of the problem at hand exists.

In SSADM, the first phase is divided into four subphases. In the last one of these subphases, a feasibility report is documented and published.
Here, aims and objectives when it comes to ethical issues in the system to be developed should be clearly stated. Identifying possible ethical dilemmas at an early stage makes it possible to take them into consideration in the design of the system, and minimizes the risk that the new system has to be redesigned at a late stage due to poor attention to ethical issues. A simple example of this, based on rights ethics, could look like the following one: Suppose a software consulting company designs a medical database containing patient records for a hospital. Even if an advisory board suggests that security might be violated in the current system design, the decision-makers of the hospital have chosen to settle for a minimum-security solution to minimize the costs for the new system. During the implementation phase, it is shown that a hacker could easily access the system. If the decision-makers choose to introduce the system anyway in the hospital departments, they would neglect patient rights to security and integrity, by not ensuring that the system is safe enough. A scenario like this, when ethical questions have been ignored, would mean that the system would have to be redesigned, probably from an early development phase, with increased costs compared to the expenses for a system with the right security level from the beginning.

In *Effective Technical and Human Implementation of Computer-based Systems* (ETHICS), the first phase is called *Why change?* (Mumford, 1995; in Avison and Fitzgerald, 1995). It is the job of the design group to identify the current problems in the existing system, as well as the systems opportunities.

Identifying the opportunities could be described as the design group trying to extract what has been considered contributing factors to the success of the current system. The broad statement opportunities (Mumford, 1995; in Avison and Fitzgerald, 1995) in ETHICS could include reflection of the contributions of ethical standpoints in the current system, as well as economic and ethical ones. This design approach also suggested that one should learn from experience, and try to forward this knowledge to the new system. When confronted with an ethical dilemma, the designers ought not to leave it untouched. They should instead
analyse it using an ethical theory, to avoid being stuck with the same problem again in the new design.

ETHICS does not claim that certain factors in system design are more important than others, such as economic or technical. Instead, for a system to be successful, all contributing factors need to be considered.

This creates room for environmental, human and social factors to be considered. Keeping a strict economic perspective would make the use of duty or rights ethics in systems development difficult, since this might conflict with the basic philosophy of these theories. Consequently, it would be easier to introduce ethical theories into a methodology that recognizes a wider perspective of system design factors. Thus, it is easier to apply ethical reasoning to ETHICS, than to STRADIS and SSADM.

In phase two of ETHICS, System boundaries (Mumford, 1995; in Avison and Fitzgerald, 1995), the boundaries are set for the system to be designed and where it will interface with other systems.

Now, the decision-makers must set the standard for how stakeholders affected by the system should be treated. The implicit ethical values of the decision-makers will directly affect the policy towards employees, customers, stockholders, and government agencies.

The aim of the third phase of ETHICS, Description of existing system (Mumford, 1995; in Avison and Fitzgerald, 1995), is to inform the design group how the existing system works. The methodology states that people tend to know the details only of their own work and the work of those they interact with directly.

In performing this survey, it is possible to identify the views of the employees when it comes to practical ethical matters. The employees’ understanding of ethical aims and objectives in the organization (to the extent such an understanding exists, implicitly or explicitly), and the extent to which the decision-makers have achieved these, can be investigated at this phase. When doing the survey, it would also be a suitable moment to identify ethical dilemmas in the current system. How well the system works will be affected by the ethical views of the organization, and these are thus just as important as economic and technical factors.
5.1.2 System investigation

Phase two of STRADIS, Detailed study (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) is a more detailed study of the existing system compared to phase one.

Potential ethical problems that have been identified in phase one should now be analysed in detail. Underlying causes of the ethical dilemmas that the system faces must be looked upon. This should be carried out to ensure that these problems are not transferred to the new system, but instead are solved in the design of the new one.

With the decision-makers rests the profit responsibility. They are in charge of how economic resources should be used in the development of the system. Consequently, by the way they assign the economic resources to the development process and the new system to be built, they largely influence how ethical considerations will be treated and put into practice. The system will be expected to correspond to the decision-makers standpoint. It is, therefore, important that the decision-makers take on themselves the task of studying ethical issues, and that they are provided with sufficient and correct information on these issues by the analysts.

In STRADIS, the analyst examines the interests and demands of the three groups identified in the methodology.

When choosing to add ethical issues as a part of concern in the design process, it will be the task of the analyst to include these issues in the examination as well. The analyst’s examination will also include information on those outside the system affected by it, and in what way. The CIS can be expected to have an impact outside the system boundaries, thus this impact must be included in the analysis. Not doing so would make ethical reasoning pointless. For example, not including stakeholders outside the system would allow a factory to dump toxic waste in the surroundings, since this could be considered not being an integral part of the manufacturing system.
In phase two of STRADIS, it should be ensured that all vital aspects of the project have been covered. This should give a basis for analysing how the organization will be affected by different costs and contributions. When choosing this cost and contribution perspective as basis for judgement, it would be interesting to ask the question whether ethical “costs” could be considered important enough to discontinue parts of, or even the whole, project, and on which basis this decision should be made. Choosing an ethical theory and tackling the problem using it could provide guidance on how to act. An act-utilitarian perspective could be that a company should discontinue a product out of goodwill reasons, since it harms a small part of their customers, and this gives the company an overall bad reputation. Duty ethics could be introduced in a corporate policy, in the sense that the company has certain rules that should be followed, without considering the actual “good” they would produce. Rights ethics can be exemplified by a company not choosing to place production with manufacturers in a developing country, known for their use of underpaid labour, giving the workers no possibility to improve their situation. This decision is done on the basis that proponents of rights ethics believe “…moral reasoning should be governed by respect for individual rights and a philosophy of fairness.” (Spinello, 1995, p. 31).

In phase two of STRADIS, a detailed study should be compiled and presented to the decision-makers. As an important part of this study, possible benefits of the new system should be identified. Examples of benefits are increased incomes, reduced costs, or improved service.

This could be compared to the broader perspective of the ETHICS methodology. The content of the word “benefits” will be defined by the decision-makers. There needs to be a discussion about what should be considered benefits and why. The convictions of those involved in this discussion will directly affect the outcome of the definition. If ethics should be considered as an important entity in the design process, this must be made explicit in the definition of the benefits that should be obtained. Otherwise, it is likely that ethical thinking will only be hypocrisy when it comes to its practical realisation.
The first phase of SSADM, *Investigation of current environment* (Weaver, 1993; in Avison and Fitzgerald, 1995) is aimed at providing comprehensive information regarding the requirements of the system. This information should be used to help guiding the rest of the project.

Thus, the standards according to which ethical aspects should be treated in the rest of the project will be, largely, established at this early stage. This standard should then permeate the rest of the project.

SSADM states that present data and processing methods are examined, and presented together with the examination of requirements of the new system, to the decision-makers.

This examination could be extended to include present ethical views and an examination of why these standpoints were chosen, looking at the question “Why did the decision-makers reason as they did?”.

When the second phase of SSADM, *Business system options* (Weaver, 1993; in Avison and Fitzgerald, 1995) is finished, only the user requirements that are economically justified are considered for further development.

It is doubtful whether ethics can be implemented in SSADM without modifying this statement. Clearly, what is economically and ethically justified is not always the same thing. A strictly economic perspective would leave little room in a methodology for duty or rights ethics.

In SSADM, several different alternatives describing how to proceed with the systems development are presented to the decision-makers.

If ethical reasoning is added to the methodology (when the problem stated above has been resolved), different alternatives regarding ethical paths for the new system could be presented as well. Out of this, the decision-makers should select one of the alternatives for further development. SSADM states several factors that should be outlined in the plan for the continued development of the system. Soft factors, human and social, are not considered explicitly. In order to adopt ethical thinking to system design, this should be the case.
In the first phase of Soft Systems Methodology (SSM), called The problem situation: unstructured (Checkland, 1981; in Avison and Fitzgerald, 1995), it is stated that it is the job of the analyst to expose as many views as possible that show possible solutions to the problem situation. This information should be gathered from the problem owners (those who initiated the analysis) and other stakeholders, based on as many views as possible.

A good foundation for an ethical analysis should exist at this point. When this information has been presented to decision-makers, there is an opportunity for them to stop and reflect over ethical standpoints and the reasons for choosing them.

In SSM, the analyst examines the problem situation by looking at its physical, reporting, and communication characteristics.

When ethical reasoning is adopted to systems development, it will be the job of the analyst to draw attention to questions regarding ethics.

In the second phase of SSM, The problem situation: expressed (Checkland, 1981; in Avison and Fitzgerald, 1995), the problem of phase one is more formally stated.

Ethical choices should also be formally stated at this point. One way of doing this is to create a policy for the task of developing a CIS. To introduce ethical views in the design and put them into practice, they will need to be clear; to ensure that everyone involved in the process can understand these views.

5.1.3 Systems analysis

The third phase of STRADIS, Defining and designing alternative solutions (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) deals with the definition and design of solutions to problems in the current system. STRADIS states that the abstract organizational objectives now should be converted to system objectives. These system objectives describe how the organizational objectives should be reached.
Although STRADIS describes the organizational objectives as increasing income, decreasing costs or improving service, here possible ethical objectives could be transformed from the aims of the organization considering these aspects into ethical system objectives, describing how to realize these aspects in the design to be implemented.

In line with STRADIS, ethical system objectives should have a firm definition. A firm definition, in the STRADIS methodology, is described as being specific and measurable. Here, specificity is likely to be easier to estimate compared to the measurability of ethical objectives. Ethics deals with human and social factors, which are more difficult to measure compared to hard ones (such as technical and economic) considering that different observers might judge the same situation in different ways. The designers and decision-makers of the new system should have the character of ethical analysis in mind. Here, again, is shown the importance of a common understanding of an ethical dilemma to be dealt with.

STRADIS makes a distinction between weakly and strongly stated objectives (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) to show how the system objectives should be stated compared to the organizational objectives. Weakly stated objectives are abstract and general, while strongly stated objectives are specific, describing how the former should be obtained.

Ethical objectives can be stated in the same way. An example could be the weakly stated ethical objective (in this case based on rights ethics) in a government agency’s information systems policy “The system should respect the rights of people to privacy”. This could be expressed in a strongly stated ethical objective as “To obtain the aim of providing a sufficient level of privacy, the database containing personal records should restrict access to personal records, by password protection, logging of accesses and encryption of data and communications.”

In STRADIS, three designs meeting different levels of demands should be presented to the decision-makers, before the actual design is carried out. These three designs are described as a low, mid and high budget, meeting not all, most, and all objectives from the launch of the new system, respectively. Together with
these possible designs, an outline of the costs, advantages and development time-scales of the proposals should be made explicit.

Using this approach, it will be possible for the decision-makers to get an idea of the “costs” connected to the solution of different ethical dilemmas that might be inherent in a design. Clearly, this approach incorporates reasoning using utilitarian ethics. The different incomes are measured against their costs. As Oz (1994, p. 9) describes it, “In mathematical terms we could use vectors to describe this approach...”. Rights ethics does not necessarily need to be in conflict with the costs versus incomes reasoning of STRADIS, as long as the rights of the different stakeholders affected by the system will not be affected negatively. Whether decisions are ethical or not, in a rights ethics sense, could be examined by looking into a particular decision to see if it violates some individual human rights (Spinello, 1995). Duty ethics is likely to conflict with the approach described above, at least if one chooses to reason according to Kant’s views, where there is no room for compromises. Here, there are duties to the stakeholders, and one ought to fulfil them, “...independently of whether it will make us happy.” (Martin and Schinzinger, 1989, p. 37) Finally, it is stated in STRADIS that possible risks involved in the design should be included in the description of design alternatives. If ethical aspects are to be considered, possible dilemmas should be described here, as well as ways to tackle these.

In the third phase of SSADM, Definition of requirements (Weaver, 1993; in Avison and Fitzgerald, 1995) the system design proceeds from investigation and analysis to specification and design. The new system, not its forerunner, will be focused on.

The analyst could present a prototype to the users at this stage. It is used to ensure the analyst’s understanding of the user demands and preferences regarding the design of the interface of the new system.

Having the users participating in this way in the development could be extended to the subject of ethics. The SSADM methodology states that this participation will lead to increased user commitment to the new system. To involve the user in the work of establishing organization policy regarding ethics could have many benefits.
User knowledge of the practical work in the organization could give important contributions to the work of establishing ethical standards.

At the fourth phase of SSADM, *Technical system options* (Weaver, 1993; in Avison and Fitzgerald, 1995), the design must be implementation specific. This is a transition phase in the design of the new system.

Once that enough information has been gathered in this phase of SSADM, findings should be presented to and agreed with the decision-makers. These kinds of checkpoints are important, so that the decision-makers can check that the system design is on the right track.

This is also true for ethical issues. It will be the task of the decision-makers to merge and, where needed, negotiate the different views of the stakeholders affected by the new system, in order to turn the ethical aims of the organization into practical applications.

The fifth phase of SSADM, *Logical design* (Weaver, 1993; in Avison and Fitzgerald, 1995) is the last one before the systems development proceeds to physical design.

In this phase, comprehensive ethical matters must be addressed and possible dilemmas must be resolved. The resolutions will then be intrinsic features of the physical design.

Systems analysis in *ETHICS* begins with *Definition of key objectives and tasks* (Mumford, 1995; in Avison and Fitzgerald, 1995), which consists of phases four to six. The essential objectives of the new system should now be defined. The role and purpose of different areas is questioned. To examine if an area is justified, an ethical theory can be used as support for reasoning. The outcome will depend on the theory adopted: utilitarian, duty or rights ethics. When this has been done, the responsibilities of the different areas should be agreed upon. Here, the actor responsible to ensure that ethical views will be put into practice is stated. Thereafter, one should look upon to what an extent current activities comply with what they are actually expected to achieve. Here, the analyst should look at the
question “To what extent does the current organization reach basic ethical values?”

This broader definition of the objectives of the system compared to STRADIS and SSADM implies that there are more factors to be considered than merely economic and technical ones. This implies that there exists a possibility for ethical considerations to play an important role in the design of a system.

In *Diagnosis of efficiency needs* (Mumford, 1995; in Avison and Fitzgerald, 1995), the seventh phase of the methodology, one looks for weaknesses in the interconnections of the current system.

It is possible to look for human factors in this analysis. It is not necessarily true that a malfunction in the current system depends on economical or technical factors, such as lack of funding or equipment, respectively. The analyst should start the analysis without bias towards any factors involved.

In phase eight of ETHICS, *Diagnosis of job satisfaction needs* (Mumford, 1995; in Avison and Fitzgerald, 1995), job satisfaction needs are measured.

The worldviews of the decision-makers in the organization are likely to have a large impact on what is finally to be considered a suitable level of job satisfaction, based on a utilitarian, duty or rights ethics point of view.

It is stated in phase nine of ETHICS, *Future analysis* (Mumford, 1995; in Avison and Fitzgerald, 1995), that the new system should be flexible enough to be able to deal, to some extent, with changes that might occur in the systems environment in the future.

To be able to do this, the system should rest on a solid ethical ground, with respect to the ethical aims, stated by the decision-makers, that should be well-reasoned and likely to endure a changing environment. Sustainability becomes one of the key words in the system to be developed.

In the tenth phase of ETHICS, *Specifying and weighing efficiency and job satisfaction needs and objectives* (Mumford, 1995; in Avison and Fitzgerald, 1995), it is stressed that it is important to reach consensus regarding this matter. Everyone affected by the new CIS should be involved in this process, not only the design group.
Thus, the views and values of the users are considered equally important compared to those of the analysts and designers. Hereby is acknowledged that everyone affected by the system under development could contribute to it with individual expertise.

In phase eleven of ETHICS, *The organizational design of the new system* (Mumford, 1995; in Avison and Fitzgerald, 1995), the question “What should be the responsibilities of different areas and functions?” is answered.

With regard to ethics, clearly identifying who is responsible for what area, and therefore the supervision of its ethical aims, will ensure that these aims are implemented in the way intended. Ethics is implemented in a top-down way here: the decision-makers are ultimately responsible for the overall ethical views and values in the organization, but anyone affected by the new system, who can contribute to the development of views and values, should be involved in the process. It will be the responsibility of the decision-makers to set an ethical standard in the organization, and to allocate resources to have it implemented according to the ethical aims and objectives existing. The new system can be considered an extension of the ethical aims that exists within an organization.

Now, enough information should exist to address the fundamental organizational design process. One of the questions raised is “What special skills are required, if any, of the staff?” (Mumford, 1995; in Avison and Fitzgerald, 1995, p. 361).

The process of implementing the ethical objectives is believed to benefit greatly if the affected stakeholders inside the system have a basic level of “ethical skills”, thus this is to be viewed as one of the special skills required. Ethical skills here would mean an understanding of the ethical views and values that the work inside the organization is based upon, as well as an understanding of why they are formulated as they are, and why they exist. This, taken together, would enable the analyst, designer, and user to participate in the systems development as “ethically skilled staff”.

In phase 12 of ETHICS, *Technical options* (Mumford, 1995; in Avison and Fitzgerald, 1995), different technical options that are suitable with respect to
software, hardware and human-computer interface are specified. It is emphasized that technical and organizational objectives should be considered at the same time, since one might create limitations regarding the choice of the other.

Here, ethical objectives should be made explicit as one of the key objectives, either on their own or as a part of the organizational objectives. This will ensure that ethical views and values are implemented when it comes to the choice of technical platform.

SSM begins systems analysis with *Root definitions of relevant systems* (Checkland, 1981; in Avison and Fitzgerald, 1995), which is the third phase in the methodology. Relevant is defined in SSM as a way to look at a problem that provides useful insight.

Thus, if, and when, an ethical evaluation of a problem provides useful insight, it could be used in this methodology. The mode of thought in SSM when it comes to problem solving is extended using the above definition compared to more economically and technically oriented methodologies as STRADIS and SSADM. With this in mind, it is not necessarily true that ethical evaluation should be performed at every stage of the systems development. Instead, ethical evaluation should be viewed as a supportive tool that can be brought forth when needed, to evaluate ones views and values and to identify and examine ethical dilemmas.

The fourth phase of SSM is *Building conceptual models* (Checkland, 1981; in Avison and Fitzgerald, 1995). Here, a conceptual model should be created. In order to do this, the stakeholders, in SSM defined as the problem owners and problem solvers, should agree that the root definition of the previous phase has a solid foundation.

Here, there is a need for consensus to be reached about what the views and values are that should be integrated into the conceptual model.

The fifth phase of SSM is *Comparing conceptual models with reality* (Checkland, 1981; in Avison and Fitzgerald, 1995). In this methodology it is recognized that, in a human activity system, the different views of the individuals involved in the
process must be taken into consideration, since individuals have different views and might not be talking about the same things.

A rights ethics perspective, acknowledging the rights of everyone to participate in the development process and share their knowledge and views, would be easy to adopt at this point using SSM. This process could be important to the success of the system, by identifying possible problems at an early stage of the systems development, so that major redesigns at a later stage can be avoided. Rights ethics can also be argued to give the designers an implicit responsibility to inform the decision-makers of possible risks with the new system, giving the designers responsibilities outside the system: “Many of the rights... arise within institutions and professions, such as the right of engineers to warn the public about unsafe technological products.” (Martin and Schinzinger, 1989, p. 40).

SSM emphasizes that one should notice the different perspectives on the activity that exists within different parts of the organization. In SSM, it is stated that there should exist a discussion of changes, and out of this discussion, a recommendation regarding change should be obtained.

This discussion is a more democratic forum to obtain change compared to the more analytical STRADIS and SSADM methodologies. Can different participants in the design process form a common opinion on the ethical aspects of the system? It will be the task of the decision-makers to bring together different views. Their task is to create foundations for a new system in which ethical aims are considered sensible and possible to obtain by all involved in the systems development, thus the different parties in the process should be team players.

This work is extended in the sixth phase of SSM, Assessing feasible and desirable changes (Checkland, 1981; in Avison and Fitzgerald, 1995), where a proposal of changes is stated.

In the seventh, final phase of SSM, Action to improve the problem situation (Checkland, 1981; in Avison and Fitzgerald, 1995), the views and values of the stakeholders in the development process will implicitly affect how the recommendation to improve the problem situation is designed.
In the first phase of *Multiview, Analysis of human activity* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995), the search for a worldview is in focus. This worldview will be carried forward to the following phases of the systems development.

Everyone has an ethical value and view, either implicit or explicit. This will affect the worldview of the participants in the development process. Especially the worldview of the decision-makers will affect how the system will eventually turn out.


In the latter of these two phases, it is stated, in the methodology that everyone, not just the system designers, should be allowed to take part in the analysis and design of the system they will eventually be using. This is based on the belief in Multiview that people have a fundamental right of controlling their own lives.

Clearly, this reasoning is based on rights ethics. Here, this ethical theory is directly implemented into the Multiview methodology. It is a positive rights statement, in contrast to negative rights statements that are more common in society (Spinello, 1995).

In Multiview, it is explained why participation is important in system design: if the future users of the new system are allowed (or better yet, encouraged) to take part in the development of the system they ultimately will be the users of, then the most will be made out of the system, with respect to implementation, approval and operation. The view in Multiview implies that all factors in systems development are to be considered equally important; human, technical and economic ones.

Multiview states that it is the task of the problem solver to produce a good balance between the interests of different stakeholders, and thus between the different factors involved.

Ethical analysis could be well suited to support this process. Stating that a good balance is to be found does not imply that the problem solver should reason by
utilitarian ethics. Rather, it emphasizes the necessity of a broad view of what is important in the design of a successful system, and that there exists a minimum level of requirements regarding all factors, that must not be reduced by increasing the resources devoted to others.

Multiview emphasizes that it is important to identify different alternatives in this phase, to be able to fulfil different objectives. These alternatives are ranked.

Here, Multiview takes on a view based on utilitarian ethics, in the sense that “...one chooses the alternative that produces the greatest net expectable utility, that is, the one with the greatest net benefits (or the lowest net costs).” (Spinello, 1995, p. 20).

The process of ranking in Multiview is based first on the alternatives’ ability to accomplish chosen objectives, second based on costs, available resources, and limitations. This is done by weighing social and technical factors.

Again, “weighing” indicates that this phase is based on utilitarian ethics. Here, an important feature of utilitarianism is demonstrated by its use in Multiview: “Another key advantage of utilitarianism is that it requires one to consider as objectively as possible the interests of all parties affected by one’s action.” (Spinello, 1995, p. 21).

### 5.1.4 Systems design

In the *Physical design* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995) phase of *STRADIS*, a physical design is to be created. The physical design is specified until a solid assessment of its costs exists. This is the final phase of STRADIS.

Contributions to this cost are considered only to consist of technical and economical factors, such as hardware required, time to develop different system modules, time required to maintain and do future enhancements of the system, and so on. In order to apply ethics in a methodology, a wider perspective of the word “costs” is needed. STRADIS and SSADM have previously in this analysis
shown to have some roots in utilitarian ethics, based on the cost-benefit analysis (Johnson, 1994) that is used to examine the net good produced by an act. However, utilitarianism requires one to consider all actions that produce happiness or unhappiness. Here, STRADIS only consider technical and economical factors, while human and social factors should be considered, since, indeed, people are eventually going to use the system. Thus, STRADIS cannot be considered to adopt an ethical theory at this point. To change this into applying utilitarian ethics, all factors that affect all stakeholders must be taken in account of.

Gane and Sarson (1979; in Avison and Fitzgerald, 1995) complements the list of economical and technical factors to be considered in the design, with factors deemed necessary to complete the design. Evaluating and ensuring user acceptance is considered key points here.

It could be argued that this is a late stage in the systems development to consider these issues. Fine tuning a new system designed is always likely to be needed, but if the system should fail to a large extent when it comes to meeting user demands, it is likely that a major (and costly) remake of the design is needed. It is also likely that, because of this, the problems in the new design are left untouched by the decision-makers, who control how economic resources should be used. It would have been better to involve all stakeholders at an early phase, and to catch their views and values regarding how the system should be designed. This is also true for ethical considerations, since those of the stakeholders should permeate the system design. The system design can be considered an extension of these views and values. It would be hard, or even impossible, to try to add ethical considerations on top of a nearly finished system design. Evaluating and ensuring user acceptance could be interpreted as confirming that the ethical considerations, considered all the way through systems development, have been implemented properly. Then STRADIS could be considered to be in line with a methodology that acknowledges ethical considerations as an important feature of systems development.
In the final phase of SSADM, Physical design (Weaver, 1993; in Avison and Fitzgerald, 1995), the roles of those turning system design into practical use are emphasized. Still, SSADM claims that the analyst and future users should be involved in the process in order to ensure that the design will match objectives and user demands.

In this way, it is more likely that the design being implemented is the one required by the stakeholders. This is also true when it comes to the ethical aspects of the system being developed, aspects that are not as easy to measure as those of a technical or economic kind. This approach, enabling a continuous review of the system by its future users, will also minimize rework needed later. Ultimately, it will be the task of the decision-makers to ensure that the communication between the design group and the users exists and works.

It is suggested that “‘Quality Assurance Reviews’” (Weaver, 1993; in Avison and Fitzgerald, 1995, p. 302) should be carried out at this stage.

Explicitly stating that a review, involving the users, should be carried out minimizes the risk that possible errors in the new system will persist. It will also be an opportunity to gather the stakeholders to review in what way ethical considerations that where implemented in the design did and did not contribute to the success of the system. This process will increase knowledge that can improve the current system as well as future systems.

Phase 13 of ETHICS, The preparation of a detailed work design (Mumford, 1995; in Avison and Fitzgerald, 1995) extends the work of previous phases by a detailed design. It is emphasized that the responsibilities and relations of the organizational groups and individuals involved are determined.

ETHICS stresses not only what is to be done, but also who is responsible to make it happen. It would be less easy to measure to what extent previously chosen ethical considerations are reflected in the design. Therefore, it is important that those with the responsibility to implement them are clearly identified.
In the same way as in STRADIS and SSADM, a review takes place to ensure that the design still complies with all objectives established in the earlier phases. This review should include all factors, thus ethics will be a part of the review.

In the first phase of the system design in *Multiview, Design of human-computer interface* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995), the human-computer interface will be designed. It is stated in the methodology, that this part is of importance if the new system should be successful. To have the users accept the system, it needs to have an interface which they find useful.

This statement could be viewed as based on rights ethics, since this way of designing the system accepts the users right to influence the tools they will eventually be using. Multiview could be considered to apply utilitarian ethics here, too. Having the users accepting the system will make them happier (in the utilitarian sense), and thus likely to be more productive. This will contribute to the net good of the system.

In the next phase of Multiview, *Design of technical aspects* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995), all information gathered in the previous phases is used to implement the technical design. The system will now be implemented and tested.

In Multiview, it is recognized that the system now is likely to need changes, but this is considered the norm. Considering ethical aspects, the more energy that has been put into identifying and resolving these at an early stage, the less likely they are to create problems implicit in the system design at this time.

### 5.1.5 Implementation

In phase 14 of *ETHICS, Implementation* (Mumford, 1995; in Avison and Fitzgerald, 1995), the system will be implemented. ETHICS emphasizes that work should be undertaken to ensure that the transition from the old system to the new one works flawlessly.
When it comes to implementing ethical objectives, the design group could benefit by the knowledge obtained from experiences with the present system. This knowledge could be reused, to minimize the risk of transferring old problems to the new system.

If enough time and resources have been devoted to resolving the ethical issues and possible dilemmas faced in the earlier phases, ethical dilemmas should not prevent the implementation.

5.1.6 Review and maintenance

In phase 15, which is the final phase of ETHICS, Evaluation (Mumford, 1995; in Avison and Fitzgerald, 1995), it is stated that it is important that the system is reviewed, in order to ensure that the objectives are implemented according to specifications. Efficiency and job satisfaction are considered especially important. If the system should fail to meet its objectives, it is always remade with the objectives as a basis.

In ETHICS, the objectives as such, not their practical implementation in systems design, are in focus. This is considered a good approach when ethics should be integrated in a methodology, since ethical considerations belong to the domain of objectives, and should exist in its core.

In ETHICS, design is believed to be a cyclical process, because of the changes becoming necessary by time. Before change takes place, the ethical aims and objectives of the current design should be looked upon, to examine if and in what way they contributed to the system, in order to put this knowledge to practice in the new design.
5.2 How three ethical theories will influence the SDLC

Here, an analysis of how utilitarian, duty and rights ethics will affect the SDLC, if they are to be integrated into systems development, will be presented.

Below is a compilation of the distinguishing features of each of the three ethical theories. There may exist additional important features. However, the points below will give a good outline of the characteristics of each ethical theory, respectively. Literature by Johnson (1994), Spinello (1995), Oz (1994) and Martin and Schinzinger (1989) was used as a basis for this compilation. It is followed by an analysis of how each point will affect the SDLC, identifying affected phases and participants where applicable. Literature by Avison and Fitzgerald (1995) was used to describe the SDLC, its phases and participants.

**Utilitarian ethics**

- The group, not the individual, is in focus
- The totality of the good created is the basis for the evaluation, not the parts that contributed to the result
- Goals, not means, are emphasized
- Good and bad must be measurable in order to make an assessment
- That an alternative is considered to be the best one to obtain the goals of the system, does not imply that it is a qualitatively beneficiary one
- Everyone affected by a decision must be taken into consideration, regarding how the decision affects them
- Humans strive for happiness. Happiness is considered the foremost good
- What is considered to be good and bad might vary from one individual to another, and is difficult to estimate.
Duty ethics

- The actor’s behaviour is in focus, not its effects
- What is to be considered moral in an act is in the intention to do the right thing, not the act itself
- An ethical behaviour is a behaviour that everyone can apply: it is universalizable (Martin and Schinzinger, 1989)
- Duties are separated from the will to obtain happiness or pleasure
- To respect the individual is a duty
- The individual has certain duties
- Ethical decisions are based on the categorical imperative: they must apply to all rational beings.

Rights ethics

- Duties are created out of rights, not vice versa
- Rights and duties have a reciprocal relationship
- The individual, not the group, is in focus
- The rights of the individual must not be neglected in order to promote the good of the group
- Different communities create different categories of rights
- Rights can be divided into negative and positive ones
- There exists a distinction between legal and human rights
- Fair judgements should guide decision-making.

5.2.1 Utilitarian ethics

The group, not the individual, is in focus

The group relation is important and teamwork becomes important. The achievements of the group will be considered as a whole. Thus, what the users,
analysts, designers and decision makers can obtain working together is emphasized, not their individual roles.

Co-operation is important. This put demands on the decision-makers’ leadership, and their ability to lead the group to work toward its collective aims.

*The totality of the good created is the basis for the evaluation, not the parts that contributed to the result*

A system approach, for instance as described in van Gigch (1991), should be adopted during the systems development. The different phases in the SDLC are considered with the whole in mind, not the other way around.

*Goals, not means, are emphasized*

All decision-making starts with the mission in mind. The organization’s mission will be central in the development of a CIS. Thus, a clearly legible statement of the organization’s mission is a prerequisite to have it influence the development of the CIS.

Any available tool lacks a value in itself. Tools are considered to be all resources available to develop a CIS, such as software, hardware and the individuals in different groups involved in the systems development. Every tool must be viewed in the context of the particular result it is intended to achieve. What gives tools value are what they can be used to obtain. Thus, they must be justified in the context of the goals of an organization.

A CIS cannot be considered only to be a means to generate economic profit. Goals, in the utilitarian sense, have no direct connection to the motive that in most cases has the biggest influence on systems development, that is economic profit. Every factor affected by the CIS must be considered, in order to examine its costs and contributions: economic, technical as well as human and social. The consideration for human factors, here being overall user satisfaction, should be implemented to such an extent that its contribution to the organization,
versus its costs, is justified. The amount of resources, such as the time and costs required by the analysts and the designers, software and hardware needed, devoted to implement a CIS that takes user satisfaction into consideration, will be directly compared to how these resources could be used to generate higher overall payoffs, if assigned to other parts of the systems development. Thus, the optimal system will always contain adjustments and compromises.

Economic (or other demands) do not automatically have precedence in decision-making. Instead, they are a part of the whole to be considered. The decision-maker must have this fact in mind when making decisions based on a (utilitarian) ethical view. However, the view that economic and other factors could be decisive in ethical decision-making is not wrong as such: all factors should be considered and be treated with equal thoroughness before making a decision.

Good and bad must be measurable in order to make an assessment
Measurability requires legibility and simplicity. Too complex situations become difficult to survey. Those who should introduce the basic data for decision-making, that is the analysts, must be perfectly aware of the directives regarding what to look for, when an analysis of an ethical dilemma will be carried out. It is likely that the basis for this exists implicitly in the organization’s comprehensive goals and its policy (the organization’s policy is a good place to practically express its standpoint regarding ethical issues).

What is to eventually be considered a good outcome of the SDLC will be a CIS with such an implementation that it satisfies the demands of as many stakeholders as possible, to as large an extent as possible. The decision-makers and the system’s owners are likely to judge the system by the revenues it generates. Stakeholders outside the system relying on it for daily operation might put availability, reliability, and the system’s security foremost. The quantifiable nature of these requirements make them easier to measure,
compared to soft factors, such as overall user satisfaction. It should be emphasized that this does not imply that the soft issues are to be considered less important.

Possible ways to measure these issues could be by interviewing the personnel, by directly studying the application area, by examining studies regarding similar systems, and so forth (Avison and Fitzgerald, 1995).

*That an alternative is considered to be the best one to obtain the goals of the system, does not imply that it is a qualitatively beneficiary one*

Each situation must be judged based on its own characteristics, to find solutions that are optimal to obtain the overall goals. There is no norm telling the analysts, designers and decision-makers, that if one always follows a certain way of solving systems development issues, it will be the optimal implementation. This flexibility required in the development of a CIS is different from the more absolute ethical beacons available in duty and rights ethics. This puts requirements upon the analyst and designer, when it comes to their understanding of what criteria that are decisive.

For example, the analysts and designers could trade a complicated technical solution or an user-friendlier interface, which will require extensive development work, for a simple one. This might not be ideal for the users of the affected part of the new system. However, if the analysts and designers, by choosing such an approach can devote more time to other parts of the system, considered to promote in a better way the overall goals of it, a utilitarian would argue that it is the right decision.

However, it is possible that this could be looked upon using a “positive” approach: instead of trying to maximize the benefits for the different stakeholders, the analysts and designers should try to minimize the bad consequences produced to as many individuals as possible, and thereby achieve the overall aim, that is a CIS with such an implementation, that it satisfies the demand of as many stakeholders as possible, to as large an extent as possible.
Everyone affected by a decision must be taken into consideration, regarding how the decision affects them.

Questions such as “What are the consequences for those affected by a decision?” and “What is the significance of change to these stakeholders?” must be answered before making a decision. A broad perspective regarding the different issues in the CIS to be developed is required of those establishing its direction, that is the decision-makers. It will be the responsibility of the decision-makers to ensure that the voices of the different stakeholders are noticed and taken into consideration.

The analyst and designer should provide the decision-makers with information regarding the possible consequences to the system of a decision, since they are directly involved in the creation of a new CIS. They cannot focus only on how to practically solve a problem in the CIS being developed. They should do their utmost to try to perform the difficult task of anticipating the consequences of the system, before it is implemented and made operational. To illustrate the necessity of this, consider the feasibility of changing the direction of a ship that has already run ashore. It will be better to put the CIS right at the first time. This will require reflection by the analysts, designers, as well as decision-makers.

Humans strive for happiness. Happiness is considered the foremost good

Happiness will mean different things to different stakeholders (Oz, 1994). The extent, to which the wishes and desires of all stakeholders are fulfilled by the use of a CIS, can be seen as a simple quantitative measurement of success in implementing ethical considerations in the design of the CIS.

What is considered to be good and bad might vary from one individual to another, and is difficult to estimate

This requires the information gathering, carried out in the feasibility study, system investigation, and systems analysis in the SDLC, to be done carefully. The collection of information should provide a foundation for decision-making.
The individual is always more or less subjective, and there is a risk that the development of the CIS absorbs subjective judgements.

To minimize the risk of having the CIS developed on subjective grounds, one should always strive for consensus, taking into consideration as many views as possible. When in doubt, the decision-maker should turn to specialists outside the system, in order to obtain a neutral view of the problem at hand. This neutral view is a prerequisite to make the correct (utilitarian) decisions.

### 5.2.2 Duty ethics

*The actor’s behaviour is in focus, not its effects*

This emphasis on the intrinsic features of the CIS being developed, makes the early phases in the SDLC of great importance, in order to embed the correct decisions in the CIS. To change the system during the later phases of the SDLC will be most difficult, since in order to do this, the system’s foundation must be changed. This puts emphasis on the decision-makers’ responsibility regarding their ability to steer the CIS being developed, since the decision-makers are responsible for establishing a direction of the CIS in the feasibility study, system investigation and systems analysis phases. The decision-makers role and influence regarding ethics should be emphasized in the beginning of the SDLC.

It will be most difficult to cancel or reverse an action or its effects, embedded in the realisation of the CIS, if ethical dilemmas are encountered in a later phase of the SDLC, such as implementation or review and maintenance. Fundamental thoughts and values must be worked out thoroughly before the designers enter the systems development scene. This will of course apply to the integration of any ethical theory into systems development.

These demands emphasize the need to carry out the feasibility study in a thorough manner. The decision-makers must be able, together with the analysts providing the information necessary for decision-making, to answer questions
that concern why the system should be developed in a certain way, not just what to develop. When making a decision, the question “Will it be possible for everyone to act in the same way as we have chosen to do?”, that is, is the behaviour universalizable (Martin and Schinzinger, 1989) must be able to be answered positively. When this beacon is established, it will be up to the designers how to transform the answers to these questions into how they should be implemented in the new CIS.

What is to be considered moral in an act is in the intention to do the right thing, not the act itself

This implies that the goals of an organization cannot be considered the only important thing. Instead, the participants in the SDLC should express why the goals should be obtained, and how most effectively to use the means available, such as software, hardware and the individuals in the organization, to obtain the goals. If the basic ideas behind the CIS to be developed are not correct (in a duty ethics sense), its extension, that is the way the CIS is being designed, implemented and applied in the systems design, implementation and review and maintenance phases, can never be correct. As “correct” will eventually be considered a CIS that is implemented in such a way that the duties of all its stakeholders are taken into consideration. It is also a duty to respect the individual as an end in herself (Johnson, 1994) in the organization. Thus, mere economic gain (when the individual is viewed only as a revenue generator) can never be the only goal of an organization. The implementation must also rest on views and values that are universalizable (Martin and Schinzinger, 1989), that is that the views and values embedded in the system are of such a nature that they can be applied by everyone. The implementation, which will be duty ethics put into practice, should also be of such a nature that it is acceptable to those directly affected by it (Spinello, 1995).

The emphasis on the intentions of the decision-makers and of the other stakeholders implies that in order to build a sustainable system, its foundation
Analysis

(where ethical analysis is considered one useful tool to provide guidance) must be well considered. The analyst and designer should have long-term considerations in mind when the analysis and design phases, respectively, are carried out. A good foundation, established in the early phases of the SDLC for the CIS being developed, will last, whereas a faulty one will put the CIS into question, before it is even put into practice.

The organization must be of such a nature, that it is manifest that there exists within it an appreciation of the value in itself to act in certain ways. This should lead to a CIS developed based on universalizable (Martin and Schinzinger, 1989) decisions and the respect for the individual.

It must be emphasized that the different duties that should be put into practice in the CIS are not those of the decision-makers solely; every group of individuals have duties to others, for example the duty of the users towards the decision-makers to participate in the work towards the organization’s goals. However, it is the decision-makers that should show the way for the CIS being developed.

An ethical behaviour is a behaviour that everyone can apply: it is universalizable (Martin and Schinzinger, 1989)

If this condition is not fulfilled, it is everyone’s duty to avoid the particular act. This responsibility rests upon every individual in the different groups forming the participants in the SDLC. Accordingly, it is not only the responsibility of the decision-makers that the CIS is used correctly. In the same way, it will be the responsibility of the users to call attention to a possible unsatisfactory state of the CIS being developed (this could be a possible security hazard), for example during the analysis phases, in order to have the analyst to forward this information to the designer. It will then be the responsibility of the designer to put this information into practice in the design. To make this mutual information exchange possible, information transfer thresholds within the organization must be kept low. It will be required of the analyst and the
designer that they stay in continuous contact with both the decision-makers and
the users during the development of the CIS.

Participation becomes an important feature of the SDLC, in order to develop
a successful CIS. This can also be motivated by the infological equation, as
described in Langefors (1995). Infological analysis shows that the “…cognitive
structure of people has emerged as a critical design element.” (Langefors, 1995,
p. 144) In addition, the people that should interpret the data must be
considered parts of the information system. Without doing so, there will be no
information system, since data are not information, and data systems will not
automatically be information systems. An information system will only emerge
when a data system is combined with the organization (Langefors, 1995).

All groups of stakeholders must be considered important, based on the
certain information they can contribute to the SDLC: the expertise of the users
in applying their knowledge of the use of the CIS as a tool to obtain the
organization’s goals, the decision-makers expertise in commanding the system,
and making every stakeholder work towards the common task of obtaining the
organization’s goal, and so on.

To examine if a decision is universalizable (Martin and Schinzinger, 1989) is an
easily applicable and understandable tool, in order to test whether a decision
will be sustainable (and thus well fit to be applied in a new CIS) or not. It is
most likely that the decision-makers, analysts and designers will confront ethical
dilemmas, where it is not obvious which standpoint is the right one, especially
in the feasibility study, system investigation and systems analysis phases. If (or
more likely, when) this occurs, it will be advantageous to call for help from
specialists outside the system, who have expert knowledge in the field (the
analyst will turn to another analyst, for example), to obtain a neutral and
unbiased view of the situation at hand. All individuals can be expected to make
more or less subjective judgements of a situation in which they are stakeholders.
Thus, this type of injections of neutrality is likely to contribute to the selection
of the correct decisions.

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Duties are separated from the will to obtain happiness or pleasure

The basic duties of every individual must be considered primarily in a decision situation, where different interests conflict. To act in a way that is universalizable (Martin and Schinzinger, 1989), and that respects the individual, is the duty of every individual in every group participating in the SDLC, and eventually in the use of the CIS that is the outcome of this process. Performing acts based on the view that their only purpose is to make a stakeholder wealthier (and thus promote happiness and pleasure) is not acting out of a sense of duty, and must therefore not be allowed. For example, the analysts and designers (in the role of consultants) will not do their duty if they rush the analysing phases and the design phase, respectively, in order to make fast profits. The duties of the individual always have precedence over the will to obtain happiness or pleasure. On the system level, again, the system will also be judged by its underlying intentions, not to the extent it will promote happiness or pleasure, for example by giving large revenues.

This does not imply that economic or other gain cannot be considered when designing systems. Nevertheless, it does imply that the CIS is not merely a means to generate these gains. The individuals (and their duties) must not disappear or be ignored in the SDLC. The decision-makers must be able to see the whole spectrum when making decisions. This call for receptiveness when it comes to looking for and choosing solutions that satisfy all demands put upon the CIS.

To respect the individual is a duty

The individual is expected to contribute to the system, by participating in the work to obtain the goals of the organization. One of the means used to improve individual efficiency is by the use of a CIS. However, the CIS must be appreciated by the individual, otherwise she will be treated merely as a means (Johnson, 1994). When using duty ethics, treating the individual this way is considered to express the utmost lack of respect. Individual expertise (in the role of user, analyst, and so on) should be taken advantage of in the system, but
the individuals must at the same time be compensated for their efforts. This
does not only include economic compensation in terms of salary. Soft factors do
also contribute, for example job satisfaction.

If it is possible to develop a CIS in such a way that it does not only give the
individual fair pay, why should not this be taken advantage of in the SDLC? Fair
pay is the sum of all factors that contribute to the well being of the individual.
Thus, a CIS should be developed in such a way that it satisfies as many aspects
of the individuals needs and wishes as possible. A “human requirements
specification” might be considered, to be added to the already existing
economical and technical requirements of systems development. It should,
among others, concern such matters as participation, responsibility, influence
and respect. It should also state how to absorb these aspects into the SDLC, in
order to transform them into intrinsic features of the CIS being developed.

*The individual has certain duties*

The role of the individual will decide which duties will apply. In the SDLC,
one’s duties will also be decided by the context in which one contributes to the
CIS being developed, that is which group one is considered to belong to. Each
group of stakeholders will create a responsibility area of duties. The reason for
this is that a given group, such as the analysts, can be expected to have the
greatest insight and knowledge in their own field. It would be difficult for a
decision-maker to look into and comprehend all the details of the analyst’s
work, without the same expertise as the individuals in this group. The special
responsibility of the analysts could be to carry out search for information to as
large an extent, that it will be possible to provide the decision-makers with
information needed to make decisions, that in turn will ensure that the
individual is regarded as valuable as such in the CIS to be designed and
implemented. This is the responsibility area of the analyst, and no ones else’s,
since it is a well-defined area of work. The duty to perform one’s responsibilities
as an individual cannot be transferred to somebody else. In the same way, the
responsibilities of the group, viewed as one entity, cannot be transferred to another group.

This requires that the different areas of responsibility must be well thought through and defined within the organization, in order that participants might understand their role as contributors to the SDLC, as well as their role in the whole. Good communication between the groups forming the different areas of responsibility will be important, since the responsibilities will extend beyond the group (the responsibilities of the analyst will be extended into the design phase, for example).

It could be argued that the conclusions drawn above imply that the organization could be divided into parts, considered as autonomous units. This is not true, since the groups of individuals in the SDLC work towards common goals, and they benefit directly from the co-operation between the different groups in a symbiosis.

*Ethical decisions are based on the categorical imperative: they must apply to all rational beings*

When duty ethics are being adopted, the decision-maker is assumed to act rationally in all decision situations. This puts large requirements on the role of the decision-maker, since humans are always more or less subjective in their judgements, and cannot be expected to act completely rational in situations in which they themselves are stakeholders. In addition, the categorical imperative puts great demands on the CIS being developed. It should satisfy many different demands, maybe contradictory. This makes it a necessity that decisions are well-reasoned and motivated, to such an extent that they can be expected to last in the long run, when the CIS is exposed to different kinds of pressure, such as the rapid introduction of new technology, a changing marketplace or new demands imposed by government or the society within which the CIS will eventually exist.
The decision-maker will be required to express courage in the early phases of the SDLC, where decisions critical to create a viable CIS are to be made. The decision-maker will have to create consensus regarding the different demands and expectations the stakeholders have on the system. The decision-maker’s role in systems development will at this stage be to merge and co-ordinate the different views that exist. When the categorical imperative is examined to see whether decisions are acceptable also to those directly affected by it (Spinello, 1995), duty ethics takes on a directly human perspective, and it is made clear why this demand must not be compromised away. The analysts, designers and decision-makers should all use this question as a beacon when developing the CIS.

5.2.3 Rights ethics

*Duties are created out of rights, not vice versa*

Consideration for the rights of the individual is the starting point when developing a CIS. The individual has certain rights, and the CIS must be designed and implemented in such a way that it does not interfere with these rights, but instead promotes them. These rights will create duties, which the different participants in the SDLC will have to fulfil. This approach to applying ethics will put the individual in the centre.

Human rights are not set in the CIS being developed, or by its participants, for example the decision-makers. Instead, they are always present before a system is created, since human rights are the rights of every individual, no matter of time, place or context (Spinello, 1995). Human rights say that one should always respect the individual, and make decisions based on a philosophy of fairness (Spinello, 1995). This implies that the wishes of those that are to eventually use the CIS, that is the users, must be taken into consideration, when the analyst carry out a search for information in the early SDLC phases, when the designer
creates the design in the later phases, as well as when the decision-maker decides what and how to develop the CIS. Ignoring the users, would not respect the human right of the individual to control her life, since one’s work is considered an extension of one’s person (Johnson, 1994). Fairness in the development process requires the decision-maker to ensure that every stakeholder in the development is treated with equal consideration in the SDLC, and that the interests of all stakeholders are considered equally important. The analysts should provide the information necessary to make decisions based on this view during the feasibility study, system investigation and system analysis phases.

Rights and duties have a reciprocal relationship
An example of this is whistle-blowing (Martin and Schinzinger, 1989). Participants in the SDLC have rights to draw attention to unsatisfactory conditions in the CIS being developed. For example, this could be the designer calling attention to an implementation that will not satisfy minimum safety requirements, for example a database for a hospital containing patients’ records. At the same time, the unsatisfactory security in the CIS here also creates a duty for the designer to inform the decision-makers, and if this does not help, to take further steps such as refusing to implement the given design.

The participants most likely to end up in situations like this one are the analysts and designers, since they should collect, in a neutral way, the information needed to create a sustainable CIS, and then transform this information into an implementation, respectively. When doing this, they are likely to confront conflict situations, when they consider the requirements of both the users and decision-makers. Other similar situations are when the design is to be controlled solely by economic considerations, ignoring other factors. The analysts’ and designers’ professional rights and its codes of conduct might support them when these conflicts of interests occur. Professional rights arise from participation in a certain community (Martin and Schinzinger, 1989). There exist different codes of conduct, defined by their respective professional organizations, for example computer professionals.
Different considerations will be implemented using the following order of precedence in the SDLC:

1. Human rights. Respect for the individual’s rights, such as the right to freedom and privacy. Decisions should be based on a fair treatment of all individuals affected, taking their needs into equal consideration. These rights form a minimum core, if rights ethics are to be applied in the SDLC. These rights are negative rights, meaning that they call for restraint by others (Johnson, 1994).

2. Professional rights. These are set by professional organizations or exist implicitly within a given community. These rights are set outside the CIS being developed, in the same way as human rights. Professional rights, in turn, are based on human rights.

3. Positive rights. These rights imply that someone has a duty to do something for the holder of the right (Johnson, 1994). This could be a feature of the CIS to be developed, agreed by reaching consensus between the users and decision-makers in the early phases of the SDLC. The positive rights will extend the assumptions upon which the CIS should rest.

For every right, there is a correlative duty. Accordingly, it is not enough to examine only rights in the development of a CIS. It must be specified in the design who is responsible for having a right carried out, and in which way this should be done. It will be the responsibility area of the individuals to implement different rights, based on which group of stakeholders they belong to. The reason for this is that the system should take advantage of the expertise of the different groups in their respective field.

Duties can be seen as the application of rights. When developing a CIS, which is a more concrete task than establishing an ethical foundation for it, it will be more to the point to talk about those duties that are created out of rights, than about the rights of the individuals. The reason for this is that duties explicitly
state what should be done to ensure that individual rights are practically applied in the design and implementation phases of the SDLC.

**The individual, not the group, is in focus**

This implies that the decision-makers must never only look at the whole CIS and its characteristics when making judgements. They must also take notice of the individuals that contribute to the success of the system. The view that individuals are those who should form the CIS, and not the other way around, must be adopted in the SDLC. The CIS should be designed in such a way that the individual does not disappear in it, among its other features such as its software and hardware, as well as in the goals of the organization which the CIS is used to achieve. An individual cannot be seen only as a means, since this view gives no motive (and thus, no room for) recognizing the rights of the individual. For example, in a strictly economic view, the individual in the organization is someone that generates revenues and costs. Treating individuals in this manner does not reflect the view that basic human values such as equality and freedom should point out the direction in all decision-making.

**The rights of the individual must not be neglected in order to promote the good of the group**

When the decision-makers are to find a satisfying solution to an ethical dilemma, the individual and her rights must always be put first. This does not imply that the importance of the group and the relations within will be belittled. However, if the basic rights of an individual conflict with other interests, such as constraints to the system design created by use of software or hardware, another implementation path must be chosen. Examples of such implementations of a CIS likely to interfere with the basic rights of individuals could be a questionable technical implementation of a security system in a publicly accessible database, or an unreliable communication system that is of vital importance to the society, for example a system used to control emergency response.
Different communities create different categories of rights

This can be illustrated by professional rights. These rights, which extend beyond basic human rights, depend on the context of a group of individuals. In the context of a CIS, they are created by the special relationships and roles the participants in the SDLC might have.

The analysts and designers are two groups who are likely to be supported by an existing body of professional ethics, including a statement of their professional rights, when confronted with situations in which they are forced to try to satisfy contradictory demands. An example of such a situation, where the professional rights could provide guidance, is when a decision-maker wants the designer to implement a surveillance system into the software to be used in a CIS being developed, in order to monitor user activity, without their knowledge. It is possible, but not necessarily so, that such an act would interfere with user rights.

It should be emphasized that all individuals have the same human rights, which are absolute and not dependent on any conditions. Thus, they should always be considered paramount in the SDLC.

Rights can be divided into negative and positive ones

A negative right implies that the individual has certain rights that no one and nothing must interfere with (Spinello, 1995). These rights are the basic human rights such as the rights to freedom, free speech, privacy, and equality before the law. These principal features must not be violated in the CIS, and should be built into the design. In the context of a CIS, this could mean that the design should be of such a nature that it will be possible for the users to make their voices heard (and thus, influence the system), and that the privacy of the users is protected when a risk situation might occur, for example in databases containing personal information about employees.
Positive rights, on the other hand, are not associated with the same kind of absoluteness. Positive rights are most likely to be features of a successful CIS, since it will then be based on the view that a CIS should be designed with the satisfaction of more than just basic needs of its users in mind. These considerations could intensify the focus on the human value by including attention to soft factors such as how to maximize the overall user satisfaction in the CIS. This could, for example, practically mean that the designers implement a user interface that allows for easy and swift operation of the system.

The kind of features, in the positive rights sense, that should be considered important enough (based for example on the effort needed to implement them) has to be decided upon at an early stage in the SDLC, by the users and decision-makers reaching consensus. These features should rest on a firm footing. It is a failure if external circumstances (for example, lack of funds) allow that the less absolute positive rights are questioned later in the SDLC. Features once considered worth striving for cannot suddenly be considered a problem in the development of the CIS. Either the features considered for design and implementation have been chosen on insufficient grounds, or the extension of the system to include consideration of human factors and thus social responsibility will only be an “...element of system design to which managers only pay ‘lip service.’ ” (van Gigch, 1991, p. 427) If this is the case, the decision-makers have not established the firm ethical standard they are ultimately responsible for.

There exists a distinction between legal and human rights

When choosing to apply a rights ethics perspective to the SDLC, the decision-makers must understand the difference between rights created by law, and human rights (Johnson, 1994). The rights of the individual will have to be considered in a wider sense than those created by law. The decision-makers cannot satisfy themselves with statements such as “The system complies with all laws, and that should be enough”. To expect that all demands on a CIS being developed should exist implicitly or explicitly in current laws is a simplistic
picture of reality. Laws are constantly being created and modified, whereas the values of ethical theories are permanent, as a beacon for taking a stand in decision-making and conflict situations.

The rights created by law can be seen as an absolute minimum standard, when applying ethical considerations to a CIS being developed. Instead of this approach, the decision-makers should use the means available to them, that is software and hardware and all individuals involved in the design process, to implement positive rights in the SDLC. This will maximize the effectiveness of the system, and thus strive towards the goals of the organization, since individuals treated in a respectful and fair manner are more likely to feel comfortable with the CIS, and thus to be more effective.

*Fair judgements should guide decision-making*

When adopting rights ethics, individuals should always be treated in a fair manner and with respect to each one's individual rights (Spinello, 1995). In order to do this, attention must be paid to their special needs and wishes. This attitude will put emphasis on the user as an individual in the CIS being developed.

Fair treatment requires transparency among the decision-makers, to enable them to treat all individuals equally. It would enhance the decision-making process if several perspectives could be incorporated into a decision, as this is a precondition for the neutrality that is a requirement for fair treatment of the individual in the CIS. Decisions must be free from self-interest, prejudice and deception.
6 Results

Here, the results based on the analysis will be presented. Results regarding what characteristics will be necessary if ethical considerations are to be integrated into the selection of methodologies will be presented, as well as how utilitarian, duty and rights ethics will affect the SDLC, if these theories are to be applied in systems development. The reader will notice that these two different analyses give several similar results regarding ethics and systems development.

Below is a general result that is not directly connected to the analysis. Nevertheless, it was considered important enough to be included here.

There has been found sufficient proof in the literature which has been studied, that there indeed is a need to consider ethical issues in the context of computer technology. This is based on the multitude of different ethical issues that the literature regarding ethics and computer technology brings up. It appears to be a void regarding how to approach these issues before they confront the stakeholders of a CIS, that is in the systems development. Thus, it would be fruitful to try to integrate ethics in development processes such as the SDLC, since doing so will eventually lead to a CIS that rests upon ethical considerations. Ethical analysis will seldom provide a “yes” or “no” answer to an ethical dilemma. Nevertheless, an ethical evaluation could serve as a powerful tool to identify and analyse one’s views in the decision-making process.
6.1 Results from the analysis of how ethics is adopted in the methodologies

There is a clear difference in the possibility of integrating ethical issues in systems development, when comparing methodologies that apply the hard and soft schools of systems development. Out of the examined methodologies, STRADIS and SSADM are considered hard ones, while SSM, ETHICS and Multiview are soft ones. van Gigch (1991, p. 425) defines hard systems as “A system usually devoid of biological properties and related to the physical science domain.” van Gigch (1991, p. 427-428) also defines soft systems as “[Systems that] react to their environment by changing their short-term functions, undergo slow long-term changes, but maintain their identity and evolve.” During the examination of how ethics is adopted in the five different methodologies, it was found that it is difficult to integrate ethical considerations in methodologies based on the hard system approach. To be able to integrate ethical issues in a methodology, it should be designed in such a way that it allows soft factors to be considered.

In the soft methodologies, it is not claimed that certain factors, such as economic or technical, are more important than others in systems development. For example, in ETHICS (Mumford, 1995; in Avison and Fitzgerald, 1995), it is considered that for a system to be successful, all contributing factors need to be considered. This creates ample room for ethical considerations in systems development when applying this methodology.

The soft methodologies imply that a broader definition of the objectives of the system should be stated, compared to the hard methodologies. A holistic view is adopted in these methodologies, making room for the contributions to systems development that ethical considerations can create.

In methodologies where ethical considerations can be integrated, it is made explicit that the concept of participation is important. For example, in SSM (Checkland, 1981; in Avison and Fitzgerald, 1995), it is stated that it is the job of the analyst to expose as many views as possible that show possible solutions to the problem.
situation. This information should be based on as many views as possible, gathered from the problem owner and other stakeholders. ETHICS (Mumford, 1995; in Avison and Fitzgerald, 1995) states that everyone affected by the new information system should be involved in this process, not only the design group. Thus, the views and values of the users are considered equally important compared to those of the analysts and designers in ETHICS. Multiview (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995) states that everyone, not just the system designers, should be allowed to take part in the analysis and design of the system they will eventually be using. This is based on the belief in Multiview that people have a fundamental right in controlling their own lives. If the future users of the new system are allowed (or better yet, encouraged) to take part in the development of the system they, ultimately, will be the users of, then the most will be made out of the system, with respect to implementation, approval and operation (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995).

**Ethical considerations cannot be added on top of a methodology based on the hard system approach.** Trying to do this in the methodologies based on the hard system approach (where ethical considerations are generally lacking) will create contradictory situations, because these methodologies put such a strong emphasis on economic and technical factors. Satisfying only these requirements does not mean that ethical factors will be taken into consideration neither in a decision situation, nor in the SDLC. Ethics must be considered in the SDLC from the ground up.
6.2 Results from the analysis of how the ethical theories will influence the SDLC

If ethical considerations are to be integrated in the SDLC, systems development will have to take on a system approach. It was found, in the analysis of the three ethical theories applied to the SDLC, that a broad perspective regarding the different factors that influence system design will have to be taken. It will not suffice to consider only a limited range of factors. Nor will it be possible to consider the CIS to be only a means to generate economic profit.

Economic or other demands do not automatically have precedence in decision-making. Instead, they are a part of the whole to be considered. The reason for this will vary according to the ethical theory adopted. However, the result (that is, the need to consider all factors) will be the same.

Today, it will be the responsibility of the decision-makers to establish an ethical standard for the CIS being developed. Tomorrow, ethical considerations might characterize methodologies used to develop a CIS. Until then, a noticeable responsibility will rest upon the decision-maker when it comes to ethical issues in systems development. The decision-makers are those who direct how to use available economic means. Thus, they will control the amount of time and the recourses allocated to the integration of ethical considerations.

Considering the position of the decision-makers in the SDLC, it is reasonable to require that they should lead the development work, when it comes to establishing the ethical foundation for the CIS being developed. The decision-makers should also control how ethical considerations are integrated into the CIS. However, the responsibility to develop a sustainable CIS with respect to ethics will not only be the responsibility of the decision-makers. All stakeholders are necessary participants in the process.
There is a need to obtain consensus regarding the ethical standards according to which a CIS is to be developed. The worldviews of the participants involved in the SDLC will vary. Everyone has an ethical value and view, either implicit or explicit. Whether these worldviews are made explicit or not, the worldviews of the decision-makers and other stakeholders regarding ethical issues will be properties of the CIS designed. The worldview of the decision-makers, in particular, will affect how the system will eventually turn out.

Making these worldviews explicit in the SDLC will improve the chances to build a consensus regarding the direction of the CIS to be developed. What is considered to be good and bad might vary from one individual to another, and is difficult to estimate. Absorbing as many different views as possible in the early phases of the SDLC should lead to the result that the wishes and demands of different stakeholders are acknowledged. The decision-maker will then be required to coordinate and merge the different views that exist.

The shape of the system regarding its ethical foundations must be established early on in the SDLC. The system should rest upon ethical values, no matter which ethical theory is adopted. Therefore, the values of an ethical theory must be made an intrinsic feature of the CIS being developed. To change the system during the later phases of the SDLC will be most difficult, since the foundation of the system must be changed to do this.

The ethical standards according to which a CIS is developed are established early in the SDLC. Therefore, consensus regarding these issues must be reached at an early stage. It will be most difficult to adopt an ethical standard in a system, if ethics, and reasoning about it, was not considered as a cornerstone of the early systems development phases. Here, the decision-makers need to state ethical aims and objectives early on, and make efforts to ensure that everyone involved in the process understands these aims and objectives, and views them as sensible. That is, everyone should participate in the SDLC from its beginning. The ethical standards agreed upon should then permeate the development work.
Identifying possible ethical dilemmas at an early stage makes it possible to take them into consideration in the design of the system, and minimizes the risk that the new system needs to be redesigned at a late stage due to poor attention to these issues. To consider ethical issues in the SDLC will help to bring about this overall goal of systems development.

In order to put the examined ethical theories into practice, the SDLC must be based on participation of its stakeholders. It was found in the analysis that the different ethical theories will create different standpoints for considering participation. However, participation is an essential feature of all methodologies that apply ethical considerations. The different groups of stakeholders must be considered equally important in the development of the CIS. They can all contribute with different pieces of information and knowledge that is necessary to make the right ethical decisions.

For example, the standpoint that participation will contribute to the success of the system being developed, by exposing as many views as possible, could be deduced from the utilitarian view that doing so would maximize the good produced for all stakeholders. Participation could also be motivated by the statement that the views and values of the users are considered equally important compared to those of the analysts and designers, as Mumford (1995; in Avison and Fitzgerald, 1995) states. This statement can be deduced from duty ethics: the duty to respect the individual. In Multiview (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995) it is argued that participation should be a feature of the design process, since people have a fundamental right in controlling their own lives: a statement based on rights ethics.

Basing decisions in the SDLC on utilitarian or rights and duty ethics, respectively, will put different emphasis on the group and on the individual. If utilitarian ethics is applied consistently in systems development, the goals of the organization will be strongly influential in shaping the CIS being developed. If duty or rights ethics are applied consistently, the user as an individual will be considered most important.
In utilitarianism, the sum of the effects, good or bad, that a decision creates is considered paramount. The achievements of a group will be considered as a whole. Thus, what the users, analysts, designers and decision makers can obtain working together is emphasized, not their individual roles. In duty and rights ethics, the effects of a decision for the individual are considered. When adopting duty ethics, respect for the individual will be placed foremost. In rights ethics, consideration for the rights of the individual is the starting point when developing a CIS. The individual has certain rights, and the CIS must be designed and implemented in such a way that it does not interfere with these rights, but instead promotes them.

*There is a need to adopt a neutral attitude in decision situations.* The neutral approach is a precondition for making fair decisions when adopting rights ethics in the SDLC, but this approach is of importance regardless of which ethical theory is adopted. Decisions must be free from self-interest, prejudice and deception.

All individuals can be expected to make more or less subjective judgements of a situation in which they are stakeholders. When in doubt, the decision-maker should turn to specialists outside the system, in order to obtain a neutral view of the problem at hand.
7 Discussion

First, let us recapture the aims and objectives. The aims of this work was to investigate the importance of ethical considerations in the development and use of CIS, and when and where ethical issues should be taken account of in the SDLC.

The objectives to obtain these aims were:

- By gaining knowledge of the fundamentals of ethics and its major schools of thought, giving a background for ethical thinking in CIS
- By giving a possible foundation for the issues that should be considered in the development of CIS
- By examining the SDLC and methodologies adopting it, then applying the conclusions regarding ethics and the development process.

Regarding the aims, the emphasis has been on how to integrate ethical considerations into the development process, and less work has been devoted to examining why this is needed. As to the latter question, which is an important one, it was found that there already existed a sufficient body of material (as presented in the introduction) that suggested that ethical considerations in systems development indeed are important.

It is the author’s belief that the aims have been covered to such an extent that it is possible to extract results that should make a valuable contribution to the knowledge of the subject.

Considering the first objective, gaining knowledge of the ethical schools of thought was necessary to provide foundation for further study. Searching for this knowledge in the context of literature also covering computer technology might not have been necessary. However, this choice of point of departure has provided good insight into the current issues in the development and use of CIS.
Regarding the question about what should be considered in the development of CIS, the examination of some different methodologies adopting the SDLC has been rewarding, since this examination shows some characteristics that are necessary in a methodology, if integrating ethics in the SDLC should be possible at all. The analysis of how utilitarianism, duty and rights ethics will affect the SDLC, should provide guidance about how to create a methodology that applies ethical considerations.

The three ethical theories studied here are considered to contain the characteristics of utilitarianism, duty and rights ethics, respectively. Variations or new extensions to the fundamentals of these theories have generally not been considered. Instead, the least common denominator regarding the general characteristics of each theory has been looked for. This is not saying that there are not any important new developments to the ethical theories, such as Rawl’s (Martin and Schinzinger, 1989) extension of rights ethics. The reason for not choosing to focus on a specific ethical theory in this work is that looking for the general characteristics has been considered more fruitful. Further work could select one of the theories for a more in-depth examination, in the context of how it affects and will contribute to the SDLC and the CIS that is the outcome of this process.

To what extent do the results found satisfy the stated aims? There are limitations as to what extent the aims have been reached when looking at practical application. This work describes prerequisites for integrating ethics in general into the SDLC, as well as how three major ethical theories affect the SDLC. Thus, it indirectly describes how a methodology, that is able to adopt a specific ethical theory, should look like. To develop such a methodology (based on the SDLC), that will turn the results of this work into practice is considered a possible future extension of this work.

In addition, it is important to remember that this work reflects what the author has found to be essential features when examining the five different methodologies,
as well as how the three ethical theories affect the SDLC. Using the same material, it is possible that additional features that will affect the SDLC will be found.

To place this work in the context of other research in the area, it has been difficult to find other work that is directly related. There exists a sufficient body of studies of ethics applied to the field of computer technology, and how this technology affects its environment. Nevertheless, no material covering how to direct the development of a CIS on a comprehensive level before (that is, in the SDLC) this technology has the possibility to affect its environment, have been found. Instead, this work rests upon existing work regarding ethics in the context of computer technology, as well as descriptions and analyses of the SDLC already existing.

At the outset of this work, the intention was to have a rather practical direction. Instead, it turned out to be of a more fundamental, theoretical, nature. Considering the author’s improved knowledge of the subject at this point, if this work was started from now on, it should either emphasize the core of some ethical theories in the context of the SDLC, or what ethical considerations will mean to a methodology on a more detailed, practical level. This would have enabled the author to be more specific as to either subject.

However, contingent to this approach is an already established clear understanding of the topics of importance today, when ethics and computer technology are considered together. This was not the case of the author when this work was begun. Without this understanding, the author would have no arguments (and thus, no reason) to state why this subject is indeed important.
8 References


9 Appendix

This chapter provides a more thorough coverage of the methodologies examined in this work, that is STRADIS, SSADM, ETHICS, SSM, and Multiview, compared to the brief descriptions presented in the analysis. The descriptions of the methodologies are based on Avison and Fitzgerald (1995).

The separation of the methodologies into the six phases of the SDLC is done in the same way and for the same reasons as described in the analysis. It is stated in the descriptions where phases of the methodologies do not fit with those of the SDLC.

9.1 Presentation of five different methodologies

9.1.1 Feasibility study

In STRADIS, the methodology starts with an Initial study (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995). This is an attempt to assure that the systems chosen to be developed are the one most fit in a competing environment. Studying economical factors, weighing the possible expenses versus the incomes of the system is the basis for the selection. The system should promote incomes, avoid costs, or improve services.

The analysts collect the data from managers and users in relevant areas to gain the information needed for the initial study. The analyst should review existing documentation and form an opinion on the initial study based on the strategic plans that might exist within the organization.
When the initial study is finished, the management reviews what the analyst has reported, and the management decides whether the organization should proceed with a more detailed study or not. If management approves the study, they accept the costs of a more detailed study, but do not necessarily proceed to the development of the system suggested in the initial study.

**SSADM** begins with *Feasibility* (Weaver, 1993; in Avison and Fitzgerald, 1995), which is considered to be phase zero in this methodology. SSADM emphasizes that documentation affects all aspects of the development of a CIS. The methodology does not cover program design. The phases following the design are considered installation specific.

The feasibility phase is the first part of the project in SSADM. The aim of this phase is to ensure that a project suggested in the planning phase is feasible, with respect to technology and economy. The proposed system must be technically realizable, and the benefits of the new system must outweigh its costs.

SSADM divides this phase into four sub-phases (Weaver, 1993; in Avison and Fitzgerald, 1995):

- Prepare for the study, which estimates the bounds of the project
- Define the problem, which compares the requirements on the new system with the current one. The weaknesses in the current system can be partly used to specify the requirements of the new system
- Select feasibility option, which considers the different alternatives and out of them selects one
- Assemble feasibility report, where the conclusions drawn in this process is documented and then published.

When the problem has been defined in this way, various alternatives can be considered and out of them, it is possible to select the one that is the most suitable with respect to economical and technical factors.
In *ETHICS*, the first phase of the methodology is entitled *Why change?* (Mumford, 1995; in Avison and Fitzgerald, 1995). The group responsible for the design discusses this basic question and identifies the current problems in the existing system and its opportunities. The design group should find a convincing statement of the need for change. If this is not identified in this phase, the process stops here.

The second phase in ETHICS, *System boundaries* (Mumford, 1995; in Avison and Fitzgerald, 1995), is the identification of the system’s boundaries. Both the boundaries of the system that is to be designed and where it interfaces with other systems are defined. ETHICS (Mumford, 1995; in Avison and Fitzgerald, 1995) considers four areas: business activities affected (this could be sales, finance and human resources); the existing technology that is affected; the parts of the organization that will be affected (such as different departments); and parts of the organization’s environment affected (the organizations different stakeholders).

In the third phase of ETHICS, *Description of existing system* (Mumford, 1995; in Avison and Fitzgerald, 1995), the existing system is described. The aim of this phase is to inform the design group how the existing system works. It is stated in the methodology that people often tend to know the details only of their own work and the work of those they interact with directly, but not the functions of the whole system. Therefore, this phase is necessary.

### 9.1.2 System investigation

Phase two of *STRADIS* is called *Detailed study* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995). Now, the existing system is studied in detail, compared to the initial study of phase one. STRADIS identifies the potential users of the system at three levels (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995):

1. Senior managers. They have profit responsibilities. They agreed with the system proposal of phase one
2. Middle managers of affected departments
3. The end users. They are the individuals who will work with the system directly.

When the three categories of users has been identified, the analyst examines their interest and demands by interviewing them. Then the analyst creates a draft logical Data Flow Diagram (DFD) (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995). It is likely that this new DFD will extend beyond the new system chosen, since it needs to capture exactly the boundaries of the system and where it interfaces with other systems.

In phase one, the costs and contributions of the new suggested system where sketched. Now, the bases for these estimates should be investigated further. The assumption the present estimates where based on needs to be analysed, in order to ensure that all vital aspects have been covered, and to give a basis for analysing how contributions and costs will affect the organization. This phase should provide a better estimate on which decisions can be made.

The detailed study contains (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995):

- A definition of the users of the new system. This should contain names of executives, the operations to be carried out by the different departments and their relationship to each other, description of the jobs that will be affected, the number of people carrying out each job, the hiring rates and natural attrition rates
- A logical model of the present system. This should contain an overall DFD, descriptions of interfacing systems, detailed DFD for each process, a logical specification of each essential process and data definitions
- A statement of the possible benefits of a new system, such as increased incomes, reduced costs, or improved service. Where possible, financial benefits should be estimated
- A report of competitive pressures and statutory demands on the system, comprising their possible costs. A solid cost versus time budget, presenting different possible alternatives, should also be presented.
The results of the detailed study are now to be presented to management. They can choose either to stop at this stage, or to advance to the next phase.

In SSADM, the first phase is *Investigation of current environment* (Weaver, 1993; in Avison and Fitzgerald, 1995). This phase and the following one will provide a foundation for the later phases. This phase should provide comprehensive information regarding the requirements of the system. This will help forming a direction for the rest of the project.

Knowledge gained in the feasibility phase is examined and the bounds of the system from phase one re-evaluated. When this is done, the analysts should come to an agreement with management regarding a comprehensive plan. Concurrently with examining the requirements of the new system, present data and processing methods are examined. This is done in more detail compared to the feasibility study.

The second phase of SSADM is *Business system options* (Weaver, 1993; in Avison and Fitzgerald, 1995). Now, the functionality of the new system is established. In phase one of SSADM, user requirements where defined. From now on, only those requirements that are economically justified are considered for further development. This is done using a cost-benefit analysis. When the economically justified requirements have been sorted out, these are specified in detail compared to phase one.

Several different alternatives are presented to management, with respect to the limitations stated above. Each one of them should satisfy a minimum set of user requirements. Then, management selects one for further development. Each of these alternatives will have an outline of its cost, development time scale, technical constraints, physical organization, volumes, training requirements, benefits and impacts on the organization.

In SSM, the first phase is called *The problem situation: unstructured* (Checkland, 1981; in Avison and Fitzgerald, 1995). The first two phases of SSM tries to capture as many views regarding the problem situation as possible. It is not likely
that the views of the problem owners (those who initiated the analysis) and other stakeholders in the system will be the same. It is the analyst’s job to expose as many views as possible that show possible solutions to the problem situation. The structure of the problem situation will be examined by the analyst by looking at its physical layout, reporting structure and the communication patterns present (formal as well as informal).

The following phase of SSM is called *The problem situation: expressed* (Checkland, 1981; in Avison and Fitzgerald, 1995). The informal nature of the problem described in phase one of SSM is now more formally stated.

### 9.1.3 Systems analysis

In phase three of STRADIS, *Defining and designing alternative solutions* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995), alternative solutions to the problems in the current system are defined and designed. Thus, this phase of STRADIS covers aspects belonging to both the systems analysis and systems design phases of the SDLC.

In the initial study, organizational objectives were defined. The organizational objective is an abstract description of objectives effecting the organization. These objectives are now converted into system objectives, describing how the organizational objectives should be reached.

Organizational objectives could be to increase income, improve service, or decrease costs. This is an abstract definition of the goals of the organization compared to the system objectives, which defines how the organizational objectives should be obtained.

In contrast to the organizational objectives, the system objectives should have a firm definition, concerning being specific and measurable. These attributes have precedence over the general statements of the organizational objectives. For example, “to improve customer satisfaction” is a weakly stated objective. A strongly stated objective would be “to decrease customer support response time by
hiring a new technician and increase opening hours”. System objectives should be expressed as the latter statement.

When system objectives are stated, the design phase can be entered. The analysts and designers will work together to create several different possible implementations, satisfying different levels of compliance with the system objectives. STRADIS states that designs meeting three different levels of demands on the system should be presented to management for decision on which one to choose for further development. These three designs are: Firstly, a design developed for a low budget, which can be implemented quickly. This implementation will not initially meet all objectives. Secondly, a design meeting most of the objectives from the introduction of the system. This design should be adapted to a mid-budget. Thirdly, a design meeting all of the objectives from the introduction. Together with each alternative design, there should be estimates of the costs, advantages, and development time-scales. An outline of the different alternatives with respect to software and hardware should also be stated. The possible different implementations should now be presented to decision makers, and they should choose one of the alternatives for further development.

Briefly, each of the possible alternatives should state (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995):

- The parts of the DFD to be implemented
- The user interface
- An estimate of costs and advantages
- A outline of a time plan for the implementation
- Possible risks involved.

The third phase of SSADM is Definition of requirements (Weaver, 1993; in Avison and Fitzgerald, 1995). This phase should lead to a complete requirement specification. It should also give enough information to proceed to the following design phases. Up to now, the new system has been investigated and analysed. This
should now be replaced by specification and design, and focus moves from the current system to the new one.

Here, a prototyping phase can be added to SSADM. The analyst should present a design to users, in order to ensure a understanding of the users’ demands and preferences when it comes to the design of the interface of the new system. Giving the user insight at a relatively early stage does not only ensure this. Having the user taking an active interest in the design process will ensure increased user commitment to the new system.

The fourth phase of SSADM is *Technical system options* (Weaver, 1993; in Avison and Fitzgerald, 1995). This phase is carried out in parallel with the next one, *Logical design* (Weaver, 1993; in Avison and Fitzgerald, 1995). As the name implies, this phase set the standards out of which the physical parts of the new system will operate. Software, hardware, and a development strategy are chosen. The organizational impact and the systems level of functionality are also decided upon.

At this point, it is considered that the design must be implementation specific. There exist too many different options when it comes to software, hardware, and the implementation strategies of these, to create a more general specification of the system. Different constraints might be put upon the analyst, for example that the software of the system must be compatible with a standardized interface to external systems. Other constraints that must be dealt with at *Technical system options* (Weaver, 1993; in Avison and Fitzgerald, 1995) are security, performance, and level of availability. This will also restrict the level of choice in the following phases. Once these issues have been resolved, a specification should be presented to and agreed with management.

*Logical design* (Weaver, 1993; in Avison and Fitzgerald, 1995) is the fifth phase of SSADM. This phase defines what the system should be able to do, in contrast with a specification of how to do it. This latter stage belongs to the domain of physical design.

This phase should give a more detailed view of how the system should behave and apply when different events occur. This could be routines for validating data
entered into the system. When this phase is finished, there should exist enough information to begin the physical design.

The systems analysis phase of ETHICS begins with *Definition of key objectives and tasks* (Mumford, 1995; in Avison and Fitzgerald, 1995). This phase consists of three phases (four, five, and six), used to define the key objectives of the new system (Mumford, 1995; in Avison and Fitzgerald, 1995):

1. Why do special areas exist? What are their roles and functions?
2. Considering the areas above, what should be their responsibilities?
3. To what extent do the current activities comply with what they are actually expected to do?

When these questions have been answered, the key objectives of the system can be identified. These are then used to establish the design objectives of the new system. The key tasks that must be carried out to accomplish the key objectives are also defined in outline at this stage.

Phase seven of ETHICS is *Diagnosis of efficiency needs* (Mumford, 1995; in Avison and Fitzgerald, 1995). Possible weaknesses in the interconnections of the current system are identified and documented.

Phase eight of ETHICS is *Diagnosis of job satisfaction needs* (Mumford, 1995; in Avison and Fitzgerald, 1995). Job satisfaction needs are measured by a questionnaire provided with ETHICS.

Phase nine of ETHICS is *Future analysis* (Mumford, 1995; in Avison and Fitzgerald, 1995). The new system should be flexible enough not only to manage the current demands in the existing system, but also be able to, to some extent, deal with changes that might occur in the systems environment in the future, such as new technology or a new organization. The analyst should try to identify likely changes, and thus build a level of durability built into the new system.

Phase ten of ETHICS is *Specifying and weighting efficiency and job satisfaction needs and objectives* (Mumford, 1995; in Avison and Fitzgerald, 1995). In the
methodology, Mumford (1995; in Avison and Fitzgerald, 1995) stresses that it is important that everyone affected by the new information system is involved in this process, not only the design group. The needs are ranked in an iterative process until a list of the priorities is produced.

Phase eleven of ETHICS is *The organisational design of the new system* (Mumford, 1995; in Avison and Fitzgerald, 1995). Phase five of ETHICS, which answered the question “What should be the responsibilities of different areas and functions?”, is defined in more detail by the design group. The fundamental data for the organizational design process exists when the questions below can be addressed (Mumford, 1995; in Avison and Fitzgerald, 1995, p. 360-361):

- “What are the operating activities that are required?
- What are the problem prevention/solution activities that are required?
- What are the co-ordination activities that are required?
- What are the development activities that are required?
- What are the control activities that are required?
- What special skills are required, if any, of the staff?
- Are there any key roles or relationships that exist that must be addressed in the new design?”

The last phase of ETHICS belonging to systems analysis, phase 12, is *Technical options* (Mumford, 1995; in Avison and Fitzgerald, 1995). The different technical options that exist and might be suitable with respect to software, hardware and the human-computer interface are now specified. Each option, with respect to these, is evaluated in the same way as organizational options (efficiency, job satisfaction, and future change). The technical and organizational objectives should be considered at the same time, since one might force limitations when it comes to choice of the other.

In SSM, the systems analysis begins with *Root definitions of relevant systems* (Checkland, 1981; in Avison and Fitzgerald, 1995), which is phase three of the
methodology. The problem solver should visualise and name the relevant systems. Relevant is defined as a way to look at a problem that provides useful insight.

The fourth phase of SSM is *Building conceptual models* (Checkland, 1981; in Avison and Fitzgerald, 1995). When the stakeholders, that is the problem owners and problem solvers, agree that the root definition has a solid foundation, out of this definition a conceptual model can be created. In this context, by a conceptual model is meant a diagram of the different activities that the system will carry out.

The fifth phase of SSM is *Comparing conceptual models with reality* (Checkland, 1981; in Avison and Fitzgerald, 1995). This phase refers to the comparison of the problem situation as analysed in phase two using rich pictures by the conceptual models in the previous phase. Different views of the individuals involved in the process should also be taken into consideration. Since a human activity system is designed, and the views of individuals about a given matter might be different, this must be taken into consideration, because one might not be comparing similar things. This will lead to a discussion of changes, and out of this discussion, recommendations regarding change should be obtained.

The sixth phase of SSM is *Assessing feasible and desirable changes* (Checkland, 1981; in Avison and Fitzgerald, 1995). This phase is concerned with analysing and absorbing the current views into a plan for realistic improvements.

The seventh and final step of SSM is *Action to improve the problem situation* (Checkland, 1981; in Avison and Fitzgerald, 1995). This will be a recommendation how to carry out actions to contribute to the problem situation.

In *Multiview*, the systems analysis begins with *Analysis of human activity* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995), the first phase of the methodology. This phase focus on the search for a particular view or set of views. This worldview is used to establish the foundation for the systems requirements. The worldview will be carried further to the following phases in the methodology. The worldview is obtained from the problem situation by discussing the main aims of the organization concerned.
The second phase of Multiview is *Analysis of information* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995). In this phase the entities and roles of the application is analysed.

The third phase of Multiview is *Analysis and design of the socio-technical aspects* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995). This phase is based on the belief that people have a fundamental right in controlling their own lives. If everyone, not just the system designers, are allowed to take part in the analysis and design of a system they will eventually be using, then the system will be used to its utmost capacity, with respect to its implementation, approval and operation. This view implies that consideration of human factors, such as job satisfaction, is considered equally important as technical and economical factors. The task of the problem solver will be to produce a good balance between the interests of the different stakeholders; both people’s demands on working environment; economical demands regarding organizational structure and profit; and technical demands and limitations in computer systems.

It is of importance to identify different alternatives in this phase, for example regarding social and technical arrangements, in order to be able to fulfil different objectives regarding these. The alternatives are then ranked. This is done, firstly, on the basis on their ability to accomplish the chosen objectives, secondly, based on their costs, available resources and limitations, weighing both social and technical factors that are related to each objective.

### 9.1.4 Systems design

The first phase of the systems design in *STRADIS* is phase four, *Physical design* (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995). This is the final phase of the methodology.

The design team elaborates on the chosen alternatives to create a specific physical design. Specifying the physical design is carried out until it is possible to provide a solid assessment of the costs connected with developing and operating
the new system. The most important parts of the costs are considered to be (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995, p. 272):

- “The professional time and computer test time required to develop the identified modules
- The computer system required
- The peripherals and data communication costs
- The professional time required to develop user documentation and train users
- The time of the users who interact with the system
- The professional time required to maintain and enhance the system during its lifetime.”

The above list can be extended with the following parts to complete the development of a system (Gane and Sarson, 1979; in Avison and Fitzgerald, 1995):

- Sketch a plan for the implementation. This should include plans for the testing and evaluating acceptance of the new system
- Simultaneously develop the application programs of the system together with database and data communications functions
- Convert present databases
- Test each part of the system to ensure compliance with its demands, and to ensure user acceptance
- Test the system under real world conditions, to ensure it meets performance criteria under realistic system usage
- Put the system to practice and adjust it so that bottlenecks are avoided
- Compare how the new system meets the initial objectives with respect to functionality and performance, and remedy differences where possible
- Analyse and give priority to new requests for enhancements. The system is now ready to enter a maintenance state.
Phase six of SSADM is called *Physical design* (Weaver, 1993; in Avison and Fitzgerald, 1995). This is the final phase of the methodology. This phase emphasizes the roles of those who should design the system, that is to say engineers, programmers, and database designers. Still, the analysts and the future users of the system should be involved in the process to ensure that the definitive design will match objectives and user demands.

Now, it should be possible to design the system as defined in the earlier phases. At this point SSADM stops, and the detailed software design and testing of software begins.

The advocates of SSADM claims that “‘Quality Assurance Reviews’” (Weaver, 1993; in Avison and Fitzgerald, 1995, p. 302) based on a structured survey should be carried out. In this survey, identifiable end products of the phases of SSADM are reviewed. The review could be carried out by analysts and designers working with related projects. A possible effect of this participation is guaranteeing a common standard of work. It is also possible to carry out this review with the help of users or a quality assurance group. The purpose of the reviews is to identify errors in the new system. Errors are not solved in the review groups, only identified there. They will be solved outside the review meetings. The purpose of the meetings is to identify errors in the product, more of an audit of the system.

In *ETHICS*, phase 13 concerns systems design and is defined as *The preparation of a detailed work design* (Mumford, 1995; in Avison and Fitzgerald, 1995). In this phase, the system developed in the previous phases is designed in detail. The following issues in the system are now set (Mumford, 1995; in Avison and Fitzgerald, 1995):

- Data flows
- The tasks of the different stakeholders
- Organizational groups
- Individuals involved
- In addition, the responsibilities and relations of the two above are determined.
A review is carried out to guarantee that the detail of the design still complies with the objectives established in the previous phases, with respect to both technical and organizational factors.

In *Multiview*, phase four is *Design of the human-computer interface* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995). In this phase, the technical design of the human-computer interface will be carried out. In order to do this, the designers will have to choose a specific system implementation. This phase is of importance if the new system should be successful. It is claimed that for the users to accept the system it must have an interface, which they find useful enough.

When the design of the human-computer interface is finished, Multiview proceeds to phase five, *Design of the technical aspects* (Avison and Wood-Harper, 1990; in Avison and Fitzgerald, 1995). This is the final phase in the methodology. Here, the conclusions of previous analysis and design phases are integrated in the technical design.

In Multiview, it is noticed that it is probable that changes will be required, but this should be considered the norm. Information systems are never in a fixed state, but in a continuous development. This will require continued interaction between the systems users, analysts, designers, and owners.

### 9.1.5 Implementation

Phase 14 of *ETHICS* is *Implementation* (Mumford, 1995; in Avison and Fitzgerald, 1995). The design group should now implement the new system. In order to do this, a detailed implementation plan will be created. Included in this plan will be the strategy, education, training, and co-ordination needed to guarantee that the transition from the old system to the new one will work flawlessly.
9.1.6 Review and maintenance

Phase 15 of ETHICS, Evaluation (Mumford, 1995; in Avison and Fitzgerald, 1995), is the final phase in the methodology. The implemented system should be reviewed to guarantee that the objectives set forth in the previous phases is working according to specifications. ETHICS emphasizes efficiency and job satisfaction in this review. If the system is not meeting a objective, it should be put right according to the objectives. ETHICS notices that change will become necessary over time, and that the design will therefore be a cyclical process.