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A Comprehensive Change Management Framework for Information Technology-driven Change in Organisations

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Abstract

The implementation and use of new information technology initiate changes. These changes can be either of a technological nature (and often explicitly known), or of a social nature (usually not as easily identifiable). Nonetheless, both the technological and social factors should be managed. When faced with change, managers should follow an appropriate change strategy. As all changes are not always predictable, a way should be found to identify the forces that initiate these changes so that they can be managed. The problem addressed in this paper is “how should information technology-driven change be managed” and the objective is to propose a comprehensive framework for managing such change. It is proposed that the Soft Systems Methodology could be included in a comprehensive framework that addresses both technological and social change.

1. Introduction

Most organisations today have numerous information systems. Almost every individual uses information technology during a workday to complete or assist in performing tasks. This means that most individuals will be faced with the implementation of new or enhanced information technology at one time or another. When new information systems are developed, it is expected that the users thereof should be enthusiastic towards the new processes [11]. However, it is not uncommon for the implementers of change to experience resistance towards the change initiative [12]. This may have the result that the system is unacceptable to the users and the organisation in which it is being implemented.

Dealing with change is one of the most fundamental challenges facing Information Systems professionals today [6]. De Michelis *et al* [6] argue further that the computing field has responded to the challenge of change

but still lacking among its efforts is a conceptual cohesion – a comprehensive approach that recognises the many types of system evolution that can take place and the interdependencies between the changes. Despite the great need for a comprehensive solution to the problem of managing change, no such solution has yet been found.

When following traditional change management approaches as described in Management Sciences the implementers of change are required to understand the factors and situations that will change in order to plan accordingly [18]. From this viewpoint, traditional change management can thus be regarded as a mechanistic approach of managing the change process. As information systems consist of both deterministic (the hardware and software) and non-deterministic subsystems (otherware) [7], changes of both deterministic and non-deterministic nature result from the implementation of new information technology. Following only a mechanistic approach towards managing information technology-driven change would thus seem inappropriate.

This paper proposes a comprehensive framework for managing information technology-driven change in organisations.

2. The nature of information technology

Information systems can be viewed as a system composed of three subsystems, namely a hardware, software and “otherware” subsystem [7] as illustrated in fig. 1. The hardware subsystem (the machines) and the software subsystem (the coded procedures) are both deterministic system components. These components are designed to be reliable and function in a predetermined manner. The “otherware” subsystem relates to the people in the organisation using the information system. People have unpredictable behaviour patterns and function in an unpredictable organisational environment. The “otherware” subsystem is consequently more complex to

predict and information systems can therefore be viewed as essentially non-deterministic systems.

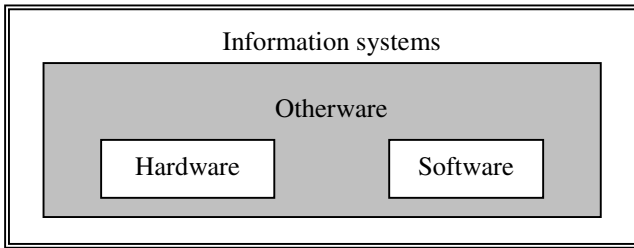


Fig. 1: Schematic illustration of an information system [7].

The introduction of information technology into everyday life led to numerous changes in organisations and for the people working in them. Changes in organisations are for example, changes in its competitive environment, changes in its structure and changes in the culture of the organisation. The increased efficiency and effectiveness in performing tasks; the increase in the amounts of data and information that can be processed, distributed and stored; and the ease of co-ordinating tasks in spite of the problems created by time and distance are further examples of the progress brought about by information technology [15]. The developments in information technology have also created additional problems that manifest in various **social** (i.e. the impact of computerisation on working life), **moral** (i.e. issues pertaining to intellectual property) and **political** (i.e. issues relating to power structures within organisations) questions [9] & [15].

When one considers the advantages and disadvantages that are part of the implementation of information technology, the following question arises: should the developers of information technology not contemplate beforehand the impact of information technology on the users thereof, and on the environment within which the technology is used? The structuration model of information technology (fig. 2) provides one answer to this question by providing a way in which the impact of technology on people and the organisation can be analysed.

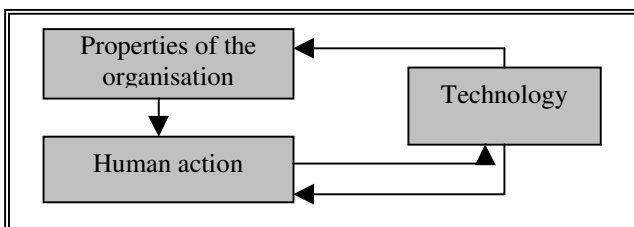


Fig. 2: The structuration model of information technology [16].

According to this model human action influence technology by developing and using that technology in a certain way. The technology is used to perform certain procedures or provide certain functionality in an organisation that in turn can influence the attributes of the organisation as well as impact on the way people work. The attributes of the organisation will, in turn, influence the way in which the workers act and react [16].

In summary it can be said that information systems are developed by people to be used by people in organisation. The hardware and software subsystems are mechanistic, whereas the people and the environment in which the system is used, are more complex to predict. For this reason it is not always possible to determine or predict the manner in which people or the environment will be influenced or changed [8].

3. The change process

Change can be defined as "... to cause or to become different, alter, transform, convert. Implies a radical alteration of character or replacement with something else" [12]. According to Smit and Cronjé [18] management should be sensitive towards potential change in order to prepare for it and should be aware of the steps involved in a change process to increase the possibility of its successful implementation. Management should select an appropriate strategy when introducing change. Often change strategies are organised around or developed from the Lewin model for change [18] & [19]. According to Lewin, change can be conceptualised as a three-stage process. The **first phase** consists of the unfreezing of the current attitudes and behaviours that people follow and making the need for change obvious. During the **second phase** the organisations change to the new procedures. In the **third phase** the attitudes and behaviours of the workers are refreezed by integrating the new patterns into the individual or group's way of conduct. To follow a change strategy management should display a consciousness of the forces that could lead to change. It can therefore be said that traditional change management approaches are based on knowledge about the factors that lead to change and in identifying the changes that will take place.

Change within an organisation is often met with resistance. Various tactics can be employed to overcome this resistance, for example communication, participation, facilitation and negotiation [17]. Another method that can be used to enable the organisation and its employees to become more adaptable in a changing environment is organisational learning [2]. Systems developers might acquire these skills if they want to successfully implement change.

It has been indicated that changes of a technological nature (and easily predictable) as well as changes of a human nature (and more difficult to predictable) can be expected. If systems developers cannot identify the expected changes with certainty, how can they plan for these changes?

4. Soft systems methodology

The traditional nature of information systems development is based on a hard or mechanistic view of problems [5]. A hard view of a problem (e.g. a new information system) regards it as real and solvable and assumes that the ends are easily and objectively definable [10]. In reality, many problem situations are not well structured and the end or solution can often not easily or clearly be defined. According to Mingers [14], the developers of information technology often face problems that are part of a wider business and organisational setting and problems that relate to individual's needs. These problems can thus be seen as ill-structured or "soft" problem situations. In these "soft" problem situations it is necessary to acknowledge the importance of people and human activity and that different viewpoints might exist.

The soft systems methodology was essentially developed for use in ill-structured problem areas where no clear definition of what constitutes the problem or uncertainty over what actions to take to overcome the problem exist [10]. The soft systems approach is not a solution-oriented approach, but is useful in clarifying problems. Once a problem is clearly understood, other analytical techniques may have to be applied to define the solution. Initially, the SSM was designed as a seven-phase, structured process of inquiry requiring its users to apply thinking in both the real and the systems worlds. (Although this first version of the SSM might create the impression of a mechanistic process, it is clearly indicated in latter versions that the SSM should not be used as a step-by-step process as is typical in hard systems methodologies [1]). A problem situation can be resolved by using this approach to identify and create necessary changes that will lead to improvements in the situation. Furthermore, it allows for the different perceptions of the situation under discussion to be expressed and for these perceptions to be accommodated in a final solution. The methodology is a guideline for examining situations and there is no fixed set of rules that govern its use. The stages are executed in continual iteration until the real world is improved [10]. Besides the flexibility of use, it is important to note that the degree of successful improvement of the real world depends on the participation of all involved parties.

Since the nature of information technology is inherently non-deterministic it can be concluded that when faced with information technology related problems, the problem solving approach cannot solely be based on a hard systems view. A soft systems methodology can be used to solve such problems [4]. Should we not then also try to incorporate a soft systems view in our change management approach for information technology-driven change? Despite the known limitations of the SSM [5] & [10], this is exactly what is proposed in this paper. Before presenting a new framework a brief overview of the change management approaches that are currently applied are provided.

5. Technological change models

The approaches that are most widely used in organisations to facilitate the implementation of information systems are mainly based on technological models [20]. When information systems are introduced according to a technological model, the task is entirely left to technological specialists. Furthermore, little or no attention is directed towards the processes and the people that are influenced by the technology. Training initiatives are usually not seen as an important aspect of change management when such an approach is followed [20] & [13]. Notwithstanding this fact, user involvement in the development of new information systems is often recommended because new systems are experienced as less strange and thus less of a threat [13] & [21].

Technological change models incorporate important activities [13] that are essential for the development of reliable and stable software. Although the processes and people that are influenced by the technology do not receive adequate attention, the activities that form part of the model are no less important. These activities should therefore be included as part of a comprehensive change framework for the management of information technology-driven changes. It has however been found that organisations are moving away from the technological change models when introducing new information systems [20]. A greater emphasis is being placed on aspects such as the development of the organisation and the relationships between people and processes.

According to Humphrey [13] the management of the software development process does not differ from managing any other process and therefore traditional management principles could be applied when managing the software process. However, when following traditional change management principles, the managers should know "*what*" to manage in order to apply an appropriate change model. Yet, the nature of information

technology is such that the changes resulting from the development and use of information systems cannot always be predicted, as argued above. This should be an important concern when managing information technology-driven change. It is therefore suggested that the soft systems methodology could be applied to clarify the uncertainty of what changes to expect. Only when we know what changes to expect, can these changes be effectively managed.

6. A change management framework for the implementation of information technology

When developing a comprehensive framework for managing information technology-driven changes, it is necessary to consider the aspects that will lead to (or result in) changes in order to manage such changes. The first aspect to consider when constructing a change management framework is to identify the initial source of changes. When developing information systems, systems developers follow certain systems analysis and design methods. In one way or another these methods conform to the systems development life cycle (SDLC). We can therefore select the SDLC as the starting point to identify information technology-driven changes.

The SDLC traditionally consists of five phases. Each phase include certain tasks. The deliverables of the tasks of a phase are used as input to the next phase. It is also possible that the information provided as a result of a previous phase is insufficient to continue with the tasks at hand, and it then may become necessary to revert to previous phases of the cycle. During each phase of the SDLC decisions are made regarding the proposed or altered system. These decisions can relate to the hardware and software that will be used to develop the system (technological decisions) or can be decisions regarding the processes or work procedures that will be automated (social decisions). These decisions can lead to changes of either a technological or social nature.

The changes that follow from the decisions made in the SDLC can either be explicit from the outset, such as new requirements for hardware, or can be unstructured and “fuzzy” at this stage. These unstructured changes usually relate to changes that are part of the organisational setting, human actions and human needs. Regardless of the type of changes, the changes should be managed. However, if the impact of the information technology is not clear, a technique should be implemented to illuminate possible change options. The soft systems methodology was explicitly constructed to cope with difficult to define problems. For this reason it could be applicable during

change management as a method for clarifying ill-structured and vague change areas. Fig. 3 illustrates the basic shape of the SSM applied to changes that follow from the SDLC.

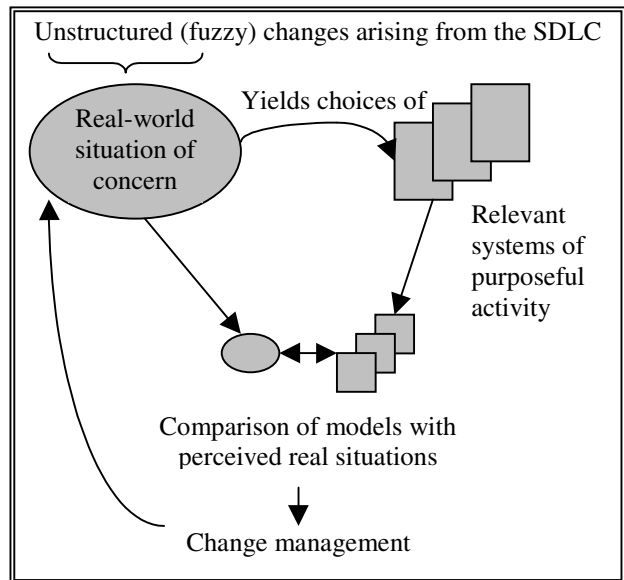


Fig. 3: Applying the SSM to changes that follow from the SDLC

It is only after a “fuzzy” problem is clarified and structured that it is possible to take appropriate action – thus managing the change. As a result of applying traditional change management approaches, new situations can be expected that will lead to a new cycle of the SSM where new factors that will bring about change can be identified and managed.

The theory of duality (fig. 2) shows three areas where change can be expected and that can be used to consider changes in the following ways, namely:

- a) **Required changes:** When information technology is implemented in an organisation the technology should not be implemented without considering what changes to make to the organisations and the way in which the employees work. Therefore, changes in the technology, human actions, and organisational areas should be considered.
- b) **Resultant changes:** As a result of the implementation and use of information technology, changes in one area can lead to changes in any other area. It should therefore be considered that when changes in any one of these areas are implemented, new changes could result in any other area.

The preceding discussion now leads to the proposition of a framework whereby information technology-driven change can be identified and managed. This framework addresses both technological and social changes that

result from the development and use of new or enhanced information systems. It includes a way to clarify ill-structured changes, and to consider the broader impact of these changes (fig. 4).

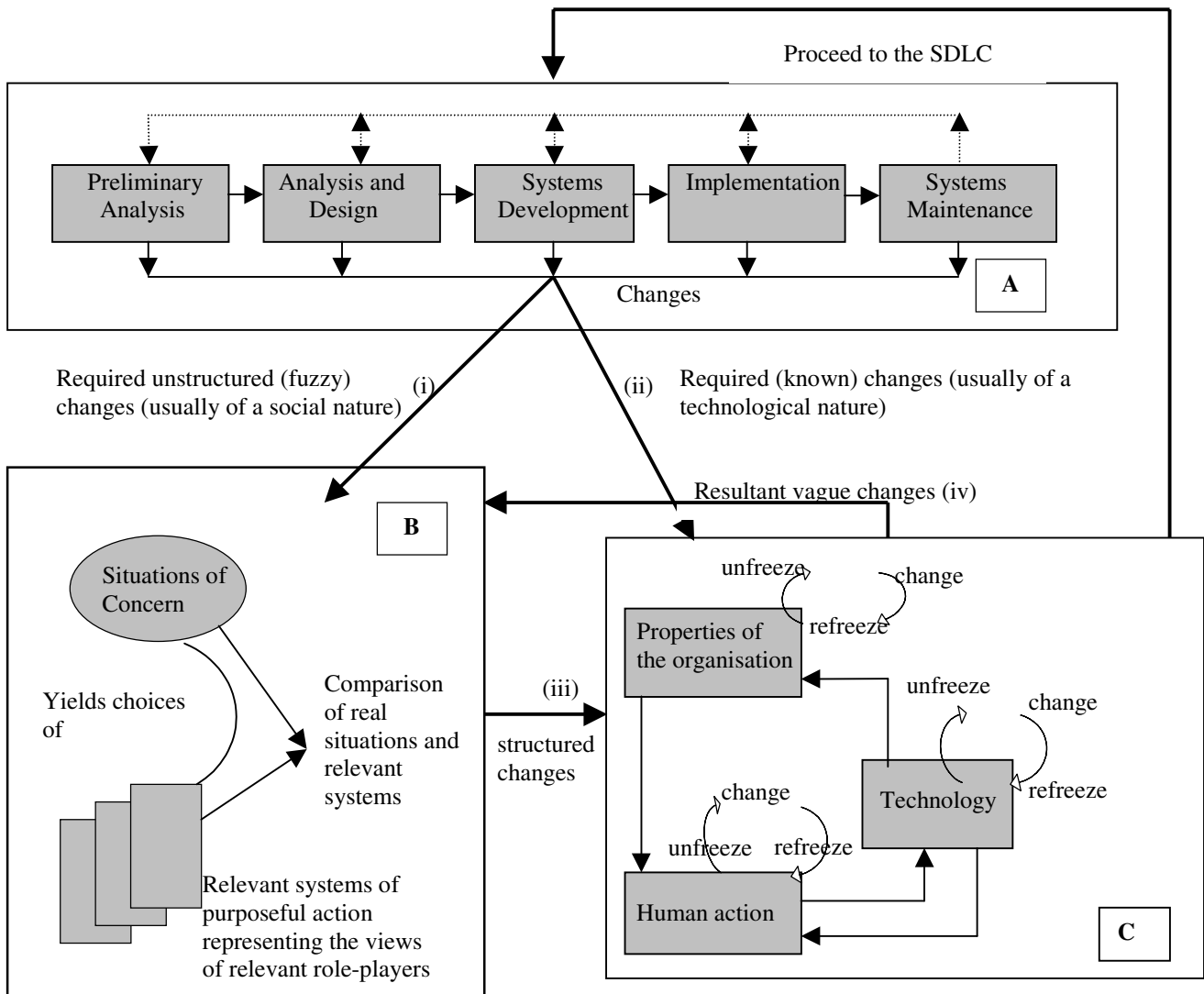


Fig. 4: A change management framework for information technology change

7. Application of the framework

Three areas of importance are shown in the framework and are respectively marked A, B and C. Area A shows the systems development life cycle, area B the process of the continuous SSM and area C the duality of information technology (the interaction between technology and the organisation). The change strategy is illustrated by using the phases of unfreeze, change, and refreeze. It should be noted that this division into the three areas is purely

theoretical - when using the framework the three areas should be linked to form a whole.

The systems development life cycle is the starting point for the framework. Changes follow from the decisions made during each phase of the SDLC (area A). These changes may be known from the outset, such as new requirements for hardware, or can be unstructured and vague at this stage. If the changes are vague it is firstly necessary to involve all parties concerned in a process of

“finding out” about the uncertain circumstances, and thereby clarifying the changes before the changes can be managed. When uncertainty exists around the changes to expect, one should proceed to area B following the arrow marked (i). However, if the changes are explicitly clear, one could proceed directly to area C following the arrow marked (ii).

In area B the different role-players could become involved in a process of debate in which real situations and relevant systems are compared. The terms “real situations” and “relevant systems” could be explained in terms of the change management framework, as follows:

- a) **Real situations:** The current situation of concern is the current information system or procedure that will be replaced by new or enhanced technology.
- b) **Relevant systems:** Relevant models are the different views that parties might have of the new or enhanced system. Analysing the new system as it is perceived by the different role-players could give an indication of how the technology will be used, how it will impact on the work that the users are responsible for, and how it will effect organisational attributes.

The comparison between real situations and relevant systems may indicate changes that will result from the new information system and therefore action could be taken to manage these changes (proceed to area C following arrow (iii)). Furthermore, as a result of applying traditional change approaches (in area C) improvements can be expected in either the current situation or the way in which the new system is perceived.

When the changes that could result from the development and use of information systems are known, these changes need to be managed by means of traditional change approaches (area C). In addition to this process, it should be considered what additional changes will be required or will result from the initial change and in which area (that is organisational changes, technological changes or changes in human action) these additional changes will take place. If these changes are clearly defined it could again be sufficient to manage them by means of traditional change approaches (following the arrows in area C). On the other hand, if the resulting changes are unclear or ill-structured, clarification of the problem is first required (proceed to area B by following the arrow marked (iv)). Once a change has been implemented or planned for, the next phase in the SDLC can be focused on (proceed back to area A following the arrow marked (v)). The framework is consequently a stepwise and recurring management process in which each decision made in the SDLC can lead to potential changes and each

change initiative could in addition be planned for and managed.

By following the guidelines of the framework it is possible to consider the changes that will result from the introduction of the technology, and only if it is clear what changes can be expected, is it possible to plan accordingly. In addition, at an early stage in the change process consideration should be given to the methods that can be applied to eliminate any resistance towards the changes. The soft systems methodology can help with this. Management should be convinced that it is necessary that workers are seen as part of the development and change process in order to hear their opinions, and if applicable, include their suggestions in the system. This involvement creates the opportunity to communicate the influences and benefits of the new system to all parties concerned. A final point should be stressed: before any new model, and hence this framework, can be implemented with success in an organisation, it is necessary to examine the existing management philosophy followed in the organisation [3]. For the framework to be beneficial and to show up changes to be managed there should be a willingness to encourage debate and to bring the differing viewpoints of the people affected by the technology into the open. Furthermore, it is essential to break away from a systems-theoretical approach that considers technology alone as the most important and determining factor.

8. Exploring the use of the framework

As the framework was developed from knowledge gained from a literature study it is further necessary to apply and evaluate it in a real life situation in order to assess its value and applicability. To evaluate the framework the researcher would be required to participate in the development process of an information system from the outset and follow it even after completion. Secondly this should happen in an environment in which user involvement is valued and where people are knowledgeable in the use (or the concepts) of the SSM. For the purpose of evaluation the framework an approach similar to a thought experiment was considered a feasible and useful research device purely because of the difficulties of evaluating the framework in a real case scenario by means of either a case study or action research. (The author however does not debate the importance of testing the framework in a real life situation and it should be included for further research).

The exploratory testing consisted of two parts. In the first part a study of an unsuccessful information system was done. This was performed while working for an insurance company as a business analyst over a period of

four years. In addition, the project documentation, including minutes of meetings and user specifications, as well as interviews were investigated. The case study was then used as basis for this experiment. The following approach was applied: **firstly** the system was investigated according to the SDLC. **Secondly**, the change aspects that could have been planned for and managed in each phase of the SDLC were identified. **Thirdly**, the framework was applied to each phase of the SDLC. Ideal circumstances were created to see if the application of the framework was worthwhile.

From the study the following conclusions, deductions and recommendations were made:

- The case study facilitated a better understanding of the research question under investigation. It was clear that the changes that resulted from this project were managed by applying a technological change model. Although the users were initially involved in voicing business requirements for the system, the task of designing, developing, and implementing the system was entirely left to the development team. Minimal attention was directed towards the influence that the system could have on the users and on the business processes of the organisation. The only preparation that the users received was two brief training sessions. This was apparently not sufficient to comprehensively manage the technological and social changes that resulted from this project.
- The case study was structured according to the systems development life cycle. In each phase of the life cycle the applicability of the framework for managing information technology-driven change was explored by means of a thought experiment.
- From this experiment it was concluded that the framework is effective in identifying changes that takes place within all three areas of information technology, namely in the technology itself, in human actions and in the organisation. It is also concluded that by applying the framework, possible changes can be identified early on in the life cycle. This makes it possible to effectively plan for these changes and avoid reactive change management which amounts merely to crisis management. Although one cannot claim that the application of the framework would have avoided all the problem situations described in the case study, the researcher submits that the exploration of the framework shows that it would have been applicable and useful.
- Some limitations to the framework were also identified. Because participation is the main principle in the framework, the framework is not suitable for an environment wherein a coercive approach is followed. The success of the framework depends on co-operation between the stakeholders.

- The framework was explored in a setting where the information systems development was done internally to the organisation, and where the users and the development team were housed in one building. This arrangement facilitated the application of the framework. It could not be established whether the same results would be obtained if the composition were different. It is thus concluded that the framework is best suited to be applied in organisations where information technology is developed internally in the organisation, and where the culture of the organisation supports co-operation.

9. Conclusion

The management of systems implementation consists of the management of technological changes and improvements, but also the relationships between people, between people and technology, and between the work that they do and the organisation [21]. When change management is done from a technological perspective, little or no attention is directed towards the users and the business processes that are affected by the technology. However, the theory of duality of information technology indicates that technology, organisational attributes and human actions are inseparable and impact on one another. The implementation of information technology causes social consequences that, in addition to the technological changes, should be managed through a planned change process. By combining traditional change management approaches and the soft systems methodology an environment is created in which participation in the change process is encouraged. By applying the change management framework it will be possible to identify the effects of the new technology and to create a positive attitude towards the new system. A positive attitude may lead to a greater acceptance of the implementation of new or changed technology.

It is concluded and proposed that this change framework could be used in the case of information technology-driven changes. The changes that are explicitly known can be managed by applying traditional change management principles. If the changes are vague and of a social nature they can be identified through making the soft systems methodology part of the change framework and through the active participation of involved parties. Lastly, the framework could be adapted to fit a specific organisation's circumstances. This can be achieved by reflecting on previous change processes and learning from past experiences. If necessary, enhancements or alterations could be made to the framework.

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