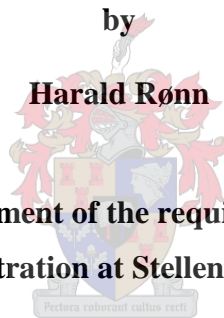


An investigation into the worldview of a selected group of Norwegian Army Cadets from a complexity and leadership perspective

by

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DECLARATION

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Abstract

This thesis examines the Norwegian Army Cadets' worldview in light of Complexity Theory and the implications of this theory for leadership.

The investigation uses two contradicting theories as a point of departure, Complexity Theory and Newtonian Theory. Complexity Theory is a Social Science-theory that originates from the Natural Science-theory of Quantum Physics where aspect such as non-linearity, chaos and self-organization are highlighted. Furthermore, holistic thinking and bottom-up processes are emphasized.

Newtonian Theory is on the other hand based on a mechanistic and reductionist worldview where a constant strife to achieve balance and control through deterministic- and rational mechanisms are highlighted. A Newtonian system thus operates in a causal- and relatively closed environment where change is incremental and top-down driven.

Using Complexity Theory as a theoretical starting point speaks for a shift in the way we look at leadership. Traditional leadership theories are normally based on the assumptions of Newtonian thinking, i.e. objectivity, reductionism and determinism. A traditional leader is actively shaping the future through regulations that ultimately end in the obtainment of goals. In other words, the processes are characterized as rational, "hard" and incremental. A Complexity Approach, on the other hand, supports Complexity Theory Principles such as self-organizational processes and chaos. Hence, leaders in complex systems should function as enablers of bottom-up processes and embrace chaos and uncertainty as something positive and nourishing. Furthermore, leaders in complex systems use vision and values as guiding principles and focus on micro-level interactions as opposed to a rule-bound and technical approach.

The results from the empirical survey reveal that the Norwegian Army Cadets have a relatively balanced worldview towards Complexity Theory- and Newtonian Principles. On the one hand, a number of strong Newtonian trends such as the perception of conflict, chaos and change as something negative and the embracement of a direct and "hard" leadership style are evident. On the other hand, the Cadets express an adherence towards typical Complexity Theory Principles such as relationship orientation and informal leadership. Hence, it can be argued that the Cadets' worldview have elements of both Newtonian Theory and Complexity Theory.

This study can be used to evaluate the effect of the current educational paradigm in the Norwegian Army and simultaneously contribute to further insight and discussion around the field of leadership.

Opsomming

Hierdie verhandeling ondersoek die wêreldbeskouing van Noorweegse Leer-kadette in die lig van die Kompleksiteitsteorie, en die implikasies van dié teorie vir leierskap.

Twee teenstrydige teorieë word as vertrekpunt in die ondersoek gebruik, naamlik. Kompleksiteitsteorie en Newtoniaanse Teorie. Kompleksiteitsteorie is 'n Sosiale Wetenskapsteorie wat uit die Natuurwetenskaplike teorie van Kwantum-Fisika ontstaan het, met klem op aspekte soos nie-lineariteit, chaos en self-organisasie. Verder word holistiese denke en prosesse wat van onder na bo werk, beklemtoon.

Newtoniaanse Teorie, aan die ander kant, is gebaseer op 'n meganistiese en reduksionistiese wêreldbeeld, met klem op 'n konstante strewe na balans en kontrole deur deterministiese en rasonale meganismes. 'n Newtoniaanse sisteem opereer dus binne 'n kousale en relatief geslote omgewing, waar verandering inkrementeel is en van bo na onder gedryf word.

Die gebruik van Kompleksiteitsteorie as 'n teoretiese vertrekpunt dui op 'n verandering in die manier waarop ons leierskap benader. Tradisionele leierskap-teorieë is normaalweg gebaseer op Newtoniaanse denke, d.w.s. objektiwiteit, reduksionisme en determinisme. 'n Tradisionele leier vorm die toekoms aktief deur regulasies wat uitloop op die bereiking van doelstellings. Met ander woorde, die prosesse word gekarakteriseer as rationeel, "hard" en inkrementeel. 'n Kompleksiteitsteorie-benadering aan die ander kant, ondersteun beginsels van Kompleksiteitsteorie soos self-organiserende prosesse en chaos. Leiers in komplekse sisteme moet dus funksioneer deur prosesse wat van onder na bo werk moontlik te maak, en deur chaos en onsekerheid as iets positief en voedend te beskou. Verder gebruik leiers in komplekse sisteme visie en waardes as riglyne, en fokus op mikro-vlak interaksies in teenstelling met 'n reël gebonde en tegniese benadering.

Die resultate van die empiriese studie toon aan dat Noorweegse Leer-kadette 'n relatief gebalanseerde wêreldbeskouing het t.o.v Kompleksiteitsteorie- en Newtoniaanse beginsels. Aan die een kant, is daar duidelik 'n aantal sterk Newtoniaanse tendense teenwoordig, soos die persepsie van konflik, chaos en verandering as iets negatiefs, en die aanhang van 'n direkte en "harde" leierskapstyl. Aan die ander kant, is daar 'n neiging tot tipiese beginsels van Kompleksiteitsteori soos verhoudingsoriëntering en informele leierskap. Dit kan dus

aangevoer word dat die Kadette se wêreldbeskouing elemente van sowel Newtoniaanse Teorie as Kompleksitetsteorie bevat.

Hierdie studie kan gebruik word om die effek van die huidige onderwysparadigma in die Noorweegse Leër te evalueer, en terselfdertyd 'n bydrae lewer tot dieper insig in en bespreking van die terrein van leierskap.

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Chapter 1: Introduction

“I wanted a perfect ending. Now I’ve learned, the hard way, that some poems don’t rhyme, and some stories don’t have a clear beginning, middle, and end. Life is about knowing, having to change, taking the moment and making the best of it, without knowing what’s going to happen next. Delicious ambiguity”

Gilda Radner

We live in an ever-changing world where thoughts and ideas that were seen as relevant and leading two decades ago might have nothing to do with today’s approaches. Globalization has created a smaller world in which more and more elements are interconnected and interdependent, which again creates a more boundary-less environment for individuals, organizations and nation-states to work within (McGrew, 2005: 24; Martin, 2007: 3). Technological evolution has opened up doors and created opportunities that were unthinkable two decades ago, but it simultaneously creates stronger demand for knowledge on how fully to understand and take advantage of these systems (Cilliers, 1998: 1).

The increasing complexity of our society raises questions of how to understand and respond adequately to this complexity. The traditional or orthodox Newtonian Approach has proven not to be a comprehensive framework for interpreting the complexity and producing pareto-optimally solutions (Wheatley, 1999: 7). The Newtonian way of thinking is often linked to the metaphor of a machine or clockwork where the future is deterministically predictable (Darwin, 2001: 483). The organizations and the leaders are equilibrium-seeking and want to control the events (Praught, 2002: 516-517). The causal and linear interpretation of reality offers an atomistic view where the whole can be analysed through its parts (Cilliers, 1998: 456).

Complexity Theory provides us with a different framework for understanding the environment. Complexity Theory is a step away from the mechanistic Weberian bureaucracy and a step towards recognizing organizations and systems as *whole* systems, as organic structures and to interpret change and disequilibrium as something positive (Keene, 2000: 16; Plowman et al, 2007: 342-343). Some of the basic principles of Complexity Theory refer to how situations emerge through self-organization that eventually ends in unpredictable and non-linear behaviour. Control, which is a central part of the Newtonian Approach, is looked upon from a different perspective in the Complexity Approach. Control can be defined as

letting go of the predicaments and planned long-term actions and instead embracing uncertainty and spontaneity (Fernandez, 2007: 174; Stacey & Griffin, 2005: 8).

An approach to Complexity Theory as a basis for understanding the forces that are present in society will also have consequences for how we look at leadership. The traditional view of leadership, mainly based on Newtonian Principles, grow out of the view that organizations are equilibrium seeking systems whose futures are predictable and the future state of mind is reached by *inter alia* leaders who plan interventions and control behaviours (Plowman et al, 2007: 341). Davenport (2001) notes that the old model of leadership is based on a “*totally different set of circumstances and it is therefore of questionable relevance to the contemporary work[ing] environment*” (Uhl-Bien, Marion & McKelvey, 2007: 299). The assumptions of a complex system, however, are based on almost the opposite assumptions as a Newtonian Approach, i.e. *inter alia* non-linearity, non-causality, chaos and self-organization (Schneider & Somers, 2006: 354-355), which speaks for the need of a re-definition of what leadership is and of what it consists.

A leadership has to continuously take a number of variables into consideration. Depending on the organizational framework, some structures, designs or leadership-styles are more favourable than others. The vast amount of literature on the field of leadership and organizations is a strong indicator of the depth of the impact leadership has and the complexity thereof.

The Norwegian Army and the leaders' characterizations are traditionally connected to a high degree of *inter alia* formalization, standardization, bureaucracy and authoritarian leadership skills and principles. However, the environment in which the Officers lead, and the very nature of the Army as a social organization, clearly speaks for complex environments. The traditional leadership skills and approach to general systems thinking are in many cases a distinct contradiction to the *de facto* circumstances, which evidently may cause dysfunctional and incomprehensive responses to a complex situation.

1.1. Motivation for the Study¹

The Norwegian Army and the Cadets at the Norwegian Military Academy, the subject of study in this thesis, have traditionally had an orthodox approach to leadership practice and theory. Some of the arguments for researching how Complexity Theory affects leadership

¹ The author of the thesis has the rank of 1st lieutenant and has been educated at the Junior Officer School, the Military Academy and has served as platoon-commander, company-commander (line-manger at Junior Officer School) and staff officer at the Junior Officer School (New School concept).

and simultaneously why the subject of study is the Norwegian Army and the Cadets at the Norwegian Military Academy are:

- In terms of the subject itself, Complexity Theory and its implications on leadership is still a topic that has not been fully researched and this thesis might contribute with some relevant inputs and approaches to the field of study. In that sense it may impact future events instead of simply serving as the static analysis of a concept.
- Complexity Theory and its implications for leadership have not been empirically connected to leadership in the Norwegian Army. This thesis does not offer a direct link between leadership in a complex system and leadership in the Army *per se*, but it may provide a basis for the investigation of this link in a future study, e.g. a normative study of what the Norwegian Army should do concerning leadership education in order to better respond to complexity.
- Complexity Theory and its implications for leadership have not been comprehensibly studied in the Norwegian Army and this thesis will thus contribute to further insight and discussion around the field of leadership. This may be especially evident because of the contradictions the principles of Complexity Theory have in relation to the traditionally orthodox leadership thinking in the Norwegian Army.
- The Norwegian Military Academy will get specific feedback from the Cadets on how they interpret reality and if this meets the requirements of Complexity Theory and leadership in a complex environment. This feedback, seen in connection with other feedback sessions, can be used as the basis for further planning and (re)-structuring of education.

1.2. Limitations of the Study

This thesis does not seek to do a normative evaluation of the Army's educational and leadership program or institutions *per se*. I.e. try to explain and discuss why they are educating the way they are, why they have a certain focus or why the Military Academy is organized in a particular way. The focus is rather to contribute with a new view on leadership and if the Cadets' view on reality correspond with the realities of Complexity Theory.

This thesis does not intend to investigate in detail the specific leadership view and the traditions within the Army and whether or not this correlates with the principles of leadership in a complex system. In addition, no normative evaluation will be done concerning whether the general implications for leadership in a complex system are suitable for leadership in the

Army or not. In other words, no direct research link will be drawn between leadership in a complex system and the present leadership structure in the Army.

As the thesis so far has presented the background for this study, the thesis will not continue presenting the research- question and objectives.

1.3. Research Question

As an Officer with operational leadership experience educated at the Military Academy and as a student of public and developmental management it is interesting to investigate an alternative approach on how to understand organizational and Social Science phenomena. A Complexity Approach raises a lot of tough questions on how and why we do things the way we do, including the way we educate and train Officers. In that sense, and especially in connection with the radical changes towards a more complex environment for military units to work within, this thesis finds it relevant to ask the following question:

What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?

As a logical continuation of the research question this thesis will now present a number of research objectives.

1.4. Research Objectives

The overall intention with this study is to investigate the relationship between Complexity Theory, leadership and the worldview of the Cadets at the Norwegian Military Academy.

Given the possible impact of complexity, and the theories associated with this phenomenon, some research objectives, as illustrated in figure 1 can be formulated, relating complexity to leadership and the worldview of the Cadets.

1. Based on a non-empirical literature review, define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.
2. Based on a non-empirical literature review, investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.

3. Based on an empirical survey, describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.

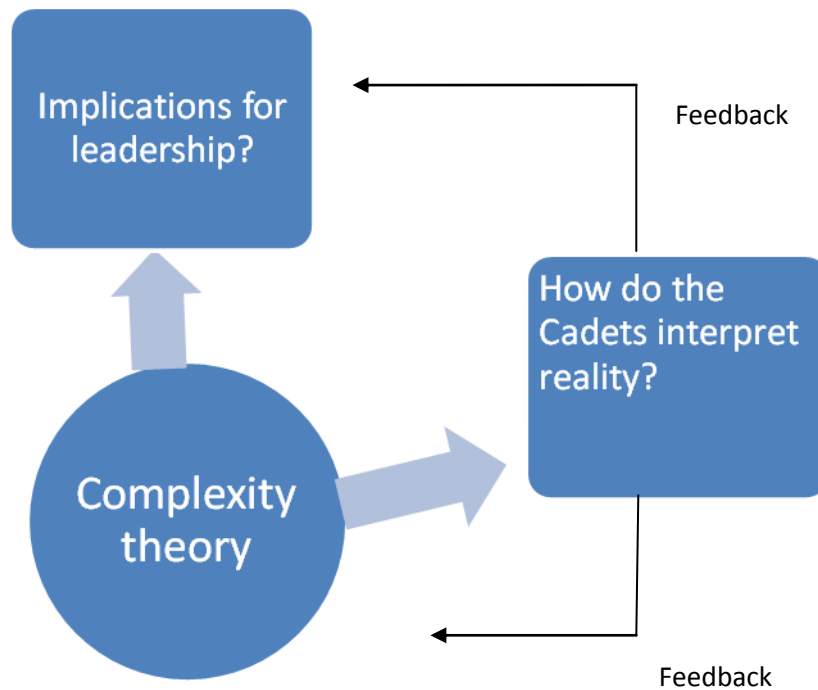


Figure 1 - What will be studied?

The presentation has so far revealed what this thesis aims to do, however the method of achieving the research objectives has not yet been elaborated. The next section will indicate the research design and methodology, and describe the structuring of this thesis.

1.5. Indication of Research Design and Methodology

This thesis has two major approaches to the research design. First of all, there will be a non-empirical literature review in order to attain research objective 1 and 2. Research objective 1 is to define and describe Complexity Theory and differentiate it from orthodox theory and research objective 2 is to investigate the implications Complexity Theory has on leadership and how it differs from the traditional characteristics of leadership.

Secondly, based on the findings in the non-empirical literature review, there will be an empirical survey based on primary data in order to establish the worldview of the Cadets. The data collection, which will be organized as a structured questionnaire, will be conducted

at the Norwegian Military Academy. The Military Cadets on the line of operational studies is the subject of study.

The research design and methodology is illustrated in figure 2 – indication of research design and methodology. Based on the literature study a number of characteristics and components of Complexity Theory will be revealed. These characterizations and components is anticipated to have implications for the desired leadership capabilities in a complex system, i.e. the behavior in a *traditional* framework will *most likely not* be desired in a complex system, so there is a need to investigate a possible new approach. Based on the achievement of research objective 1 and 2 a structured questionnaire will be made in order to carry through an empirical survey based on primary data. The results from this survey will again reflect back on the initial research question: What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?

The research design and methodology is fully presented in chapter 4 – Research Design and Methodology.

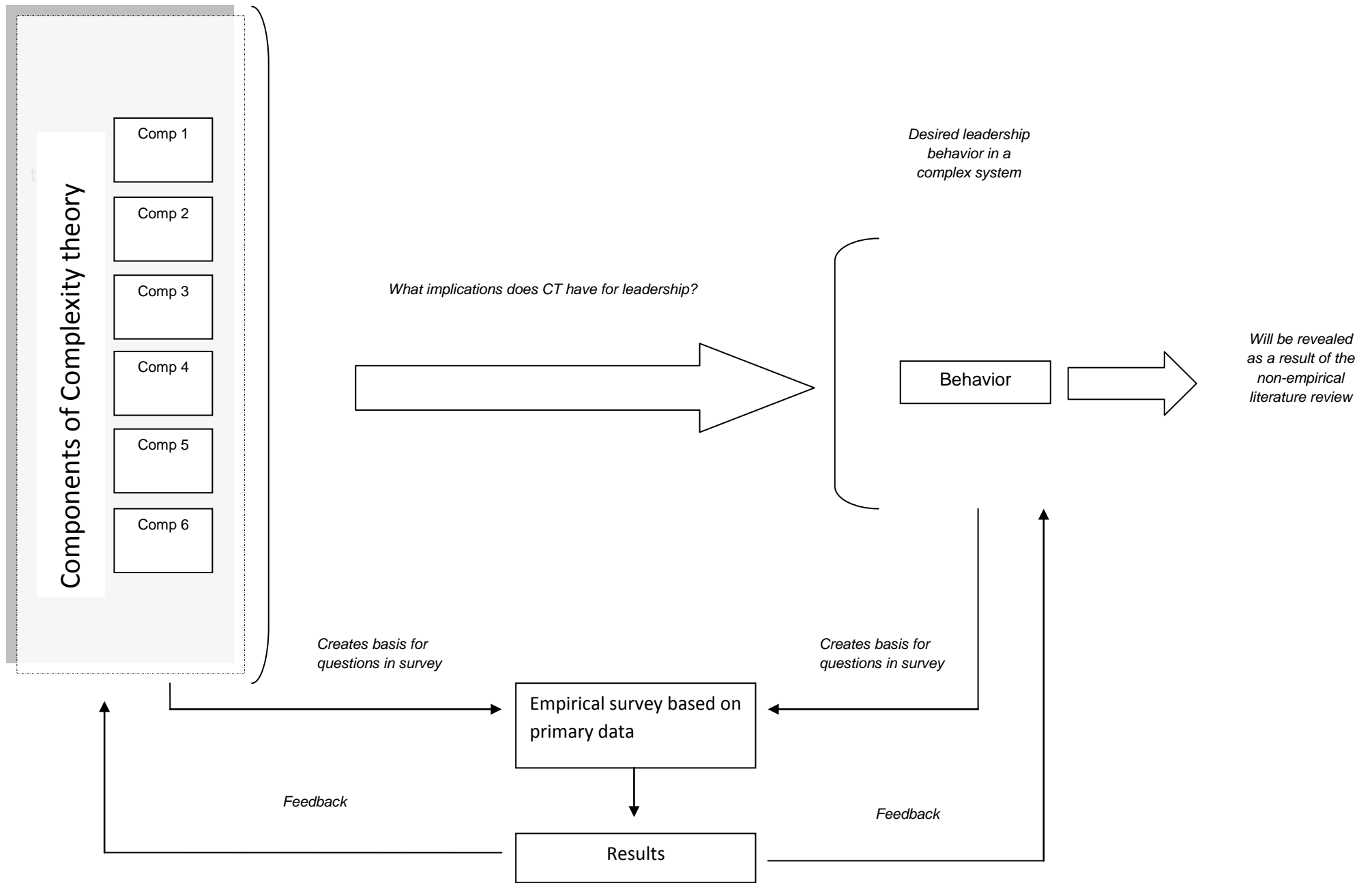


Figure 2 - Indication of research design and methodology

While the presentation of the research design and methodology gives an indication of how this thesis will obtain the research objectives, the next section will describe how this thesis will be organized.

1.6. Research Overview

In order to reach the stated research objectives, this thesis will organize its chapters in the following way:

Research objective 1: *To define and describe Complexity Theory and differentiate it from orthodox theory.*

Chapter 2 – Complexity Theory, reviews Complexity Theory and how it differs from a traditional Newtonian way of thinking. Through the work of *inter alia* Kiel (1994), Wheatley (1999), Darwin (2001), Cilliers (1998; 2001; 2002) and Stacey (1997; 2000; 2005; 2006) this thesis will describe and discuss the characteristics of complex systems and its components with the intent to create the foundation for both the non-empirical literature study and the empirical survey. The review will argue that the Newtonian machine-based way of thinking is not adequate as a sound basis to understand reality (in all forms) and that the Complexity Theory as a contradiction to Newtonian thinking, offers a more comprehensive framework to understand, interpret and handle the complex reality.

Research objective 2: *To investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.*

Chapter 3, Traditional leadership and Complexity leadership, describes the mainstream approach to leadership and the implications Complexity Theory has for leadership. The *first part* of this chapter will describe different definitions to leadership, the traditional components of a traditional way of thinking and how these components inter-relate to a Newtonian way of thinking. This study will argue that the traditional approach and the General Systems Theory to leadership is outdated and based on assumptions that are not coherent with complexity thinking. The *second part* investigates the implications Complexity Theory has on leadership. This thesis argues that, seeing the world from a complexity perspective has created a need to redefine the way we look at leadership. Based on the work of the authors used in chapter 2 and *inter alia* Schneider and Somers (2006), Uhl-Bien et al (2007), Plowman et al (2007) and Marion and Uhl-Bien (2001), this study offers a set of desired leadership capabilities in a complex system.

Research objective 3: *To describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.*

Chapter 4- Research design and methodology, describes the research design and methodology for the empirical survey. This chapter initially repeats the research questions and then describes the conceptualization of the study. A number of factors are identified based on the obtainment of research objective 1 and 2. The factors presented make the foundation for the empirical survey based on primary data. The issue of measurement, the data collection process and research design are then presented and finally the analysis and possible sources of error and shortcomings are discussed.

Chapter 5 – The Cadets and their worldview, presents the results from the survey using the factors identified through chapter 2, 3 and 4. The results will make a foundation for the identification of certain Newtonian- and Complexity Theory-trends which then will be discussed in terms of the literature.

Chapter 6 – Summary and Conclusions, summarizes the most important points of this thesis.

Chapter 7 – List of references, presents all the literature that has been referred to in course of this thesis.

This thesis will now provide a summary of the most important features of this chapter.

1.7. Summary

Today's society, and the knowledge of it, reveals an increasing level of complexity. So far, the traditional approach based on Newtonian laws has been the leading paradigm in explaining both natural- and social phenomena, but Complexity Theory offers a new framework to understand and interpret the everyday events.

The Norwegian Army has historically been under massive influence by a bureaucratic and Newtonian way of thinking. Based on this belief, and the fact that the *modus operandi* of the Army is highly complex, this thesis finds it interesting and highly relevant to formulate the following research question:

What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?

In order to do so the thesis has defined three major research objectives:

First of all, based on a non-empirical literature review, define and describe Complexity Theory and differentiate it from orthodox theory. Secondly, Based on a non-empirical literature review, investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership. Third and finally, based on an empirical survey, describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.

The research design and methodology is based on two different approaches. First of all, this thesis will have a non-empirical literature review to obtain research objective 1 and 2. Secondly, based on the non-empirical literature review, this thesis will have an empirical survey at the Norwegian Military Academy that seeks to achieve research objective 3.

This thesis will be structured in chapters, where chapter 2 – Complexity Theory, seeks to reach research objective 1, chapter 3 – Traditional leadership and Complexity leadership seeks to reach research objective 2 and finally chapter 4, 5 and 6 seek to reach research objective 3.

As this thesis now has clarified the general framework for the study, this thesis will now continue with the non-empirical literature review in chapter 2, Complexity Theory.

Chapter 2: Complexity Theory

*All that happens is symbol,
and as it represents itself perfectly,
it points to all the rest*

Goethe (1818)

Complexity Theory is, as the name clearly indicates, a complex field of study. It challenges the “established truths” and the traditional view points in society on a wide range of concepts. The debate around complexity takes place on a number of different levels, from Natural Science (e.g. Capra, 2007) to theoretical (e.g. Cloete, 2006; Wheatley, 1998) and empirical application in the Social Sciences (Dalseg, 2005; Gimmetstad, 2007).

Carlos (2007) describes three different approaches on how to interpret the term complexity. The first of these looks at complexity as *science*, i.e. “*the study of non-linear dynamics in various specific systems*” (2007: 48). The science-approach can be looked at from *inter alia* a Natural Science perspective or a Social Science perspective. Secondly, complexity can be interpreted as a *method of thought* focusing on learning to think in terms of relations, e.g. through a number of different leadership theories. Thirdly, complexity can be seen as a specific *worldview* arguing for a new understanding of the world where reductionism and sectoral thinking are substituted by emerging and holistic thinking, e.g. how anti-globalization movements are structured and act (Johnson, 2001: 225).

Najomanovich (2007: 92-93), on the other hand, argues that complexity cannot be reduced to a *a priori theory* or generalized into a new global theory or worldview. The categorization of the complexity sciences is a contradiction to the science itself and the metaphors of complexity go far beyond science. Instead, she argues, the Complexity Approach is a radical, complete and multidimensional transformation of the way we look upon ourselves and the ever changing environment (Najomanovich, 2007: 104).

As these two short paragraphs illustrate, the Complexity Approach is indeed *complex* and needs further elaboration. This chapter seeks to attain research objective 1:

Research objective 1: To define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.

In order to achieve research objective 1 this chapter is divided into multiple sub-objectives:

Research objective 1.1: To define Complexity Theory.

Research objective 1.2: To describe the evolution of the Complexity Approach.

Research objective 1.3: To describe and differentiate between what is simple, complicated and complex.

Research objective 1.4: To describe and discuss what the characteristics of a complex system are.

Research objective 1.5: To describe the Newtonian Approach and its general implications.

Research objective 1.6: To describe and discuss the most important components of Complexity Theory and differentiate it from a Newtonian way of thinking.

Research objective 1.7: To summarize the most important points of the chapter.

With the aim of attaining research objective 1 and its sub-objectives this chapter will initially present different definitions of complexity. Then it will continue with a short elaboration of the evolution of Complexity Theory in order to gain an understanding of the background and the link between the Natural- and Social Sciences on this field. The field of complexity is a field of symbols, metaphors and semantic questions. In order to clarify some of these questions this thesis will discuss the difference between the simple, the complicated and the complex. Then the study will continue with describing and discussing a framework for understanding the characteristics of complex systems. As an opposite pole to the complex approach, the principles of Newtonian thinking will be presented and discussed with the view to creating a framework for comparison. This discussion will be followed by describing and discussing the different components of Complexity Theory and directly and indirectly show how these components, and much more importantly, how the systems as a whole, differ from the traditional Newtonian way of thinking. Finally, the chapter will summarize the most important points and indicate the further progress of this thesis.

2.1. Definition of Complexity Theory

This section of the discussion now looks to a number of dictionary definitions for complexity. According to the New English Oxford Dictionary complexity can be defined as “*not easy to analyze or understand*”, while the Cambridge International Dictionary of English defines it as “*involving a lot of different but related parts*” (Nilsson, 2007: 237). Microsoft Encarta 2008

defines complexity in the same way as the Cambridge International Dictionary of English, but at the same time refers to complexity as something complicated. The distinction between complex and complicated will be discussed later in the thesis (Microsoft Encarta 2008 (1)).

In what way do some of the prominent authors in this field of science define complexity?

Zimmerman and Plsek (1998), quoted in Praught (2002: 515), define complexity as

“A description of the complex phenomena demonstrated in systems characterized by nonlinear interactive components, emergent phenomena, continuous and discontinuous change, and unpredictable outcomes”.

Waldrop (1992), quoted in Cloete (2006: 465) defines complexity as *“the domain between linearly determined order and indeterminate chaos”.*

Blackman (2001: 440) and Cilliers (1998: 456) describe complex systems as defined by relationships and networks, rather than by their isolated elements.

Cowan (1994: 1-2) says that *“complexity...refers to systems with many different parts which, by a rather mysterious process of self-organization, become...ordered...’ordered complexity”*

The first thing one might notice with the above definitions is that they all seem to define different phenomena or concepts. Zimmerman and Plsek in Praught (2002: 515) focus on some of the different components of a complex system. Waldrop on the other hand has a more macro-perspective and describes the framework or the boundaries of complexity. Blackman and Cilliers state the importance of a holistic approach instead of atomistic view and finally Cowan centers on the underlying processes of complexity and the possible end-state (interpreted from a linear point of view).

The many different definitions, and indeed the different content may imply that:

- 1) The content of the Complexity Approach is mostly qualitatively oriented. A quantitative approach would most likely and to a higher extent offer more objective facts, and thus more consistent definitions.
- 2) The Complexity Approach is difficult to understand and raises many fundamental and philosophical questions about nature itself.
- 3) The multiple definitions are often a symbol of a multi-dimensional nature, which again imply that one must look for answers from a broader field.

Thus, there is no general conformity as to what the correct definition of complexity is. As pointed out by Fernandez et al (2007: 175) every definition focuses on different parts of the Complexity Approach and does not offer a holistic useful explanation. As noted by Capra et al (2007:17) imposing strong limitations on what complexity is or what the different components should mean, oppress the great potential of complexity.

In the continuously growing literature on the field of complexity there are a number of other “expressions” or “labels” that are connected to Complexity Theory.

Chaos Theory, by some characterized as a building block to Complexity Theory (Schneider & Somers, 2006: 355) and by others labeled as a distinct version of Complexity Theory (Cloete, 2006: 467), can be defined as the study of “complex, dynamic, deterministic, non-linear systems that reveal patterns of order out of seemingly chaotic behavior” (Cloete, 2006: 469).

Some academics refer to Complexity Theory as a “complex adaptive system” (CAS), thus referring to the idiosyncratic nature of such systems (Cloete, 2006: 466). Zimmerman, Lindberg and Plsek (1998) in Praught (2002: 518) use the term CAS as an expression of a complex system and define it as:

“A system of individual agents, who have the freedom to act in ways that are not always totally predictable, and whose actions are interconnected such that one agent’s actions change the context for other agents”

Uhl-Bien, Russ and McKelvey (2007: 299) describe CAS as the basic unit of analysis in the science of complexity. A CAS consists of interdependent and interacting agents who cooperate with the view to achieve *inter alia* common goals and fulfilling needs. The structure of a CAS is in continuous flux as the dynamic agents in the system build new relationships and sub-structures.

As partially described above, a number of concepts or terms are used to describe and define the perception of complexity. Whether the authors refer to complexity as *inter alia* chaos, CAS, non-linear systems, quantum approach, Advanced Systems Theory or bounded stability (Uys, 2002: 35), they refer to the same basic principles but with a different focus or different rhetoric.

Having discussed different definitions of complexity, this thesis will now continue by presenting the evolution of Complexity Theory.

2.2. From Simplicity to Complexity – The Evolution of A Complexity Approach

The Science of Complexity has been and still is an emerging field of study which captures the interest of the researchers within *inter alia* Biology, Anthropology, Economy, Sociology and Management. The common denominator seems to be the fundamental search for answers about living, adaptability and change (Praught, 2002: 515).

The work of significant scientists like *inter alia* Albert Einstein and Niels Bohr have contributed to what we now refer to as “The New Sciences”, i.e. new insight and knowledge about the driving forces behind the natural world surrounding us (Cloete, 2006: 463). Cloete uses the work of Albert Einstein as an example where some of the characteristics of Complexity Theory are highlighted. Einstein’s conclusion was that “*possible unidentified, multiple, complex non-linear, organistic cause-effect relationships*” might be important driving forces behind natural phenomena. Newtonian logic was, from Einstein’s point of view, either defective or misleading as an explanatory tool for natural phenomena (Cloete, 2006: 464).

The French mathematician Henri Poincaré (1854-1912), together with other pioneers on the field of dynamics such as Birkhoff and Kolmogorov, introduced the ideas of how non-linear deterministic systems could behave unpredictably and in an apparently chaotic way (Baets, 2007: 105). More recent work from the Santa Fe Institute in New Mexico and Nobel Prize winners such as Prigogine and Kaufmann also has the seemingly simple, but of course difficult mission aimed at understanding complexity (Microsoft Encarta 2008 (2)).

But what is the link between the Natural Sciences and the Social Sciences?

Dilworth (1998: 497) describes Chaos Theory as emerging from the Natural Sciences and Cloete (2006: 465) characterizes the assumptions of the New Sciences, i.e. complex psychological and social processes, as equivalent to the assumptions driving complex natural processes. In other words, principles from Natural Sciences, e.g. quantum dynamics, are used to describe Social Science phenomena.

Wheatley (1999) also describes, as Einstein did, the logical defect of Newtonian Principles as an explanatory tool for Natural Science, and as will be later discussed, also for the Social Sciences. Wheatley argues that Complexity Theory and its application to the Social Sciences are *inter alia* based on the quantum theory of Natural Sciences. The Quantum Theory view offers a new view on how to interpret reality, how relationships are the key determiner of everything and a new understanding of the role of change and disorder.

Najmanovich (2007: 97-99) describes the evolution from simplicity to complexity as “*shaking off the tyranny of method*”. She argues that the paradigms of science have developed from a set of conservative laws, homeostasis and causality to non-linear dynamics, creativity far-from-equilibrium and emergence. She further describes a transformation from analytical thinking to emphasizing multi-dimensional and polyphonic thinking.

In the discussion concerning the evolution of a Complexity Approach, a distinction between what is complicated and what is complex is important. As these are two concepts that can easily be interpreted as equivalent, this thesis will now discuss the difference between what is simple, complicated and complex.

2.3. The Simple, Complicated and Complex – A Semantic Discussion

Cilliers (1998: 3) emphasizes the distinction between simple-, complicated- and complex systems. The Microsoft Encarta Dictionaries (3) define “simple” as “*the lack of complexity, complication, embellishment, or difficulty*”. As discussed under the section “Definition of Complexity Theory”, the dictionaries often equate complicated and complex, a distinction which now will be discussed in further detail.

As a starting point it may be fruitful to make some general distinctions. A simple and a complicated system refer to something mechanistic and materialistic, e.g. a car or a kitchen-machine, while a complex system refers to something organic and living, e.g. a social organization (Cilliers, 1998: 3).

Nilsson (2007: 245) uses the metaphor of a factory with production units and regular staff to explain the difference between simple, complicated and complex. *The simple view* represents a single production machine in the company. The machine can quite easily be optimized towards a predetermined goal, as long as the goal is within the boundaries of the system. The mechanistic processes in the machines are closed systems with clearly linear output. Cilliers (1998: 2) uses an internal combustion engine as a similar metaphor for a “simple” object.

If, however, this perspective is expanded to include multiple production units, i.e. more machines with different functions, the situation tends towards getting more *complicated*. The reason for this being *inter alia* the rising number of variables present in order to optimize

the system (Nilsson, 2007: 245-246). The process is, however, perfectly understandable, but may presuppose some knowledge in order to be better able to analyze it.

As described at the start of this paragraph complex systems are often linked to something living and organic. The company that runs the machines and the production units of course consists of people, something which evidently makes it lean towards a *complex system*. The people who are responsible for parts of or the whole production process have their own subjective view on how to organize production or how to operate the machines. The production manager, or any other manager in the organization, is responsible for communicating and interpreting signals from all parts of the organization and its customers, external relations etc. The social organization perspective and everyday rich human interaction both internally and externally lead to for non-linear behavior, feedback-loops and self-organizational properties (Nilsson, 2007: 246). Compared with the rather predictable behavior of a complicated system, the dynamics of a complex system is difficult and sometimes impossible to understand. To understand a complex system is to acknowledge that you cannot fully understand it (Cilliers, 2002: 82), while a complicated system usually can be deconstructed and analyzed in an objective and rational way.

But does the human factor always make a situation or a system complex?

Yorks (2007: 227) uses the example of a child and their favorite toy to illustrate this situation. As an adult one may characterize the relationship between the child and the toy as a simple relationship, although the toy most likely has a name, is alive in the child's mind, and offers confidence and joy. Imagine one of the children at the kindergarten insisting on playing with the child's favorite toy. Reactions to the situation are multiple, each depending on the child's disposition in that precise moment. However, if you add a kindergarten teacher or a parent into the equation, the situation instantly moves from being full of potential and complex to becoming merely complicated. The adult's intervention instantly changes the emergent relationship between the child, the playmate and the toy into a reactive and corrective action.

Presented in a more simplified way:

“Child+toy+playmate+adult = punitive damages;

“Child+toy+playmate = possibilities” (Yorks, 2007: 227).

As this example illustrates, despite the fact that something living and organic may be a prerequisite for complexity, it does not mean that it automatically causes complexity. This will be further elaborated on under the next paragraph where we look at what the characteristics of a complex system are.

Cilliers (1998:2-3) argues that one must take into consideration the possible pitfall of what seems to be simple, but what *de facto* is complex or vice versa. E.g. a nut or a seed seems to be simple, but reveal high levels of complexity when examined in detail. In the same sphere of thought, a system that appears to be complex, e.g. a computer-program or a specific machine, is actually simple or complicated. A complicated system can have a large number of components and perform seemingly sophisticated operations, e.g. a high technological combat vehicle with a high number of sensors and a complicated internal target acquisition system, but consists of few non-linear and non-causal elements and can therefore be fully analyzed, which is not the case of complex systems.

The thesis has so far described different debates linked to complexity, i.e. different definitions, the evolution of a Complexity Approach and the distinction between what is simple, complicated and complex. In order more clearly to present what complexity is, the thesis will now enter into a discussion of the different characteristics of a complex system.

2.4. What Are The Characteristics of A Complex System?

In the section “from simplicity to complexity – the evolution of a Complexity Approach” the thesis describes the link between the Natural- and Social Sciences in the evolution of Complexity Theory. It is therefore natural to have a look at some of the principles of what constitutes biological life and natural systems.

Capra (2007) identifies some key characteristics of biological life. First of all, a living system is materially and energetically open. Secondly, biological life is dependent on a continual flow of energy in order to survive, i.e. it exists in a far-from-equilibrium environment. Third and finally, it has self-organization and self-generating capabilities, e.g. each element plays a role in transforming and replacing other elements. Wheatley (1999: 20) calls the latter point *autopoiesis*, a “new” academic word meaning self-production and self-making. The process of autopoiesis is a fundamental network of processes that creates and renews itself, having a recurrent flow of energy to enable change.

Cilliers (1999: 24) describes some of the limitations of using a quantitative analytical approach to understand complexity. A quantitative method will not be able to catch all the elements of a complex system, and will thus not produce an accurate picture. A model of complexity has to conserve the level of complexity in the system itself. Hence, Roodt (2007) describes what a *non-quantitative* framework must take into consideration in order to understand a complex system.

- 1) The framework must allow for emergence, thus favoring possibility above probability.
- 2) Co-existence and non-linear interactions are key factors instead of linearity and causality.
- 3) Based on the assumption that complex systems are constantly evolving, the framework must be able to “*rise above temporal truncation or bracketing*” (Roodt, 2007: 218)
- 4) To ensure evolutionary development the framework must embrace hierarchical relationships.

Johnson (2001: 77-78) argues that natural systems are designed to learn through *bottom-up processes*. By investigating the life of ants and ant-colonies Johnson (2001) presents five basic principles to create macro-intelligence and adaptability through local interaction and knowledge.

The first principle is labeled “*more is different*” and points out the importance of a sufficient number of agents that interact. Imagine the difference in probability of finding food if a group of ten foragers (food collecting ants) are sent out as opposed to a group of 10 000 foragers.

The second principle is tagged “*ignorance is useful*” and refers to how the relatively simple and stupid ants through a dynamic process of interconnectedness exhibit sophisticated and complex behavior. As Cilliers (1999, 4-5) points out, the agents in a complex system react on local information. Individual agents that have an overall view of a system can be a direct liability to the emerging process.

The third principle is named “*encourage random encounters*” and emphasizes the importance of random interactions within a system. The random interaction and the constant search for new ground create opportunities (Johnson, 2001: 78-79). E.g. an ant-colony that does not expand its territory will eventually run out of food sources. A company that does not meet the ever changing demand of the free market will eventually run out of customers. The company cannot, however, adapt to the ever changing environment without having the capacity of being sensitive to the conditions, i.e. the company must have the insight, the knowledge and most importantly a constant interaction with the market to be able to adapt.

The fourth principle is called “*look for patterns in the signs*” and identifies the need for actions based on patterns in time and not indications based on a few signs. In the ants’ world, the meeting with simply one other forager does not mean much, but meeting 50 other foragers in the space of two hours give information about the holistic state of the colony (Johnson, 2001: 79).

The fifth principle is labeled “*pay attention to your neighbors*” and is implicitly incorporated into the other principles. A close relationship with your neighbors is the basis for local interaction and the process of self-organization and emergence (Johnson, 2001: 79). Again, in the ants’ world, a colony without local sensible interaction would be closer to total randomness instead of the intricate and often invisible underlying structure of a complex system. In a quantum physics framework, it is the relationship that is the fundamental object of interest, not the object itself (Wheatley, 1999: 34), i.e. the ant itself is not the most interesting aspect, it is the relationship and the interaction between the ants.

So far, there are a number of principles that emerge in the discussion around the characteristics of a complex system. Based on the knowledge of how natural systems function, an open and qualitative framework are preferred in contrast to a closed and quantitative framework. Principles of emergence, self-organization, adaptability and a fundamental focus on relationships are presented in the literature as important components, and prerequisites, for complexity.

This thesis will now elaborate on the discussion by integrating Cilliers’ characteristics of a complex system.

2.4.1. Cilliers and the Characteristics of a Complex System

The thesis will now use the framework of Cilliers (1998: 3-5) to present a list of characteristics of a complex system. As the reader will notice, many of the same principles as described above will be presented, but together with a number of new principles. The example of individuals as economic agents in a given national financial system will function as the empirical framework (Cilliers, 1998: 6-7)

- I. A complex system consists of a *large number* of agents or elements (Cilliers, 1998: 3). As described earlier, “more is different” when it comes to building complex systems. A fairly small number of elements will most likely make it easier to understand, i.e. they are either simple or complicated. This is especially the case with something mechanical and inorganic.

In a given country there are usually a high number of economic agents. E.g. in 2005 there were 2,524,817 workers in Norway (Microsoft Encarta (14)).

- II. The many elements of complex systems have to *interact* and the relationships have to be dynamic (Cilliers, 1998: 3).

The roughly 2, 5 million workers interact continuously and dynamically by *inter alia* investing, lending and borrowing.

- III. The interaction needs to be *fairly rich*, i.e. one component does not affect just one other component, but multiple other elements as well (Cilliers, 1998: 3-4).

In the course of a week for instance an economical agent interacts with a relatively high number of other elements, e.g. paying the bills through the bank, buying groceries or investing in stocks.

- IV. The interactions must be of a *non-linear character*. Without non-linearity, a complex system is not possible (Cilliers, 1998: 4).

An investment in stocks will most likely over a defined period of time result in a change in the value of the investment. In a linear interaction the input would be equivalent with the output.

- V. Information is primarily received from elements in close proximity, i.e. the *interactions are relatively short range*, but they do not rule out a wide-range influence (Cilliers, 1998: 4).

An economic agent will in most cases interact with the local environment, e.g. the grocery-shop around the corner from the house and eating at the local restaurant. They can, however, by the use of Internet or brokers, interact with more distant parties (Cilliers, 1998: 6).

- VI. A complex system has *feedback-loops* that can be either positive or negative (Cilliers, 1998: 4).

Negative feedback, which often connected to a planned system, is characterized by a linear process of a traditional gap-analysis. The direction is set, an analysis reveals the gap between the desired state and the actual state and an action is taken to close the

gap, e.g. how a central heating system is functioning. Positive feedback, on the other hand, would widen the gap between the desired state and the actual state. In other words, while negative feedback is stabilizing, positive feedback is reinforcing, amplifying and destabilizing. For example in the case of the central heater, a positive feedback would increase or decrease the temperature (all depending on the initial condition), instead of stabilizing it (Parker & Stacey, 1997: 25-26).

The action of an economic agent may ultimately reflect back on itself. The investment made may evidently result in either good returns or negative returns when the investment is processed (Cilliers, 1998: 6).

- VII. Complex systems interact with their environment. In other words, complex systems are often *open systems*. A closed system, on the other hand, does not interact with its environment to the same degree as an open system, and is merely a simple or complicated system (Cilliers, 1998: 4).

The economic agents and the economic system is constantly being affected by *inter alia* political-, socio-economical-, technical - and environmental factors and it is difficult, if not impossible, to delineate the exact borders of the economic system (Cilliers, 1998: 6).

- VIII. Equilibrium is equivalent with stagnation and death. Complex systems operate in a *far-from-equilibrium environment* constantly changing and creating opportunities for creativity and change (Cilliers, 1998: 4).

A market-driven economy is based on the dynamic relationship between supply and demand and is therefore never in a state of equilibrium. Irrespective of the markets going up or down, the common denominator is a constant process of change.

- IX. *The history of a system is an important element* in a complex system, i.e. the past of a complex system is "*co-responsible for [its] present behavior*" (Cilliers, 1998: 4; Smith, 2007: 194).

The prices on today's stocks are always based on a continuation of yesterday's stock prices. As the external environment changes, the system reacts by adapting, not adjusting to a pre-defined futuristic goal.

- X. The pattern of interaction between agents results in an emerging complexity. Each actor reacts or acts based on *local information* and does not have a holistic view (Cilliers, 1998: 4-5). This may seem as a contradiction, but assuming that each element has the total view of what is happening to the system as a whole also directly means that all of the complexity is present in that specific element, which is not the case.

When an economic agent is purchasing a commodity the agent takes a decision based on the local information he or she has available, as it is impossible for the agent to have the knowledge of what every other element is doing. The local information can for example be the individual's own needs or the individual's financial situation.

The description of quantum physics and the different characterizations of biological life and complex systems offer an alternative view on the basis for life in general and how we look at our organizational life. However, what *de facto* often is the basis is another story. The thesis will now continue by describing and discussing a Newtonian or traditional way of thinking, an approach that in many ways differs strongly from a Complexity Approach.

2.5. Newtonian Way of Thinking

The core of Newtonian thinking and the metaphors that are often connected to this way of thinking, is a machine, an approach that endorses predictability, reductionism and equilibrium.

The Newtonian conception derives from the work of Sir Isaac Newton and the three dynamic laws that describe the movement of the planets. Together with Cartesian Reductionism, which emphasizes that a system can be understood by merely studying and analyzing the parts of a system, the Newtonian worldview symbolizes a world which is understood through reductionism (Fernandez et al, 2007: 171). The reductionist way of thinking is deeply rooted in Western intellectual thinking and dates back to ancient Greece and the scientific revolution of the 17th century (Strand, 2007: 198).

Another metaphor that is used to describe a Newtonian organization is the clockwork. Darwin (2001: 482) describes a clockwork approach in the following way:

“Everybody knows what the organization is all about and is concerned solely with carrying out its mission; people are basically happy at their work; the level of anxiety is low; people interact with each other in frictionless, mutually supportive cooperation; and if there are any managerial problems at all, these are basically technical problems, easily solved by someone who has the proper skills and knows the correct techniques of management”.

This thesis presents the Traditional or Newtonian Approach with metaphors of a machine and clockwork. But what does it actually mean? This thesis will now continue to present some characteristics of Newtonian thinking.

2.5.1. Characteristics of Newtonian Thinking

Depew and Weber in Ulanowicz (2007) refer to a Newtonian system as causally closed. In other words, they are either conceived as a simple or complicated system based on a mechanical and materialistic view.

As mentioned earlier, non-linearity is a prerequisite for complexity. However, in a Newtonian system a *linear* approximation is employed. Looking at the differences between linear and non-linear systems two important distinctions emerge. First of all, in a linear relationship the cause has only one effect, whereas a non-linear approach will reveal multiple outcomes or effects (Parker & Stacey, 1997: 12).

A second distinction emerges when we consider that while a linear system merely is a product of its components, a non-linear system must be analyzed through the patterns of behavior that the system as a whole produces (Parker & Stacey, 1997: 12-13). In other words, in a linear system 1+1 is always 2, while in a non-linear system 1+1 could be 3 or 4 or even 50.

A Newtonian system is *equilibrium seeking* and *deterministic* (Kiel, 1994: 12; Fernandez et al, 2007: 173). The diverse sets of plans and strategies aim at creating balance by reaching pre-defined goals and objectives based on future predicaments. Implicit in this way of thinking is a disposition towards behaving like the organization and the individuals exist independent of its environment, i.e. they are *closed systems* (Juarerro, 2007: 110). Stated otherwise, a Newtonian organization is likely to hold more strongly onto its goals, plans and strategies despite changing circumstances in the environment.

Control is often connected to the degree to which the organization is believed to be in equilibrium or not (Wheatley, 1999: 28). This control is achieved by tidy planning on all levels of the organization. Personnel have detailed explained job descriptions and the managers on the different levels have clear boundaries of authority. The goals and decision-making processes are often based on *quantitative methodology* (Darwin, 2001: 483). The quantitative approach is believed to be the best basis for decision-making because it provides solid “evidence” and is relatively easy to understand. The decision maker can therefore justify its actions based on thorough quantitative analysis. The structure is most

likely hierarchical with clearly defined sub-units for clearly defined tasks. *Chaos* is defined as the opposite pole of control and is looked upon as something destructive and negative.

Another significant feature of Newtonian systems is that they are *atomistic*, i.e. the focus is on isolated parts and how they by a simple puzzle are capable of building up the system as a whole (Cilliers, 1998: 456). The *reality* is based on objectivity and can often be explained through mathematical and logical language (Strand, 2007: 198). There are no links between the observer and the studied phenomena, thus the observer does not affect the behavior of the studied object (Fernandez et al, 2007: 173). The world is best understood as isolated, unchallengeable and a static object that operates in a deterministic framework (Juarrero, 2007: 110).

This thesis will now enter into a discussion concerning the general implications of a traditional way of thinking as it relates to a deterministic and reductionist approach and how it forms a basis that affects the fundamental view of life.

2.5.2. General Implications of a Newtonian Approach

Wheatley (1999) writes about Newtonian Organizations in a quantum age and how the desire to control reality and the focus on reductionism, has reduced what should be dynamic and open organizations, into simple cause-effect based organizations with a world limited to lines and boxes. The decision processes in Newtonian organizations have been, and are based on sophisticated and quantitative mathematical formulas, reducing “reality” to something expressed in numbers, which again creates an illusion of control (Wheatley, 1999: 28-30). The external environment is something from which we must be protected in order to survive and protect our individual freedom (Wheatley, 1999: 84). The search for order and equilibrium in organizations creates less space for constructive change and creativity.

Vladimir Lenin once said that “freedom is good – control is better”, something which still has its principle relevance if one analyzes the life of organizations. Johnson (2001: 187) illustrates the consequences of too much control using the Sims computer-game where the principles of self-organization and emergence are evident. The game, in which the player constructs communities, still has options that allow the inhabitants of the city to have “free will” or not. If the Sims are on “free will” self-organizing properties and emergence are evident, but when you leave “free will off”, the Sims rapidly disintegrate into a state of “around the clock” maintenance and the player has to command every single action. Of course, this is not the fact in all Newtonian inspired organization. The relevance of the principle however, is self-evident.

As noted above, stability (or control, equilibrium and balance) is one of the primary objects for Newtonian organizations to meet. Juarrero (2007: 112-113) emphasizes the distinction between stability and resilience. Stability is characterized by “*low fluctuation around specific states*”, while resilience on the other hand is “*the system’s ability to absorb perturbations and evolve into a metastable level of organization*”. If one takes the principles from biological life (e.g. Capra, 2007) presented earlier in this thesis into consideration, one will quickly come to the conclusion that stability is equivalent with extinction, while resilience symbolizes survival. A system which has great fluctuation, i.e. high resilience, might be perceived as an unstable system from a traditional point of view, and thus as something negative. However, and as our ecosystem teaches us, the more heterogeneous the environment is, the more interconnected it is which again leads to a higher level of resilience (and lower level of stability) (Juarrero, 2007: 113). Another example is the financial markets, which historically and indeed in the last couple of years, show a high degree of fluctuation and instability. The counter-action, however, is often a state intervention to restore stability, which – it may be argued - decreases the survivability of the economy.

The Protagonists of Traditional Theory will argue that there exists little concrete and quantitative proof that chaos and complexity is present in the Social Sciences. However, and as a critique of this view, a quantitative approach has a number of limitations when it comes to exploring qualitative phenomena. This is especially evident in terms of chaos and complexity where using a well-defined statistical approach will be to clearly counter-act the principles of quantum mechanics (Parker & Stacey, 1997: 18-19). A quantitative approach will evidently try to reduce a complex phenomenon to a simple one (Cilliers, 1998: 24), which certainly fails to conserve the representation and validity of the research. A second perspective on the mainstream critique of complexity is that despite long studies of e.g. management, and a very high number of different theories, management still surprises, i.e. a hidden complexity are *de facto* evident (Parker & Stacey, 1997: 19).

Forecasting is an essential element in the traditional management tool-box. Robbins (1980) defines forecasting as “*looking toward the future through the eyes of today*” (Schwella, 2005: 52). Forecasting is for example used in planning processes (Schwella, 2005: 52) and in policy-making models such as Dunn (1994) and Wissink (1991) (De Coning & Cloete, 2005: 71-73). Interpreting forecasting from the proposed point of view of complexity results in the same critique as noted under the last paragraph, i.e. a quantitative approach. Some main critical questions one might ask are:

- How is it possible to integrate all variables in a model in order for it to be able to predict? This of course implies that you need to *know* all variables.

- How is it possible to know the specific *state* of the variable, i.e. what is the correct initial condition?

As Parker & Stacey (1997: 74-75) note, errors are usual in quantitative analysis, e.g. such a simple thing as to round off economic data might eventually end up being a considerable source of error. Given that complex systems are sensitive to initial conditions, a tiny error in either of the phases might strongly amplify itself to a big error through non-linear dynamics. In order to correctly predict the future, all known and unknown variables must be present and the specific state of the variable must be accurate. In other words, to predict the future, we need to know the future in advance. Looking at this from a practical point of view, the conclusion must be that incorporating forecasting as an essential part of its planning and decision processes, is mildly speaking deceptive and counter-productive.

Although this part of the thesis criticizes a Newtonian Approach, it is important to underline that a traditional approach to leadership or planning is still relevant in the sense that it gives people insight into processes and different perspectives on how to meet challenges (Schneider & Somers, 2006: 363). However, the possible negative aspects of a traditional approach can be substituted by a different approach. The thesis will now investigate different components of Complexity Theory and how the principles they represent are different from traditional Newtonian Principles.

2.6. Components of Complexity Theory

The thesis has so far *inter alia* defined complexity and discussed the different approaches to understand complexity. Based on the simple-complicated-complex discussion and the different characteristics of a complex system, a number of “technical” terms have been evident. The literature presents labels like non-linear, emergence, chaos, self-organization, far-from-equilibrium and a number of other expressions. But what do these technical terms actually imply?

This section of the thesis will discuss different components of Complexity Theory while simultaneously differentiating it from the Newtonian Principles. In order to do so the thesis will initially present the main differences between the Newtonian Approach and a Complexity Approach. Then it will discuss the components of Complexity Theory in four main categories, namely non-linearity, chaos, feedback and self-organization/emergence. Based on the description of the different components the thesis will continue discussing the possible implications for organizations.

What is crucial to underline is that despite the presentation of different components, the components are not isolated parts but are instead inter-connected.

This thesis will now continue with a short presentation of the main differences between a Newtonian and a Complexity Approach.

2.6.1. The Clockwork, Snake-pit and the Rainforest

The Newtonian Approach has been connected to metaphors such as a machine and clockwork. Darwin (2001) introduces two other metaphors in the discussion concerning complexity, namely snake pit and rainforest. The snake pit is the label for random chaos, i.e. chaos has spun totally out of control and there is no hidden or underlying order present. The rainforest is the label for the Complexity Approach that has been elaborated on in this chapter.

Darwin (2001: 485) proposes a set of language labels that can be put on the different categories. These labels are reproduced in table 1:

Clockwork (Newtonian)	Snake pit (randomness)	Rainforest (Complexity)
Control	Chaos	Complex
Order	Disorder	Order within chaos
Modern	Post-modern	Constructivist
Objective	Subjective	Interconnected
Realist	Non-realist	Neither
Analytical	Instinctive	Evolving
Safe	Unsafe	Dynamic
Logical	Illogical	Fuzzy logic
Certain	Uncertain	Adaptive
Foundations	No foundations	Web or net
Predictable	Unpredictable	Pattern
One best way	Any way	Multiple approach
Structured	Unstructured	Codetermined
Planned	Unplanned	Memory of the future
Competitive	Competitive	Co-evolution

Table 1 – Labels per category (Darwin, 2001: 485)

As the reader might notice, a number of these labels have been pointed out earlier, e.g. Cilliers’ characteristics of a complex system describe a number of the labels in the rainforest category, while the elaboration of a Newtonian system describes a number of the clockwork-characteristics.

This thesis will now continue to elaborate further on the components of a Complexity Approach and how these distinguish themselves from a Newtonian perspective.

2.6.2. Non-linearity

Microsoft Encarta (5) provides a number of characterizations for the word “non-linear”. The first refers to nonlinear as “*not lying on the same straight line*”, thus referring to a rather direct interpretation of the word. The second refers to it in terms of “*a relationship or function that is not strictly proportional*”.

As discussed under the paragraph “characteristics of Newtonian thinking” a traditional approach often has a linear approach, thus assuming a strictly causal relationship which holds that the whole is just a reflection of the sum of its parts. A non-linear approach is, as one might expect, based on different principles.

A non-linear system is *highly sensitive to initial conditions*, i.e. something that might seem like a small change might escalate to be a rather big change (Parker & Stacey, 1997: 13). The example of how the flap of a butterfly-wing in Tokyo can affect a tornado in Texas is a much alluded metaphor to illustrate this phenomenon. The flap of the butterfly’s wings, which is inherently a very small action globally speaking, can through feedback loops amplify and produce unexpected outcomes (Wheatley, 1999: 121; Praught, 2002: 517; Casti, 1994: 95).

Sensitivity to initial conditions has been in the media and the public’s spotlight in recent years. The discussion around climate change and rising global temperatures are in the headline of newspapers almost every day, illustrating how relatively small changes in the global average temperature (i.e. the initial condition) might cause devastating outcomes such as rising sea-levels, more extreme weather, less food-production and more migration as end results. In an organizational setting non-linear dynamics is also constantly present. Imagine how a small humoristic comment about the company’s future in the corridor from a manager can spread from employee to employee, who slightly changes the story with a subjective interpretation, and eventually ends up as a potentially irreparable misunderstanding.

Galbraith (2004) presents in table 2 some of the differences between a non-linear and linear system:

Property	Linear system	Non-linear system
Initial conditions	Not important	Very important
Equilibrium	Stability	Chaos
Prediction	Deterministic	Chance
Feedback	Negative	Positive

Table 2 - Difference between non-linear and linear systems - Galbraith, 2004: 14

There are not merely grand systems or organizations that are subject to non-linearity. Every human being exerts *non-linear behavior* on a daily basis. A psychological study conducted by

Stanford University shows that people can often be risk-averse when expecting a gain, in this case the subjects of study would rather take \$ 85 000 instead of the chance of getting \$ 100 000 and risk-seeking when facing a loss. In this case the subjects of study would choose to run an 85% chance of losing \$100 000 instead of a guaranteed loss of \$ 85 000 (Parker & Stacey, 1997: 23-24).

The causal relationship identified in Newtonian thinking is not representative for complex systems. Causality only applies to a system which is undisturbed by its surrounding environment (Baets, 2007: 107), i.e. what can be characterized as a simple system. The lack of representation between Newtonian thinking and quantum mechanics is evident on many levels. Wheatley (1999:33) claims that Quantum Theory cannot be described by using the present set of metaphors based on Newtonian thoughts. “*Quantum imagery challenges so many of our basic assumptions, including our understanding of relationships, connectedness, prediction, and control*”.

Relationships are, in a world governed by the principles of Quantum Theory, the basic unit of any system and agents working within the systems are interconnected (Wheatley, 1999: 37). Based on the findings from quantum physics, the relationships between particles, i.e. the process in which particles meet, inter-connect and change, are far more important than the particle itself (Wheatley, 1999: 34). In Newtonian thinking, however, the focus is on the particle itself and its physical substance (Cilliers, 1998: 456). Stacey, Griffin and Shaw (2000: 189-190) describe the process of relating as a continually forming process and the transformation of individual and collective identities. The processes are characterized by action and interaction through which individuals in an organization act jointly, co-creating their identities and the surrounding environment. Stacey et al emphasize that these processes are both *creative and destructive* by nature and that they both enable and constrain action.

The Quantum and Complexity Approach imply that there is *more to reality than physical objects*. The reality is just not something material, but consists of space filled with “*invisible, intangible, inaudible, tasteless and odorless*” fields. The fields can be *inter alia* gravitation, magnetism, electromagnetic radiation that each through interconnectedness with other abstract and concrete objects co-create the present. This, of course, forces every person to expand the box from its traditional “thing” thinking where physical reality is only physical, into looking at the universe as an interconnected whole and physical reality as consisting of something physical and non-material (Wheatley, 1999: 50-52).

Looking at the aspect of fields in an organizational setting, a number of non-material forces are evident. Imagine how your own organization has a formal or informal working culture, a

specific set of values or a specific ethical foundation. These non-material and qualitatively oriented forces normally have an incredible impact on the organization, especially in organizations that are knowledge-driven.

So far this thesis has stated that *reality* must include both a material and a non-material perspective. But how about the notion of objectivity and subjectivity? A Newtonian perspective clearly states that reality is something objective, e.g. that you as an observer can observe an event and consider it as an objective reality. However, from a complexity point of view, any act of observation is connected with, and influences the situation being observed (Cloete, 2006: 468). This important distinction between objective (Newtonian) and subjective (complexity) reality is often related to as the Heisenberg Uncertainty Principle as time and space in a Newtonian world cannot be used to express the world of quantum mechanics (Baets, 2007: 107).

Non-linearity is an essential part of a complex system, because a complex system cannot be complex without it. However, there are a number of other aspects that are essential in understanding a complex system. This thesis now continues by embarking on a discussion of the importance of chaos as a prerequisite for complexity.

2.6.3. Chaos

The dictionary provides two definitions of “chaos”. First of all, it will refer to “chaos” in the direct sense of the word, i.e. “*a state of complete disorder and confusion*”. On the other hand, it will also refer to chaos as *apparent* disorder, i.e. “*apparently random changes occur as a result of the system’s extreme sensitivity to small differences in initial conditions*” (Microsoft Encarta, 2008 (6)). In other words, the latter definition implies an added sense of underlying structure.

The first definition presented is often a Newtonian view on chaos. It is looked upon as something negative that implies that the system is out of balance and thus out of control. Although this view on chaos goes back many centuries, it has not always been the common view. In Greek history, Gaia and Chaos were partners. Gaia represented stability and life, while Chaos represented the endless abyss (Wheatley, 1999: 115). In the same way as in the old Greek history, a Complexity Approach embraces chaos as a partner and as a possible creative force on the pathway to create higher order.

Ilya Prigogine’s work on *dissipative systems* is one of the fundamental explanations to the apparently contradictory phenomenon of chaos creating order. Dissipation here refers to a loss or wasteful use (Microsoft Encarta, 2008 (7)), in Natural Science it is often referred to as

a gradually loss of energy (Parker & Stacey, 1997: 37). From a traditional point of view this loss might be interpreted as a slow death, but as the work of Prigogine shows the apparent loss creates a number of opportunities for the system.

The imbalance or instability becomes a source of renewal through self-organization and emergence (Wheatley, 1999: 21). Analyzing this phenomenon in the light of present global events might create an empirical framework. The present financial crisis (and all previous “crises”) serves as examples of how a system is out of balance. As explained above these changes in initial conditions might cause surprising outcomes through non-linear dynamics. But this also creates the opportunity for possibilities. As with all previous financial crises the markets *adapt* and find new and better solutions to existing problems.

According to Parker and Stacey (1997: 38-39) some properties of dissipative systems can be identified.

- 1) They use positive feedback to amplify changes in the environment and thus dislocate existing patterns of behavior.
- 2) They have self-organizational capabilities.
- 3) They make decisions at critical points, also called bifurcation points (Dilworth, 1998: 497).
- 4) They behave unpredictably (Parker & Stacey, 1997: 39).

But if a system is in a state of imbalance and looks to be on the path to total randomness, we might ask ourselves what is causing the sudden change in behavior that restores order?

When the systems seem to be on the verge of collapsing, the *strange attractor* emerges and order is present. As illustrated in figure 3 a system’s movement is tracked in multiple dimensions. As the system moves from being stable to be unstable, then through oscillation, chaos and finally order, *patterns and shapes* become evident. Concentrating on individual moments might just emphasize the belief that you observe chaos, but observing the shape taking place over time reveals order and wholeness developing as patterns over time (Wheatley, 1999: 117-119). Another outcome is that the system does not have a strange attractor and moves further towards total randomness and a state of anarchy (Uys, 2002: 38). In that sense, a chaotic and emergent system is inherently neither good nor bad.

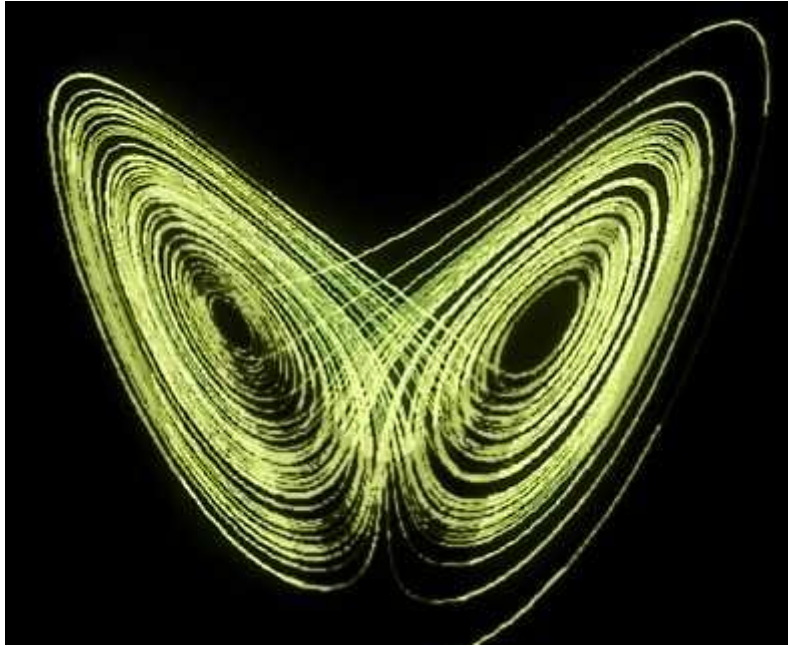


Figure 3 - Strange attractor (Microsoft Encarta, 2008 (8)).

In a Newtonian system the attractor is not strange. It is rather “a fixed point or state of equilibrium that the behavior of the system is attracted to and tends to imitate” (Microsoft Encarta, 2008 (9)), e.g. a specific and concrete goal. A complex system on the other hand pays attention to dynamics and attractors that are not static, in other words they are dynamic and “strange”. Microsoft Encarta (2008 (10)) relates to strange attractors as “a form represented in an abstract mathematical space that corresponds to the evolution of an apparently random system”.

One might also refer to a strange attractor as multiple mobilization points in a dynamic process that due to sensitivity to initial conditions serve as a catalyst for reshaping the whole system (Dilworth, 1998: 497; Parker & Stacey, 1997: 97). From a more empirical point of view, a strange attractor in an organizational setting might be a set of values, ethics or morals that navigate the system to a new order when needed (Wheatley, 1999: 132).

In a stable system tiny causes create tiny effects (Cilliers, 1998: 109), i.e. it is a causal relation. As noted above in the paragraphs about Newtonian thinking, stability is of core essence. In order to create stability huge effort is put into predicting the future, and from there, put to life goal oriented actions. But as this thesis has showed until now, forecasting is not available means of producing accurate predictions, but rather probabilities.

To operate in an environment characterized as *inter alia* dynamic, open and unstable, a high degree of *flexibility* is necessary. As Cilliers (1998: 109) points out, based on the knowledge that the future cannot be predicted, any plan of action must be adapted as the environment

and the agent co-exist. If a plan from the outset point is too rigid and centralized, the system will not be able to adapt to the changing circumstances. An authoritarian system usually needs to use a lot of power in terms of *inter alia* rules, formalizations and procedures, which makes them inherently unstable (Collier, 2007: 89). On the other hand, trying to adjust to every little change or fluctuation in the system will cause the system to waste its resources instead of adapting to a higher order. To create this balance, which again is vital for the survival of the system, a decentralization of control to the whole system is preferred in contrast to a rigid and centralized control method (Cilliers, 1998: 110). A self-organized system distributes the control of the system to all its agents, thus creating less need for power and simultaneously greater resilience (Collier, 2007: 89).

A non-linear approach based on chaos principles might at first be difficult to understand. The principles are a strong contradiction to Newtonian Principles and offer a strong challenge to think outside the common pattern of thought. However, there are more factors that are interlinked in non-linear dynamics. This thesis will now move on to the notion of positive and negative feedback.

2.6.4. Feedback

As briefly explained under Cilliers' characteristics of a complex system, every complex system consists of both *positive and negative feedback*. Negative feedback symbolizes a linear and equilibrium seeking force, while positive feedback on the other hand is reinforcing and destabilizing (Parker & Stacey, 1997: 25-26).

According to Johnson (2001: 134) the probability of feedback loops in a system is directly linked to the degree of interconnectedness of the system. Thus, a simple system will often have a limited degree of interconnectedness, a complicated system a higher degree and a complex system an unlimited and unknown degree of interconnectedness (Casti, 1994: 271). In that sense a high degree of feedback is a prerequisite for complexity (Uys, 2002: 39).

Negative feedback is a principle often connected to a Newtonian Approach. Negative feedback is a means to keep the system in balance despite changing external conditions (Johnson, 2001: 138). In that sense, negative feedback is the contrary of an open system that constantly adjusts to the environment. However, negative feedback is present in simple, complicated and complex systems and materializes in many shapes and sizes. From the most simplistic point of view negative feedback consist of measuring the current state of a system, comparing it with the desired state and finally taking action to minimize the gap (Johnson, 2001: 140). An example of this is how "smart" ballistic missiles function. The

missile is set to hit a specific coordinate, but due to a number of factors the missile can miss its optimal trajectory, which evidently can result in the missile missing its target. The negative feedback kicks in when the missile is out of its optimal trajectory, i.e. there is a gap between the current- and desired state, and through internal mechanisms the missile is pushed into the right trajectory again to hit the desired coordinates. In other words, the balance has been restored.

However, addressing the example of the missile in terms of *positive feedback* will give a drastically different (and undesired) result. The change in initial condition will rapidly be amplified by the positive feedback system, which will result in the missile missing its target by many kilometers. In other words, the process has been a non-linear dynamic

If you analyze your own organization, feedback loops will quickly become evident. As earlier noted, in equilibrium seeking organization, negative feedback loops will be more frequently present than positive feedback loops. A typical technique to limit instability is by incorporating a bureaucratic organizational design with firm rules and regulations. Another technique by which equilibrium can be reached is to attain enough knowledge of a system so adequate counter-measures can be put in place in the case of disturbance (Uys, 2002: 40). A typical complex organization, however, will seek to integrate positive feedback-loops to intentionally avoid stagnation and equilibrium. Dilworth (1998: 497) uses Japanese business leaders as examples, citing where they intentionally change organizational structure in order to “free” the employees from current mind-sets and create organizational self-renewal. Former CEO of General Electric, Jack Welch, is used in McKelvey (2008: 1-4) as an example of how positive feedback loops are created through employee empowerment and the inception of a “boundary-less” organization. These feedback loops eventually caused an extraordinary profit.

The thesis will now continue with an elaboration of the fourth and final component of Complexity Theory, namely self-organization and emergence.

2.6.5. Self-organization and Emergence

This section of the thesis has described and discussed the importance of non-linear dynamics, dissipative structures, relationships, reality, chaos, as well as strange attractor and feedback loops. However, the thesis has not yet presented *how* a complex system organizes itself.

While a simple or complicated system will have a closely designed structure to reach specific objects, the interactions between the elements of a system and its environment create

emerging properties in a complex system (Fernandez et al, 2007: 177), i.e. they are self-organizing. Microsoft Encarta (2008 (11) describes “emerge” as something that appears “*out of or from behind something*”. In contrast to a simple or complicated system, where the path is already planned, a complex system is about relating and adapting to what *emerge* through our co-existence with the environment.

Cilliers (1999:90) defines self-organization as:

“The capacity for self-organization is a property of complex systems which enables them to develop or change internal structure spontaneously and adaptively in order to cope with, or manipulate, their environment”.

While emergence is the result of our co-existence with the environment, self-organization is the process in which we *adaptively* react and co-exist with emerging events. As such, these are two phenomena that are closely interrelated and will therefore be presented together.

2.6.5.1. Characteristics of Self-organizing Systems

As the reader may have noticed, a number of the characteristics can be found directly or indirectly in the above description of complexity, thus also illustrating the inherent interconnectedness of a complex system. A system is not complex if it does not have emergence and self-organization, and a system cannot possess emergent and self-organizational properties without being a complex system.

Let us start off with a simple illustrative example.

Imagine that you are on your way to the city centre from your suburban house. Driving to the city there are a number of crossroads and roads merging into bigger roads (and vice versa). In a typical Newtonian Approach all these crossroads and “decision-points” are regulated by either “stop” signs or traffic-lights, i.e. there is a central authoritarian command ordering you what to do to what time. This pre-determined pattern of behavior often causes irrational, inefficient, ineffective and of course highly irritable situations. In the last decade however there are many places been an increase in implementing traffic circles instead of traffic lights. The effect is more in line with self-organizational systems, although it lacks some of essential properties. Instead of relying on a top-down approach regulated by traffic-lights, the agents (the drivers and their cars) base their behavior on a bottom-up and self-regulatory behavior. Simple rules such as “give way for vehicles coming from the right” give a very general guideline on how to act when coming to a traffic circle. These simple rules, however, give the

driver, and of course the overall traffic system, more flexibility and possibilities to adapt to the *de facto* environment.

Having the traffic-example in mind, the thesis will now take a look at some of the properties of a self-organized and an emergent system.

- I. Emergent and self-organizing systems are *neither good nor bad* (Johnson, 2001: 137).

As discussed above, complex systems rely on negative and positive feedback to survive. The negative feedback is equilibrium-seeking and stabilizing, while positive feedback is destabilizing and reinforcing. The feedback-mechanism, and the emerging result and self-organizing response, do not possess a moral or ethical compass that determine whether it is a good or a bad thing. Schneider and Somers (2006: 362) use the War in former Yugoslavia as an example of the potential “dark side” of emergence.

- II. The structure of the system is not determined by the system’s agents *or* the external environment, but the *interaction* between the system’s agents *and* the external environment (Cilliers, 1998: 91).

Paying attention to your neighbors (please also see “what are the characterizations of a complex system?”) is an essential part a complex system. On an atomistic level, every cell in the body does not wait for a command from a central authority, but acts on its own information based on the interaction with the neighboring cells (Johnson, 2001: 86). Each agent does not have a clear view of the whole picture, i.e. the complexity, and act only based on local information (Cilliers, 1998: 94). In other words, in a complex system each element needs to *adapt* to the environment (Nordstrom & Bloch, 2007: 15).

- III. Emergence and self-organizing systems are *patterns in time*, not isolated incidents (Wheatley, 1999: 125).

From a Newtonian perspective the whole is understood by merely having information about its different parts, while a Complexity Approach speaks for looking at the system from a more holistic point of view focusing on the patterns the system produces over time. This is best illustrated in the case of ants and ant-colonies, where the isolated agents of the colony are the ants. The ants have a quite short life expectancy and every agent does not affect the colony much during its life cycle. However, over a longer period of time, exceeding many generations of ants, the colony as a whole can change patterns dramatically. As the generations of ants come and go, the colony gains more collective

intelligence, become more stable and more organized (Johnson, 2001: 82). By simply studying the isolated parts of a system, the whole disappears (Wheatley, 1999: 125).

IV. Emergence and self-organization *increase in complexity over time* (Cilliers, 1998: 92).

The history of a system is important in developing complexity (Smith, 2007: 194). Without any historic data, the system starts at “ground zero” without any references on what to do, e.g. in a city some of the history, or its initial condition, is its physical infrastructure. Sidewalks, for example, are a necessity for creating local interaction which again lays the foundation for a higher order structure (Johnson, 2001: 96). Without sidewalks or any other arenas for interaction the conditions for the creation of higher order through self-organization are negatively affected.

While the term of increasing complexity over time so far has been connected with a relatively long period of time (years), e.g. as in the case of the ant-colony presented in point V, the principle is also relevant across shorter periods of time.

V. Self-organization and emergence are *bottom-up processes*, not top-down approaches (Johnson, 2001: 67; Cilliers, 1998: 91).

Self-organization and emergence are not the result of a pre-determined design, but as earlier described, a result of the interaction between the system and the environment. A Newtonian Approach will often emphasize *engineering* something, i.e. a top-down approach, while a Complexity Approach is interested in “*growing*” of a system, i.e. the bottom-up-process.

The bottom-up process is also closely linked to another phenomenon, namely *swarm logic*. The swarm logic is based on how seemingly simple behavior and in the ants case, a limited cognitive capacity can produce collective intelligence and results far exceeding the capacity of each agent. In response to changes in the environment, e.g. lack of food sources, ants who worked with nest-building will, without any centralized command, change to searching for food. The micro-organization, in this case the isolated ant working on the nest, and macro-organization, i.e. the overall state of the colony, is connected (Johnson, 2001: 74). This swarm-like behavior is also observable in organizations where a set of simple rules create the basis for complex collective behavior (Plowman et al, 2007: 350).

Because one characteristic of a complex system is that it has self-organizational capabilities, it is also evident that the process of self-organization tends to result in an optimum structure, i.e. *self-organized criticality* (Cilliers, 1998: 95-96).

Imagine that a little child is playing in a sandpit. As the child heaps spade upon spade of sand, one atop the other, the result is a pyramid (assuming that the sand is quite dry). Once the pyramid reaches a certain state the sand will start to roll down again, i.e. the pyramid has reached a *critical height*. If the child tries to heap more sand on, grain by grain, these grains will not fall off individually but rather either stick to the pile or create small avalanches.

This example is related to self-organized criticality in a number of ways. First of all, the critical height is continually maintained. If it is too low, more sand will attach itself to the pyramid and if it gets too high, more will fall off. Secondly, the effect of one more grain put on to the pyramid is not possible to predict, thus it is not causal. When, however, the one grain starts an avalanche which brings the pyramid down to the critical height again, it is through non-linear dynamics. Thirdly, this example shows how a system tunes itself to a critical point where it is highly sensitive to initial conditions. Fourth and finally, a self-organized system will try to balance operating on the edge of chaos on the one hand and rigid stability on the other hand. A chaotic condition that develops to total randomness is equally dangerous as a static condition (Cilliers, 1998: 96-98).

So far this thesis has described four different components of Complexity Theory, namely non-linearity, chaos, feedback and self-organization/emergence. As earlier emphasized, these components (and every other component) are interconnected and must be interpreted from a holistic point of view. In order to put the characteristics and components of a Complexity Approach into an empirical framework, this thesis now addresses some of the implications it may have for organizations.

2.6.6. Implications for Organizations

Stacey and Griffin highlight two general consequences of adapting a Complexity Approach. First of all, *“no one can step outside of their interaction with others”* (2005: 9-10). The main thought behind this principle is that we co-create the future based on local interaction. From a traditional point of view, individuals can be viewed as agents working on a lower level than the organization, but from a complex point of view it is the individuals who are the organization. Patterns of the organization emerge as a result of interaction between agents across the organization and outside the organizational framework, not by someone who

stands on the “objective” outside looking down on the organization and giving directions to follow. Secondly, the organization’s plans and designs are not valid if the individual components of the organization do not incorporate it in their local interaction (Stacey and Griffin, 2005: 10).

The latter points out what is essential in a Newtonian system, namely *planning*. In a Newtonian system detailed plans, blueprints and policies are the pathway to obtain organizational objects. As illustrated in the traffic-light example under the paragraph “self-organization and emergence” urban engineers and city planners create more and more *complicated* and *top-down solutions* to achieve flow in the traffic. However, as the traffic-flow *de facto* is a complex system with a high degree of emergent behavior, the complicated and top-down solutions become insufficient.

As explained by Stacey, Griffin and Shaw, there are *strict limitations on predictability* in a complex system. Short term developments are predictable to a higher degree due to the fact that it takes time for a complex system to amplify small changes in the initial conditions phase. It is therefore important for any individual or organization to plan the next step, but long term development emerges over time and cannot be predicted (Parker & Stacey, 1997: 41) Thus, the ability to plan and design are limited in a complex system (Stacey, Griffin & Shaw 2000: 123-124; Stacey, 2006: 138). Some might ask the critical question what would happen if you take away all regulations (e.g. traffic-lights and stop-signs). The answer is not whether to have regulations or not, but the way to impose these regulations. In the case of the complicated and top-down solutions presented by city planners and engineers, the solution might be to integrate the traffic-lights into a learning network based on bottom-up processes, feedback-loops, local interaction and pattern recognition, all principles based on self-organizing systems.

In other words, the organizations *should*, in order to *adapt to* complexity, redefine their approach to planning. Short term planning with detailed descriptions is often a necessity, but long term planning should have some of the following characteristics:

- Long term planning should not be based on assumptions of the future, i.e. trying to forecast what the future might bring.
- The plans must be open and flexible in order to create opportunities to adapt to changing circumstances.
- The plans should not only be based on quantitative measurements, but also integrate qualitative measurements to a larger extent. Or said differently, the plans should integrate the potential negative side effects of using a quantitative approach.

- The plans should focus on what the organization wants to achieve, i.e. the intention and purpose of the plan, but not in terms of quantitative measurements.
- The plans should reflect general principles and values and not specific steps on how to reach the desired state, thus keeping the door open for self-organization.

One might suspect that the emphasis on flexibility, principles, values, adaptation and bottom-up processes imply that a complex system does not have rules, where in fact it is the opposite. Complex systems are *highly rule-governed systems* (Johnson, 2001: 181). The point of distinction between a Newtonian and a complex system is, however, when Newtonian systems are governed by a high number of rules and procedures throughout the organization, a complex system is in contrast governed by a *set of small simple rules* working from a bottom-up approach.

In the case of the ants, for example, an ant meeting other ants will be based on local interaction to decide whether to forage or not (Johnson, 2001: 181). When you see a flock of geese flying in a perfectly triangular shape over the sky, one might use it as a metaphor of leadership from front. However, the fact is that the birds form the flock based on following a set of simple rules, finally ending up together in a perfect shape (Johnson, 2001: 166-167). This principle has also been adapted by many successful organizations such as the General Electric. In order to optimize the organization the CEO Jack Wells created “strange attractor cages”. The cages consisted of a vision instead of supervision, process-incentives instead of content-directives and “Management by tension” instead of the traditional “Management by objectives”. The general framework, together with a number of other principles, created a space for the employees to work within which still allowed emergence, self-organization, creativity and novelty (McKelvey, 2008: 3).

So far this thesis has investigated the differences between a Complexity- and Newtonian Approach. At this point we might stop and ask ourselves how these approaches become visible in the organization’s actions? The thesis will now discuss organizational attributes in equilibrium seeking and self-organizing organizations.

2.6.6.1. Organizational Attributes

Kiel (1994:185) highlights the differences between equilibrium seeking and self-organizing organization. The equilibrium seeking organization is often connected to a Newtonian organization, while the self-organizing organization is connected to a Complexity Approach. Table 3 presents the different macro- and micro level properties for different organizational attributes.

Attribute	Equilibrium seeking	Self-organizing
	<i>Macro level properties</i>	
Culture	Unified equilibrium	Diversified far-from-equilibrium
Strategy	Adjustment	Continuous emergence
Planning	Stable goals	Continuous bifurcation
Structure	Flattened	Process structure
Distance from client	Remote	Involved participation
Environmental fluctuations	Damping	Creative response
Work force demographics	Mandated diversity	Intentional diversity
	<i>Micro level properties</i>	
Work teams	Stable	Unstable
Control mechanisms	Defined tasks	Bounded instability
Work process	Sequential	Re-engineered parallelism
Process analysis	None	Activity based costing
Variations in systems	Source of error	Source of learning
Change process	Incremental restabilization	Perpetual innovation
Chaos	As excuse	As opportunity

Table 3 - Attributes of organizations (Kiel, 1994: 186-187)

A unified organizational *culture* has the potential downside of creating intellectual “lock-in” (Kiel, 1994: 185). The consequence is an organization less capable of reacting to sudden change and less likely to exhibit innovation and creative ideas. A culture that might be characterized as operating far-from-equilibrium will have a majority of heterogeneous agents, both in terms of background, knowledge and culture, and will have a better starting point for creating novelty (McKelvey, 2008: 3). One of the means to achieve the far-from-equilibrium organizational culture is intentionally to create *diversity* in the work-force demographics (Kiel, 1994: 188). Multiculturalism will most likely create more instability in the organization, an important issue for the creation of organizational renewal.

Traditionally, an organizational structure has different stable *work teams* assigned to solve specific missions. In a far-from-equilibrium organization however, the work teams are constantly shifting in order to create new arenas for the employees to express themselves (Kiel, 1994: 188). Jack Wells refers to this as “weak tie flooding”. As opposed to “strong ties”, the “weak ties” do not create group thinking and offers more potential for innovation (McKelvey, 2008: 3).

This thesis has earlier emphasized the limitations of predictability. From a Newtonian point of view a *strategy* is based on the assumption of future events. In reaction to changing circumstances an equilibrium-seeking organization will adjust through an incremental process. A self-organizing system will, however, have multiple and flexible strategies allowing emergence instead of continuously adjusting (Kiel, 1994: 188-189). The question of strategy is also very much connected to *planning*. Stacey, Griffin and Shaw (2000: 123-124)

and Stacey (2006: 138) point out that long term planning is not possible in a complex system. However, short term planning is highly possible and necessary.

Organizational Design Theories teach us that one can organize through the use of categorical and functional thinking. In a Newtonian organization the structure will often be hierarchical, top-down based and “engineered” to fulfil the objectives of the organization (Kiel, 1994: 190). The *control mechanisms* are often based on input and well-defined tasks (Burger & Woods, 2008: 22).

Complexity Theory emphasizes process-orientation instead of objective orientation. Instead of functional analyses, the managers should identify the internal and external *processes* that are linked to the organization and adapt the structure to the *de facto* circumstances (Kiel, 1994: 191). This view implies a number of things. First of all, the control function must be redefined integrating process-thinking, output and outcome oriented work and possibilities for self-adjustment (Kiel, 1994: 191). Secondly, it speaks for a networked and interdependent environment, not just vertical integration popular in hierarchical thinking (Burger & Woods, 2008: 27). Thirdly, *variations* in systems are looked upon as opportunities and not as sources of error (Kiel, 1994: 191). Fourth and finally, the outcome or output is much more important than the product itself. A strict focus on product quality is connected to input-orientation, while a holistic approach integrates input, convergence, output and outcome into the equation (Burger & Woods, 2008: 22).

The way the public relates to the public services have changed considerably over the last couple of decades. Especially in OECD-countries where a new public demand has emerged as a reaction to a little transparent and inclusive government (Manning, 2001: 297). The traditional view has, from the government perspective, been to *remote* itself from the public. A self-organizational approach, however, emphasizes the organization’s co-existence with the environment (Kiel, 1994: 192). Earlier, the participation, or the attempt to participate could be interpreted as a possible source for destabilization, i.e. as something *chaotic* and negative. However, a Complexity Approach suggests that this destabilization and chaotic condition is something positive that creates opportunities for renewal and change.

As discussed in this part of the chapter, adhering to Complexity Theory-principles will have big implications for organizations. The organizational attitude towards either Newtonian or a Complexity Approach becomes visible through the culture, the strategies, the work-teams and the control mechanisms in the organization.

We now provide a summary of the most significant finding of this chapter.

2.7. Summary

This chapter has attempted to obtain research objective 1, *to define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.*

In order to achieve research objective 1 the thesis divided research objective 1 into multiple sub-objectives. The main findings of this chapter are linked to the different sub-objectives.

Research objective 1.1: To define Complexity Theory.

There is no uniform and generally acknowledged definition of Complexity Theory. The common denominator seems to be that every definition explains different aspects of a Complexity Approach. However, there are a number of key points that are highlighted, such as non-linearity, hidden or underlying order, self-organization, emergence and network-thinking.

Research objective 1.2: To describe the evolution of the Complexity Approach.

The *evolution* of the Complexity Approach is based on the evolution of the Natural Sciences. The work of Einstein, Bohr and Poincaré created much of the basis for the development of Quantum Mechanics that is the foundation for the Social Science Theory of complexity. The Quantum Approach can, simplistically speaking, be characterized as opposite of a Newtonian way of thinking.

Research objective 1.3: To describe and differentiate between what is simple, complicated and complex.

In order to further differentiate between a Newtonian and a Complexity Approach it is necessary to distinguish between what is *simple, complicated and complex*. A simple and complicated thing is something non-organic that in varying degrees consists of linear and causal relationships working in a relatively closed system. A complex thing, however, is a living thing that consists of non-linearity, non-causality and that can be characterized as an open system. A simple and complicated system can be perceived to be a complex one because it appears to be complex, and vice versa for the perception of a complex thing. E.g. a fighter plane might appear to be complex because it consists of many different parts, but it is merely complicated. A nut, on the other hand, might appear to be simple, but a closer look reveals complexity.

Research objective 1.4: To describe and discuss what the characteristics of a complex system are.

A complex system will inherently have many similarities as a natural system, i.e. a *living* system. From the work of Capra (2007) Johnson (2001) and Cilliers (1998) a number of key features can be identified. First of all, there are a large number of agents. Second, the large number of agents has to interact with each other in a dynamic way. Third, one agent is not solely affecting another one, but many other agents, i.e. the interaction is rich. Fourth, the interactions are of a non-linear character. Fifth, the interaction is based on local information from the immediate neighbouring agents. Sixth, there are positive and negative feedback-loops. Seventh, complex systems interact with their environment, i.e. they are open systems. Eighth, in order to maintain a constant flow of energy a complex system operates in a far-from-equilibrium state. Ninth, the history of a complex system is co-responsible for the present actions of the system. Tenth and finally, each agent of a complex system responds to local information and does not have clear view of the holistic status of the system.

Research objective 1.5: To describe the Newtonian Approach and its general implications.

The Newtonian Approach is based on amongst others Cartesian Reductionism and the work of Sir Isaac Newton. The main characteristics of a Newtonian system, which is often referred to as a machine or clockwork, is that it is a casually closed systems based on linear thinking. It has an atomistic approach to analysis and argues that the whole of a system can be understood by merely analyzing the parts. Control and equilibrium are two important components and are the optimal objectives of any mechanistic organization.

Prediction and forecasting are essential elements in order to create balance and control. The detailed plans and blueprints are therefore based on assumption of what the future will bring and does not include the external environment. A Newtonian Approach further implies that reality is merely something objective and material, and that the best way to understand the world is through the use of a quantitative methodology. Chaos or instability is looked upon as something negative, a source of error, and not as a possibility. In that sense, any change, either internal or external, is seen as something destabilizing. The organizations that are heavily influenced by this way of thinking are often heavily formalized hierarchical structures with a top-down approach to leadership.

Research objective 1.6: To describe and discuss the most important components of Complexity Theory and differentiate it from a Newtonian way of thinking.

A complex system does not consist of single components, but must instead be looked upon as a holistic system where the different units or agents are interconnected. In that sense, a total differentiation between the components is difficult. However, in order more easily to present and highlight the differences, this thesis has divided the most important features into

four categories, namely non-linearity, chaos and strange attractor, feedback and self-organization/emergence.

A system cannot be complex without being *non-linear*. Non-linearity refers to how a relationship is not proportional and the manner in which tiny causes can create huge effects. Implicit in this statement is the fact that a non-linear system is highly sensitive to initial conditions. A slight increase in the average global temperature, e.g. a couple of degrees Celsius, might result in drastic changes for all life forms. In a non-linear system the relationship between things is a subject of interest, in stark contrast to the objective-oriented Newtonian Approach. The relationship does not need to be of a physical character, thus reflecting the view of reality as consisting of more than simply physical items.

Chaos refers to the fact that a system is out of balance. From a traditional point of view, this might be interpreted as a disaster, but in a complex system the instability reflects a constant flow of energy and opportunities. When a system is in an *apparently* chaotic state of mind it is the strange attractor that brings the system back into balance. In a Newtonian system an attractor is fixed, e.g. a quantitatively measured objective, while in a complex system the attractor is “strange”. The “strange” refers to the fact that the attractor is dynamic and not stable, e.g. in an organizational setting values and culture might behave as a strange attractor. Without chaos in a system, the system will be in a constant equilibrium with little opportunity for novel change.

In a complex system there exists both negative and positive *feedback*. The negative feedback is stabilizing and equilibrium seeking, while positive feedback is destabilizing and reinforcing. A Newtonian system will rely on negative feedback in order to close the gap between the desired state and the *de facto* state. Positive feedback will, on the other hand create a bigger gap between the desired and *de facto* state. The latter is linked to how seemingly insignificant changes in the initial conditions might lead to great effects based on positive feedback and non-linear dynamics. The positive feedback, but also the negative feedback, is then an important part of a complex system.

The *emergence* of events in a complex system creates the need for *self-organizational* properties. While the future is already set from a Newtonian perspective, emergence highlights the importance for adaptation and co-existence with the environment. Self-organization is the process where a complex system adapts to the changing environment and learns how to work within the boundaries. The self-organizational process is therefore just not a reaction to the environments’ action, but rather a continually learning process of adaptation.

A Complexity Approach creates a number of implications for organizations. Some of the critical questions one might ask are to what extent it is necessary, and suitable for our purposes, to implement long term planning and a highly regulated regime? How efficient is a top-down and hierarchical approach?

As the thesis has clarified what Complexity Theory is and how it differs from a Newtonian Approach, the study will now look at what implications a Complexity Approach has on leadership.

Chapter 3 – Traditional leadership and Complexity Leadership

“We’re in a knowledge economy, but our managerial and governance systems are stuck in the Industrial Era. It’s time for a whole new model”

Manville & Ober (2003) quoted in Uhl-Bien et al, 2007: 298.

Comparing a Newtonian Approach and a Complexity Approach, the only common denominator seems to be that they are based on different and often contradicting principles. Historically, a Newtonian Approach has been the foundation in the leadership debate, but as the discussion in this thesis so far has illustrated, a shift may be necessary. In this connection this thesis finds it relevant to formulate the following research objective.

Research objective 2: To investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.

In order to achieve research objective 2 this chapter is divided into multiple sub-objectives:

Research objective 2.1: To define leadership.

Research objective 2.2: To describe the traditional approach to leadership.

Research objective 2.3: To describe the general implications of a traditional approach to leadership

Research objective 2.4: To discuss what implications a Complexity Approach has on leadership

Research objective 2.4.1: To discuss the changing context and future of leadership

Research objective 2.4.2: To discuss the complex leader as an enabler

Research objective 2.4.3: To discuss the complex leader and the aspect of change

Research objective 2.4.4: To discuss complex leadership and the use of values and vision

Research objective 2.4.5: To discuss complex leadership and micro-level interactions.

Research objective 2.5: To present a list of propositions for complex leadership

Research objective 2.6: To summarize the most important points of the chapter

With the aim of attaining research objective 2 and its sub-objectives this chapter will initially present different definitions of leadership. Then it will continue to describe the traditional approach to leadership that encompass *inter alia* different approaches and fundamental principles. When describing the general implications of a traditional approach, this thesis will argue that there is a strong link between the Newtonian view presented in chapter 2 and the traditional approach to leadership. As the chapter now has made a comparative basis, the thesis will continue with a discussion on the implications a Complexity Approach has on leadership. The discussion will be divided into five different sub-sections where the changing context and future of leadership, the leader as an enabler, the leader and change, the use of values and vision and micro-level interaction will be discussed. As a concluding and summarizing part, this thesis will then present a list of propositions for complex leadership. Finally, the thesis will summarize the most important parts of the chapter and indicate implications of this investigation for further progress and development.

3.1. Definition of Leadership

There are many definitions of leadership in the current leadership paradigm, which perhaps also symbolizes the complexity, diversity and somewhat abstract and intangible sides of what is considered to be a contemporary interpretation of leadership.

Katz and Kahn (1978) quoted in Schneider and Somers (2006) define leadership “as *incremental influence over and above compliance with routine direction*”.

Leadership is the process through which leaders exert influence on others to achieve their mutual goals and maintain effective working relationships among members (Johnson & Johnson, 2006: 168).

Yukl (1981: 2) defines leadership as *inter alia* “*the behavior of an individual when he is directing the activities of a group toward a shared objective*”.

Dubrin (2007: 2) defines leadership as “*the ability to inspire confidence and support among the people who are needed to achieve organizational goals*”.

Fox (2005: 4) points out that all traditional definitions of leadership usually assume that there is interaction between two or more people, where intentional influence is present by one person over others persons.

A number of authors make a distinction between leadership and management. While leadership is about people, management is about planning, organizing, directing and controlling (Dubrin, 2007: 4-5). This view however is artificial and a contradiction to the

principles of Complexity Theory. Leadership and management are interconnected and treating it as two separate concepts only make it harder to understand the whole (Taylor, 2005: 140). Thus, in this thesis leadership will also include certain aspects of what traditionally have been referred to as management, e.g. the issues of planning and forecasting that have been presented in chapter 2.

In order to make a basis for comparison this thesis will now present the traditional approach to leadership.

3.2. The Traditional Approach to Leadership

When you are describing what the traditional approach to leadership is the first thing one must acknowledge is the huge amount of literature available on the field of study. A Google-search for books and articles related to leadership results in approximately 533 million hits (Dubrin, 2007: 2). This vast amount of literature also implies that leadership is a dynamic field of study that is non-tangible and difficult to understand fully.

In order to more clearly differentiate between a Newtonian and Complexity Approach to leadership, this thesis will focus on traditional leadership approaches that are most compliant with a Newtonian way of thinking. As such, there are traditional leadership theories that to *some* extent incorporate some of the principles from complexity, but still are based on a majority of Newtonian Principles.

According to Schneider and Somers (2006: 352-353, General Systems Theory (GST) forms the foundation for the majority of traditional organizational and leadership research, e.g. systems thinking approach by Hunt (1991) and contingency thinking by Fiedler (1967).

Two poles are often identified in exercising leadership. These are an autocratic approach and a democratic approach. The autocratic perspective is leader focused, masculine and task-oriented, while the democratic perspective is people-centered, feminine and relationship-oriented (Fox, 2005: 92; Park, 1997: 168; Park, 1996: 13). The task-orientated style is again linked to what Rowe and Mason (1987) refer to as the *directive and analytical decision style*, which emphasizes masculine values like practical orientation, authoritarianism, impersonality, intellect and control-orientation. The relations-oriented leadership style, however, is associated with the *conceptual and behavioral decision style*, which emphasizes traditionally feminine values like being flexible, adaptive, sociable, friendly and supportive (Park, 1996: 13-14).

Hersey and Blanchard (1977) and their *Situational Leadership Theory* describes how a leader, influenced by the characteristics of group members, should act in accordance with the situation (Dubrin, 2007: 145). The theory uses the earlier explained task and relationship-oriented approach as a starting point for the leader to choose the correct action according to the group members' job- and psychological *maturity*.

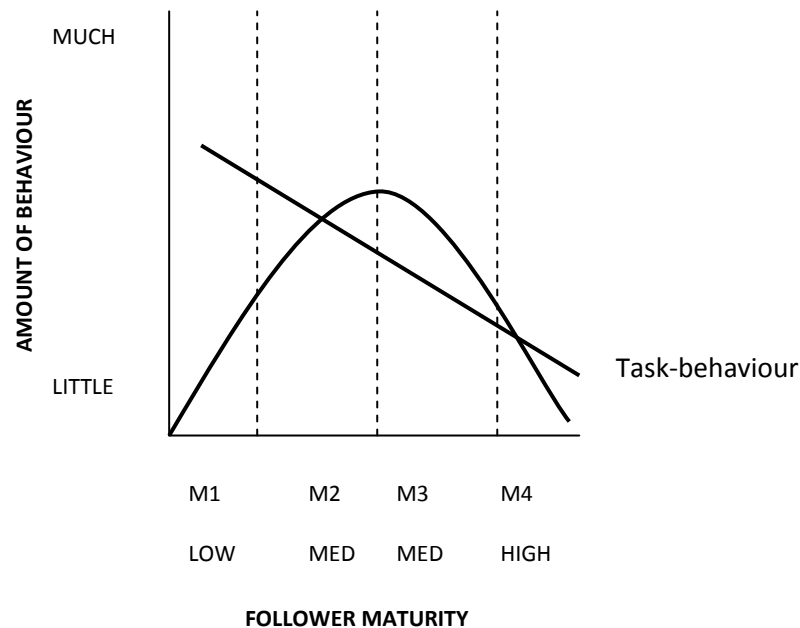


Figure 4: Task and relationship behaviour (Fox, 2001: 102)

As illustrated in figure 4, the theory claims that as the level of the subordinates' maturity increases, the leader should use less task-behavior and more relationship-behavior until the level of maturity is moderate (M2 & M3). If the subordinate has low job maturity (M1), the leader should concentrate on task-behavior instead of relationship-behavior. If the individual on the other hand has high maturity in both job- and psychological maturity (M4), the individual will have both high technical skills and self-confidence and the leader does not need to use much task- or relationship behavior, both rather focus on delegation and self-autonomy (Fox, 2001: 102).

In addition to situational leadership, the following main research directions have been evident:

The power-influence approach to leadership focuses on what power the leader has available and how the leader exercises the power over its subordinates (Yukl, 1981: 7).

The trait-approach to leadership emphasizes on what traits the leader has and how these characteristics make them leaders (Yukl, 1981: 7). The traits can be physical, e.g. appearance, or mentally such as intelligence (Schwella, 2008: 17).

The behavioral approach to leadership has a lot in common with the situational approach to leadership, but states that the leader should always focus on both task- and relationship behavior, while the situational approach argues that the leader might only focus on one of them or none, all depending on the situation (Schwella, 2008: 18). The importance is thus not the amount of power or what traits the leader has, but what the leader *de facto* does.

The transformational - or charismatic approach to leadership emphasizes that leaders should inspire and motivate the organization for the pursuit of a shared and powerful vision (Schwella, 2008: 18-19). As such, the leader is *the* essential part of the organization's capability to achieve goals.

Some generalized observations can be made based on the discussion of the traditional approach:

- The leadership perspective is person-centered.
- The leadership perspective is based on the relationship between the leader and his/her subordinates, but not necessarily on the interaction.
- The leadership perspective is based on the belief that the leader is to a large extent the initiator, director, controller and evaluator. In other words it is a top-down process.
- The leadership perspective is based on a rather closed-system-view where the external environment, to a high degree, is left out.

These generalized observations become evident when analyzing the rational model of management (figure 5).

The process is divided into three different stages, discovery, choice and action. The *discovery* phase is initiated because there is a change in circumstances, i.e. there is a gap between the desired state and the *de facto* state. *The choice phase* intends to create balance by looking at a set of options that are generated based on new and existing objectives. Through thorough analyses and evaluation the most cost-effective and feasible option is chosen. The *action phase* is when the chosen option is implemented. The action may be in a form of policy change or changes in standard operational procedures (SOP) (Parker & Stacey, 1997: 49-52; Edvardsen, 2000: 265).

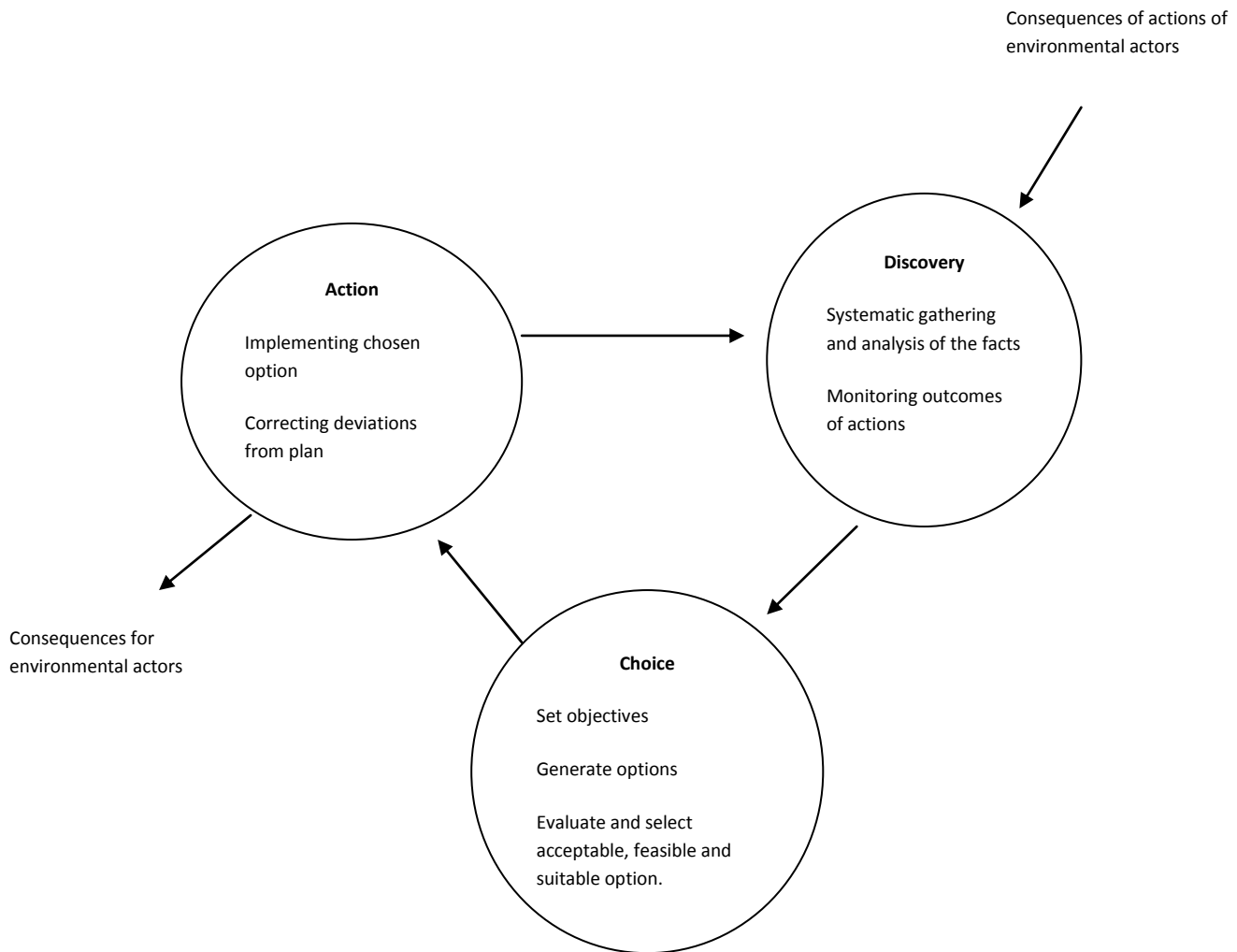


Figure 5 - The rational approach to management (Parker & Stacey, 1997: 51)

The model is a “step-by-step” procedure on how to manage changing circumstances. The process is causal and does not consider the impact of the environment. Negative feedback mechanisms are highly evident in the search for creating balance in the organization. Although it is a presentation of a rather closed system, the model implies a reaction to changing external circumstances, but not an adaptation. The choices and actions being made are based on the objective of reaching a certain specific goal or state. In order to formulate the goals and objectives assumptions of the future are made in order to create as feasible strategies as possible.

Dubrin (2007: 3-5) argues that leadership can be looked upon from different aspects, i.e. either as a partnership, as a relationship or leadership as equivalent with or a part of management. In addition, Dubrin offers evidence that formal leadership does not always make a difference. Substitutes for leadership such as close-knit teams, intrinsic satisfaction, computer technology and professional norms downscale the need for traditional leadership.

Another point of view is that leaders are irrelevant, due to the fact that there are more factors outside the leaders' control that have more impact on the organization than the leader itself (Dubrin, 2007: 8-10).

Given the generalizations on the traditional perspective on leadership the question arises how this approach relates to the literature previously presented. In the next section the relationship between the traditional approach to leadership and the Newtonian Approach will be examined.

3.2.1. Key Implications of a Traditional Approach to Leadership

According to Fernandez et al (2007: 181- 182) the traditional approach to leadership and management has been anchored in a western way of thinking and is deeply rooted in Newtonian Principles. As discussed in chapter 2 there are a number of key assumptions to this way of thinking, the most important ones being:

- Reality is objective
- Based on a view that relationships are causal and that effects are linear the future can be predicted. In other words it is deterministic.
- A system can be understood by merely analysing its parts. In other words complexity phenomena are reduced to simple ones through a process of reductionism (Nilsson, 2007: 247).

Uhl-Bien, Russ and McKelvey (2007) further highlight some implications and assumptions in traditional leadership thinking. First of all, goals are set according to a rational process and the organization and its elements are structured to achieve these goals. Secondly, the traditional approach emphasizes how leaders within the hierarchy and formal structures can influence the others to achieve the desired goals, e.g. through means of motivation. Thirdly, effectiveness and efficiency are important components and objectives in the incremental and rational organizational processes. Fourth and finally, there is a contradiction between the need of the knowledge era and the often centralized and formalized reality of the organizations.

Plowman et al (2007: 341) argue that a traditional approach to leadership implies that organizations are equilibrium seeking systems that assume the future is possible to predict and that the world is a mechanistic place that demands prescribed rules, a high degree of formalized power and hierarchical authority (Plowman, 2007: 343). The planning processes, the implementations processes and the monitoring and evaluation processes are all means

for leaders to create balance and control within the organization (Stacey & Griffin, 2005: 3). Leadership styles in the traditional approach, whether it is trait-based, behavior based or transformational, share the common assumption that leaders actively shape the future through e.g. planning, directing and monitoring. The processes are deterministic in that they inhibit bottom-up approaches and assume chaos is something negative (Plowman et al, 2007: 343-344). Precise predictions, which are an important part of the traditional approach to leadership, are impossible especially over long periods of time or in the case of considerable turbulence (Burns, 2002: 43).

A traditional approach can in many ways be connected to the characteristics of a simple or complicated system, but not a complex system. A simple and complicated system is based on the same premises as the traditional approach, e.g. causality, linearity, rationality, objectivity, order, stability and equilibrium seeking. A complex system, however, is based on different principles. Using a traditional approach to leadership in a complex system clearly offers a mismatch. E.g. while a traditional approach speaks for an objective world where prediction and forecasting are central, a Complexity Approach argues that reality is co-created and long term planning based on assumptions of what will happen in the future is impossible.

Burns (2002), however, claims that the role of the leader is the same in the traditional approach as in the Complexity Approach. The difference however is the *purpose* of the leadership. While leadership in the traditional approach strives for predictable control, the leadership in complexity works as the glue in the organization, holding it together during lack of control and long-term accurate predictions (Burns, 2002: 49-50). As such, traditional leadership theories might contribute to some insight and understanding in particular contexts (Schneider & Somers, 2006: 363), but the general assumptions are based on principles that much contradicts the *de facto* reality of our nature. In other words, it is the underlying and supporting processes around the actual execution of the leadership that is a contradiction, not necessarily the leadership approach *per se*.

The mismatch between the traditional approach to leadership and complex reality raises a number of questions on how the leaders should *react* to complexity, e.g.:

- What actions or behavior should leaders emphasize?
- What approach to leadership is best?
- Is there a need for a change in values?

The thesis will now continue to investigate what implications a Complexity Approach has on leadership.

3.3. Complexity Theory and Leadership Implications

Leadership has originally been treated as if it is something tangible and objective that someone can possess (Taylor, 2005: 141). The past events have been the main focus in creating future events. The present has been interpreted as a single moment in time to analyze the past and determine the future, not a place where action takes place. The history of a system is indeed important, but is important in a sense that it is a prerequisite for co-existence which happens in precisely this moment. A Complexity Approach to leadership speaks for a fundamental shift, where the present is the main area of focus and where the future is understood as something emerging through a process of interaction between human beings and the environment (Taylor, 2005: 131).

This part of the discussion will fall in to three (3) parts. The first part will be a short discussion of the changing context and the future of leadership. Secondly, different characteristics of complex leadership will be discussed. Thirdly and finally, a table of propositions for complex leadership will be presented.

3.3.1. Changing Context and the Future of Leadership

Thomas L. Friedman in his book “the world is flat” examines how globalization of our world is creating a flatter world. Friedman argues that the fall of the Soviet Union and the introduction of the World Wide Web were two of the leading events to the flattening of the world (2005: 50, 59). The changes in global patterns have been manifested by relatively uniform work flow software, the uprising of virtual communities, outsourcing, off shoring, supply chaining, information availability and the development of the digital world (Friedman, 2005: 76, 93, 126, 136, 151, 176 & 186).

Martin (2007) claims that globalization has created a rise in complex challenges and that the leadership skills needed to address these challenges are different than in traditional leadership. A shifting competition base, increased expectations, the need for innovation, mergers and acquisitions and the persistent need for reinvention are some of the factors that contribute to the complex challenges (Martin, 2007: 7). This is a major step away from the Weberian bureaucracy where the focus is stability, effectiveness in production and incremental change. The increased complexity speaks for the development of a leader’s capabilities. The survey managed by the Center for Creative Leadership (CCL) shows that in 2002 the ranking of an individual’s leadership skills were relatively Newtonian and masculine-oriented, e.g. by the emphasis on resourcefulness, straightforwardness, rationality

and decisiveness. The future rank, however, shows a change towards relationship orientation, change management and participation management (Figure 6 - Martin, 2007: 6), i.e. more complexity oriented leadership skills and traditionally feminine values.

<i>Individual leadership skill categories</i>	<i>2002 rank</i>	<i>Future rank</i>
Leadership employees	1	1
Building and mending relationships	5	2
Change management	7	3
Participation management	6	4
Resourcefulness	2	5
Decisiveness	4	6
Doing whatever it takes	7	7
Straightforwardness and composure	3	8

Figure 6 - Leadership skills – past and future (Martin, 2007: 6)

In order to meet the challenges of the increasing complexity leaders should emphasize a new skill set that highlights collaboration, teamwork and innovation. Organizational design must promote interdependence and collaboration. In order to develop the desired skills leaders must seek new challenges and be open and adaptable to new ideas (Martin, 2007: 6-8).

The changing context illustrates the need to think new about what should be important in leadership. The next section will investigate the leadership capabilities which are desirable in a complex setting.

3.3.2. Complexity Leadership

The often automatic response to complexity is complex solutions that generate more coordination, more direction and more planning. The result is the overproduction of boundaries so that the organization is unable to react to its environment (Edvardsen, 2000: 273). The mechanistic and often technical perspective from the traditional approach to leadership is substituted in a Complexity Approach by looking at leadership from a social perspective focusing on everyday interaction between human beings (Griffin, 2005: 29).

In order to substantiate the latter view, this thesis will discuss the complex leader as an enabler, the complex leader's role in change, the use of vision and values in a complex leadership and the focus on micro-level interactions. Each part will also include a proposition of steps one can take in order to achieve complex leadership.

3.3.2.1. Complex Leaders as Enablers

Schneider and Somers (2006) state that the leadership process in a Complexity Theory approach is qualitatively different from a traditional General Systems Theory (GST) approach. Instead of relying upon autocratic structures, control, formalization and routine, the leader must put emphasis on serving as a context setter and an enabler for the self-organizational processes (Schneider & Somers, 2006: 356; Plowman et al, 2007: 344). The leadership role is not just a result of a formal procedure, e.g. due to a position, but is often based on informal leadership.

Complex leaders seldom use authority as a means of leading, but rather support the indirect and catalytic processes within the organization (Schneider & Somers, 2006: 357; Burns, 2002: 49; Simpson, 2006: 479; Fairholm, 2004: 375-380; Cole, 2007: 229). In order to enable these processes and create a complex environment the leader can indirectly and directly affect the number of elements in the system, the inter-relatedness within the organization, the inter-relatedness with the external environment and the common beliefs shared by the different sub-departments (McKelvey, 2008: 3; Schneider & Somers, 2006: 358). In other words, in order to lay the framework for the creation of both a complex environment and an approach to manage complexity, the leader must support important principles such as interdependence, network thinking and diversity.

According to Uhl-Bien, Russ and McKelvey (2007) leadership in Complexity Theory can be gathered around three main functions; administrative-, adaptive- , and enabling leadership. *Administrative leadership* refers to the more traditional approach to leadership where actions are taken to accomplish organizational goals in an efficient and effective way. The approach is top-down-driven, authoritarian and person-centered. *Adaptive leadership* refers to “*adaptive, creative and learning actions that emerge from the interactions of CAS [complex adaptive systems] as they strive to adjust to tension*”. Adaptive leadership is not person-focused, but rather a dynamic process that emerges through interaction between agents and the environment. As with all complex systems, the possibilities for adaptation are evident when the system is out of balance, e.g. when there are conflicting ideas and interests within the organization. Prerequisites for adaptive leadership are network dynamics and emergence. *Enabling leadership* refers to the structuring and enabling of complex behavior and to the management of the entanglement between the administrative and adaptive-leadership (Uhl-Bien et al, 2007: 299, 305-308, 314). In order to *enable* adaptive leadership enabling leadership must:

- Catalyze interaction to allow more freely flowing information.
- Create interdependent agents
- Foster tension to create instability (Uhl-Bien et al, 2007: 309, 310 & 311).

The framework presented by Uhl-Bien et al presents the dynamic relationship between administrative-, adaptive- and enabling leadership. The approaches are interrelated and every approach is important in the organization. A high degree of administrative leadership, i.e. an authoritarian and control-based approach can negatively affect the adaptive capacity of the organization, while a too high degree of adaptive and enabling leadership might cause the system to lean towards randomness (Uhl-Bien, 2007: 306). McKelvey (2008: 3) refers to this as the “complexity catastrophe”, where there are too many connections and interaction.

The observant reader will notice that adaptive and enabling leadership, and the views offered by Schneider and Somers (2006) have a number of similarities to Cilliers’ characteristics of a complex system presented in chapter 2. The approaches emphasize a system consisting of a relatively large number of agents that through interaction and interdependence co-create the present and the future. These views support a system operating far-from-equilibrium and it consists of both negative and positive feedback mechanisms.

In light of the literature presented in this section a set of steps to achieve complex leadership can be proposed.

Steps to achieve complex leadership

Plowman et al (2007) argue that power in an organization is the result of the leader’s capability to allow emergence and self-organization rather than engagement in deterministic planning and control sequences. Leaders should aim at destabilizing instead of stabilizing, e.g. through disrupting existing patterns, creating and surfacing conflict and embracing uncertainty (Plowman et al, 2007: 344; Parellada, 2007: 166; McKelvey, 2008: 3; Uhl-Bien, Russ and McKelvey, 2007: 311; Uys, 2002 41; Kiel, 1994: 204-205; Walker, 2006: 102-103; Parker & Stacey, 1997: 34, 64). Traditionally speaking, the job of a leader is often the opposite, to stabilize and create harmony and certainty. Furthermore, leaders should encourage innovation instead of innovating, i.e. leaders should empower the employees and create enough space for self-development. Some of the actions leaders can take to substantiate this are to establish simple rules and encourage “swarm like behavior”.

The first point highlights the need for leaders not to lead by a high number of detailed rules and regulations, but rather emphasize the use of few and simple rules that everyone can

easily relate to. By integrating a simple framework employees in the organization know the boundaries, but there are simultaneously more opportunities for emergent behavior and self-organization. The boundaries do not necessarily need to be in the form of rules or regulations, but can also symbolize a set of values or the organizational culture (Plowman et al, 2007: 347; Johnson, 2001: 226).

The second point of “swarm like behavior” refers to how social organizations achieve objectives and goals without the involvement of direct supervision. The swarm behavior is an expression of a collective intelligence that exceeds the capabilities of individuals, e.g. in the world of ants, termites and bees the colony achieve astonishing accomplishment as a result of collective intelligence and without a top-down design (Plowman et al, 2007: 350).

The use of simple rules, more freedom of action on lower levels and a continuous destabilization of the organization are evidently linked to a process of change, which the thesis now will discuss.

3.3.2.2. Complex Leadership and Change

Change is an important aspect in both Newtonian and Complexity thinking. As discussed in chapter 2 a Newtonian Approach will often interpret change as something negative that forces the system out of equilibrium, while a Complexity Approach argue that in order to survive the system has to change constantly.

Falconer (2007: 137-139) presents some aspects on change.

- Change management, a popular aspect of modern leadership and management, is in itself a contradiction due to the fact that it assumes a control-based concept onto something which is inherently not controllable.
- While traditional leadership emphasizes to manage change, i.e. a hard approach, a soft approach such as guidance, navigation and coaching will result in a better ability for the organization or individuals to adapt to change.
- While traditional leadership argues that change is about *being*, implying thus that the landscape is stable, a Complexity Approach speaks for change as *becoming*, thus assuming that the environment is constantly changing.
- Change exists independently and does not necessarily change if you try to affect it.

As these bullet points from Falconer point out, change is something abstract and intangible that is difficult to put a label on. Change often results in some physical and material

modification from the status quo, but is based in immaterial processes (Wheatley, 1999: 153). As discussed in chapter 2, reality in a complexity setting consists of both material and non-material forces that through interaction create the present (Wheatley, 1999: 50-52).

Thus, it is important for complex leaders to *interpret* change instead of creating change. As new events emerge in the organization it is the complex leader's role to "make sense" of the new situation in the organizational context (Taylor, 2005:149; Schneider & Somers, 2006: 356; Griffin & Stacey, 2005: 10, 25-26). However, it is not the complex leader's function to direct what will happen next. As such, a complex leader can become a catalyst for change and become the "tag" to enable specific behaviour (Plowman et al, 2007: 351-353). Plowman et al (2007: 352) defines a "tag" as:

"Tags enable specific behaviours by directing attention to what is important, and what things mean. A leader becomes a tag when others recognize them as a symbolic reference for their corresponding message."

This is closely linked to an indirect form for leadership where the leader acts as a facilitator, *making things possible* for the organization instead of *making it happen*. By emphasizing stewardship and creativity the leader encourages innovation by allowing emergence and self-organization (Plowman et al, 2007: 354; Keene, 2000: 16-18; Karp & Helgø, 2007: 35; Fairholm, 2004: 375-380; Parker & Stacey, 1997: 65; Johnson, 2001: 226; Parellada, 2007:16; Wheatley, 1999:161; Martin, 2007: 7).

Kiel (1994: 175) refers to this as non-linear leadership, where risk-takers on the one hand represent a Complexity Approach, and the rationalists on the other hand represent a traditional approach. The risk-takers are playful and create innovation by exploring new and unknown territory, while the rationalists only work with what they know for certain. The optimum and ongoing challenge of leaders in complex systems is to avoid stagnation and stability. Due to the ever changing environment, in which the organization is dependent to adapt to, equilibrium will be the death of the organization (Burns, 2002: 56).

A step away from a control-based and equilibrium-seeking direction is to incorporate a decentralized form of leadership. The dispersion of control to all parts of the system will, from a Newtonian view, be equivalent with less control. However, from a complexity point of view, the overall system creates better control and resilience (Cilliers, 1998: 110). A decentralized approach teaches us that we need to trust the process and people involved, and not intervene unnecessarily because as a leader one might not have control. This perspective will also increase the leader's capabilities to have a good overview of the system by concentrating on *patterns* of behavior instead of small scale and isolated indications

(Johnson, 2001: 231; Keene, 2000: 16-18; Parellada, 2007: 166; Fernandez et al, 2007: 184-186; Kiel, 1994: 205). In order for a decentralized system to function there is need for a high degree of freedom of action and a structural flexibility within the organization. As such, the planning and allocation of resources must allow the organization to respond rapidly and flexibly to upcoming challenges (Parrelada, 2007: 166-167).

Based on the discussion around change and leadership there are a number of steps a leader can take to achieve complex leadership.

Steps to achieve complex leadership – the case of Al Qaeda

Marion & Uhl-Bien (2004: 3-29) use Al Qaeda as an example of complexity leadership that effectively incorporates what has been highlighted above.

- The organization uses an indirect and decentralized approach to leadership
- The leaders are symbols (“tags”) of the struggle between the Muslim and the Western World.
- The leaders have little to do with the ongoing management of the networked organization, but are offering *purpose* for the organization through the use of intentional and often strong language.
- The leaders do not try to control the events, but allow emergence and spontaneous development within the organization, e.g. by imposing a set of simple rules.
- The networked structure allows a high degree of flexibility, which makes it possible for self-managed cells, and the system as a whole, to quickly adapt to change.

A complex leader works as an enabler and emphasizes to adapt to change. Through an indirect form for leadership and the use of simple rules the organizational conditions for emergence and self-organization are favourable. But what more can the leader do to support and guide the organization? In the next section this thesis will present the use of vision and values as adequate guiding principles in a complex setting.

3.3.2.3. Complex Leadership using Vision and Values

Burns (2002) argues that the function of leadership in a complex system is primarily to “*inspire agents to revisit the ultimate purpose and core values of the system*”, which together with the focus on the environment allows the organization to lift its collective vision from the everyday and short term hassles to its essential purpose (Burns, 2002: 48-49; Keene, 2002: 16-18).

The opposite of using values and vision as guiding principles is the notion of incremental change through rules, regulations and procedures that are closely linked to the Newtonian Approach. The use of vision and values instead of detailed rules and regulations support the view of the organization as a living organism where emergence and self-organization are evident, in contradiction to the Newtonian machine-metaphor.

But what is actually meant by values and vision?

Microsoft Encarta defines values as “*the accepted principles or standards by a person or a group*” (Microsoft Encarta (12)).

Stacey and Griffin (2005: 7) argue that values emerge as a result of self-formation in social processes and that values are the basis for every person’s choice over another.

Microsoft Encarta defines vision in a number of ways, e.g. the ability to anticipate what will happen in the future or vision as a mental picture (Microsoft Encarta (13)).

Senge (1990), with his now well-known theory of learning organizations, regards vision as the future that the organization wants to create and giving direction in terms of *what to do*. The values in a company are the foundation for *how* the company is going to act in the pursuit of the vision.

The common denominator for both values and vision, as it is presented here, is that it is something intangible and abstract. The processes that create values, and the futuristic picture of the vision, both strongly imply that it is difficult to control and fully understand. However, the view, as Senge presents, states that the leader can use the vision as a means of direction-setting, which again imply that the vision is something which is a result of a top-down process and is thus controllable. The view offers a strong link to a Newtonian view of a gap-analysis, where the current values and vision are described with its advantages and disadvantages, and where a new set of values and visions are implemented in order to close the gap between the *de facto*- and desired state (Stacey & Griffin, 2005: 116).

Stacey and Griffin (2005), on the other hand, stress the difference of a leader as a vision- and value setter and the leader as a *participant* in the emergence of vision- and value making. The visions and values in a company therefore emerge in a bottom-up process based on the everyday interaction between human beings, not as a result of a grand design from top management (Stacey & Griffin, 2005: 106, 116-117, 121-122).

In other words, the view of Stacey and Griffin substantiate the view of an indirect approach to leadership, where the traditional task-oriented leadership style is substituted with more focus on relationships. As everything is a result of a social process, the leader must orient towards

soft values such as inspiring, empowering, listening and observing, understanding and coaching (Falconer, 2007: 137; Fairholm, 2003: 375-380). A complex leader needs to learn how to facilitate process using proper communication skills (Wheatley, 1999: 39; Marion & Uhl-Bien, 2001: 395).

As discussed in chapter 2, the non-material and intangible forces of fields are an important factor in reality. As Stacey and Griffin (2005) also argue, the use of vision should not be an expression of a desired end state, but rather be a picture of the processes (Wheatley, 1999: 55-58). These intangible and non-material processes become visualized in the way we behave and what we say, e.g. by observing how the people “on the floor” do their work, or the top-management of the same company behave, a strong indication of the organization’s values and vision become evident (Wheatley, 1999: 129).

In order for the organization to become more successful the leaders should, according to Wheatley (1999), take two main steps. First of all, they should guide the organization by expressing simple prospects of purpose, intent and values. Secondly, based on the general framework provided in step one, the individuals in the organization are themselves responsible for assimilating the expressed purpose, intent and values and to turn these into valuable actions (Wheatley, 1999: 129). As earlier argued by Stacey and Griffin (2005: 106, 116-117, 121-122), the values and vision in an organization are the result of social processes. Thus, the view presented by Wheatley is in many cases a contradiction to the view presented by Stacey and Griffin.

The two sides both argue that the vision and values should be an expression of the processes, but they differ concerning the *making* of the processes. While Wheatley on the one hand presents the leader function as giving gentle guidance through articulating of purpose, intent and values, Stacey and Griffin on the other hand argue that the leadership function is to participate in the emergent social process where the vision and values appear naturally. In other words, Wheatley supports a mix between a mild top-down approach and a rather strong bottom-up-approach, while Stacey and Griffin emphasize a bottom-up approach. However, Wheatley also argues that the behavior of the organization does not change just by proclaiming a new set of values. The change process is slow and the organization must develop a greater self-awareness through open communication of *how* and *why* they are acting as they are (Wheatley, 1999: 130). In that sense, the views of Wheatley and Stacey and Griffin are, from this thesis’s point of view, in many ways similar, but they emphasize a different initial approach for reacting to change.

Given the importance of developing a strong vision and values as a means of guidance, what steps should a leader take to achieve complex leadership?

Steps to achieve complex leadership

In order to ensure the emergence of a strong vision and organizational values a leader should *inter alia* take the following steps:

- A leader should emphasize the use of soft management tools instead of the traditional hard management tools (Wheatley, 1999: 57; Falconer, 2007: 137; Fairholm, 2003: 375-380).
- The first step towards collectively creating a set of values and vision is to discover individual and shared *meaning* in the organization. The leader discovers meaning through dialog and awareness in the everyday interaction with the employees (Taylor, 2005: 132-133, 148-149; Shiel, 2005: 182-183; Wheatley, 1999: 148-149).
- A leader should emphasize the facilitation process in order to create emergent behavior (Fairholm, 2004: 375-380; Stacey & Griffin, 2005: 122; Keene, 2000: 16-18; Marion & Uhl-Bien, 2001: 395).
- When the vision and values emerge after a social process, the leader's task is to embody and strengthen these principles (Wheatley, 1999: 130).
- The leader must help the organization to develop a clear identity (Wheatley, 1999: 129-131).
- Leaders much acknowledge that the behavior of the organization is best shaped through concepts that include the employees' participation, not through top-down mechanisms such as policies and detailed rules that restrain freedom of action (Simpson, 2006: 479; Martin, 2007: 6; Wheatley, 1999: 131).
- In order to substantiate the emergent process of creating a shared vision, leaders should encourage experimentation and risk-taking, empowerment of the employees and creating a culture that is based on tolerance for unpredictable behavior (Burns, 2002: 49-50; Kiel, 1994: 204-205).

The views presented here offer a strong link to a soft and qualitative approach characterized by interpreting any organization as a social organization and supporting bottom-up processes. As such, the technical and often quantitative aspect of management is of less importance. Hence, the leader's capacity to interact with human beings is of great importance, which the next section will discuss.

3.3.2.4. Complex Leaders and Micro-level Interactions

In chapter 2 of this discussion we describe how the *relationship* is the basic unit of all systems and how the non-material and intangible nature of this point of view contradicts with the traditional view. In the Newtonian world it is the physical object itself, and not the relationships between them, which are of importance.

The traditional view is often materialized in a top-down and rational approach to leadership where the leader imposes rules, regulations and systems in order to obtain control and organizational goals. Edvardsen (2000: 263) argues that a traditional way of thinking in today's complex environment creates great limitations for control and destroys the vitality of the organization. This claim is based on the fact that the company is dependent on turbulence and change for constant development (Edvardsen, 2000: 272).

Karp and Helgø (2007: 35) argue that in order to respond adequately to challenges in complex organizations leaders must move the main focus from abstract macro-systems to the micro-level interactions between people. The interaction between people is the basis for a bottom-up process of self-organization, as opposed to a top-down incremental change process. The focus on human interaction strongly implies that the leader would benefit from having high emotional intelligence. Sterret (2000: 2) defines emotional intelligence (EQ) as:

"(..) the array of personal-management and social skills that allows one to succeed in the workplace and life in general. EQ encompasses intuition, character, integrity, and motivation. It also includes good communication and relationship skills".

According to Stacey (2005: 11) complex leaders are dependent on emotional awareness and the capacity for attunement and empathy. As such, a complex leader has an *"increased capacity to think, feel, reflect and imagine"*. Emotions are traditionally an antonym for a rational and quantitative approach and emotional intelligence has been treated as a too soft management tool (Tobin, 2005: 67).

This view supports the notion of leadership as being something more than just the individual characteristics of a leader. Leadership is not a "condition", but an ongoing process of human relating (Walker, 2006: 108). From a traditional point of view, leaders can be perceived as objective observers standing *outside* of the processes and who intervene when the organization is "off track" to obtain the defined goals. However, a focus on relationships and complexity principles, speaks for a leader who is a *participant* in the continuous process of emergence (Simpson, 2006: 479). As such and from a complexity point of view, the role of

the leader arises as a result of the social processes of acknowledgment, and has little to do with the formalized power often present in Newtonian organization (Stacey, 2005: 10; Tobin, 2005: 86-87; Taylor, 2005: 141). The leaders often adopt an informal and indirect approach to leadership, emphasizing support of the emergent processes instead of directing the events through formal procedures. (Schneider & Somers, 2006: 357; Marion & Uhl-Bien, 2004: 3; Stacey, 2005: 106; Griffin & Stacey, 2005: 10, 25-26).

Burns (2002: 48) argues that in Chaos Theory leadership is not limited to one key position or a group of elite-people, but rather that all participants or agents in a complex system are conducting leadership through their interaction with the environment. Leadership is thus a picture of the collective behavior of the system, not the actions by a single leader (Uhl-Bien, Marion & McKelvey, 2007: 306-307; Stacey, 2005: 106; Taylor, 2005: 148; Marion & Uhl-Bien, 2004: 29; Walker, 2006: 108). Interpreting this argument from a rather radical point of view it can be argued that Complexity Theory is quite a pessimistic and negative approach to leadership, because there is little a manager or leader can do about development (Dubrin, 2007: 10). However, the importance of the argument is that the role of a leader in a complex system is not to direct or control through rational and objective mechanisms, but rather participate in and support the social processes of constant emergence.

Looking at leadership as a social phenomenon also implies a focus on what happens in the *present*. Although the history of a complex system is important, a complex leader must interpret the events in light of the *de facto* circumstances. The actions taken must “*come in experience, not from experience*” (Taylor, 2005:148).

A focus on the micro-level interactions and the organization as a social organization also has implications for *what* we emphasize in the change process. A Newtonian Approach will often look at the physical aspects of change, e.g. in terms of what changes the organization can do to the structure or the organizational design. However, arguing that relationships and micro-level interaction is the most important thing means that we should emphasize changing the collective social patterns first, not the structure. Based on the new alternative model of the collective social pattern the physical changes needed to support the processes are more evident (Sotolongo, 2007: 129-130). In order to change the collective social pattern it is necessary to view people as *interdependent* individuals *within* society, not as people being neither independent nor dependent individuals (Cole, 2007: 222-229). Although relationships and interdependence are essential, it does not necessarily mean that it is good. Included in the positive sphere of open communication, dialog, understanding and empowerment, is also the fact that relationships in many cases generate power-conflicts and clashing interests (Stacey et al, 2000, 65).

The Complexity Approach speaks of the importance of creating innovation and a creative work atmosphere. However, as in the case of relationships, there are also potential downsides. Creativity and innovation also have a destructive aspect, e.g. that a creative process in most cases includes ambiguity, uncertainty, confusion, conflict and anxiety (Edwardsen, 2000: 269-270; Parker & Stacey, 1997: 64). In order to reduce anxiety the traditional approach often has clear lines of responsibility and authority, control systems, formal roles and a hierarchical structure (Walker, 2006: 102). However, one can also argue that the traditional counter measurements against anxiety in fact are also a source for anxiety due to the suppression of creativity and innovation (Tobin, 2005: 72).

The reaction to anxiety is like balancing on a knife-edge. On the one hand, a policy that does not take into account the need for diversity will block the possibilities for innovative solutions and decrease adaptability (Parker & Stacey, 1997: 64). On the other hand, too much diversity will increase the anxiety among employees, which might have negative consequences over all (Simpson, 2006: 479).

As this section argues, a focus on micro-level interactions is important in order to adapt to change. What specific steps should a leader take to support a complex approach to leadership?

Steps to achieve complex leadership

In order to support the focus on micro-level interaction a leader should take the following steps:

- It is the leader's role to *assist* the organization to move into unknown territory through a continuous emergent process of meaning and communicative interactions (Shiel, 2005: 182-183).
- A complex leader shows greater capacity to live with anxiety (Stacey, 2005: 12). In other words, the leader can take risks and has developed an ability to handle spontaneous and surprising situations (Griffin & Stacey, 2005: 25-26).
- Complex leaders embrace soft values and are more dependent on emotional intelligence than technical intelligence (Martin, 2007: 7; Wheatley, 146, 148-149, 154; Darwin, 2001, 482; Taylor, 2005: 132-133; Griffin & Stacey, 2005: 11; Karp & Helgø, 2007: 35).
- Complex leaders must acknowledge that in order to allow innovation to create itself, flexibility and freedom of action must be present on as low an aggregation level as possible (Baets, 2007: 108).

- In order to create a basis for innovation, leaders must focus on developing the self-management capacity of employees and replace its control-focus with stewardship and trust (Keene, 2000: 16-18).
- Psychological processes are more important than strictly “technical management” processes. Complex leaders must emphasize processes such as respect, credibility, recognition and trust, instead of hard and autocratic behavior (Karp & Helgø, 2007: 35; Fairholm, 2004: 375-380).
- Complex leaders are not interventionist, but value-centered (Dilworth, 1998: 497).
- Qualitative matters are more important than quantitative matters (Fairholm, 2004: 375-380).
- Complex leaders focus on small and simple things, e.g. allowing a free flow of information and participating in the everyday happenings (Fairholm, 2004: 375-380).

The thesis has, in this part of the chapter, discussed the complex leader from four different perspectives. First of all, the complex leader acts as an enabler for adaptive leadership. Secondly, a complex leader does not handle or manage change, but adapts to change through the use of *inter alia* an indirect and decentralized approach to leadership. Thirdly, a complex leader embraces the use of vision and values as guiding principles instead of detailed rules, regulations and procedures. Fourth and finally, a complex leader has focus on the everyday interaction between human beings and participates in the emergence of shared meaning. Based on the findings in the chapter, this thesis will now present a list of propositions for complex leadership.

3.3.3. Propositions for a Complexity Approach to Leadership

The list of propositions is built up by a general proposition for what complex leadership is, which is followed up by what leadership behavior a complex leader should display in order to obtain the specific proposition. In order to strengthen the propositions the list of references is attached to each proposition.

This list serves as the foundation for the third part of the questionnaire which has complexity leadership as the topic.

Nu	General Proposition	Leadership behavior	Authors	
1	Leadership is a decentralized process, not a centralized process.	<ul style="list-style-type: none"> ○ Trust the process and the people ○ Pay attention to the patterns, not the indications ○ Let go of control and embrace uncertainty 	<ul style="list-style-type: none"> ○ Johnson, 2001: 231 ○ Cilliers, 1998: 110 ○ Keene, 2000: 16-18 ○ Parellada, 2007: 166 	<ul style="list-style-type: none"> ○ Fernandez et al, 2007: 184-186 ○ Kiel, 1994: 205
2	Leadership is something intangible and abstract	<ul style="list-style-type: none"> ○ Thinking outside the box ○ Acknowledging that one cannot fully understand everything. ○ Complex interpretation of reality ○ Acting imaginatively ○ Reflection ○ Process- orientation 	<ul style="list-style-type: none"> ○ Taylor, 2005 ○ Wheatley, 1999: 50-52 ○ Shiel, 2005: 200 	<ul style="list-style-type: none"> ○ Fernandez et al, 2007: 184-186 ○ Griffin & Stacey, 2005: 11, 25-26
3	The <i>role</i> and <i>work</i> of the leader arises as a result of an emerging process based on a constant interaction between human beings and the environment	<ul style="list-style-type: none"> ○ Change management ○ Participation management ○ Building and mending relationships ○ Open communication ○ Focus on immaterial and invisible processes as the source of change ○ Participation in the everyday interaction ○ Paying attention to the present ○ Focusing on leadership as a process 	<ul style="list-style-type: none"> ○ Taylor, 2005: 131-141. ○ Martin, 2007: 6 ○ Schneider & Somers, 2006: 356 ○ Fox, 2001: 102 ○ Simpson, 2006: 479 ○ Wheatley, 1999: 153 ○ Fernandez et al, 2007: 184-186 ○ Cole, 2007: 229 	<ul style="list-style-type: none"> ○ Tobin, 2005: 86 ○ Stacey, 2005: 106 ○ Taylor, 2005: 132 ○ Shiel, 2005: 182-183 ○ Walker, 2006: 106, 108 ○ Schwella, 2008: 22 ○ Griffin & Stacey, 2005: 10, 25-26
4	Complex leaders disrupt existing patterns	<ul style="list-style-type: none"> ○ Create and highlight conflict ○ Acknowledge uncertainty ○ Award risk taking and experimentation in the organization ○ Entrepreneurial behavior ○ When needed, create discomfort in the organization. 	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ McKelvey, 2008: 3 ○ Martin, 2007: 8 ○ Uhl-Bien, Russ and McKelvey, 2007: 311 ○ Uys, 2002 41 	<ul style="list-style-type: none"> ○ Fairholm, 2004: 375-380 ○ Kiel, 1994: 204-205 ○ Walker, 2006: 102-103 ○ Parker & Stacey, 1997: 34, 64
5	Complex leaders encourage novelty	<ul style="list-style-type: none"> ○ Establish simple rules ○ Encourage “swarm like” behaviors ○ Promote non-linear interactions ○ Leaders encourage innovation rather than innovate. ○ Support the organization to be more playful ○ Emphasize stewardship ○ Open communication ○ Facilitation ○ Non-linear leadership 	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ Martin, 2007: 7 ○ Wheatley, 1999: 161 	<ul style="list-style-type: none"> ○ Johnson, 2001: 226 ○ Parellada, 2007: 166 ○ Kiel, 1994: 175

Nu	General Proposition	Leadership behavior	Authors
6	Complex leaders act as sense-makers	<ul style="list-style-type: none"> ○ Create correlation through language ○ Accept the role of “tag” ○ Leaders interpret emerging events rather than direct events ○ Leaders manage words rather than manage people 	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ Schneider & Somers, 2006: 356 ○ Griffin & Stacey, 2005: 10, 25-26 ○ Taylor, 2005:149
7	Complex leaders operate in a boundary-less and unpredictable system	<ul style="list-style-type: none"> ○ Complex leaders must develop skills and behavior that enable adequate response to uncertainty and surprise ○ Acknowledge uncertainty ○ Tackle anxiety ○ Award risk taking and experimentation in the organization ○ Leaders must continuously adapt ○ Entrepreneurial behavior ○ Non-linear leadership 	<ul style="list-style-type: none"> ○ Marion & Uhl-Bien, 2001: 395 ○ Martin, 2007: 3, 7, 8 ○ McKelvey, 2008: 3 ○ Burns, 2002: 49 ○ Kiel, 1994: 175, 204-205 <ul style="list-style-type: none"> ○ Griffin & Stacey, 2005: 12, 25-26 ○ Parker & Stacey, 1997: 92, 93
8	Complex leaders are more dependent on emotional intelligence than technical intelligence	<ul style="list-style-type: none"> ○ Emphasize stewardship ○ Open communication ○ Active listening ○ Coaching and mentoring ○ Facilitation ○ Empathy and attunement ○ Participation in the everyday interactions ○ Developing self-awareness in leaders 	<ul style="list-style-type: none"> ○ Martin, 2007: 7 ○ Darwin, 2001, 482 ○ Fairholm, 2004: 375-380 ○ Griffin & Stacey, 2005: 11 <ul style="list-style-type: none"> ○ Tobin, 2005: 67 ○ Taylor, 2005: 132-133 ○ Schwella, 2008: 22 ○ Wheatley, 146, 148-149, 154
9	Complex leaders are often informal leaders that are not reliant on formal autocratic structures	<ul style="list-style-type: none"> ○ Focus on social processes ○ Emotional intelligence 	<ul style="list-style-type: none"> ○ Schneider & Somers, 2006: 356 ○ Marion &Uhl-Bien, 2004: 3 ○ Griffin & Stacey, 2005: 10, 25-26 ○ Stacey, 2005: 106
10	Complex systems are better led by indirect than direct leadership behaviors	<ul style="list-style-type: none"> ○ Provide models of creativity ○ Drop seeds of innovation ○ Encourage innovative initiatives ○ Stimulate growth of supporting resources ○ Stay out of the way of spontaneous growth and innovation ○ Manage words instead of people ○ Emphasize stewardship and facilitation ○ Leaders manage words rather than manage people ○ Non-linear leadership ○ Open communication 	<ul style="list-style-type: none"> ○ Marion &Uhl-Bien, 2004: 3 ○ Plowman et al, 2007: 354 ○ Keene, 2000: 16-18 ○ Karp and Helgø, 2007: 35 ○ Fairholm, 2004: 375-380 ○ Parker & Stacey, 1997: 65 ○ Kiel, 1994: 175

Nu	General Proposition	Leadership behavior	Authors	
11	Complex leaders support bottom-up processes	<ul style="list-style-type: none"> ○ Participation management ○ Facilitation ○ Emphasize stewardship ○ Facilitation and open communication ○ Support and affect as low aggregation level as possible (organizational structure, human participants, emotions etc.) to allow innovation emerge. 	<ul style="list-style-type: none"> ○ Schneider & Somers, 2006: 356 ○ Martin, 2007: 6 ○ Uhl-Bien, Russ and McKelvey, 2007: 308 ○ Keene, 2000: 16-18 ○ Burns, 2002: 49 ○ Simpson, 2006: 479 	<ul style="list-style-type: none"> ○ Karp and Helgø, 2007: 35 ○ Baets, 2007: 108 ○ Praught, 2002: 522 ○ Stacey, 2005: 106 ○ Schwella, 2008: 22
12	Complex leaders support the indirect and catalytic processes within the organization in order to create and handle complexity	<p>Affect:</p> <ul style="list-style-type: none"> ○ Number of elements ○ Inter-relatedness within the organization ○ Inter-relatedness with the external environment ○ Common beliefs (also see points under proposition 15) 	<ul style="list-style-type: none"> ○ Schneider & Somers, 2006: 356 ○ McKelvey, 2008: 3 ○ Burns, 2002: 49 ○ Simpson, 2006: 479 ○ Fairholm, 2004: 375-380 ○ Cole, 2007: 229 	
13	Complex leadership is not just about individuals (<i>the</i> leader), but is also interpreted as a complex and dynamic social process that focus on the collective.	<ul style="list-style-type: none"> ○ Adaptive leadership ○ Enabling leadership ○ Participation in everyday interaction, not an objective outside observer. 	<ul style="list-style-type: none"> ○ Uhl-Bien, Marion & McKelvey, 2007: 306-307 ○ Burns, 2002: 48 	<ul style="list-style-type: none"> ○ Stacey, 2005: 106 ○ Taylor, 2005: 148 ○ Marion & Uhl-Bien, 2004: 29 ○ Walker, 2006: 108
14	Complex leaders enable adaptive leadership	<ul style="list-style-type: none"> ○ Catalyze interaction to allow a more free flow of information. ○ Create interdependent agents, i.e. network thinking. ○ Foster tension to create instability 	<ul style="list-style-type: none"> ○ Uhl-Bien, Marion & McKelvey, 2007: 309, 310, 311 ○ Fairholm, 2004: 375-380 	
15	Complexity leadership substantiates the importance of vision and values as the core elements of direction setting in leadership instead of the mechanistic rule bound traditional approach to leadership.	<ul style="list-style-type: none"> ○ Leadership must focus on creating and determining the purpose of the organization, not just its objectives. ○ Leaders must emphasize an attempt to teach the employees to be self-managed in order to enhance creativity and innovation. ○ Trust and stewardship must replace control ○ The leader must act more as a facilitator, creating an environment for interaction and development. ○ The leader should encourage experimentation. ○ The leader should support the creation of a culture which is based on tolerance for unpredictable behavior. ○ The leader must make sure the organization knows itself. ○ The leader must help developing a clear identity for the organization. ○ The leader must acknowledge that the development of the organization's values is a bottom-up approach. 	<ul style="list-style-type: none"> ○ Keene, 2000: 16-18 ○ Burns, 2002: 49 ○ Fairholm, 2004: 375-380 ○ Wheatley, 1999: 55, 130-131 ○ Praught, 2002: 522 ○ Stacey & Griffin, 2005: 122 	

Nu	General Proposition	Leadership behavior	Authors
16	Resources in a complex system must be planned and allocated in such a way that allows flexibility and ad hoc solutions	<ul style="list-style-type: none"> ○ Leadership must plan with a buffer of resources ○ A decentralization of resources will allow rapid and flexible responses 	<ul style="list-style-type: none"> ○ Parrelada, 2007: 166-167
17	Complexity leadership must take into account that the creative processes will most likely cause confusion, conflict, anger and anxiety within the organization due to unclear outcomes.	<ul style="list-style-type: none"> ○ Emphasize stewardship and open communication ○ Facilitation ○ The leader must help develop a clear identity for the organization. ○ Discover individual and shared meaning 	<ul style="list-style-type: none"> ○ Edvardsen, 2000: 269-270 ○ Simpson, 2006: 479 ○ Tobin, 2005: 72 ○ Shiel, 2005: 182-183 ○ Parker & Stacey, 1997: 64 ○ Walker, 2006: 102
18	Complex leaders must shift the main focus from abstract macro-systems to the micro-level interactions between people.	<ul style="list-style-type: none"> ○ Change social collective patterns, not necessarily physical structure ○ Focus on the present and the processes that together create the future. ○ Leadership as a social process ○ Open communication 	<ul style="list-style-type: none"> ○ Karp and Helgø, 2007: 35 ○ Fairholm, 2004: 375-380 ○ Wheatley, 1999: 39, 146, 148-149, 154 ○ Sotolongo, 2007: 129-130 ○ Fernandez et al, 2007: 184-186
19	Complex leaders must have more focus on soft values and network theory than hard, rational and autocratic behavior	<ul style="list-style-type: none"> ○ Emphasize stewardship and open communication ○ Facilitation ○ Active listening ○ Facilitation ○ Respecting individual uniqueness ○ Promotion ○ Encouragement ○ Focus on problems of relations, not technical problems. 	<ul style="list-style-type: none"> ○ Karp and Helgø, 2007: 35 ○ Fairholm, 2004: 375-380 ○ Wheatley, 1999: 39 ○ Sotolongo, 2007: 129-130 ○ Griffin & Stacey, 2005: 6, 25-26 ○ Schwella, 2008: 22 ○ Falconer, 2007: 137

During this part of the thesis we have discussed the implications Complexity Theory has on leadership. The discussion started with a brief debate about the globalization of our world and the need for a shift of leadership focus from technical and traditionally “hard” management tools to more “soft” management tools. Then the thesis continued with a discussion about different characteristics of complex leadership and what a leader should emphasize in order to achieve complex leadership. Finally, and based on the rest of the chapter, the thesis presented a list of propositions for complex leadership.

The thesis will now provide a summary of the most important findings of this chapter.

3.4. Summary

This chapter aimed at obtaining research objective 2, which is *to investigate the implications Complexity Theory has on leadership and how it differentiates from the traditional characteristics of leadership.*

In order to achieve research objective 2 the thesis divided research objective 2 into multiple sub-objectives. The main findings of this chapter are linked to the different sub-objectives.

Research objective 1.1: To define leadership.

Some say that there are as many definitions of leadership as there are leaders, something that might offer a good metaphor for the diversity of what leadership is. This thesis finds that the most relevant definition of a traditional approach to leadership is that there is interaction between two or more people, where intentional influence is present by one person over others persons (Fox (2005: 4). However, the definition is not specifically relevant for a Complexity Approach to leadership.

This thesis does not differentiate between leadership and management.

Research objective 1.2: To describe the traditional approach to leadership.

General Systems Theory (GST) is the basis for the majority of the traditional approaches to leadership. There a number of different approaches such as the behavioral-, trait-, situational-, power- and transformational-based approaches to leadership.

A traditional approach to leadership is often connected with a rational model of gap analysis where a specific need is discovered, a choice is taken based on the resources available, the degree to which the solution is suitable and finally action is taken to restore balance.

The common denominator in the majority of traditional theories is that it is centered on the leader and it supports a top-down approach and rational objectivity.

Research objective 1.3: To describe the general implications of a traditional approach to leadership

The traditional approach to leadership is often based on Newtonian Principles such as determinism, reductionism and an objective perception of reality.

These principles are manifested in the organizational focus on rational processes and a view where leaders use formal structure and often “hard” approaches to achieve organizational effectiveness and efficiency. The goal is often to restore or maintain stability and balance through a rational and incremental based planning process where prediction of future events is important. Instability and turbulence is thus looked upon as something destructive and negative that must be avoided.

As the leaders actively shape the future through regulations and detailed policies little effort is spent in adapting to changing circumstances. This view supports the notion of an organization as a simple or complicated system similar to a machine where the leaders can control the machine by possessing simple technical knowledge.

Research objective 1.4: To discuss what implications a Complexity Approach has on leadership

A Complexity Approach offers a new view on leadership and what leaders should emphasize. Some of the major principles are *inter alia* a focus on present and everyday events, bottom-up processes and a strong relational- and adaptive approach.

Research objective 1.4.1: To discuss the changing context and future of leadership

The globalization of our world, and an ever increasing complexity, has in the last decades revealed a need to redefine the way we look upon leadership. As such, a focus on soft management tools such as building and mending relationships and participation management is far more important than the traditional notions of having many resources available and using hard management approaches.

Research objective 1.4.2: To discuss the complex leader as an enabler

Instead of looking at the leader as a person who directs events, a complex leader works as an enabler of self-organization. Thus, a complex leader focuses on *making it possible* for the

organization to reach organizational goals through bottom-up processes, instead of directing *how to reach it* through top-down mechanisms.

In order to enable self-organization and the organizational ability to adapt, the leader should disrupt existing patterns through destabilization and the highlighting of conflicts. Further, the leader should lead by a set of simple rules which make space for freedom-of-action of lower levels and finally support the possibilities of swarm-like-behavior.

Research objective 1.4.3: To discuss the complex leader and the aspect of change

A Complexity Approach to leadership emphasizes that change is something positive and that we must learn to live with – and adapt to change. Traditionally, change is something that must be managed or handled, but the function of the complex leader is to interpret the change and “make sense” of emerging events by taking the role of “tag”.

In order to adapt to change a complex leader should emphasize a non-linear-, indirect- and decentralized approach to leadership that supports innovation and spontaneous development within the organization.

Research objective 1.4.4: To discuss complex leadership and the use of values and vision

A traditional approach argues that an organization must be guided through the use of rules, regulations and procedures, while a Complexity Approach speaks for the use of a more widely defined vision and values as more efficient guiding principles.

This thesis presents two slightly different views, where the one view supports an approach where the leader articulates the simple prospect of purpose, intent and values, and the second a view where the leader is merely a *participant* in the emerging process of creating a shared vision and set of organizational values.

In order for the organization to create a strong and shared vision and set of organizational values the leaders should use soft management tools, help the organization discover individual and shared meaning, facilitate emergent behavior, include employee participation and encourage experimentation and risk-taking.

Research objective 1.4.5: To discuss complex leadership and micro-level interactions.

In quantum physics *relationships* are the only relevant unit of analysis, which stands in direct opposition to the traditional view on physical objects. As such, in Complexity Theory a leader must focus on micro-level interaction as a means to generate self-organizational behavior.

This kind of approach implies that leadership is a social process of recognition, where the leader is a participant instead of an objective observer who intervenes when the events deviate from the plan. There is also a view presented where leadership is an expression of every agent's interaction with the environment, i.e. the leadership is an expression of the collective behavior of the system.

The creative processes and focus on innovation will most likely create anxiety in the organization, something which the organization as a whole must address by adapting to change instead of running away from it.

In order to support the micro-level interactions a leader should be emotionally intelligent and focus on soft management tools. Complex leaders must emphasize qualitative matters such as values, psychological processes, creating a free flow of information and participation.

Research objective 1.5: To present a list of propositions for complex leadership

The list of propositions is based on the literature of this chapter and is build up by a general proposition, desired leadership behavior and references.

This thesis has so far clarified what Complexity Theory is and what implications it may have on leadership. Based on the findings in chapter 2 – Complexity Theory and chapter 3 – Traditional- and complexity leadership, this thesis will now move on to the research and methodology chapter in order to obtain research objective 3.

Chapter 4: Research Design and Methodology

This chapter outlines the research design and methodology applied in order to answer the research question of the study. For this purpose the development of the measuring instrument, the process of data collection and the analysis of the gathered data will be the main focus. This chapter is essential in order to meet research objective 3. Research Objective Three is expounded upon below:

Research objective 3: Based on an empirical survey, describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.

In order to achieve parts of research objective 3 this chapter is divided into multiple sub-objectives:

Research objective 3.1: To describe conceptualization.

Research objective 3.2: To describe key factors identified through non-empirical literature study.

Research objective 3.3: To describe and discuss the development and content of the questionnaire.

Research objective 3.4: To describe and discuss the sampling design, sampling methods and subject of study.

Research objective 3.5: To describe and discuss the process of data collection included administering.

Research objective 3.6: To describe and discuss the process of data-capturing and data-editing.

Research objective 3.7: To describe and discuss the process of data analysis.

Research objective 3.8: To describe and discuss possible shortcomings and sources of error.

Research objective 3.9: To summarize the most important features of this chapter.

In order to obtain research objective 3.1-3.8, which is a part of research objective 3, this thesis will initially repeat the research questions and research objectives defined in chapter 1 – The Introduction. Then it will continue by describing the process of conceptualization. For the purposes of this thesis, conceptualization is defined as the logical development of this thesis. Based on chapter 2 – Complexity Theory, and chapter 3- Traditional and Complexity

Leadership, this thesis identifies 29 factors which are linked to the development and content of the measuring instrument. This study will present the development of the survey by describing and discussing the content of an empirical survey based on primary data, the process of data collection and finally the structuring of the measuring instrument. Then this thesis will elaborate on the sampling technique, the administering of the survey and the process of data capturing and data editing. As a logical continuation of the latter points this thesis will describe and discuss the data analysis before it finally discusses some possible shortcomings and sources of error.

4.1. Research Question

The research question, as posited in the introductory chapter of this thesis, was formulated as follows:

What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?

Based on the research question above, this thesis has formulated a number of research objectives which provide the framework for an accurate research question;

1. Based on a non-empirical literature review, define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.
2. Based on a non-empirical literature review, investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.
3. Based on an empirical survey, describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.

Research objective 1 and 2 have been attained respectively by Chapter 2 – Complexity Theory and Chapter 3 – Traditional and Complexity Leadership, while research objective 3 is attained by Chapter 4, Research Design and Methodology, Chapter 5 – The Cadets and their worldview and Chapter 6 – Conclusion and Recommendations.

In order to give an overview of the development of the research, this thesis will now present the conceptualization component.

4.2. Conceptualization

Figure 7, development of the thesis, gives an overview of the conceptualization of this thesis.

Research objective 1 and 2, which have been obtained respectively by Chapter 2 and 3, have formed the basis for the identification of certain factors or components of Complexity Theory and desired leadership capabilities in complex systems. The different factors have then together created the foundation the development of a measuring instrument of which the main purpose is to measure the Cadets' attitude towards Complexity Theory Principles.

Research objective 3, which will be covered by Chapter 4, 5 and 6, will after a process of analysis, provide feedback on what Complexity Theory- Principles the Cadets agree or disagree with.

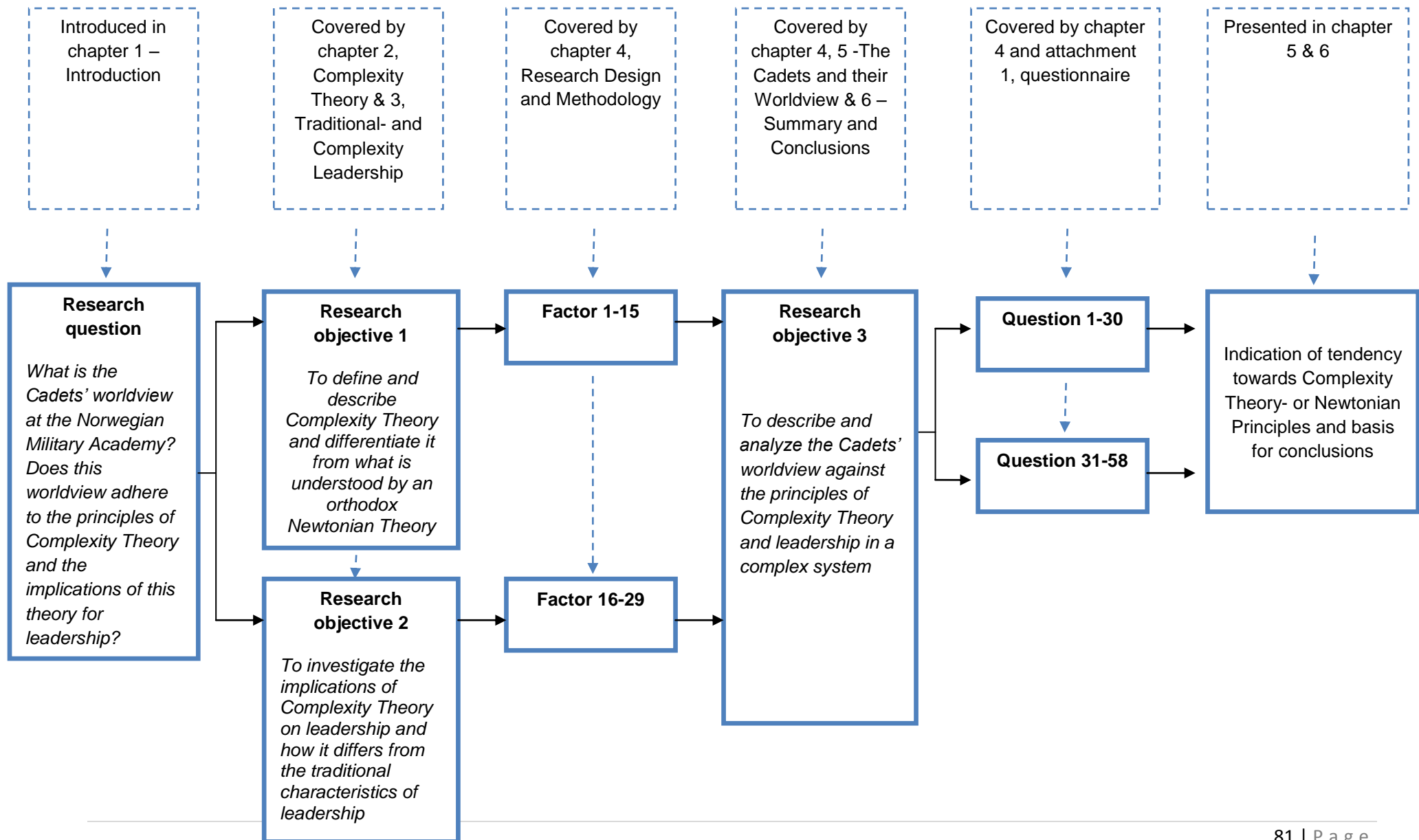


Figure 7 – Development of this thesis

As figure 7 shows, research objective 1 and 2 form the foundation for the identification of factor 1 – 29. The remainder of this section of the thesis focuses on elucidation and elaboration of these factors.

4.3. Key Factors

Based on the non-empirical literature review in chapter 2 and 3 this thesis has identified a set of factors. Factors 1 – 15 reflect the content of Chapter 2, which is connected with research objective 1. Factors 16-29 reflect the content of Chapter 3, which is connected with research objective 2. Together these factors form the basis for the design of the statements in the questionnaire.

Table 4 – factors in Complexity Theory, is organized with three columns, i.e. number, factor name and references.

Table 5 – factors in complexity leadership, is organized in four columns, i.e. number, factor name, proposition and references. The propositions refer to the list of propositions for a Complexity Approach to leadership, which is presented in Chapter 3. The different factors are based on multiple propositions.

The name of the factors in most cases represents the view of a Complexity Approach, for example in factor 1 the factor name is “heterogeneous agents” which reflects the importance of diversity. However, some of the factors are named based on the substantive critique of that particular factor in the literature review. For instance, in factor 3 the factor name is “planning – long term”, refers to something which is a strong Newtonian mechanism. The names of the factors are therefore chosen based on what is best reflected in the literature.

Factors 1-15 is connected to research objective 1, which is formulated as follows: *Based on a non-empirical literature review, define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.*

No.	Factor name	References
1	Heterogeneous agents	Kiel, 1994: 186; McKelvey, 2008: 3; Praught, 2002: 522
2	Conflict	Kiel, 1994: 186; Cilliers, 1998: 3-5; Praught, 2002: 522
3	Planning – Long term	Stacey, Griffin and Shaw, 2000: 123-124; Stacey, 2006: 138; Parker & Stacey, 1997: 41, 93
4	Forecasting – predictability	Stacey, Griffin and Shaw, 2000: 123-124; Praught, 2002: 515; Schwella, 2005: 52; Coning & Cloete, 2005: 71-73; Cilliers, 1998: 109; Parker & Stacey, 1997: 41; Kiel, 1994: 207-208

5	Qualitative methodology	Cilliers, 1998: 24; Nilsson, 2007: 242-243; Roodt, 2007: 218; Darwin, 2001: 483; Wheatley, 1999: 28-30; Parker & Stacey, 1997: 18-19, 74-75
6	Process-orientation	Kiel, 1994: 186, 209-210; Griffin & Stacey, 2005: 11, 25-26; Shiel, 2005: 200; Walker, 2006: 108; Dilworth, 1998: 498
7	Holism	Cilliers, 1998: 456; Parker & Stacey, 1997: 12-13; Fernandez et al, 2007: 171; Parker & Stacey, 1997: 12-13; Wheatley, 1999: 125; Kiel, 1994: 206
8	Chaos	Kiel, 1994: 12, 186; Najmanovich, 2007: 97-99; Nilsson, 2007: 242-243; Cilliers, 1998: 3-5; Fernandez et al, 2007: 173; Juarrero, 2007: 112-113; Wheatley, 1999: 115; Collier, 2007: 89; Dilworth, 1998: 497; Praught, 2002: 522
9	Change	Kiel, 1994: 186 and 209; Praught, 2002: 515; Parker & Stacey, 1997: 37; Wheatley, 1999: 21; Dilworth, 1998: 497; Sotolongo, 2007: 129-130; Praught, 2002: 522
10	Causality and linearity	Cilliers, 1998: 109; Baets, 2007: 105; Najmanovich, 2007: 97-99; Cilliers, 1998: 3-5; Ulanowicz, 2007; Parker & Stacey, 1997: 12, 13, 23-24; Wheatley, 1999: 121; Praught, 2002: 517; Casti, 1994: 95
11	Control	Johnson, 2001: 187; Wheatley, 1999: 28; Marion & Uhl-Bien, 2001: 395; Martin, 2007: 3, 7, 8; McKelvey, 2008: 3; Burns, 2002: 49; Kiel, 1994: 205; Praught, 2002: 522
12	Self-organization	Wheatley, 1999: 20; Capra, 2007: 7; Cilliers, 1998: 3-5; Johnson, 2001: 67
13	Open systems	Capra, 2007: 7; Cilliers, 1998: 3-5; Fernandez et al, 2007: 171; Ulanowicz, 2007; Juarrerro, 2007: 110; Wheatley, 1999: 84; Nordstrom & Bloch, 2007: 15
14	Relationships	Cilliers, 1998: 456; Stacey, Griffin and Shaw, 2000: 189-190; Wheatley, 1999: 34-37; Fox, 2001: 102; Praught, 2002: 522
15	Rationality	Wheatley, 1999: 107-108; Fernandez et al, 2007: 171; Darwin, 2001: 483; Parker & Stacey, 1997: 49-52; Edvardsen, 2000: 265; Uhl-Bien, Russ and McKelvey, 2007; Martin, 2007: 6; Karp and Helgø, 2007: 35

Table 4 - Factors in Complexity Theory

Factors 16-29 are connected to research objective 2, which is formulated as follows: *Based on a non-empirical literature review, investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.*

No.	Factor name	Proposition	Reference
16	Emotional intelligence	8	Darwin, 2001: 482; Martin, 2007: 7; Fairholm, 2004: 375-380; Griffin & Stacey, 2005: 11; Tobin, 2005: 67; Taylor, 2005: 132-133; Schwella, 2008: 22
17	Disrupt existing patterns	4	Plowman et al, 2007: 347; McKelvey, 2008: 3; Martin, 2007: 8; Uhl-Bien, Russ and McKelvey, 2007: 311; Uys, 2002 41; Parker & Stacey, 1997: 34, 64; Fairholm, 2004: 375-380; Kiel, 1994: 204-205; Walker, 2006: 102-103
18	Encourage novelty	5	Plowman et al, 2007: 347; Martin, 2007: 7; Wheatley, 1999: 161; Johnson, 2001: 226; Parellada, 2007: 166; Kiel, 1994: 175
19	Informal leaders	9	Schneider & Somers, 2006: 356; Marion &Uhl-Bien, 2004: 3; Griffin & Stacey, 2005: 10, 25-26; Stacey, 2005: 106
20	Decentralization	1, 16	Johnson, 2001: 231; Cilliers, 1998: 110; Keene, 2000: 16-18; Parellada, 2007: 166; Fernandez et al, 2007: 184-186; Kiel, 1994: 205; Parrelada, 2007: 166-167
21	System- centred leadership	3, 13	Uhl-Bien, Marion & McKelvey, 2007: 306-307; Burns, 2002: 48; Marion &Uhl-Bien, 2004: 29; Stacey, 2005: 106; Walker, 2006: 108; Taylor, 2005: 131-141, 148; Martin, 2007: 6; Schneider & Somers, 2006: 356; Fox, 2001: 102; Simpson, 2006: 479; Wheatley, 1999: 153; Fernandez et al, 2007: 184-186; Cole, 2007: 229; Griffin & Stacey, 2005: 10, 25-26; Tobin, 2005: 86 Shiel, 2005: 182-183; Schwella, 2008: 22
22	Building and mending relationships	12, 18	Schneider & Somers, 2006: 356; McKelvey, 2008: 3; Burns, 2002: 49; Simpson, 2006: 479; Fairholm, 2004: 375-380; Cole, 2007: 229; Karp and Helgø, 2007: 35; Wheatley, 1999: 39; Sotolongo, 2007: 129-130; Fernandez et al, 2007: 184-186
23	Sense-making	6	Plowman et al, 2007: 347; Schneider & Somers, 2006: 356; Griffin & Stacey, 2005: 10, 25-26
24	Indirect leadership	10, 11, 14	Marion &Uhl-Bien, 2004: 3; Plowman et al, 2007: 354; Keene, 2000: 16-18; Karp and Helgø, 2007: 35; Fairholm, 2004: 375-380; Parker & Stacey, 1997: 65; Kiel, 1994: 175; Schneider & Somers, 2006: 356; Martin, 2007: 6; Uhl-Bien, Russ and McKelvey, 2007: 308 – 311; Burns, 2002: 49; Simpson, 2006: 479; Karp and Helgø, 2007: 35; Baets, 2007: 108; Praught, 2002: 522; Stacey, 2005: 106; Schwella, 2008: 22
25	Vision and values as guiding principles	15	Keene, 2000: 16-18; Burns, 2002: 49; Fairholm, 2004: 375-380; Wheatley, 1999: 55, 130-131; Praught, 2002: 522; Stacey, 2005: 122

26	Anxiety	17	Edvardsen, 2000: 269-270; Simpson, 2006: 479; Wheatley, 1999: 39; Tobin, 2005: 72; Shiel, 2005: 182-183; Parker & Stacey, 1997: 64
27	Focus on soft values	19	Wheatley, 199: 165; Karp and Helgø, 2007: 35; Fairholm, 2004: 375-380; Wheatley, 1999: 39; Sotolongo, 2007: 129-130; Griffin & Stacey, 2005: 6, 25-26; Schwella, 2008: 22
28	Unpredictable and boundary less system	7	Marion & Uhl-Bien, 2001: 395; Martin, 2007: 3, 7, 8; McKelvey, 2008: 3; Burns, 2002: 49; Kiel, 1994: 204-205; Griffin & Stacey, 2005: 12, 25-26; Parker & Stacey, 1997: 92, 93; Kiel, 1994: 175
29	Leadership is something intangible and abstract	2	Taylor, 2005; Wheatley, 1999: 50-52; Fernandez et al, 2007: 184-186; Griffin & Stacey, 2005: 11, 25-26; Shiel, 2005: 200

Table 5 - Factors in complexity leadership

The factors identified in the non-empirical literature review evidently bring this study to the development of the measuring instrument, which this thesis now will describe and discuss.

4.4. Issue of Measurement, Data Collection and Research Design

The research design that will be used is, as described in Mouton (2001), an empirical survey based on primary data.

4.4.1. Empirical Survey Based on Primary Data

Mouton (2001: 152) defines surveys as “*studies that are usually quantitative in nature and which aim to provide a broad overview of a representative sample of large population*”, which in most cases materialize as a form of questionnaires.

One of the strengths of using this design is that the measurement reliability is very high assuming a proper questionnaire construction and control functions. On the other hand, criticism for the use of this kind of design is linked to the potential pitfall of the survey data being at “surface” level and sample and context specific (Mouton, 2001: 153). It follows from this that the main sources of error according to Mouton are “*sampling error; questionnaire error; high refusal rates; high non-response; interviewer effects; respondent effects; fieldwork error; data capturing error; inappropriate selection of statistical techniques*” (Mouton, 2001: 153).

At this point it might be worthwhile to consider the precautions taken in order to counteract the limitations and main sources of probable error:

- The subject in itself, i.e. Complexity Theory, is not (as a point of departure) context specific.
- In order to avoid context specificity, the questionnaire will focus primarily on questions that can be asked to any category of workforce, not just the category of military personnel. However, some of the questions use military terminology in order to exemplify.
- The questions in the questionnaire are formulated in an easy and comprehensive way so the participants understand the questions. The principles of Complexity Theory are often formulated in a manner that is very academic and thus complicated, so that the challenge has been to ask the questions in a way that does not result directly in a “lack of meaning”.
- The questions in the questionnaire are “closed” questions, except for a single open question at the end.
- In order to counter act sampling- and questionnaire errors, the development of the questionnaire has been monitored by two supervisors. The content and design has also been quality assured against a test-group.
- In order to insure a low refusal rate and a low-non response it has been essential that the Military Academy has scheduled time in the respondents’ educational plan. The researcher has taken the liberty of making contact with the Military Academy early in the research process and has obtained the necessary support from top management to proceed with the research.
- The practical data collection was scheduled to a “neutral” period, i.e. on the day of collection the data collection was not scheduled late in the after-noon or evening when the Cadets could possibly be less motivated or tired. Care was also taken not to schedule the data collection in the immediate aftermath of big exercises such as e.g. a survival course or other big exercises.
- The personnel in charge of the practical data collection were provided with adequate training and supervised in order to be able to carry out the survey effectively and efficiently. Please also see attachment 3.

As a logical continuation of the above literature this thesis will now continue to describe and discuss the process of data collection.

4.4.2. Data Collection

Interviewing was the data collection method used for the empirical survey. This involves a structured, self administered and paper-based questionnaire with closed-ended questions (Mouton, 2001: 105; Babbie, 2004: 245).

According to Mitchell and Jolley (1998: 288) self-administered questionnaires have the advantages of being relatively inexpensive, easy to distribute and ensure sufficient anonymity. On the other side, however, a self-administered survey often provides a low response rate, it does not allow interaction between the researcher and the subjects of study and does not give any feedback as to whether or not the participants have interpreted the survey questions correctly or not.

Using a paper-based questionnaire offers the following advantages and disadvantages.

Advantages:

- The data collection is not dependent on technological equipment.
- The participants do not need to have any data knowledge- or skills.
- The process of data collection is less sensitive to external disturbance such as loss of electrical power.

Disadvantages:

- Compared to web-based data collection the paper-based data collection method is more expensive (Ardalan, Ardalán, Coppage & Crouch: 2007).
- A paper-based questionnaire will result in a decrease in speed for the data collection process (Helaey, Macpherson & Kuijten: 2005).

In order to ensure a high response rate on the questionnaire it has proved essential to conduct the data collection when the subjects of study were gathered at the Military Academy. In this case, the Military Academy planned a time slot into the educational program to ensure that as many Cadets as possible could answer the questionnaire. A web-based data collection technique proved the most likely to decrease the response rate.

A study by Beuckelaer and Lievens (2005) concluded that a strong measurement equivalence exists between web-based and paper-based surveys. Hence, the quality of the data gathered through a paper-based questionnaire should not differ radically from a web-based questionnaire.

Babbie (2004: 246-250) gives some guidelines for asking questions. The questions should be clearly and shortly described, one should avoid double-barreled questions, the participants must be competent to answer, the participants must be willing to answer, and furthermore the questions should be relevant and one should avoid negative and biased terms. In addition to the guidelines given by Babbie, Mouton (2001: 103-104) describes some

normal sources of error in questionnaires, including no pre-test of questionnaire, leading questions, poor and confusing layout and sensitive or threatening questions.

The questionnaire developed for the purposes of this research was constructed around the use of a scale, instead of single item or questions. This was done in order to avoid mono-operational bias (Mouton, 2001: 104).

In order to counteract the main sources of error described above the study took the following steps:

- The development of the questionnaire was monitored by two supervisors.
- A pre-test of the questionnaire was conducted using 10 participants based in Norway. The majority of these participants share the same background as the Cadets. The written feedback and the analysis of the results revealed that some of the questions had to be changed in order better to reflect the literature and to improve understanding.
- The design of the questionnaire has emphasized to create a clear and understandable questionnaire. E.g.:
 - Instructions are given on the front page.
 - A small English-Norwegian dictionary is provided for reference when reading particularly difficult words as well as to minimize the probability of misinterpretation due to lack of language-skills.
 - The same scale has been used throughout the questionnaire to avoid confusion.
 - The statements given are short and precisely articulated.
 - Important words in the statements have been written in *italics* in order for the reader to more clearly grasp the essence of the question.
- The statements in the questionnaire are not linked to ideology, religion or any other sensitive topics.

The process of data collection and the content of an empirical survey lead this thesis to the development of the measuring instrument, which will be discussed in the next section.

4.4.3. Measuring Instrument

The majority of the components of the Complexity Theory are abstract and in-tangible phenomena that are not directly measurable. However, the purpose of this thesis is not to measure complexity *per se*, but rather the *attitude* towards Complexity Theory Principles.

The questionnaire consists of 62 questions with additional questions about demographic details.

The presentation of the development of the measuring instrument is divided into three (3) parts.

The introductory section of the questionnaire includes a part that elucidates its purpose and provides the instructions. The second section of the questionnaire is where the demographic details or the control variables will be presented while the third and final section of the questionnaire (here titled parts 2 and 3) is where the main part of the questionnaire will be explained and elaborated.

The measuring instrument can be reviewed in attachment 1.

4.4.3.1. Introductory Part of the Questionnaire (page 1 in questionnaire)

The intention with the introduction is to enable the respondent to correctly answer the questionnaire and inform them of their rights.

The purpose of the questionnaire is stated in order to set the context for the questionnaire and simultaneously motivate the participants by stating the possible impact their contribution can make. This thesis has, however, kept the information about background theories on a very general level in order not to lead the participants in any direction.

As emphasized by Welman et al (2005: 181) ethical considerations are essential in research. The thesis informs the research subjects of their rights to decline participation or withdraw from the research at any time without any consequences (American Psychological Association: 2001). In addition, the participants must tick of a box stating that they have been informed of their rights as a participant and that the researcher can use the response for research purposes.

Instructions are then given to the respondent on how to correctly respond to the questionnaire. In an attempt to avoid a central tendency this thesis informs the participants that there is scientifically proven evidence that participants in general lean towards answering in the middle of the scale, and that they should keep this in mind when answering.

4.4.3.2. Part 1 - Demographic Details (page 2 in questionnaire)

The participants' level of education, gender, age and military background are anticipated to influence the responses given in the questionnaire and are therefore included as control variables. The variables are presented in the following way:

- Level of education (1 = 1st level, 2 = 2nd level and 3= 3rd level),

- Gender (1= male and 2=female),
- Age in years
- Military background (1= Artillery, 2= Cavalry, 3 = Infantry, 4= Logistics, 5 = Sanitet, 6= Engineer, 7= Etterretning (Intelligence), 8= Military Police, 9= Samband (Communications) 10= other and 11=various background)

4.4.3.3. Part 2 and 3 (page 3-10 in questionnaire)

These parts form the main elements of the questionnaire and are based respectively on factors 1-15 and factors 16-29 as presented above. Part 2 reflects the attitude towards general complexity principles, while part 3 focuses on the leadership implications of a Complexity Approach.

Table 6 illustrates how the questionnaire in principle is organized. Each factor has two questions that either reinforces a Complexity Theory-view or a Newtonian view. Where possible, one of the connected questions is stated positive and the other negative. Based on the response a scaled indication from 1 to 5 is given if the Cadet on that particular statement agrees or disagrees with the statement. Based on the nature of the statement, the response will either be in favor of Complexity Theory or Newtonian Principles (or uncertain).

In order to obtain reliable and valid responses the connected questions are asked with intervals, e.g. factor 1 has question 1 and 16 and factor 2 has question 2 and 17.

Q	Statement	Reference(s)	Indication
1	I <i>usually</i> prefer working in groups consisting of many different personalities and cultures	Factor 1: Heterogeneous agents	1 = CT 5 = Newt
16	It is <i>usually</i> not beneficial for a group to have a heterogeneous composition	Factor 1: Heterogeneous agents	1 = Newt 5 = CT

Table 6 - Example of organization of questionnaire

The questionnaire uses an attitude scale named the Likert-Scale in order to measure the Cadets' disposition towards complexity principles. By using the Likert Scale the participants must indicate to what degree they agree or disagree with a certain statement (Welman et al, 2005: 156-157). This thesis uses a five point scale where the participants must encircle either strongly agree, agree, uncertain, disagree or strongly disagree (Table 7). As such

there are two positive-, one neutral- and two negative alternatives. In using an attitude scale half of the questions should be negatively formulated and the other half positively (Welman et al, 2005: 157).

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1	I usually prefer working in groups consisting of many different personalities and cultures	1	2	3	4	5

Table 7 - Example of Likert scale used in the questionnaire

The participants in the questionnaire have Norwegian as their first language, while the questionnaire is formulated in English. In order to clarify possible sources of error due to language difficulties, two additional questions are included. The first question is formulated “*Did you experience any difficulties in understanding any of the questions? (YES/NO)*” and provides, in addition, the participants the possibility to elaborate on which questions the participants find difficult and the reason why. The second question asks the respondent to rate their own English language proficiency from ONE (1) not good - to FIVE (5) native speaker.

Now that the issue of measurement, data collection and development of the measuring instrument has been clarified, it is left to us now to describe and discuss the process of sampling.

4.5. Sampling

In order to receive as many responses as possible from the Military Academy, the sampling technique adopted during the research conducted in this thesis will be a method of non-probability convenience sampling. As a general rule, the larger sample size the study has, the smaller is the error and a more accurate basis for calculations results.

The convenience sampling method is characterized by selecting the individuals that are the easiest to obtain in order to attain the research question. The method is also dependent on the availability and the willingness of the participants to take part in the survey (Welman et al, 2005: 69-70; Mitchell & Jolley, 1998: 304).

A non-probability sampling method is better to use because it is a relatively simple and cheap method. However, this technique is often not representative in terms of the general population (Welman et al, 2005: 70). This point, however, from this thesis’ point of view not

very relevant due to the fact that the research question clearly states that the Military Cadet is the subject of study, and is not intended to be representative of the entire population.

The data will be collected from the Norwegian Military Academy which has three different levels of education:

- The line of operational studies (Three years that qualifies for a bachelor-degree)
- The line of engineering studies (Three years that qualifies for a bachelor-degree)
- The line for officer qualification (One year)

The line of operational studies at the Military Academy is the most relevant for our research purposes and is characterized by a representative and accessible group for responding to the questionnaire. This line has the by far highest numbers of Cadets and is simultaneously most adequately representative of the general military system. The line of engineering, in contrast, has a very small number of Cadets and represents a relatively small niche in the military system making it largely unsuitable for our research purposes.

4.5.1. Subject of Study

The Cadet of the Norwegian Military Academy, from the line of operational studies and the branch Army forms the study unit for the purposes of the research conducted in this thesis.

A brief background of the Norwegian Army, the Military Academy and the Cadets will now be presented.

4.5.1.1. Historic background

The modern history of the Norwegian Military Service is founded in the Norwegian constitution, passed by the national assembly at Eidsvoll on the 17th of May 1814 (Wikipedia (2)).

Based on paragraph 109 in the Norwegian constitution, which states that *“Every citizen of the State is in a certain period obligated to defend its country, without taking background or wealth into consideration”*² (Wikipedia (3)), a general conscription has been the foundation for the Norwegian Armed forces.

After the Second World War, in 1949, Norway joined the North Atlantic Treaty Organization (NATO) something which has been a major contributor to Norwegian Security- and Defense

² Translated by the author of the thesis

policies. Due to its geographical location, Norway played an essential role in the “Cold War”, something that has been reflected in the importance of alliances in modern Norwegian Defense history.

The fall of the Soviet Union and subsequently the end of the Cold War resulted in major changes in the Norwegian Armed Forces. The transformation of the Armed Forces has *inter alia* been materialized in the form of a highly reduced number of soldiers, a modernization of the equipment and a shift in focus from territorial defense to international operations (Wikipedia (3)).

4.5.1.2. The Hierarchical Organization

Parliament is represented by the Norwegian National Assembly and has the task of legislation, allocation of financial assets, control of the executive branch (the Government) and general political questions like reforms and foreign policy (www.stortinget.no (1); Wikipedia (4)). The Norwegian Parliament consists of different specialist committees such as the Parliament’s committee for Defense that considers matters related to defense policies (www.stortinget.no (2); Wikipedia (5)).

Government is represented by the executive branch and is lead by the prime minister and the cabinet ministers (Wikipedia (6)), including the Minister of Defense. Government is responsible for the execution of laws and guidelines passed by Parliament (www.regjeringen.no (1)).

The Norwegian Ministry of Defense, which was established in 1814, has the responsibility in Government to shape and effectuate the guidelines given by Parliament. The Ministry is lead by the Minister of Defense, who is the political representative in the matter of defense policies. The Defense Chief, who is the highest ranked military leader of Norwegian Defense Force, also functions as the highest military adviser in the Ministry (Wikipedia (7)).

The Norwegian Army

The Norwegian Army, together with the Air Defense and the Navy, form the main operational pillars of the Norwegian Defense Force. The Norwegian Defense Force is lead by the Headquarters Defense Command Norway, which again is subordinate to the Ministry of Defense (www.mil.no (1); Wikipedia (8)).

The Norwegian Army can, in a simplified way, be presented as figure 8, organizational chart No. 1 (www.mil.no (2)).

The Commander in Chief of the Army, which is subordinate to the Defense Chief, is head of the Army and its units. Three main units make up the Norwegian Army, the Army's operational units (HSTY) where most of the Cadets serve after finishing their bachelor-degree, the Unit for Transformation and Doctrinal Work (TRADOK), in which the Military Academy is a part of and finally the Special Forces (branch of the Army).

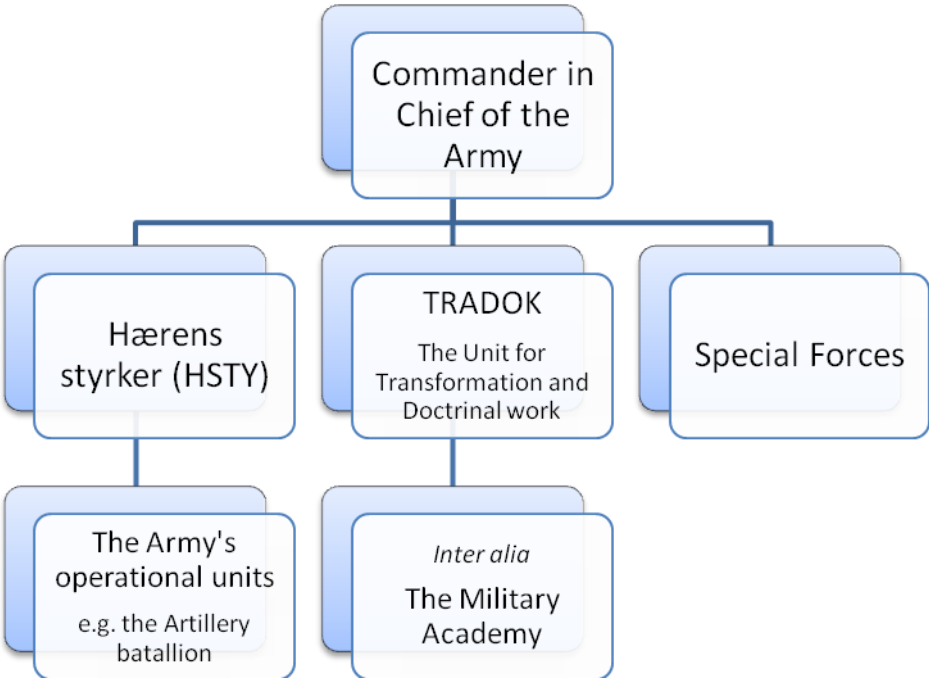


Figure 8 -Organizational chart number 1 – The main components of the Norwegian Army

The main objective of the Army is to:

“...produce military units for national and international use that can operate in the state of peace, crises or war” (Wikipedia (9)).

More specifically, the main missions of the Norwegian Army are to:

- Secure and safeguard the national territory from enemy forces in cooperation with the other elements of the Defense Force and Allied Forces.
- In cases of emergency other than war on national territory, e.g. natural disasters, give the support the Government orders.
- Participate in international operations, e.g. UN (United Nations) or NATO (The North Atlantic Treaty Organization) operations.

The Military Academy, Branch of Army

The Norwegian Military Academy is one of the oldest military academies in the world and has a robust and established role both within the Norwegian Defense Force, the Norwegian Army and within society in general.

The Academy was established by royal decree on the 16th of December 1750 and was first named the “The Free Mathematical School in Christiania” but obtained its present name, *Krigsskolen*, in 1904 (www.krigsskolen.no (1); Wikipedia (10))

The Military Academy is situated in the Army unit of TRADOK and has as its mission to “*qualify the Cadets to those challenges and demands the job as an officer give*” (Studiehåndbok Krigsskolen, 2007-2008:12). The main objective of the education of Cadets on the bachelor-program is: “*To educate officers who can train, develop and lead competent units that can deploy to relevant areas of operation, and that through a method of direct leadership quickly can be able to solve missions in a multinational alliance*”³ (Studiehåndbok Krigsskolen, 2007-2008:12; www.krigsskolen.no (2)).

The Cadets

After the Cadets have finished their bachelor degree in Military Studies they have three years of duty service which is usually served at one of the operational units (battalions) in the Army. All Cadets have a minimum of two and maximum of ten years experience from the Defense Force before they start at the Military Academy. All the Cadets have been educated at one of the Defense Force’s schools for Junior Officers.

The Cadets are rather homogenous in terms of gender and age. When it comes to other demographic indicators such as *inter alia* income, place of birth and education no distinction is made for the purposes of this research thesis. It is, however, expected to be relatively heterogeneous in terms of these demographic variables.

A further description of the sample will be presented in chapter 5 under Sample Description. The next section of this chapter looks at the administering of the collected data.

³ Translated from Norwegian by the author of this thesis.

4.6. Administering

The process of administering is divided into two parts. The first involves gaining access to the subjects of study and the second involves administering in connection with the data collection.

4.6.1. Gaining Access to the Subjects of Study

A formal contact between the researcher and the Military Academy was initiated by the researcher in January 2009. During the meeting with the Academy's Dean a formal application from the researcher accompanied with a letter from Stellenbosch University (attachment 4) was handed over to the Military Academy.

After a short period of executive work the researcher obtained the formal response from the Military Academy allowing the researcher to proceed with the survey. Simultaneously, a contact person was appointed from the Military Academy. There has been no direct contact between the researcher and the subjects of study (the Cadets).

4.6.2. Administering in Connection With Data Collection

A week before data-collection the questionnaire (attachment 1) together with general information and instructions (attachment 3) were sent electronically to the contact person at the Military Academy. Two days before data collection the researcher telephoned the contact person at the Military Academy and ran through the process of data collection in order to assure that everything was in place.

The data was gathered on Tuesday the 28th of April from the three different classes on the line of operational studies. In connection with the questionnaire the Cadets were informed according to the guidelines given in attachment 3, general information and guidelines.

In order to secure the data, the questionnaires were copied before the originals were sent back to South Africa with DHL on the 12th of May, 2009. Until the researcher is back in Norway in December 2009, the copies will be stored as restricted information at the Military Academy. The researcher is obliged to release the results to the Military Academy when this thesis is finalized.

Now that the process of administering the questionnaire to the Cadets has been discussed the next step is a description of the process of data capturing, data editing and the missing values issue.

4.7. Data-capturing, Data-editing and Missing Values

The questionnaire is based on numeric data, which according to Mouton (2001: 108) often is easy to capture and is well structured. However, there are a number of common errors in data capturing. These are referred to as “*capturing errors, post-coding errors and too many missing values*” (Mouton, 2001: 109).

In order to minimize the occurrence of capturing errors the researcher has taken the following precautionary steps:

- There were two people who worked together on the data-capturing. One read the answer from the paper-based questionnaire and one captured the data in SPSS (Statistical Package for the Social Sciences). After completing the questionnaire the procedure was repeated in order to ensure correct data capturing.
- Post-coding errors are not relevant for this questionnaire due to the use of close-ended questions.
- Each paper-based questionnaire was marked with a number similar to the row-number in SPSS in order to be better able to assure the input.

Tabaknick and Fidell (2001: 58-59) argue that missing data is often a considerable source of error in data analyses. The patterns of missing values are more important than the number of missing values. What this means is that if the missing data is scattered randomly in the questionnaire it may not cause a dramatic impact, but if the majority of the participants do not reply to demographic details for example, the consequences might be severe for the validity of the research.

It is reasonable to conclude that this study is not much affected by missing values. There are, however, some points concerning the issue of missing values that need to be highlighted:

- 11 out of 117 participants indicated a multiple military background on part 1 demographic details. The majority of these participants indicated both a Cavalry and Infantry background. This trend may be due to a merger between Cavalry- and Infantry units in the Norwegian Army in the course of the last couple of years. In order to counter of the source of this error a new category named “varied background” was created where the 11 participants were placed.
- All other missing values were marked as “no response” and are, where necessary, reflected in the results in the next chapter.

The process of data-capturing and data-editing has highlighted some important prerequisites for creating a valid and representative basis for analysis. This thesis will now move on to a presentation and discussion concerning the analysis of the captured data.

4.8. Analysis

The analysis of the data for the purposes of this research thesis will be based on a quantitative methodology using descriptive statistics to present the results obtained from the data collection. According to Welman et al (2005: 231) descriptive statistics is used to summarize the data obtained for a specific group.

According to Mouton (2001: 109-110) some of the most common errors associated with poor analysis and interpretations are *“using inappropriate techniques in quantitative analysis, drawing inferences from data that are not supported by the data and biased interpretation of the data through selectivity”*.

This thesis will use SPSS as a means to interpret the data. In order to minimize the most common errors as described above, the researcher will get support from the School of Public Management and the Statistical Department at the Stellenbosch University to assure a correct use of the data. Furthermore, in order to present the data in a comprehensive way the presentation will be structured as illustrated in figure 9.

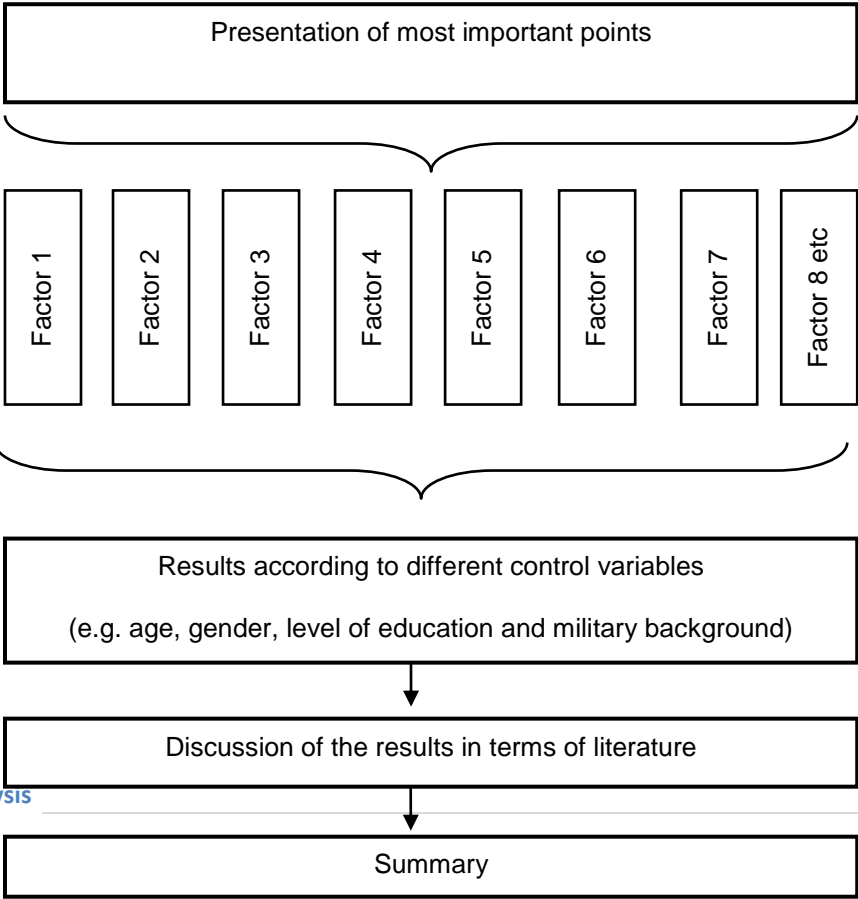


Figure 9 - Presentation of analysis

In order to provide the reader with an overview of the most important points, the chosen format to present the strongest trends is a summary.

Secondly, in order to substantiate the latter point, this thesis makes use of the different factors as presented earlier in this chapter as a starting point for the further analysis. The 29 factors each have two questions and based on the reply from the participants, an indication of the Cadets' attitude towards each factor become evident.

Thirdly, this thesis will present some results using different control variables such as age, gender, level of education and military background.

Fourthly, a discussion will be made highlighting links between the most important trends in the results and relevant literature presented in Chapter 2 and Chapter 3.

Fifth and finally, this thesis will summarize the most important findings of the chapter.

Some possible shortcomings and sources of error might affect the validity of the results. This is something which forms the focus of the discussion of the following section.

4.9. Shortcomings and Sources of Error

Some possible shortcomings and sources of error have been highlighted throughout this chapter while simultaneous actions to counter-act the possible deficiencies have consequently been proposed. However, there are some possible shortcomings and sources of error that have not yet been presented.

4.9.1. Method Variance

It is reasonable to argue that in some cases the inferences made from the Cadets' responses can be overrated due to the fact that they are obtained from a single source. In other words, making use of multiple sources of data can reduce the effect of the common method variance (Dannhauser, 2007: 369-370). Another source particular to this thesis could be the influence of individual Cadet's supervisor. However, this thesis finds that an individual rating is the most appropriate, and perhaps the only relevant means of answering the research question which is focused primarily on assessing the participants' personal worldview.

4.9.2. Data Collection in a Single Moment in Time

Another possible source of error could be that the empirical survey was collected in a single moment in time. By integrating a longitudinal approach to the data collection process the measurements would most likely be more accurate by (for example) reducing the shortcoming of using one source (Dannhauser, 2007: 371-372) and simultaneously show that the responses are consistent over time. In light of this a longitudinal approach would be

favorable in a possible continuation of the research presented in this thesis, but for the sake of the present data collection it is limited due to practical reasons such as time.

4.9.3. Single Sample

This thesis has a reasonably homogenous sample, which again implies that the results are only relevant for that specific sample. In order to generalize the findings in this thesis for wider military setting, a replication of the questionnaire is recommended. By integrating the Cadets at the Military Academy branch of Navy and Air Force it may be argued that the results be representative for lower level Officers in the Norwegian Armed Forces too.

4.9.4. Number of Questions per Factor

The questionnaire consists of 29 different factors each of which has two connected questions. It may be relevant at this point to ask whether two questions are enough to represent a factor or not. This thesis has emphasized the measurement of a relatively high number of factors instead of measuring few factors with more items relating to each question. Because this is more relevant in terms of the research question, it is also a more probable variable to consider. This thesis does, however, acknowledge the importance of having more questions per factor in a possible longitudinal approach.

4.9.5. Problems with Specific Questions

Question 61 in the questionnaire asked the respondents if they experienced any problems understanding any of the questions. 10.3% of the participants replied positively to the question and noted specific difficulties with question 49. The problems with this specific question is also reflected and substantiated by the high percentage (43.6 %) that responded “uncertain”. Thus, this thesis uses the results from this specific question with caution.

4.10. Summary

The aim of this chapter was obtain research objective 3 formulated as follows: *Based on an empirical survey, describe and analyze the Cadets' worldview up against the principles of Complexity Theory and leadership in a complex system.* In order to partly achieve research objective 3 this thesis divided research objective 3 into multiple sub-objectives. The main findings of this chapter are linked to the different sub-objectives. These are listed below.

Research objective 3.1: To describe conceptualization

The main elements of the conceptualization are the logical flow of this thesis where chapter 2 and 3 has formed the basis for the identification of a certain set of factors. Based on the factors a measuring instrument has been constructed in order to obtain research objective 3.

Research objective 3.2: To describe key factors identified through non-empirical literature study.

Factors 1-15 which are linked to research objective 1 and chapter 2 are conflict, planning, forecasting, qualitative methodology, process-orientation, holism, chaos, change, causality and linearity, control, self-organization, open systems, relationships and rationality.

Factors 16-29 which are linked to research objective 2 and chapter 3 are emotional intelligence, the disruption of existing patterns, encouragement of novelty, informal leaders, decentralization, system-centered leadership, building and mending relationships, sense-making, indirect leadership, vision and values as guiding principles, anxiety, focus on soft values, unpredictable and boundary-less system and finally leadership as something intangible and abstract.

Research objective 3.3: To describe and discuss the development and content of the questionnaire

For the purposes of this research thesis it was essential to adopt an empirical survey based on primary data in order to obtain research objective 3. The data collection will be processed through a self-administered and paper-based questionnaire. The measuring instrument is divided into three parts, the introduction with purpose, ethical considerations and guidelines, the demographic details and the main body of the questionnaire.

Research objective 3.4: To describe and discuss the sampling design and sampling methods

Based on a method of non-probability convenience sampling the Cadets at the line of operational studies at the Military Academy were identified as the most accessible and relevant sample for this research study.

The subject of study is the Cadets at the line of operational studies, Norwegian Military Academy, branch of Army.

The Norwegian Ministry of Defense, which is lead by the Minister of Defense, has the responsibility in the Government to shape and effectuate the guidelines given by the Parliament. The Defense Chief is the highest military advisor to the Government and head of the Norwegian Armed Forces. The Army is a branch of the Norwegian Armed Forces and the Norwegian Military Academy educates Officers to the Army's battalions.

Research objective 3.5: To describe and discuss the process of data collection including administering

The subject of study was accessed through filing an application from the researcher and Stellenbosch University to the Military Academy explaining the purpose and rationale of this research thesis.

The questionnaire was sent electronically to the contact person at the Military Academy, who by following guidelines from the researcher administered the practical data collection.

Research objective 3.6: To describe and discuss the process of data capturing and data editing

The questionnaire is based on numeric data and is captured in SPSS.

Research objective 3.7: To describe and discuss the process of data analysis

The analysis of the data in this thesis is based on a quantitative methodology using descriptive statistics. The analysis will describe the most important results and detailed present the results per factor and control variables. Then this section will discuss the results with links to the literature.

Research objective 3.8: To describe and discuss possible shortcomings and sources of error

This thesis has identified that method variance, data collection in a single point of time, single sample and number of questions per factor might be considered as possible shortcomings and sources of error.

The non-empirical literature review in chapter 2 and 3, and the development of the research design and methodology in chapter 4 has made the basis for the continuation of this thesis. In order to obtain research objective this thesis will now move on to presenting the results from the questionnaire.

Chapter 5: The Cadets and their Worldview

This chapter outlines the results from the survey carried out at the Norwegian Military Academy by the Cadets at the line of operational studies. This chapter is essential in order to meet research objective 3 which is formulated as follows:

Research objective 3: Based on an empirical survey, describe and analyze the Cadets' worldview against the principles of Complexity Theory and leadership in a complex system.

In order to achieve parts of research objective 3 this chapter is divided into multiple sub-objectives. These sub-objectives are a continuation of the research objectives formulated in Chapter 4 – Research Design and Methodology.

Research objective 3.10: To present the results from the empirical survey.

Research objective 3.10.1: To describe the sample.

Research objective 3.10.2: To describe the Cadets' attitude towards general Complexity- and Newtonian Principles.

Research objective 3.10.3: To describe the Cadets' attitude towards traditional leadership- and complexity leadership principles.

Research objective 3.10.4: To describe the results based on different demographic variables.

Research objective 3.11: To discuss the Newtonian- and Complexity Theory-trends in terms of the literature.

Research objective 3.12: To summarize the most important findings of this chapter.

With the aim of attaining research objective 3 and its sub-objectives this chapter commences with the presentation of the Cadets' worldview and Complexity Theory. The presentation then describes general information such as method of calculation and the sample description, before providing the results from factors 1-29. The most relevant and valid demographic control variables will also be presented at this point. In order to present a clear picture of the trends involved in an exposition of the research objectives this thesis will link the strongest Newtonian- and Complexity Theory-trends with the literature while simultaneously attempt a description of the various gaps and anomalies that occur. This chapter of the thesis

concludes with a summary of the most important issues discussed and their relevance for future study.

5.1. The Cadets' Worldview and Complexity Theory

This part of the thesis comprises a discussion of the results from the survey carried out at the Norwegian Military Academy by the Cadets at the line of operational studies, branch of Army.

A generalized summary of the results show that in the relationship between Complexity Theory- and Newtonian Principles, approximately half of the responses adhere to Complexity Theory Principles and the other half to Newtonian Principles. On the one hand, the results from factors 1-15, which investigate the Cadets' attitudes towards general Complexity Theory- and Newtonian Principles, reveal that the Cadets adhere more markedly towards Newtonian Principles than Complexity Theory. On the other hand, factors 16-29, which explore the Cadets' attitudes towards traditional- and complex leadership principles, reveal an opposite trend where the Cadets adhere more markedly towards Complexity Theory Principles. More important than these generalized trends, however, is elucidating the principles themselves.

In order to substantiate these findings this section will be organized as illustrated in figure 10, structure of presentation. First and foremost, this thesis will describe some general information including the method of calculating the Cadets' degree of adherence to each principle. Then a sample description will be presented using the demographic variables of level of education, age, gender and military background. With the intention of clarifying the Cadets' attitudes towards general Complexity Theory- and Newtonian Principles, the results from factors 1-15 will be presented. The results from factors 16-29 form the foundation for the clarification of the Cadets' attitudes towards traditional leadership- and complexity leadership principles. The results will be described as either Newtonian trends, Complexity Theory trends or miscellaneous trends (which do not fall into a particular category). Because we have anticipated that the demographic variables will influence the responses, only the most relevant and valid variables will be presented. The most relevant Newtonian- and Complexity Theory-trends will then be discussed in terms of the literature.

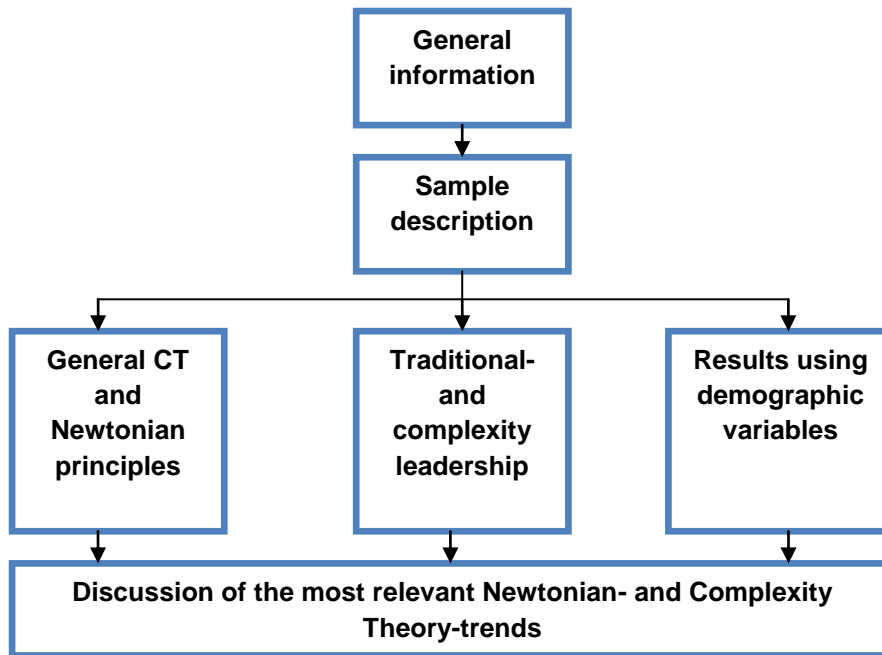


Figure 10 - Structure of presentation

This section will now continue by explaining the method of calculation.

Method of calculation

This thesis uses the computer software SPSS (Statistical Package for the Social Sciences) as an analytic tool for calculating the results.

The questionnaire uses a five-point Likert-scale where the Cadets are presented with a choice ranging from: strongly agree, agree, uncertain, disagree to strongly agree to a statement. The adoption of this scale means that there are two positive, one neutral and two negative response alternatives.

As explained in Chapter 4, Research Design and Methodology, each factor has two questions. For instance, factor 12 (self-organization) is represented by question 12 and 27. Based on the results of each question an average percentage can be calculated.

Table 8 illustrates the SPSS-calculation of question 27. Using the five point scale, frequency and percentage are calculated. On this particular question, the Cadets indicate a Newtonian tendency by disagreeing or strongly disagreeing with the statement, while strongly agreeing or agreeing are a sign of an adherence towards Complexity Theory Principles.

I think that a team in many cases can be more successful working without a formally appointed leader

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Strongly agree	1	.9	.9	.9
Agree	10	8.5	8.5	9.4
Uncertain	17	14.5	14.5	23.9
Disagree	57	48.7	48.7	72.6
Strongly disagree	32	27.4	27.4	100.0
Total	117	100.0	100.0	

Table 8 - Example of SPSS-calculation

In order to calculate to what degree the Cadets adhere to Complexity Theory- or Newtonian Principles, respectively, the reply-categories of strongly agree and agree on the one hand, and disagree and strongly disagree on the other hand are integrated. What this means is that, in the case of this question, 9.4% of the responses adhere towards Complexity Theory Principles as opposed to 76.1% of the responses that adhere rather to Newtonian Principles.

By using the same methodology on the connected question, in this case question 12, an average percentage on that specific factor for the categories of Complexity Theory, Newtonian and Uncertain can be calculated. For instance, to calculate the average percentage of Newtonian adherence on factor 12 the Newtonian values on question 12 and 27 are added and then divided by the total value on the factor ($88.9+76.1= 165/200 = 82.5$).

The results on the factor and the connected questions can then be presented as in table 9.

Reference	Q	Statement	Indication	%	Average in %
Factor 12: Self-organization	12	I think that a unit <i>usually</i> is dependent on having a leader to achieve success	CT Newt Uncertain	5.2 88.9 6.0	CT: 7.3 Newt: 82.5
Factor 12: Self-organization	27	I think that a team in <i>many cases</i> can be more successful working without a formally appointed leader.	CT Newt Uncertain	9.4 76.1 14.5	Uncertain: 10.25

Table 9 - Example of presentation

There are some points this thesis wants to highlight by using this kind of approach to calculation:

First of all, “no response” has not been taken into consideration when calculating the different results. It is, however, reasonable to conclude that this study is not much affected by the “no response” as the frequency with which it occurs is so low as to be almost negligible.

Secondly, the average percentage which is calculated on each factor may in some cases offer a deceiving picture. For instance, when the replies on the questions are strongly contradicting, the average percentage on the factor might indicate a relatively balanced distribution between the different categories. In order to counter act this shortcoming, this thesis will not highlight the average percentage on contradicting replies and instead, as a general rule, emphasize to report the results on each question.

During the analysis component of the research study a number of general tendencies in the Cadets’ responses were observed that need special attention. These tendencies are discussed in the section that follows.

General observations

The Cadets have a relatively strong tendency to agree with statements. This trend is relevant for both Newtonian and Complexity Theory-Principles. Furthermore, the majority of the responses are relatively moderate, i.e. the Cadets either *agree* or *disagree* with the statements. The participants do, to a relatively modest degree, use *strongly agree* or *strongly disagree*. However, despite these singularly interesting observations, the Cadets normally still make a choice, something which a relatively low response-rate of the neutral “uncertain” option indicates.

With the general information in mind, this thesis will now describe the sample in terms of level of education, age, gender and military background.

5.1.1. Sample Description

The questionnaire had a total of 117 participants from the line of operational studies at the Norwegian Military Academy.

The distribution between the different levels of education were relatively even with 35.9% for the 1st level, 35.04% for the 2nd level and 28.21% for the 3rd level.

As illustrated in figure 11, the majority of the participants (50.43 %) were between 24 and 27 years. 28.2% were between 20 and 23 years and 16.24% were between 28 and 31 years.

The male participants strongly dominated the survey with 95.7 % of the replies, in contrast to the 2.6 % of replies from female Cadets.

All the Cadets at the line of operational studies have previously served in a military unit with the rank of sergeant. Infantry and Cavalry were the two biggest units from which most Cadets served before they were matriculated as Cadets (figure 12).

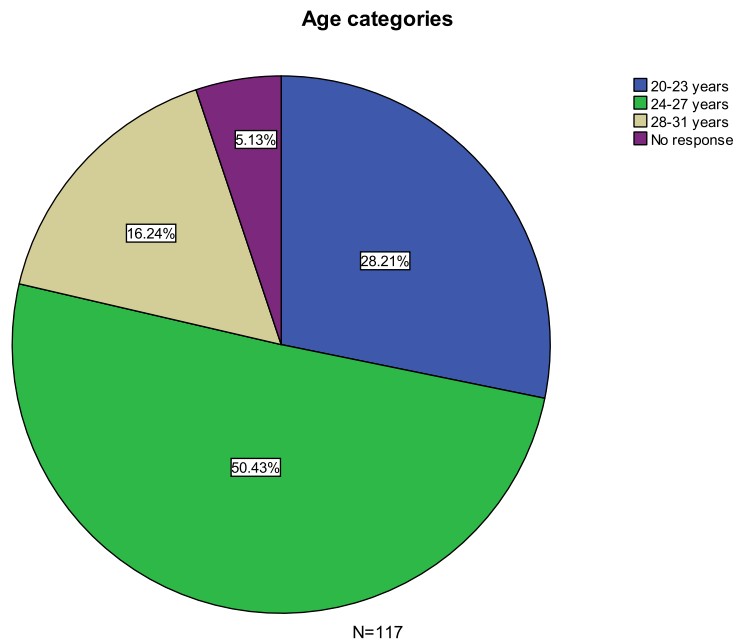


Figure 11 - Age categories and distribution

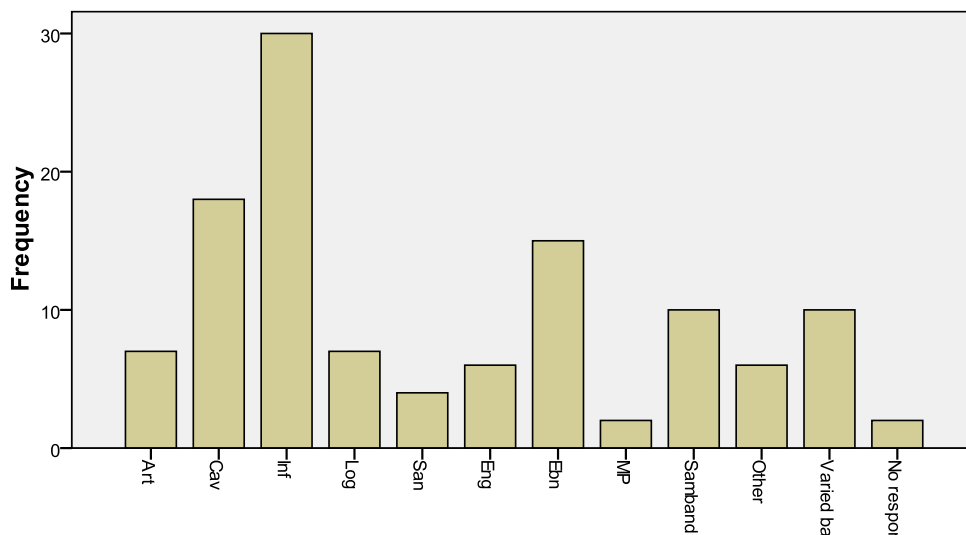


Figure 12 - Military background

Based on the information provided in this section, the next step for this thesis is to investigate how the sample has responded.

5.1.2. General Complexity Theory- and Newtonian Principles

This part of the questionnaire sets out to clarify the Cadets' attitudes towards general Complexity Theory- and Newtonian Principles.

This part of the survey comprises 15 factors with 2 questions per factor.

The presentation has integrated the responses from all the Cadets which mean that all the demographic variables have been included.

Figure 13 illustrates the main trend in this particular part of the questionnaire taking the average value of all factors into consideration. For instance, when calculating the average total percentage towards Complexity Theory Principles, all the average CT-values on each factor was added and then divided across the total sum for the categories of CT, Newtonian and Uncertain.

In this part of the survey, the Cadets have a relatively strong tendency towards general Newtonian Principles with 47 % of the responses either strongly agreeing or agreeing. However, 36 % either strongly agree or agree with Complexity Theory-Principles, which means that the trend does not offer a uniform or conclusive picture.

Percentage of adherence towards general CT- and Newtonian principles

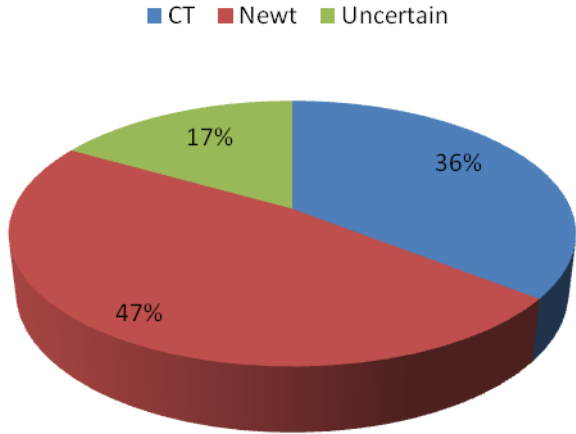


Figure 13 - Responses in percentage for part 1

Of the 30 questions of this part of the questionnaire, 18 of the questions had a majority percentage of Newtonian responses, 11 questions had a majority percentage of Complexity Theory-responses and 1 question had a majority percentage of uncertain responses.

Ten factors out of a total of 15 factors, or 66.7%, indicated a majority of Newtonian responses.

The main trend presented merely offers an average value and does for instance not illustrate which principles the Cadets agree with or not, and does not take into account the previously discussed shortcomings. In order to present a more accurate picture of the Cadets' attitudes

towards Complexity Theory- and Newtonian Principles, we now undertake a description of the most important results from the different factors.

5.1.2.1. Results from Factors 1- 15

Table 10, results factors 1-15, outlines the results on each question and the average percentage on each factor⁴. There are, however, some relatively strong indications that this section wants to highlight. In order to do so a presentation of strong Newtonian trends is used initially. Secondly, the factors that have a high response-percentage of Complexity Theory-Principles will be presented and finally the factors that have miscellaneous results will be described. This thesis will simultaneously point out possible shortcomings with the results that might affect the interpretation

Newtonian Trends

A *Newtonian trend* in the Cadets' responses is identified in the relatively related factors of *conflict* (factor 2), *chaos* (factor 8) and *change* (factor 9). The average percentages of 59.85%, 84.65% and 48.3% respectively either strongly agree or agree with a Newtonian view on these factors. The Cadets particularly support the notion of stability and balance (factor 8: chaos) as something positive and constructive in an organization (91.5%) and likewise the notion of chaos (factor 8: chaos) as something negative and destructive (77.8%).

The notion of *long term planning* (factor 3) is another essential Newtonian principle which gains support from the Cadets with an average of 52.2%. A vast majority of the responses (83.8% on question 3) believe that long term- and detailed planning usually create good results in an organization. However, and as a contradiction, 64.1% of the responses indicate a belief that detailed plans, policies and strategies rarely work out as they were intended to.

A much related factor to long term planning is *forecasting and predictability* (factor 4). An average percentage of 60.3 of the responses either strongly agree or agree with the Newtonian Principles. A vast majority of 88.9% of the responses on question 4 indicates that the Cadets usually put more emphasis on trying to predict what will happen. And interesting fact, however, is that 44.4% of the responses simultaneously strongly agree or agree with the statement that "*the assumptions one make of the future often turns out to be misleading*".

⁴ For example, when calculating the average Newtonian percentage on factor 1, heterogeneous agents, the Newtonian values on question 1 and 16 was added and then divided on the total sum for CT, Newtonian and uncertain ($40,2 + 46,1 / 200 = 42,7$).

In terms of *process-orientation* (factor 6) 72.6% of the responses to question 6 believe that managing by objectives or goals is usually the best way to create success in their organization. The average percentages on this factor (Newt: 45.25%, CT: 21.35% and Uncertain: 33.35%) illustrates a relatively strong Newtonian trend, but the high uncertainty percentage on question 21 (47.0%) indicate that the Cadets experience difficulty understanding the question.

An essential aspect of Complexity Theory is the aspect of *self-organization* (factor 12). The Cadets do, however, to a large extent disagree with this principle as it is presented in this questionnaire. For instance, 88.9% of the responses believe that a team is dependent on having a leader to achieve success and only 9.4% think teams in many cases can be more successful working without a formally appointed leader.

Half of the responses support a *rational* (factor 15), and thus Newtonian, approach to decision-making. 73.5% of the responses strongly agree or agree that they usually try to base their decisions on a thorough analysis taking all relevant facts into account. The Cadets seem, however, to have an ambivalent relationship to “rationality” as 49.6% of the responses simultaneously report that they usually make spontaneous decisions based on intuition. However, as an average value, the Newtonian Principles by far exceeding the Complexity Theory-Principles with 50.00% compared to 30.35%.

As this section has illustrated so far, the majority of the factors presented in this part of the questionnaire have a relatively strong Newtonian trend. The general Complexity Theory Principles do, however, also have some support among the Cadets. The next section of this chapter focuses on the Complexity Theory trends.

Complexity Theory Trends

In the discussion whether to choose a quantitative or qualitative methodology a majority of the responses support a *qualitative approach* (factor 5), and thus, by implication, a Complexity Approach. For instance, 82.1% of the responses on question 20 report that their experience is that statistics, facts and figures alone do not give the necessary input to fully understand something.

Non-linearity and non-causality (factor 10) are essential elements of a complex system. The Cadets strongly support a view (89.7%) of non-linear dynamics as empirically described in question 25. However, when integrating a more theoretical and abstract perspective in question 10 the majority is slightly in favour of a Newtonian view.

A relatively strong majority of the responses (average of 65.85%) support the view of the organization as an *open system* (factor 13). 74.4% of the responses on question 13 either strongly agree or agree that their organization is significantly affected by external events and that it constantly needs to adapt. Only 23.9% of the responses on question 28 support a view where the organization should always stick to the defined plans and strategies.

The description of the results has to this point indicated either a strong Newtonian- or Complexity Theory perspective. But there are also some factors that indicate a relatively mixed or balanced response rate, something this thesis will not present.

Miscellaneous

In complex systems *heterogeneous agents* (factor 1) are a necessity for the development of novelty and creativity. The average percentage on this factor shows a slight trend towards the acknowledgement of Newtonian Principles of homogenous agents (Newt: 42.7% and CT: 35.9%). Question 1 reveals a split attitude among the Cadets towards working in groups consisting of many different personalities and cultures. The results from question 16 suggest that 46.1% do not find it beneficial for a group to have heterogeneous composition, compared with 31.6% of the responses that find it beneficial.

When analysed separately or individually the responses from question 7 and question 22 in factor 7 – *Holism*, provide relatively strong contradictory information. However, articulated in the average percentage, the attitudes towards Complexity Theory- and Newtonian Principles are almost the same. From the author's perspective, reason for the strong contradictory replies might, be due the formulation of the questions. On the one hand, question 7 represents *how* the Cadets interpret holistic thinking, while question 22 on the other hand might represent the *attitude* towards thinking holistically. What this means is that the emphasis here lies not with the average percentage on this factor, but instead, where appropriate, the results from the individual questions based on the proposed interpretation.

The Cadets' ambivalent relationship with this factor is best revealed by the Cadets' responses in terms of control (factor 11). On the one hand, 48.7% of the responses strongly agree or agree that their most important goal when leading is to create or maintain control. On the other hand, 59.8% of the responses simultaneously state that when leading, freedom of action, flexibility and independence for their subordinates is the most important goal.

The same dynamics is evident with factor 14 – *relationships*, where the Cadets agree with both statements that the most important thing in order to achieve success as a leader is to be either relationship- or task oriented. 64.1% of the responses agree with a relationship-oriented approach, while 68.4% of the responses agree with a task-oriented approach.

Table 10, result factors 1-15, gives an overview of the results on each question and the average percentage on each factor. For further description of the questionnaire and how it is developed, please see attachment 1 and 2.

Reference	Q	Statement	Indication	%	Average in %
Factor 1: Heterogeneous agents	1	I <i>usually</i> prefer working in groups consisting of many different personalities and cultures	CT Newt Uncertain	40.2 39.3 20.5	CT: 35.9 Newt: 42.7
Factor 1: Heterogeneous agents	16	It is <i>usually</i> not beneficial for a group to have a heterogeneous composition	CT Newt Uncertain	31.6 46.1 22.2	Uncertain: 21.35
Factor 2: Conflict	2	I <i>mostly</i> prefer working in a harmonious work team with little friction and disagreement	CT Newt Uncertain	23.1 70.9 6.0	CT: 23.95 Newt: 59.85
Factor 2: Conflict	17	I <i>mostly</i> think of conflicts within a group as something good.	CT Newt Uncertain	24.8 48.8 26.5	Uncertain: 16.25
Factor 3: Planning – Long term	3	Long term - and detailed planning is <i>usually</i> creating good results in an organization	CT Newt Uncertain	5.1 83.8 11.1	CT: 34.6 Newt: 52.2
Factor 3: Planning – Long term	18	Detailed plans, policies and strategies <i>rarely</i> work out as they were intended to	CT Newt Uncertain	64.1 20.6 15.4	Uncertain: 13.25
Factor 4: Forecasting - predictability	4	When I plan an operation or event I <i>usually</i> put much emphasis on trying to predict what will happen.	CT Newt Uncertain	6.0 88.9 5.1	CT: 25.2 Newt: 60.3
Factor 4: Forecasting - predictability	19	The assumptions one make of the future <i>often</i> turns out to be misleading	CT Newt Uncertain	44.4 31.7 23.9	Uncertain: 14.5
Factor 5: Qualitative	5	To create an understanding of something I only need to be given the statistics, objective figures and concrete facts.	CT Newt Uncertain	36.8 39.3 23.9	CT: 59.45

methodology					Newt: 23.05
Factor 5: Qualitative methodology	20	My experience is that statistics, facts and figures alone do not give the necessary input to fully understand something.	CT Newt Uncertain	82.1 6.8 11.1	Uncertain: 17.5
Factor 6: Process-orientation	6	I believe that managing by objectives or goals <i>usually</i> is the best way to create success for my organization.	CT Newt Uncertain	7.7 72.6 19.7	CT: 21.35 Newt: 45.25
Factor 6: Process-orientation	21	I believe that the life in my organization in essence is a process of human relations and that a process-orientation <i>usually</i> achieve more than a goal-orientation	CT Newt Uncertain	35.0 17.9 47.0	Uncertain: 33.35
Factor 7: Holism	7	When I am analyzing a problem the best thing is to split the problem into smaller problems and solve each one of them independently. In other words, the whole = part+part+part etc.	CT Newt Uncertain	12.9 66.7 20.5	CT: 43.2 Newt: 41.9 Uncertain: 14.95
Factor 7: Holism	22	When I am making a decision I <i>always</i> think how the decision might affect the "bigger picture".	CT Newt Uncertain	73.5 17.1 9.4	
Factor 8: Chaos	8	Chaos in an organization is <i>usually</i> looked upon as something negative and destructive	CT Newt Uncertain	11.2 77.8 11.1	CT: 6.45 Newt: 84.65
Factor 8: Chaos	23	Stability and balance in an organization is usually looked upon as something positive and constructive	CT Newt Uncertain	1.7 91.5 6.8	Uncertain: 8.95
Factor 9: Change	9	<i>Constant</i> change is <i>always</i> necessary for an organization to survive	CT Newt Uncertain	37.6 47.9 14.5	CT: 32.5 Newt: 48.3
Factor 9: Change	24	Constant change in the organization is <i>often</i> not necessary and have more negative effects than positive	CT Newt Uncertain	27.4 48.7 23, 9	Uncertain: 19.2
Factor 10: Causality and linearity	10	Small actions <i>usually</i> create small effects. In other words, if I do little I create little.	CT Newt Uncertain	41.0 42.7 16.2	CT: 65.35 Newt: 23.9
Factor 10: Causality and linearity	25	A decision or action made by a sergeant on team level can create big effects at the strategic level	CT Newt Uncertain	89.7 5.1 5.1	Uncertain: 10.65

Factor 11: Control	11	When I am leading my unit, <i>my most important</i> goal is to create or maintain control	CT Newt Uncertain	35.9 48.7 15.4	CT: 47.85 Newt: 38.0
Factor 11: Control	26	When I am leading my unit, <i>my most important goal</i> is to create freedom of action, flexibility and independence for my subordinates	CT Newt Uncertain	59.8 27.3 12.8	Uncertain: 14.1
Factor 12: Self-organization	12	I think that a team <i>usually</i> is dependent on having a leader to achieve success	CT Newt Uncertain	5.2 88.9 6.0	CT: 7.3 Newt: 82.5
Factor 12: Self-organization	27	I think that a team in <i>many cases</i> can be more successful working without a formally appointed leader.	CT Newt Uncertain	9.4 76.1 14.5	Uncertain: 10.25
Factor 13: Open systems	13	I believe that my organization is very much affected by external events and that it needs to constantly <i>adapt</i> to changing circumstances	CT Newt Uncertain	74.4 11.1 14.5	CT: 65.85 Newt: 17.5
Factor 13: Open systems	28	I believe my organization should always stick to the defined plans and strategies.	CT Newt Uncertain	57.3 23.9 18.8	Uncertain: 16.65
Factor 14: Relationships	14	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be relationship-oriented	CT Newt Uncertain	64.1 19.7 16.2	CT: 35.9 Newt: 44.05
Factor 14: Relationships	29	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be task-oriented	CT Newt Uncertain	7.7 68.4 23.9	Uncertain: 20.05
Factor 15: Rationality	15	When I make a decision I <i>usually</i> try to base it on a thorough analysis taking all relevant facts into account.	CT Newt Uncertain	11.1 73.5 15.4	CT: 30.35 Newt: 50.00
Factor 15: Rationality	30	I <i>usually</i> make spontaneous decisions based on intuition.	CT Newt Uncertain	49.6 26.5 23.9	Uncertain: 19.65

Table 10 - Results factor 1- 15

This part of the questionnaire aims to clarify the Cadets' attitudes towards general Complexity Theory- and Newtonian Principles. The main trend among Cadets, as previously

illustrated, is an adherence towards Newtonian Principles. There are, however, a number of factors where the Cadets support a complexity point of view, as well as both approaches with equanimity. The next section aims at exploring the results from the part of the thesis which comprises traditional leadership and leadership in complex systems.

5.1.3. Traditional Leadership and Complex Leadership

This part of the questionnaire aims at clarification of the Cadets' attitudes towards traditional leadership- and complexity leadership principles.

This part of the survey comprises 14 factors with 2 questions per factor. The results that are presented are based on all responses.

Figure 14 illustrates the main trend on this particular part of the questionnaire taking the average value of all factors into consideration while using the same method of calculation as in the latter section.

The Cadets have a relatively strong tendency towards general Complexity Theory Principles with 47 % of the responses either strongly agreeing or agreeing with leadership principles in complex systems. 31 % of the responses either strongly agree or agree with traditional or Newtonian leadership principles. This part of the questionnaire reveals a higher uncertainty percentage (22.0%) than the latter part of the questionnaire (17.0%).

Percentage of adherence towards traditional leadership and complexity leadership principles

■ CT ■ Newt ■ Uncertain

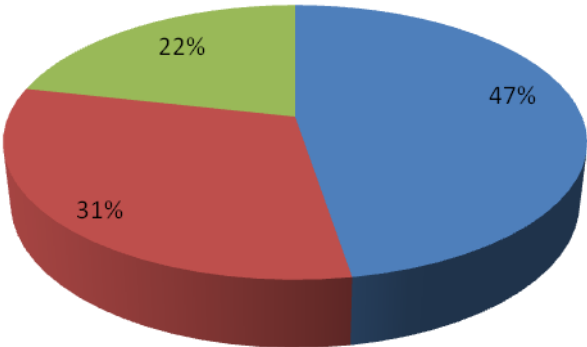


Figure 14 - Responses in percentage for part 2

Of the 28 questions in this part of the questionnaire, 17 indicated a majority percentage of Complexity Theory responses, 8 questions indicated a majority percentage of Newtonian responses and 3 questions showed a majority percentage of uncertain responses.

Ten factors out of the total 14 factors, or 71.4%, showed a majority of Complexity Theory-responses.

This main trend does not, as indicated in the previous section, offer an understanding of the percentages. The results of each question and factor will provide a more accurate picture, something this thesis now will describe.

5.1.3.1. Results from Factors 16- 29

Table 11, result factors 16-29, outlines the results on each question and the average percentage obtained on each factor⁵. However, before presenting all the results in the table 11, this thesis aims to highlight the main trends in this part of the questionnaire.

The primary aim of this part of the discussion is to provide a description of some factors that have a strong tendency towards traditional leadership principles. Secondly, the particularly strong Complexity Theory-trends and the factors that have miscellaneous results will be presented, possible shortcomings with the results that might affect the interpretation will be provided simultaneously.

Newtonian Trends

In complex systems, instability and chaos are a prerequisite for the system's survival. A leader in a complex system must thus *disrupt existing patterns* (factor 17) in order for the system or type of leadership to meet these requirements. The average percentage on the factor aimed at testing this phenomenon reveals that approximately half of the respondents believe that a leader should not disrupt existing patterns. For instance, 70.1% of the responses on question 46 support a view where the leader usually tries to minimize uncertainty and create harmony.

⁵ For example, when calculating the average Complexity Theory percentage on factor 16, emotional intelligence, the Complexity Theory values on question 31 and 45 was added and then divided on the total sum for CT, Newtonian and uncertain ($88.0 + 46,1 / 200 = 67.06\%$).

The literature on leadership in complex systems emphasizes that the leader should act as a *sense-maker* (factor 23). 70.9% of the responses on question 52 support the traditional focus on articulating goals and providing good enough systems to reach the goals as the most important function of a top-level leader. On average, 48.25% of the responses support a Newtonian Approach while 28.2% support a Complexity Approach.

Perhaps the strongest Newtonian trend in this part of the questionnaire is signaled by the factors concerning method of *leadership* (factor 24) and *values* (factor 27). From the factors testing this it is evident that the Cadets clearly express their preference for a direct approach to leadership. Almost all the responses on question 39 strongly agree or agree that their directly observed actions as leaders are strongly linked to the guidance of their subordinates' behavior. However, a majority of the responses on question 53 simultaneously believe that empowerment and facilitation, and thus a more indirect approach to leadership, is the essence of leadership.

A factor related to a direct form of leadership is the notion of "hard values". As much as 88.9% of the responses on question 56 strongly agree or agree that the more traditional metaphors of leadership roles such as leader, boss, father, doer and navigator are the best way to describe their leadership style. In comparison, only 13.7% of the respondents agree that the metaphors for complex leadership roles are the best way to describe their leadership style.

The factors presented in this section speak for a strong Newtonian trend, but as described earlier, the majority of the factors in this part of the questionnaire indicate a high Complexity Theory-response. The following section aims at presenting Complexity Theory-trends.

Complexity Theory Trends

The results of factor 16 (*emotional intelligence*), factor 18 (*encourage novelty*) and factor 19 (*informal leaders*) all indicate a strong adherence towards principles for leadership in complex systems. The average value of 67.05% on factor 16 illustrates that the Cadets think that emotional intelligence is more important than technical intelligence. As much as 74.3% (question 33) and 71.8% (question 47) of the respondents believe that innovation and creative thinking is the task of every member in the organization and that the leader should emphasize facilitation and support of these processes. The average percentage of 84.15 for factor 19 strongly indicate that the Cadets think that they are more informal- than formal

leaders, and that they get their power because they are recognized as a leader, and not because of their formal position.

In traditional Newtonian thinking *decentralization* (factor 20) of control and responsibility is often linked to poorer results. Only 12.8% of the respondents, however, support this view.

A majority of the respondents believe that a shared vision and strong organizational values are the most important *guiding principles* (factor 25) for success in their organization. In comparison, only 23.9% of the responses on question 54 support a Newtonian view where well planned policies and regulations are portrayed as the most important guiding principles for the creation of success in their organization.

In order to manage uncertainty and *unpredictable* situations (factor 28) as much as 93.2% of the respondents believe that military leaders should focus on developing the ability for constant adaptation. This might be contrasted, however, by the indication that the majority of the respondents believe that focus on detailed planning and automatic responses are the best way to manage uncertainty and unpredictable situations. In other words, almost all the respondents believe that adaptation is important in order to manage uncertainty and unpredictable situations, while a majority simultaneously believes that adaptation should be in the form of detailed planning and automatic responses.

In Complexity Theory leadership is perceived as something *intangible and abstract* (factor 29). 63.2% of the responses to question 44 indicated the belief that the ability to think abstract and “outside the box” is the most important trait of a military leader. On question 58 the majority of the responses are in favor of a Newtonian Approach with 39.3% as opposed to the Complexity Approach with 29.1% of the responses. This question has, however, a relatively high percentage of uncertain responses (31.6%), something that might indicate some problems concerning the Cadets’ understanding the question.

Some of the factors in the questionnaire indicate strongly contradicting results or a high percentage of “uncertain” responses. In order for these results to be clarified we now need to look at a number of miscellaneous trends.

Miscellaneous

The results of factor 21 (*system-centered leadership*) and factor 26 (*anxiety*) reveal a high percentage of uncertain responses on all questions and on the average percentage for the

different factors. Factor 21 indicates an uncertain percentage of 35.5 and factor 26 an uncertain percentage of 37.2. Taking these possible shortcomings into consideration, a slight Complexity Approach-trend can be identified with regards to both factors.

The responses from question 37 and question 51 in factor 22 (*building and mending relationships*) are separately analysed and produce a relatively contradictory picture. On the one hand only 12.0% of the responses support a Complexity perspective that articulates that military leaders should have their main focus on the micro-level interactions between people in order to handle complex problems. On the other hand, only 17.9% of the responses support the Newtonian, and its opposite statement, that a complex problem usually requires complex- and often technical solutions. On average, 40.6% and 35.05% respectively support a Complexity Approach and a Newtonian Approach.

Table 11, results factor 16-29, gives an overview of the results on each question and the average percentage on each factor. Please also see attachment 1 and 2 for more information.

Reference	Q	Statement	Indication	%	Average in %
Factor 16: Emotional intelligence	31	Having insight and understanding of the people one lead and cooperate with is <i>the most important feature</i> of military leadership.	CT Newt Uncertain	88.0 4.3 7.7	CT: 67.05 Newt: 22.25
Factor 16: Emotional intelligence	45	Having insight and understanding of the technical system one operate (e.g. a weapon's system, a platoon) is <i>the most important feature</i> of military leadership	CT Newt Uncertain	46.1 40.2 12.8	Uncertain: 10.25
Factor 17: Disrupt existing patterns	32	I think it can be useful to sometimes create uncertainty and instability in an organization.	CT Newt Uncertain	47.0 27.4 24.8	CT: 28.2
Factor 17: Disrupt existing patterns	46	When I am leading a task I <i>usually</i> try to minimize uncertainty and instability in my organization and create harmony	CT Newt Uncertain	9.4 70.1 20.5	Newt: 48.75 Uncertain: 22.65
Factor 18: Encourage novelty	33	I think that innovation and creative thinking <i>usually</i> is the task of the leader, not the subordinates.	CT Newt Uncertain	74.3 10.4 14.5	CT: 73.05 Newt: 8.2
Factor 18: Encourage novelty	47	Instead of being the centre for innovation and creativity, a leader should <i>usually</i> prioritize to facilitate and encourage innovation among its subordinates.	CT Newt Uncertain	71.8 6.0 22.2	Uncertain: 18.35
Factor 19: Informal leaders	34	As a military leader I get my power through the formal structure of the	CT Newt Uncertain	78.6 13.7 6.8	CT: 84.15

		organization.			Newt: 9.4
Factor 19: Informal leaders	48	As a military leader I get my power as a result of being recognized as a leader by the other group members through the everyday interaction.	CT Newt Uncertain	89.7 5.1 5.1	Uncertain: 5.95
Factor 20: Decentralization	35	I believe that a decentralization of control and responsibility <i>often</i> create poorer results	CT Newt Uncertain	62.3 12.8 23.9	CT: 48.65 Newt: 17.1
Factor 20: Decentralization	49	I do <i>not</i> think that in order to create control and effectiveness, planning and decision-making should optimally be placed centrally of the organizational hierarchy.	CT Newt Uncertain	35.0 21.4 43.6	Uncertain: 33.75
Factor 21: system- centred leadership	36	I see myself as a leader who works as an <i>objective</i> observer of events and who intervenes with corrective directions and regulations when the events deviate from the plan.	CT Newt Uncertain	35.9 30.8 32.5	CT: 36.75 Newt: 27.4 Uncertain: 35.5
Factor 21: system- centred leadership	50	I think that leadership is an expression of the collective behavior of my organization where I, as a formally appointed leader am a <i>participant</i> .	CT Newt Uncertain	37.6 24.0 38.5	
Factor 22: Building and mending relationships	37	In order to handle complex problems military leaders <i>should</i> have their main focus on the micro-level interactions between people.	CT Newt Uncertain	12.0 52.2 35.0	CT: 40.6 Newt: 35.05
Factor 22: Building and mending relationships	51	A complex problem <i>usually</i> requires complex- and often technical solutions	CT Newt Uncertain	69.2 17.9 12.8	Uncertain: 23.9
Factor 23: Sense-making	38	The <i>most important</i> function of a top-level leader is to provide <i>purpose</i> for the organization through the use of inspirational and expressive language.	CT Newt Uncertain	44.4 25.6 29.1	CT: 28.2 Newt: 48.25
Factor 23: Sense-making	52	The <i>most important</i> function of a top-level leader is to articulate goals and provide good enough systems to reach the goals.	CT Newt Uncertain	12.0 70.9 17.1	Uncertain: 23.1
Factor 24: Indirect leadership	39	For me, leadership is <i>in essence</i> directly linked to how I behave and what I say in front of my subordinates. In other words, my actions guide my subordinates' behaviour.	CT Newt Uncertain	0.0 97.4 1.7	CT: 38.45 Newt: 52.55 Uncertain: 8.55
Factor 24:	53	For me, leadership is <i>essentially</i> about	CT	76.9	

Indirect leadership		making it possible for sub-units or subordinates to solve their mission, for example through empowerment and facilitation.	Newt Uncertain	7.7 15.4	
Factor 25: Vision and values as guiding principles	40	A shared vision and strong organizational values are the <i>most important</i> guiding principles to create success in my organization	CT Newt Uncertain	67.5 12.8 19.7	CT: 56.8 Newt: 18.35 Uncertain: 24.8
Factor 25: Vision and values as guiding principles	54	Well planned policies and regulations are the <i>most important</i> guiding principles to create success in my organization.	CT Newt Uncertain	46.1 23.9 29.9	
Factor 26: Anxiety	41	I accept that processes within my organization create anxiety among the employees.	CT Newt Uncertain	36.8 24.8 37.6	CT: 40.15 Newt: 22.25
Factor 26: Anxiety	55	If processes generate much anxiety in an organization, it is not worth it.	CT Newt Uncertain	43.5 19.7 36.8	Uncertain: 37.2
Factor 27: Focus on soft values	42	I believe the following <u>group</u> of metaphors best describe my leadership style: Gardener, steward, servant, missionary, facilitator and convener.	CT Newt Uncertain	13.7 62.4 22.2	CT: 8.6 Newt: 75.65 Uncertain: 14.1
Factor 27: Focus on soft values	56	I believe the following <u>group</u> of metaphors best describe my leadership style: Leader, director, boss, father, problem-solver, doer, pathfinder, navigator.	CT Newt Uncertain	3.5 88.9 6.0	
Factor 28: Unpredictable and boundary less system	43	In order to manage uncertainty and unpredictable situations military leaders should <i>always</i> focus on developing the ability to <i>constantly</i> adapt.	CT Newt Uncertain	93.2 1.7 3.4	CT: 59.0 Newt: 26.9
Factor 28: Unpredictable and boundary less system	57	In order to manage uncertainty and unpredictable situations military leaders should focus on detailed planning and automatic responses.	CT Newt Uncertain	24.8 52.1 23.1	Uncertain: 13.25
Factor 29: Leadership is something intangible and abstract	44	I believe the ability to think abstract and “outside the box” is the <i>most important</i> trait of a military leader	CT Newt Uncertain	63.2 15.4 20.5	CT: 46.15 Newt: 27.35
Factor 29: Leadership is something	58	I believe that the <i>most important</i> leadership trait is the ability to follow procedures to solve a mission within the	CT Newt Uncertain	29.1 39.3 31.6	Uncertain: 26.05

intangible and abstract		given resource framework.			
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Table 11 - Results factor 16-29

The intention of this part of the questionnaire is to clarify the Cadets’ attitudes towards traditional leadership- and complexity leadership principles. In this section the main trend among the Cadets is an adherence towards principles for leadership in complex systems. There are, however, a number of factors where the Cadets support a Newtonian point of view. The next section of this chapter provides an analysis of the results in terms of the most relevant demographic variables.

5.1.4. Results Using Demographic Variables

The demographic data in this questionnaire were the Cadets’ level of education at the Military Academy, gender, age and military background.

The use of these demographic variables as a basis for comparison is not viable due to their uneven distribution. In terms of gender 95.7% of the participant were male and only 2.6% were female. As illustrated in figure 12 at the start of this section, the distribution between the different military backgroundcategories and age categories is uneven, and thus less relevant. The next section of this discussion presents the most relevant results in terms of the Cadet’s level of education.

5.1.4.1. Level of Education

The distribution between the different levels of education were relatively even with 35.9% of the participant from the 1st level, 35.04% from the 2nd level and 28.21% from the 3rd level.

The result-trend distribution on the different levels of education reveals that there are no big differences in the way in which Cadets with differing levels of education respond to the questionnaire. The few exceptions, however, are mainly linked to a divergence in view between the 1st level of education on the one side, and the 2nd- and 3rd level of education on the other.

The following questions are highlighted in order to clarify different trends in responses based on the educational level of the test subjects/ Cadets:

For question 35 (factor 20), *“I believe that a decentralization of control and responsibility often create poorer results”*, merely 40.47% of the responses of those who fall into the 1st level of education category disagree or

strongly disagree with the statement compared to 80.5% for the 2nd level and 69.7% for the 3rd level respectively (as illustrated in figure 15).

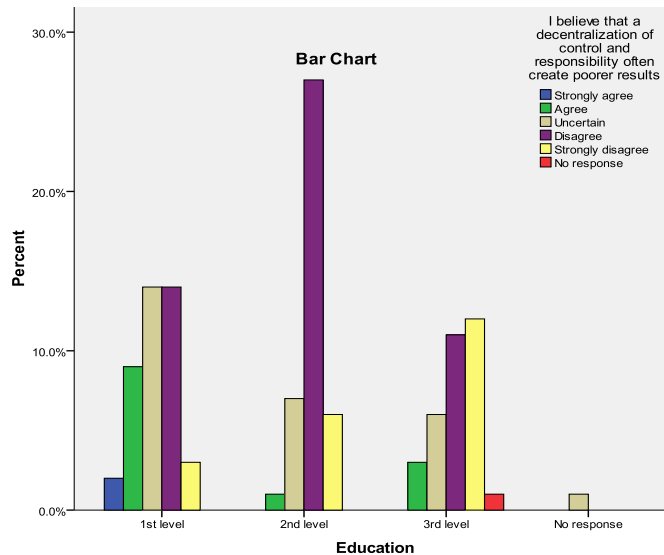


Figure 15 - Question 35 (factor 20)

For question 38 (factor 23), *“the most important function of a top-level leader is to provide purpose for the organization through the use of inspirational and expressive language”*, 64.28% of the responses of those who fall into the 1st level strongly agree or agree with the statement, while only 29.2% and 39.39% of the responses from the 2nd- and 3rd exhibit a similar pattern.

For question 45 (factor 16), *“having insight and understanding of the technical system one operate (e.g. a weapon’s system or a platoon) is the most important feature of military leadership”*, 61.9% of those who fall into the 1st level reply either strongly agree or agree compared with 29.2% for the 2nd level and 27.27% for the 3rd level (as illustrated in figure 16).

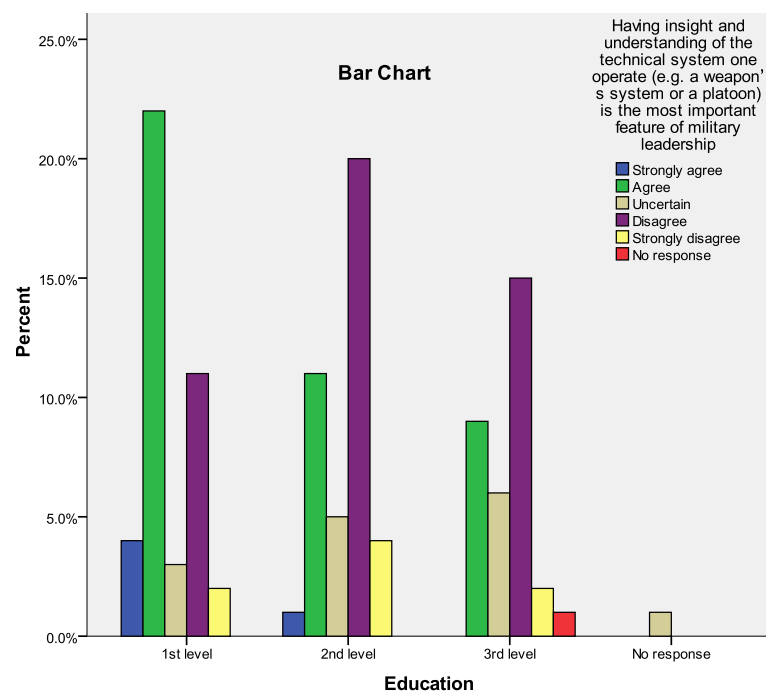


Figure 16 - Question 45 (factor 16)

The results from question 58 (factor 29), *“I believe that the most important leadership trait is the ability to follow procedures to solve a mission within the given resource framework”*, reveal that 50.0% of the responses from those subjects who fall into the 1st level strongly agree or agree with the statement, while respectively 36.6% and 30.0% for the 2nd and 3rd level.

As initially noted, there are few major differences in the responses between Cadets with differing levels of education. Taking the exceptions into consideration, the only trend that might be identified is that those who fall into the 1st level have a slightly more Newtonian perspective than the 2nd- and 3rd level.

This part of the chapter has presented the results from the questionnaire categorized as general Newtonian- and Complexity Theory Principles, traditional- and complex leadership while using demographic variables as a basis for comparison. The next section aims at providing a link the different trends while simultaneously linking them to the literature.

5.2. Discussion of the Results in Terms of the Literature

The latter sections of this thesis have identified certain trends towards Complexity Theory- or Newtonian Principles amongst Cadets in the Military Academy. In order to more clearly identify the link between the different trends and the theory, we now discuss these tendencies in light of the previously elaborated literature. This section strives to draw parallels between the general- and the leadership-part and in this way offer more support for the given trends. In the first part of this section Newtonian trends will be discussed, secondly the Complexity Theory-trends and finally the most relevant gaps and anomalies will be presented.

5.2.1. Newtonian Trends

Four highlighted Newtonian trends form the basis of this discussion together with a description of how these are represented in terms of the literature.

Trend 1: Conflict, chaos and change is perceived as something negative

According to the part presenting factors 1 to 16, general Complexity Theory- and Newtonian Principles, the Cadets have a Newtonian view on the related factors of conflict (factor 2), chaos (factor 8) and change (factor 9). The Cadets indicate by their responses that conflict is primarily looked upon as something negative. The same trend is evident regarding their view on chaos where stability and balance is looked upon as something positive and constructive, while chaos is looked upon as something negative and destructive. Change often causes more negative- than positive effects and is, according to the Cadets' point of view, not essential for the organization's survival. The view these three factors present is also

supported by question 11 on factor 11 (control) where the majority of the replies agree with the statement that when they are leading their unit, their most important goals are to create or maintain control.

In terms of leadership the Cadets' focus is on reducing conflict, creating and maintaining stability and balance and is supported by the Newtonian view that leaders should *not* disrupt existing patterns, but rather minimize uncertainty and instability (factor 17).

The Cadets' view on conflict, chaos and change reveal a Newtonian trend. It is left up to us now to look at how this view is presented in the literature.

Literature

According to Cilliers (1998: 4), equilibrium in a complex system is equivalent with stagnation and death. Complex systems operate in a *far-from-equilibrium environment* constantly changing and creating opportunities for creativity and change. This statement is based on the principles of dissipative systems developed by Ilya Prigogine where chaos is looked upon as the basic building block to create order (Parker & Stacey, 1997: 37). The imbalance or instability in a complex system becomes a source of renewal through self-organization and emergence (Wheatley, 1999: 21).

A Newtonian perspective on the other hand emphasizes control over events and strives to create balance and stability. Change is the end product of a rational and incremental process that is initiated and controlled by management through procedures and well planned events.

In order to create stability and balance there is a strong Newtonian tendency towards using forecasting, long term planning and goal-orientation as a means of restoring and maintaining equilibrium, a view the majority of the Cadets share.

Trend 2: Forecasting, long term planning and goal-orientation is the key to success

The majority of the respondents believe that long term and detailed planning usually creates good results in an organization (factor 3 – long term planning). An essential part of long term planning is the process of forecasting, something the Cadets find strongly relevant in their planning of operations (factor 4 – forecasting and predictability). An equally important aspect in the planning process- and in the execution of the plans is the articulation of goals and subsequently managing by objectives and goals (factor 6 – process-orientation), something which is a strong Newtonian trend among the Cadets. The importance of goal-orientation instead of process-orientation is also supported by the Cadets' belief that task-orientation is

the most important aspect of achieving success as a leader in their organization (factor 14 – relationships).

In terms of leadership a vast majority of the Cadets support the view where the articulation of goals and the provision of good enough systems to reach the goals is the most important function of a top-level leader (factor 23 – sense-making). Simultaneously, a majority of the respondents believe that leaders should focus on detailed planning and automatic responses in order to manage uncertainty and unpredictable situations (factor 28 - Unpredictable and boundary less system).

Literature

According to Cilliers (1998: 4) a complex system is not possible without non-linear interactions. The Newtonian view presented in the latter section however supports a view where the organization is regarded as a linear and deterministic system governed by negative feedback (Galbraith, 2004: 14)

A non-linear system is highly sensitive to initial conditions, i.e. something that might seem like a small change might escalate into a rather big change (Parker & Stacey, 1997: 13). Small changes in the internal or the external environment of the organization may for instance create big and unforeseen effects. From a Complexity point of view then, a prediction of future events and long term and detailed planning is looked upon as deceptive and counter-productive.

In a Newtonian system stable goals are important attractors and serve as a means of guiding behaviour. The diverse sets of plans and strategies aim at creating balance by reaching pre-defined goals and objectives based on future predicaments. Implicit in this way of thinking is a disposition towards behaving like the organization, which means that individuals exist independent of the organisation's environment, i.e. they are *closed systems* (Juarerro, 2007: 110).

In a complex system, however, the static attractor of a goal is substituted by strange attractors that may manifest themselves as values and vision in an organization (Wheatley, 1999: 132). Thus, Complexity Theory emphasizes process-orientation instead of objective orientation. Furthermore, instead of functional analyses, the managers should identify the internal and external *processes* that are linked to the organization and adapt the structure to the *de facto* circumstances (Kiel, 1994: 191).

Newtonian-based actions such as forecasting and long term planning are based on negative feedback (Galbraith, 2004: 14) where equilibrium is the desired end-state. A complex system, however, is characterized by positive feedback (Galbraith, 2004: 14), although

negative feedback is also a natural part of the system. Positive feedback is, in contrast to negative feedback, reinforcing and destabilizing (Parker & Stacey, 1997: 25-26).

Non-linearity and positive feedback-loops are essential aspects in the process of self-organization. However, Cadets are often sceptic of self-organization, something which forms the basis of the discussion in the following section.

Trend 3: The Cadets foster direct leadership based on a “hard” leadership-style and do not believe in self-organization.

As presented in the questionnaire, Cadets do not believe in self-organization (factor 12). The average percentage of 82.5 supports a Newtonian view where a team’s success depends on the leader and not necessarily on the ability of self-organization within a group. This attitude corresponds well with the view that leadership in essence is linked to a direct approach to leadership⁶ (97.4% on question 39, factor 24).

The Cadets’ belief in a person-centered and direct approach to leadership is also reflected in their approach to leadership-style. 88.9% of the responses strongly agree or agree that Newtonian metaphors for leadership style is the best way to describe their leadership style (question 56, factor 27), while only 13.7% of the responses identify their leadership style with Complexity Theory metaphors.

Although the literature on the topic of leadership style is vast, the core elements of Complexity Leadership are readily accessible. These are described and expounded on in the following section.

Literature

The principles of self-organization are often a strong contradiction to Newtonian organization principles. These are characterized as person-centered, top-down-driven and control-based. Cilliers (1999:90) defines self-organization as *“the capacity for self-organization is a property of complex systems which enables them to develop or change internal structure spontaneously and adaptively in order to cope with, or manipulate, their environment”*.

Self-organizational approaches emphasize the organization’s co-existence with the environment (Kiel, 1994: 192) and foster bottom-up approaches (to leadership). From an

⁶ 76.9% of the responses on question 53 (factor24) do, however, support an indirect approach to leadership based on the belief that for instance empowerment and facilitation are the essence of leadership.

organizational perspective a self-organizing organization will focus on *inter alia* operating far-from-equilibrium using unstable work teams and interpreting chaos as an opportunity. An equilibrium seeking organization on the other hand strives towards *inter alia* unified equilibrium using stable work teams and interpreting chaos as an excuse (Kiel, 1994: 186-187).

Leaders in complex systems should support the indirect and catalytic processes within the organization (Schneider & Somers, 2006: 357). The literature refers to this approach as indirect leadership (e.g. Burns, 2002: 49), non-linear leadership (Kiel, 1994: 175) and decentralized leadership (Johnson, 2001: 231; Keene, 2000: 16-18; Parellada, 2007: 166). According to these approaches the leader act as a facilitator, *making things possible* for the organization instead of *making it happen*. By emphasizing stewardship and creativity the leader encourages innovation by allowing emergence and self-organization (Plowman et al, 2007: 354).

In order to provide an adequate response to challenges in complex organizations leaders must move the main focus from macro-systems to the micro-level interactions between people (Karp and Helgø, 2007: 35). This view is based partly on the knowledge that in a complex system it is the relationship and not physical or technical objects which is important. In order to support micro-level interactions the leader must focus on soft values such as psychological processes and values, and should incorporate a qualitative approach to leadership.

The Newtonian Approach is often based on a rational and top-down approach to leadership where regulations and rules are the most important leadership tools needed in order to obtain organizational objectives (Edwardsen, 2000: 263).

As described briefly in the latter paragraph, rationality is an important building block in Newtonian thinking. The next section will discuss the Cadets' relationship to rationality.

Trend 4: The Cadets embrace rational thinking

A vast majority of the respondents agree that they usually try to base their decisions on a thorough analysis, taking all the relevant facts into account, i.e. a strictly rational approach (question 15, factor 15). This attitude is also related to the Cadets' attitude towards looking at the whole as a sum of its parts, i.e. in order to solve a problem the best thing is to split the problem into smaller problems and solve each of them independently (question 7, factor 7).

The Cadets' relationship to forecasting and predictability (factor 4) also support the notion of rational thinking.

The method of rational thinking is linked to the literature as follows.

Literature

A rational approach to decision-making implies an objective process where all hard facts are gathered and a decision is made using quantitative methods. Thus, the reality is looked upon as something physical and something one can observe objectively. A Complexity Approach, on the other hand, states that reality consists of both material and non-material aspects and that objectivity is impossible (Wheatley, 1999: 50-52; Cloete, 2006: 468).

Rational thinking is supported by an atomistic approach that seeks to understand the whole by merely analysing the parts (Cilliers, 1998: 456). As such, this kind of thinking is based on a deterministic framework that does not take into account interdependence and non-linear behaviour (Juarrero, 2007: 110). A Complexity Approach on the other hand seeks to understand the whole as patterns developing over time (Wheatley, 1999: 117-119). In other words, the whole is more than the sum of its parts.

This part of the discussion has presented the strongest Newtonian trends among the Cadets and has simultaneously created links to the most relevant literature presented in Chapters 2 and 3. The next section is a continuation of the discussion on the strongest Complexity Theory-trends.

5.2.2. Complexity Theory Trends

In this section we discuss three important Complexity Theory trends by looking at the manner in which these trends are represented in the literature.

Trend 5: The Army is an open system characterized by unpredictability and uncertainty

A vast majority of the respondents state that their organization is very much affected by external events and that the organization needs to adapt continually to changing circumstances (question 13, factor 13). In order to respond adequately to uncertainty and

unpredictable situations almost all of the respondents state that military leaders should always focus on continually developing the ability to adapt⁷ (question 43, factor 28).

Compared to using well planned policies and regulations as the most important guiding principle to create success, the majority of the respondents believe that a shared vision and strong organizational values are the most important guiding principles for the creation of success in their organization (question 40 and 54, factor 25).

The Cadets' emphasis on adaptation and "soft" guiding principles are well correlated with the Cadets' perception of quantitative- versus qualitative methodology. A vast majority of the responses indicate that quantitative measures such as statistics, facts and figures alone do not give the necessary input in order to fully understand something (question 5 and 20, factor 5).

The trends presented in this section have revealed an adherence towards Complexity Theory-principles. In the next section we investigate the link that these principles and responses have with the literature.

Literature

Cilliers (1998: 4) states that complex systems are open systems that interact with their environment. The constant process of interaction is best defined as dynamic, non-linear and unpredictable. In order to respond adequately to the changing circumstances the organization's ability to adapt is the key to its success.

The literature states that in order for the organization to respond adequately to changing circumstances the organization should focus on adaptive- and enabling leadership, using values and vision as guiding principles supporting emergence and self-organizational processes (Uhl-Bien et al, 2007: 299, 305-308, 314).

Stacey and Griffin (2005) argue that leaders should act as *participants* in the process of vision- and value making. The visions and values in a company emerge in a bottom-up process based on the everyday interaction between human beings, not as a result of a grand design from top management (Stacey & Griffin, 2005: 106, 116-117, 121-122).

⁷ However, the 52.1% of the responses simultaneously state that the method of adaption should be through detailed planning and automatic responses (question 57, factor 28), which is an interesting point of view.

A quantitative methodology is not a comprehensive and a holistically relevant model is needed to understand complex systems fully. The process of reducing the complexity into hard facts reduces the complex into something simple (Cilliers, 1999: 24).

Stating that the Cadets' organization is an open system that needs constantly to adapt have consequences for the way leadership is exercised. The next section elaborates on the subject of informal leaders and encouraging novelty.

Trend 6: The Cadets perceive themselves as informal leaders that encourage novelty

Close to 90.0% of the respondents believe that their power as military leaders come from them being recognized as a leader through everyday interaction, and not due to their formal position (question 34 and 48, factor 19). The Cadets further strongly indicate that their role is to encourage novelty instead of creating novelty themselves (question 33 and 47, factor 18). This view is also supported by the Cadets' support of the statement that their most important goal when leading their unit is to create freedom of action, flexibility and independence for their subordinates (question 26, factor 11). The Cadets further do not believe that a decentralization of control and responsibility often creates poorer results (question 35, factor 20), a point of view that coincides with the other points presented in this section.

Once again, it will be useful to see how these views are presented in the relevant literature.

Literature

In complex systems leaders emphasize support of emergent processes instead of directing the events through formal procedures, something the literature labels as an informal- and indirect approach to leadership (Schneider & Somers, 2006: 357). This approach further speaks for the leader acting as an enabler for self-organization (Schneider & Somers, 2006: 356; Plowman et al, 2007: 344). In a self-organizational system a decentralization of control is equivalent to better control and resilience (Cilliers, 1998: 110), a view that serves as a contradiction of the person- and centralized focus Newtonian Approach.

A prerequisite for successful leadership in complex systems is the leader's ability to participate in social processes, something which the next section will investigate.

Trend 7: Emotional intelligence and relationship-orientation are essential aspects of leadership

The Cadets strongly believe that having insight and understanding of the people one leads and cooperates with is a far more important feature of military leadership than having insight and understanding of the technical system one operates (question 31 and 46, factor 16). This

view is further supported by the Cadets' belief that the most important thing in order to achieve success as a leader in their organization is to be relationship-oriented (question 14, factor 14), although the Cadets simultaneously believe that the most important thing in order to achieve success as a leader in their organization is to be task-oriented (question 29, factor 14).

The belief that leaders in complex systems must focus on micro-level interactions is a highlighted part of the literature on leadership in complex systems

Literature

Leaders in complex systems are more dependent on emotional awareness and the capacity for attunement and empathy than the traditional hard and technical leadership approach (Stacey, 2005: 11). This statement is based on the fact that the bottom-up process of self-organization is manifested in the interaction between people, in contrast to the often top-down and incremental change processes in Newtonian systems. The focus on relationship as the basic element of life speaks for a leader who is a participant in the continuous social process of emergence (Simpson, 2006: 479), and not the technical- and objective-oriented leader often connected to a Newtonian way of thinking.

This part of the discussion has highlighted the strongest Complexity Theory-trends among Cadets. Although this thesis has presented some strong Newtonian- and Complexity Theory trends, there are also a number of contradictions in the Cadets' responses that are important to draw attention to in order to create a more balanced picture. In the following section we present some of the gaps and anomalies which make up a number of these contradictions and exceptions.

5.2.3. Gaps and Anomalies

Authors of Complexity Theory often characterize their field of study as full of contradictions, illogical and difficult to understand. There are results in this questionnaire that perfectly represent this picture, something which also serves perhaps as a symbol of the inherent complexity of nature.

For instance, on the one hand the Cadets perceive themselves as informal leaders that encourage novelty by creating freedom of action, flexibility and independence for their subordinates. On the other hand they foster a direct leadership approach based on a hard leadership style. A decentralized approach to leadership inherently creates less control for

the leader (in a traditional sense), while one of the strongest trends among the Cadets' responses is the importance of stability, balance and control.

The Cadets have indicated their willingness to agree that emotional intelligence and relationship-orientation is one of the most essential aspects of leadership, while simultaneously believing that military leaders should not focus primarily on micro-level interactions between people when they are handling complex problems. The Cadets further speak for a hard- and technical leadership style instead of a soft- and relationship oriented leadership style. They further state that a "technical approach", i.e. detailed planning and automatic responses, is the method military leaders should use in order to manage uncertain and unpredictable situations.

Compared to using well planned policies and regulations as the most important guiding principle for creating success in their organization, a vast majority of the Cadets state that a shared vision and strong organizational values are the most important guiding principles for the creation of success in their organization. However, the Cadets also state that articulating goals and providing good enough systems is a far more important leadership function than providing purpose for the organization through the use of inspirational and expressive language. The latter point of view is further supported by the Cadets' attitudes towards long term planning, forecasting and goal-orientation.

For the purposes of this thesis we do not interpret these contradictions as crucial or detrimental to the overall picture presented in this chapter, but more as a feedback from the Cadets on their versatile and dynamic attitudes towards things.

This discussion has presented the strongest Newtonian- and Complexity Theory-trends in the survey and has simultaneously linked the different views to the most relevant literature presented in chapter 2 and 3. Finally this chapter also provided a brief discussion on a number of relevant gaps and anomalies.

5.3. Summary

This chapter has attempted to obtain research objective 3, which is to *describe and analyze the Cadets' worldview up against the principles of Complexity Theory and leadership in a complex system.*

In order to achieve research objective 3 this thesis divided research objective 3 into multiple sub-objectives. The findings of this chapter are linked to the different sub-objectives.

Research objective 3.10: To present the results from the empirical survey.

Research objective 3.10.1: To describe the sample.

The 117 participants are evenly distributed according to their levels of education. The majority of the Cadets are between 24-27 years and 95.7% are male. The Cadets have backgrounds from all the different branches of the Army, but the branch of Infantry has the biggest representation.

Research objective 3.10.2: To describe the Cadets' attitude towards general Complexity- and Newtonian Principles.

The main trend in this part of the questionnaire is a relatively stronger adherence towards Newtonian Principles than Complexity Theory Principles.

An adherence towards Newtonian Principles can be identified in the results related to *conflict* (factor 2), *chaos* (factor 8), *change* (factor 9), *long term planning* (factor 3), *forecasting and predictability* (4), *process-orientation* (factor 6), *self-organization* (factor 12) and finally *rationality* (factor 15).

The factors that have a majority of Complexity Theory responses are *quantitative methodology* (factor 5), *(non-)linearity* (factor 10) and *open systems* (factor 13).

The results from *heterogeneous agents* (factor 1), *holism* (factor 7), *control* (factor 11) and *relationships* (factor 14) reflect an ambivalent attitude or a balanced picture between Newtonian- and Complexity Theory Principles.

Research objective 3.10.3: To describe the Cadets' attitude towards traditional leadership- and complexity leadership principles.

The main trend in this part of the questionnaire is a relatively stronger adherence towards Complexity Theory Principles than Newtonian Principles.

An adherence towards Newtonian Principles can be identified in the results related to *disrupt existing patterns* (factor 17), *sense-maker* (factor 23), *indirect leadership* (factor 24) and *soft values* (factor 27).

The factors that have a majority of Complexity Theory responses are *emotional intelligence* (factor 16), *encouraging novelty* (factor 18), *informal leadership* (factor 19), *decentralization* (factor 20), *vision and values as guiding principles* (factor 25), *unpredictable and boundary-less system* (factor 28) and *leadership as something intangible and abstract* (factor 29).

Factor 21 (*system-centered leadership*) and factor 26 (*anxiety*) have a high level of uncertain responses, while factor 22 (*building and mending relationships*) reveals a trend of contradicting replies.

Research objective 3.10.4: To describe the results based on different demographic variables.

The demographic variables of gender, military background and age-categories are not used in this part of the analysis.

The result-trend distributed on the different levels of education reveals that there are no big differences in the way the different levels of education respond to the questionnaire.

Research objective 3.11: To discuss the Newtonian- and Complexity Theory-trends in terms of the literature.

This thesis has identified the following trends among the Cadets:

- Trend 1: Conflict, chaos and change is perceived as something negative
- Trend 2: Forecasting, long term planning and goal-orientation is the key to success
- Trend 3: The Cadets foster direct leadership based on a “hard” leadership-style and do not believe in self-organization.
- Trend 4: The Cadets embrace rational thinking
- Trend 5: The Army is an open system characterized by unpredictability and uncertainty
- Trend 6: The Cadets perceive themselves as informal leaders that encourage novelty
- Trend 7: Emotional intelligence and relationship-orientation are essential aspects of leadership

This chapter has presented and discussed the results of the research survey. The next and final chapter highlights the most important features of this thesis and presents some general recommendations for further study.

Chapter 6: Summary and Conclusions

This thesis started by asking the question: *What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?* Through the different chapters this thesis has attained different research objectives and will in this last chapter summarize the findings connected to these objectives.

In order to answer the research question this chapter is divided into multiple sub-objectives,

Research objective 4.1: To summarize the findings of chapter 1, introduction.

Research objective 4.2: To summarize the findings of chapter 2, Complexity Theory.

Research objective 4.3: To summarize the findings of chapter 3, Traditional leadership and Complexity Leadership.

Research objective 4.4: To summarize the findings of chapter 4, research design and methodology.

Research objective 4.5: To summarize the findings of chapter 5, The Cadets and their worldview.

Research objective 4.6: To present the conclusions of this thesis.

In order to reach these objectives this study will summarize the most important features of this thesis in a chronological sequence starting with chapter 1 and ending with chapter 5. Second and finally, the conclusions of this thesis will be presented.

6.1. Chapter 1: Introduction

The purpose of this chapter is to introduce the topic of the study and describe how this thesis is organized to answer the research question.

The background for this study is based on the emergence of an increasing complexity in the society. The automatic response to this complexity is often based on a traditional or Newtonian Approach based on reductionism and a mechanistic worldview. Complexity Theory on the other hand offers a new approach to understand this complexity by focusing on principles taken from the Natural Science theory of Quantum Physics, for instance principles such as non-linearity, non-causality and self-organization.

The Complexity Approach raises interesting and challenging questions about the way we traditionally execute leadership that emphasizes reductionism, rationality and determinism. The Officers in the Norwegian Army have traditionally been connected to a traditional or Newtonian way of executing leadership, and based on this belief this thesis finds it interesting and relevant to investigate the Officers' relationship to Complexity Theory Principles by asking the following research question:

What is the Cadets' worldview at the Norwegian Military Academy? Does this worldview adhere to the principles of Complexity Theory and the implications of this theory for leadership?

In order to answer the research question this thesis is having a non-empirical literature review and an empirical survey based on primary data.

This thesis is organized in chapters, where chapter 2 investigates Complexity Theory, chapter 3 investigates Traditional- and Complexity Leadership, chapter 4 describes the research design and methodology, chapter 5 describes the Cadets and their worldview and finally chapter 6 which summarizes and concludes this study.

This study will now continue by summarizing the most important features of chapter 2, Complexity Theory.

6.2. Chapter 2: Complexity Theory

The purpose of this chapter is to define and describe Complexity Theory and differentiate it from what is understood by an orthodox Newtonian Theory.

Complexity Theory is a Social Science-theory that originates from the Natural Science-theory of Quantum Physics. Although there is no uniform and generally acknowledged definition of Complexity Theory, central aspects that are highlighted are non-linearity, chaos and self-organization.

A complex system has many similarities with a natural and living system. The literature emphasizes how a large number of agents in a dynamic and non-linear way interact with each other and the environment as an open- and inter-connected system. The system operates in a far-from-equilibrium state with both negative- and positive feedback which secure the system's survival through constant flow of energy.

A Newtonian system is on the other hand based on a mechanistic and reductionist worldview that manifests itself as for instance a heavily formalized- and hierarchical organization.

Central characteristics of Newtonian system are a constant strife to achieve balance and control through deterministic- and rational mechanisms such as forecasting and detailed long term planning. The organization thus operates in a causal- and relatively closed environment where change is incremental and top-down driven.

A complex system must be understood holistically by the patterns that emerge through the actions of interconnected agents, and not as a Newtonian “zero-sum-game” where the sum of the parts is equal to the whole. However, for matters of presentation, four basic components of Complexity Theory are identified. The first component of Complexity Theory is *non-linearity* and refers to how a relationship is not proportional and the manner in which tiny causes can create huge effects. The second component is *chaos* which represents how chaos and disequilibrium in a system is a prerequisite for survival and stability. The third component is *feedback* and illustrates how positive feedback loops act as a reinforcing and destabilizing force which results in non-linear outcomes. The fourth and final component is *self-organization/emergence* that emphasizes how emergence is the result of our co-existence with the environment and how a system through self-organization adaptively reacts and co-exists with emerging events.

A Complexity Approach implicates a number of things for organizational life. The strong limitations on predictability will for instance favor a focus on relations and processes instead of technical- and goal-oriented behavior. Other implications might include a focus on values and principles as guiding measurements instead of rules and regulations, and the importance of heterogeneous and unstable work teams.

But what implications do the principles of Complexity Theory have on leadership? The next section will summarize the most important features of Traditional- and Complexity Leadership.

6.3. Chapter 3: Traditional Leadership and Complexity Leadership

The purpose of this chapter is to investigate the implications of Complexity Theory on leadership and how it differs from the traditional characteristics of leadership.

Traditional leadership theories are normally based on the assumptions of Newtonian thinking, i.e. objectivity, reductionism and determinism. The common denominator in the majority of traditional leadership theories is that it is centered on the leader and it supports a top-down approach and rational objectivity. A traditional leader is actively shaping the future through regulations that ultimately end in the obtainment of goals. In other words, the processes are characterized as rational, “hard” and incremental.

Changing circumstances do, however, reveal a need for a redefinition of how we think about leadership. The literature-review on leadership in Complexity Theory identifies four major aspects. First of all, the leader functions as an *enabler* for bottom-up- and self-organizational processes and not as a director of events. Disruption of existing patterns and guiding behavior through a set of simple rules are important mechanisms in order to enable these processes.

Secondly, a leader embraces *chaos* and uncertainty as something positive. Spontaneous development and novelty within the organization is supported by an indirect-, decentralized-, and non-linear approach to leadership.

Thirdly, the leader uses *vision and values* as guiding principles instead of rules and regulations. To support the emergence of vision and values in an organization this thesis proposes to emphasize soft management tools such as facilitation, participation and empowerment.

Fourth and finally, the leader focus on *micro-level interactions* as a means to develop self-organizational behavior. Based on a fundamentally relational focus and looking at leadership as a social process of recognition, the leader should be emotional intelligent and focus on qualitative matters such as values, communication-patterns and psychological processes.

This chapter also suggests a list for a complex approach to leadership containing 19 general propositions.

The non-empirical literature review in chapter 2 and 3 has made the basis for the development of the empirical survey based on primary data, something which the next section will elaborate on.

6.4. Chapter 4: Research Design and Methodology

The intention with this chapter is to outline the research design and methodology applied in order to answer the research question of this study.

Based on the literature-review this thesis identifies 29 factors which serve as the foundation for the development of the questions in the measuring instrument. The questionnaire consists of 62 questions with additional questions about demographic details. The collection of the data was administered through a self-administered and paper-based questionnaire.

Using a method of non-probability convenience sampling the Cadets (line of operational studies) at the Military Academy were identified as the most accessible and relevant sample.

The data was captured in SPSS and the analysis was based on a quantitative methodology using descriptive statistics. The presentation of the results is linked to the 29 identified factors.

This thesis has identified that method variance, data collection in a single point of time, single sample and number of questions per factor might be considered as possible shortcoming and sources of error.

Using the research design and methodology outlined in this chapter this thesis collected the data at the Norwegian Military Academy. The next section will present the most important results.

6.5. Chapter 5: The Cadets and their Worldview

The purpose of this chapter is to present and discuss the results from the survey.

117 Cadets participated in the survey. The majority of the participants are between 24-27 years and 95.7% are male with various backgrounds from all the branches of the Army.

The results from factor 1-15, which represent general Complexity Theory- and Newtonian Principles, reveal that the Cadets adhere more towards Newtonian- than complexity principles. The results from factor 16-29, which investigate Traditional- and Complexity Leadership, do on the other hand reveal the opposite trend.

The following Newtonian trends have been identified in the discussion of the results:

- Trend 1: Conflict, chaos and change is perceived as something negative
- Trend 2: Forecasting, long term planning and goal-orientation is the key to success
- Trend 3: The Cadets foster direct leadership based on a “hard” leadership-style and do not believe in self-organization.
- Trend 4: The Cadets embrace rational thinking.

The following Complexity Theory-trends have been identified in the course of the discussion:

- Trend 5: The Army is an open system characterized by unpredictability and uncertainty
- Trend 6: The Cadets perceive themselves as informal leaders that encourage novelty
- Trend 7: Emotional intelligence and relationship-orientation are essential aspects of leadership

The results from the survey also contain a number of contradictions that add difficulty in firmly establishing clear and consistent trends. However, this thesis interprets these variations as a symbol of the Cadets' dynamic attitudes towards things, and not as a methodological weakness.

As this thesis now has summarized the most important features of chapter 1 to chapter 5, the next section will present the conclusive remarks.

6.6. Conclusive Remarks

The purpose of this section is to present the conclusive remarks of this thesis.

This study is the first to investigate the link between Complexity Theory, the implications for this theory on leadership and the worldview of a selected group of Cadets at the Norwegian Military Academy.

The analysis of the non-empirical literature review and the results from the empirical survey evidently lead this thesis to the following conclusions:

First of all, Complexity Theory is based on fundamentally different- and often contradictory principles than orthodox Newtonian Theory. While a Complexity Approach for instance emphasizes non-linearity, chaos and self-organization, a Newtonian Approach accentuates linear thinking, control and top-down organization.

Secondly, a Complexity Approach to leadership is better suited to react to complexity than a traditional and Newtonian-influenced leadership approach. Traditional leadership approaches have the objective to achieve equilibrium through regulations and detailed incremental planning processes, while a Complexity Approach to leadership speaks for process-orientation and facilitation of emergent- and self-organizational behaviour.

Third and finally, the Cadets' attitudes reflect relatively balanced Newtonian- and Complexity Theory-trends. Although there is no clear and consistent overall trend towards one of the approaches, the different sub-trends are valuable in order to develop an understanding of the Cadets' worldview and what they emphasize in their leadership.

Hence, this study can amongst others be used to evaluate the effect of the current educational paradigm in the Norwegian Army and simultaneously contribute to further insight and discussion around the field of leadership.

This thesis recommends a further investigation of the implications Complexity Theory has on different aspects of general Military activities and specifically how the Military organization

should structure its leadership education in order to develop the organizations capability to react adequately to changing circumstances.

This thesis now presents the list of references.

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- (1) Keyword: Complexity
- (2) Keyword: Santa Fe and Poincare
- (3) Keyword: Simple
- (4) Keyword: Norway + defense
- (5) Keyword: nonlinear
- (6) Keyword: chaos
- (7) Keyword: Dissipative
- (8) Keyword: Strange attractor
- (9) Keyword: Attractor
- (10) Keyword: Strange attractor
- (11) Keyword: Emerge
- (12) Keyword: Values
- (13) Keyword: Vision
- (14) Keyword: Norway

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Annexure 1: Questionnaire

PURPOSE OF THE QUESTIONNAIRE

The purpose of this questionnaire is to investigate social science theory and leadership, and how this is linked to military officers' general world view.

By participating in this study you will get the opportunity to communicate your perceptions regarding important leadership perspectives. The provided information can furthermore give valuable information for evaluation of the existing educational system in the Defense Force.

YOUR RIGHTS AS A PARTICIPANT

As a participant in this study, you have the right to;

1. decline participation
2. withdraw from the research at any time once your participation has begun.

There will be no consequences of declining or withdrawing from the study.

If further information about the research or your rights as a participant is needed, please contact roenn@hotmail.com.

INSTRUCTIONS

Your responses to this questionnaire will be treated as **anonymous and confidential** and will only be used for research purposes. Please answer **all** the questions.

The questionnaire is expected to take approximately 15 minutes to complete.

1. Please indicate your response to each question by encircle (or ticking the box) one of the alternatives provided, or fill in the answer where required. If you want to correct, please make an X over the false option and circle the new response.
2. There is statistically proven that respondents in general lean towards a central tendency, i.e. they answer on the middle of the scale. Please keep this in mind and make, if possible, choices based on preferences.
3. Please read the questions carefully and reflect for a moment before you answer.
4. The questionnaire is individual work and it is not allowed to cooperate.

Thank you for your participation. Your contribution is appreciated!

By ticking this box I agree that I have been informed of my rights in participating in this research and I give consent for the researchers to use my response for research purpose only

ENGLISH-NORWEGIAN DICTIONARY

English	Norwegian
E.g.	For eksempel
Equilibrium	Balanse
Freedom of action	Handlefrihet
Trait	Karaktertrekk (personlighet)
Disperse	Spre
Deviate	Avvike
Subordinate	Underordnet
Facilitation	Fasilitere, legge forholdende til rette
Heterogeneous	Ulik, uensartet
Adapt	Tilpasse (seg), adaptere

PART 1 - DEMOGRAPHICS DETAILS

Please mark the appropriate option.

Level in education

1st level 1

2nd level 2

3rd level 3

Gender M 1 F 2

Age _____

Background Art 1 Cav 2 Inf* 3 Log 4 San 5

Eng 6 Ebn** 7 MP 8 Samband 9

Other 10 If other, please note which unit _____

*: Includes HMKG

** : Includes GSV/ISTAR

PART 2

Please indicate on a scale to what extent you agree with the statements below, where 1 = Strongly Agree, 2 = Agree, 3= Uncertain, 4 = Disagree and 5 = Strongly Disagree.

Please encircle the appropriate option.

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1	I <i>usually</i> prefer working in groups consisting of many different personalities and cultures	1	2	3	4	5
2	I <i>mostly</i> prefer working in a harmonious work team with little friction and disagreement	1	2	3	4	5
3	Long term - and detailed planning is <i>usually</i> creating good results in an organization	1	2	3	4	5
4	When I plan an operation or event I <i>usually</i> put much emphasis on trying to predict what will happen	1	2	3	4	5
5	To create an understanding of something I only need to be given the statistics, objective figures and concrete facts	1	2	3	4	5
6	I believe that managing by objectives or goals <i>usually</i> is the best way to create success for my organization.	1	2	3	4	5
7	When I am analyzing a problem the best thing is to split the problem into smaller problems and solve each one of them independently. In other words, the whole = part+part+part etc.	1	2	3	4	5
8	Chaos in an organization is <i>usually</i> looked upon as something negative and destructive	1	2	3	4	5
9	<i>Constant</i> change is <i>always</i> necessary for an organization to survive	1	2	3	4	5

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
10	Small actions <i>usually</i> create small effects. In other words, if I do little I create little	1	2	3	4	5
11	When I am leading my unit, <i>my most important</i> goal is to create or maintain control	1	2	3	4	5
12	I think that a unit <i>usually</i> is dependent on having a leader to achieve success	1	2	3	4	5
13	I believe that my organization is very much affected by external events and that it needs to <i>constantly adapt</i> to changing circumstances	1	2	3	4	5
14	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be relationship-oriented	1	2	3	4	5
15	When I make a decision I <i>usually</i> try to base it on a thorough analysis taking all relevant facts into account	1	2	3	4	5
16	It is <i>usually not</i> beneficial for a group to have a heterogeneous composition	1	2	3	4	5
17	I <i>mostly</i> think of conflicts within a group as something good	1	2	3	4	5
18	Detailed plans, policies and strategies <i>rarely</i> work out as they were intended to	1	2	3	4	5
19	The assumptions one make of the future <i>often</i> turns out to be misleading	1	2	3	4	5
20	My experience is that statistics, facts and figures alone do not give the necessary input to fully understand something	1	2	3	4	5

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
21	I believe that the life in my organization in essence is a process of human relations and that a process-orientation <i>usually</i> achieve more than a goal-orientation	1	2	3	4	5
22	When I am making a decision I <i>always</i> think how the decision might affect the “bigger picture”.	1	2	3	4	5
23	Stability and balance in an organization is <i>usually</i> looked upon as something positive and constructive	1	2	3	4	5
24	<i>Constant</i> change in the organization is <i>often not</i> necessary and have more negative effects than positive	1	2	3	4	5
25	A decision or action made by a sergeant on team level can create big effects at the strategic level	1	2	3	4	5
26	When I am leading my unit, <i>my most important goal</i> is to create freedom of action, flexibility and independence for my subordinates	1	2	3	4	5
27	I think that a team in <i>many cases</i> can be more successful working without a formally appointed leader	1	2	3	4	5
28	I believe my organization should always stick to the defined plans and strategies	1	2	3	4	5
29	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be task-oriented	1	2	3	4	5
30	I <i>usually</i> make spontaneous decisions based on intuition	1	2	3	4	5

Part 3

Please indicate on the scale to what extent you agree with the statements below, where 1=Strongly Agree, 2= Agree, 3 = Uncertain, 4 = Disagree and 5 = Strongly Disagree.

Please encircle the appropriate option.

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
31	Having insight and understanding of the people one lead and cooperate with is <i>the most important feature</i> of military leadership.	1	2	3	4	5
32	I think it can be useful to sometimes <i>intentionally</i> create uncertainty and instability in an organization	1	2	3	4	5
33	I think that innovation and creative thinking <i>usually</i> is the task of the leader, not the subordinates.	1	2	3	4	5
34	As a military leader I get my power through the formal structure of the organization.	1	2	3	4	5
35	I believe that a decentralization of control and responsibility <i>often</i> create poorer results	1	2	3	4	5
36	I see myself as a leader who works as an <i>objective</i> observer of events and who intervenes with corrective directions and regulations when the events deviate from the plan	1	2	3	4	5
37	In order to handle complex problems military leaders <i>should</i> have their main focus on the micro-level interactions between people	1	2	3	4	5
38	The <i>most important</i> function of a top-level leader is to provide <i>purpose</i> for the organization through the use of inspirational and expressive language	1	2	3	4	5

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
39	For me, leadership is <i>in essence</i> directly linked to how I behave and what I say in front of my subordinates. In other words, my actions guide my subordinates' behavior	1	2	3	4	5
40	A shared vision and strong organizational values are the <i>most important</i> guiding principles to create success in my organization	1	2	3	4	5
41	I accept that processes within my organization create anxiety among the employees	1	2	3	4	5
42	I believe the following <u>group</u> of metaphors best describe my leadership style: Gardener, steward, servant, missionary, facilitator and convener	1	2	3	4	5
43	In order to manage uncertainty and unpredictable situations military leaders should <i>always</i> focus on developing the ability to <i>constantly</i> adapt	1	2	3	4	5
44	I believe the ability to think abstract and "outside the box" is the <i>most important</i> trait of a military leader	1	2	3	4	5
45	Having insight and understanding of the technical system one operate (e.g. a weapon's system or a platoon) is the <i>most important</i> feature of military leadership	1	2	3	4	5
46	When I am leading a task I <i>usually</i> try to minimize uncertainty and instability in my organization and create harmony	1	2	3	4	5
47	Instead of being the centre for innovation and creativity, a leader should <i>usually</i> prioritize to facilitate and encourage innovation among its subordinates.	1	2	3	4	5

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
48	As a military leader I get my power as a result of being recognized as a leader by the other group members through the everyday interaction	1	2	3	4	5
49	I do <i>not</i> think that in order to create control and effectiveness, planning and decision-making should optimally be placed centrally of the organizational hierarchy	1	2	3	4	5
50	I think that leadership is an expression of the collective behavior of my organization where I, as a formally appointed leader am a <i>participant</i>	1	2	3	4	5
51	A complex problem <i>usually</i> requires complex- and often technical solutions	1	2	3	4	5
52	The <i>most important</i> function of a top-level leader is to articulate goals and provide good enough systems to reach the goals	1	2	3	4	5
53	For me, leadership is <i>essentially</i> about making it possible for sub-units or subordinates to solve their mission, for example through empowerment and facilitation	1	2	3	4	5
54	Well planned policies and regulations are the <i>most important</i> guiding principles to create success in my organization	1	2	3	4	5
55	If processes generate much anxiety in an organization, it is not worth it	1	2	3	4	5
56	I believe the following group of metaphors best describe my leadership style: Leader, director, boss, father, problem-solver, doer, pathfinder, navigator	1	2	3	4	5

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
57	In order to manage uncertainty and unpredictable situations military leaders should focus on detailed planning and automatic responses	1	2	3	4	5
58	I believe that the <i>most important</i> leadership trait is the ability to follow procedures to solve a mission within the given resource framework.	1	2	3	4	5

Please mark the appropriate option or fill in where required.

Q59: I look at my organization as

a machine,

where the leadership functions are:

- Setting strategy
- Designing and distributing tasks
- Measuring and reporting progress
- Assigning and controlling actions

or

a living organism

where the leadership functions are:

- Inspiring
- Empowering
- Listening and observing
- Understanding
- Coaching

Q60: Please write down what you connect with this picture



- If yes, which questions? _____
- If yes, what was difficult to understand?

Q62: Rate your own English language proficiency: From ONE (1) Not good - to FIVE (5) Native speaker

1	2	3	4	5
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THANK YOU FOR COMPLETING THIS QUESTIONNAIRE. YOUR PARTICIPATION IS APPRECIATED.

Annexure 2 – Questionnaire – Research Design and Methodology

Q	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly disagree	Reference(s)	Indication
1	I <i>usually</i> prefer working in groups consisting of many different personalities and cultures	1	2	3	4	5	<ul style="list-style-type: none"> • Kiel, 1994: 186 • McKelvey, 2008: 3 • Praught, 2002: 522 • <p>Factor 1: Heterogeneous agents</p>	1 = CT 5 = Newt
16	It is <i>usually</i> not beneficial for a group to have a heterogeneous composition	1	2	3	4	5	<p>Factor 1: Heterogeneous agents</p>	1 = Newt 5 = CT
2	I <i>mostly</i> prefer working in a harmonious work team with little friction and disagreement	1	2	3	4	5	<ul style="list-style-type: none"> • Kiel, 1994: 186 • Cilliers, 1998: 3-5 • Praught, 2002: 522 • <p>Factor 2: Conflict</p>	1 = Newt 5 = CT
17	I <i>mostly</i> think of conflicts within a group as something good.	1	2	3	4	5	<p>Factor 2: Conflict</p>	1 = CT 5= Newt
3	Long term - and detailed planning is <i>usually</i> creating good results in an organization	1	2	3	4	5	<ul style="list-style-type: none"> • Stacey, Griffin and Shaw, 2000: 123-124 • Stacey, 2006: 138 • Parker & Stacey, 1997: 41, 93 <p>Factor 3: Planning – Long term</p>	1 = Newt 5= CT
18	Detailed plans, policies and strategies <i>rarely</i> work out as they were intended to	1	2	3	4	5	<p>Factor 3: Planning – Long term</p>	1 = CT 5= Newt
4		1	2	3	4	5	<ul style="list-style-type: none"> • Stacey, Griffin and Shaw, 2000: 123- 	1 = Newt

	When I plan an operation or event I <i>usually</i> put much emphasis on trying to predict what will happen.						<p>124</p> <ul style="list-style-type: none"> • Praught, 2002: 515 • Schwella, 2005: 52 • Coning & Cloete, 2005: 71-73 • Cilliers, 1998: 109 • Parker & Stacey, 1997: 41 ○ Kiel, 1994: 207-208 <p>Factor 4: Forecasting - predictability</p>	5= CT
19	The assumptions one make of the future <i>often</i> turns out to be misleading	1	2	3	4	5	<p>Factor 4: Forecasting - predictability</p>	1 = CT 5 = Newt
5	To create an understanding of something I only need to be given the statistics, objective figures and concrete facts.	1	2	3	4	5	<ul style="list-style-type: none"> • Cilliers, 1998: 24 • Nilsson, 2007: 242-243 • Roodt, 2007: 218 • Darwin, 2001: 483 • Wheatley, 1999: 28-30 • Parker & Stacey, 1997: 18-19, 74-75 <p>Factor 5: Qualitative methodology</p>	1= Newt 5= CT
20	My experience is that statistics, facts and figures alone do not give the necessary input to fully understand something.	1	2	3	4	5	<p>Factor 5: Qualitative methodology</p>	1= CT 5 = Newt
6	I believe that managing by objectives or goals <i>usually</i> is the best way to create success for my organization.	1	2	3	4	5	<ul style="list-style-type: none"> • Kiel, 1994: 186, 209-210 • Griffin & Stacey, 2005: 11, 25-26 • Shiel, 2005: 200 • Walker, 2006: 108 • Dilworth, 1998: 498 	1 = Newt 5 = CT

							Factor 6: Process-orientation	
21	I believe that the life in my organization in essence is a process of human relations and that a process-orientation <i>usually</i> achieve more than a goal-orientation	1	2	3	4	5	Factor 6: Process-orientation	1= CT 5 = Newt
7	When I am analyzing a problem the best thing is to split the problem into smaller problems and solve each one of them independently. In other words, the whole = part+part+part etc.	1	2	3	4	5	<ul style="list-style-type: none"> • Cilliers, 1998: 456 • Parker & Stacey, 1997: 12-13 • Fernandez et al, 2007: 171 • Parker & Stacey, 1997: 12-13 • Wheatley, 1999: 125 ○ Kiel, 1994: 206 	1 = Newt 5= CT
22	When I am making a decision I <i>always</i> think how the decision might affect the “bigger picture”.	1	2	3	4	5	Factor 7: Holism	1= CT 5= Newt
8	Chaos in an organization is <i>usually</i> looked upon as something negative and destructive	1	2	3	4	5	<ul style="list-style-type: none"> • Kiel, 1994: 12, 186 • Najmanovich, 2007: 97-99 • Nilsson, 2007: 242-243 • Cilliers, 1998: 3-5 • Fernandez et al, 2007: 173 • Juarrero, 2007: 112-113 • Wheatley, 1999: 115 • Collier, 2007: 89 • Dilworth, 1998: 497 • Praught, 2002: 522 	1= Newt 5= CT
23	Stability and balance in an organization is usually looked upon as something positive and constructive	1	2	3	4	5	Factor 8: Chaos	1= Newt 5= CT

9	Constant change is <i>always</i> necessary for an organization to survive	1	2	3	4	5	<ul style="list-style-type: none"> • Kiel, 1994: 186 and 209 • Praught, 2002: 515 • Parker & Stacey, 1997: 37 • Wheatley, 1999: 21 • Dilworth, 1998: 497 • Sotolongo, 2007: 129-130 • Praught, 2002: 522 • <p>Factor 9: Change</p>	1 = CT 5= Newt
24	Constant change in the organization is <i>often</i> not necessary and have more negative effects than positive	1	2	3	4	5	<p>Factor 9: Change</p>	1 = Newt 5= CT
10	Small actions <i>usually</i> create small effects. In other words, if I do little I create little.	1	2	3	4	5	<ul style="list-style-type: none"> • Cilliers, 1998: 109 • Baets, 2007: 105 • Najmanovich, 2007: 97-99 • Cilliers, 1998: 3-5 • Ulanowicz, 2007 • Parker & Stacey, 1997: 12, 13, 23-24 • Wheatley, 1999: 121 • Praught, 2002: 517 • Casti, 1994: 95 <p>Factor 10: Causality and linearity</p>	1 = Newt 5 = CT
25	A decision or action made by a sergeant on team level can create big effects at the strategic level	1	2	3	4	5	<p>Factor 10: Causality and linearity</p>	1 = CT 5 = Newt
11	When I am leading my unit, <i>my most important</i> goal is to create or maintain control	1	2	3	4	5	<ul style="list-style-type: none"> • Johnson, 2001: 187 • Wheatley, 1999: 28 ○ Marion & Uhl-Bien, 2001: 395 ○ Martin, 2007: 3, 7, 8 ○ McKelvey, 2008: 3 	1 = Newt 5= CT

							<ul style="list-style-type: none"> ○ Burns, 2002: 49 ○ Kiel, 1994: 205 ○ Praught, 2002: 522 <p>Factor 11: Control</p>	
26	When I am leading my unit, <i>my most important goal</i> is to create freedom of action, flexibility and independence for me subordinates.	1	2	3	4	5	Factor 11: Control	1= CT 5= Newt
12	I think that a team <i>usually</i> is dependent on having a leader to achieve success.	1	2	3	4	5	<ul style="list-style-type: none"> ● Wheatley, 1999: 20 ● Capra, 2007: 7 ● Cilliers, 1998: 3-5 ● Johnson, 2001: 67 <p>Factor 12: Self-organization</p>	1 = Newt 5= CT
27	I think that a team in <i>many cases</i> can be more successful working without a formally appointed leader.	1	2	3	4	5	Factor 12: Self-organization	1 = CT 5 = Newt
13	I believe that my organization is very much affected by external events and that it needs to constantly <i>adapt</i> to changing circumstances	1	2	3	4	5	<ul style="list-style-type: none"> ● Capra, 2007: 7 ● Cilliers, 1998: 3-5 ● Fernandez et al, 2007: 171 ● Ulanowicz, 2007 ● Juarerro, 2007: 110 ● Wheatley, 1999: 84 ● Nordstrom & Bloch, 2007: 15 <p>Factor 13: Open systems</p>	1 = CT 5= Newt
28	I believe my organization should always stick to the defined plans and strategies.	1	2	3	4	5	Factor 13: Open systems	1 = Newt 5= CT

14	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be relationship-oriented	1	2	3	4	5	<ul style="list-style-type: none"> • Cilliers, 1998: 456 • Stacey, Griffin and Shaw, 2000: 189-190 • Wheatley, 1999: 34-37 • Fox, 2001: 102 • Praught, 2002: 522 <p>Factor 14: Relationships</p>	1 = CT 5 = Newt
29	The <i>most important thing</i> in order to achieve success as a leader in my organization is to be task-oriented	1	2	3	4	5	<p>Factor 14: Relationships</p>	1= Newt 5= CT
15	When I make a decision I <i>usually</i> try to base it on a thorough analysis taking all relevant facts into account.	1	2	3	4	5	<ul style="list-style-type: none"> • Wheatley, 1999: 107-108 • Fernandez et al, 2007: 171 • Darwin, 2001: 483 • Parker & Stacey, 1997: 49-52 • Edvardsen, 2000: 265 • Uhl-Bien, Russ and McKelvey, 2007 • Martin, 2007: 6 • Karp and Helgø, 2007: 35 <p>Factor 15: Rationality</p>	1= Newt 5= CT
30	I <i>usually</i> make spontaneous decisions based on intuition.	1	2	3	4	5	<p>Factor 15: Rationality</p>	1= CT 5= Newt

Part 3

Please indicate on the scale to what extent you agree with the statements below, where 1=strongly agree, 2= agree, 3 = uncertain, 4 = disagree, 5 = strongly disagree.

Please encircle the appropriate option.

	Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly disagree	Reference(s)	Based on proposition from Chapter 3	Indication
31	Having insight and understanding of the people one lead and cooperate with is <i>the most important feature</i> of military leadership.	1	2	3	4	5	<ul style="list-style-type: none"> • Darwin, 2001: 482 ○ Martin, 2007: 7 ○ Fairholm, 2004: 375-380 ○ Griffin & Stacey, 2005: 11 ○ Tobin, 2005: 67 ○ Taylor, 2005: 132-133 ○ Schwella, 2009: 22 <p>Factor 1: Emotional intelligence</p>	8	1 = CT 5= Newt
45	Having insight and understanding of the technical system one operate (e.g. a weapon's system, a platoon) is <i>the most important feature</i> of military leadership	1	2	3	4	5	<p>Factor 1: Emotional intelligence</p>	8	1 =Newt 5= CT
32	I think it can be useful to sometimes create uncertainty and instability in an organization.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ McKelvey, 2008: 3 ○ Martin, 2007: 8 ○ Uhl-Bien, Russ and McKelvey, 2007: 311 • Uys, 2002 41 ○ Parker & Stacey, 1997: 34, 64 ○ Fairholm, 2004: 375-380 ○ Kiel, 1994: 204-205 ○ Walker, 2006: 102-103 <p>Factor 2: Disrupt existing patterns</p>	4	1 = CT 5= Newt
46	When I am leading a task I <i>usually</i>	1	2	3	4	5	<p>Factor 2: Disrupt existing</p>	4	1= Newt

	try to minimize uncertainty and instability in my unit and create harmony						patterns		5= CT
33	I think that innovation and creative thinking <i>usually</i> is the task of the leader, not the subordinates.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ Martin, 2007: 7 ○ Wheatley, 1999: 161 ○ Johnson, 2001: 226 ○ Parellada, 2007: 166 ○ Kiel, 1994: 175 <p>Factor 3: Encourage novelty</p>	5	1 =Newt 5= CT
47	Instead of being the centre for innovation and creativity, a leader should <i>usually</i> prioritize to facilitate and encourage innovation among its subordinates.	1	2	3	4	5	Factor 3: Encourage novelty	5	1 = CT 5= Newt
34	As a military leader I get my power through the formal structure of the organization.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Schneider & Somers, 2006: 356 ○ Marion &Uhl-Bien, 2004: 3 ● Griffin & Stacey, 2005: 10, 25-26 ● Stacey, 2005: 106 <p>Factor 4: Informal leaders</p>	9	1 = Newt 5= CT
48	As a military leader I get my power as a result of being recognized as a leader by the other group members through the everyday interaction.	1	2	3	4	5	Factor 4: Informal leaders	9	1= CT 5= Newt
35	I believe that a decentralization of	1	2	3	4	5	<ul style="list-style-type: none"> ○ Johnson, 2001: 231 	1, 16	1= Newt

	control and responsibility <i>often</i> create poorer results						<ul style="list-style-type: none"> ○ Cilliers, 1998: 110 ○ Keene, 2000: 16-18 ○ Parellada, 2007: 166 ○ Fernandez et al, 2007: 184-186 ○ Kiel, 1994: 205 ○ Parrelada, 2007: 166-167 <p>Factor 5: Decentralization</p>		5= CT
49	I do <i>not</i> think that in order to create control and effectiveness, planning and decision-making should optimally be placed centrally of the organizational hierarchy.	1	2	3	4	5	Factor 5: Decentralization	1, 16	1 = CT 5= Newt
36	I see myself as a leader who works as an <i>objective</i> observer of events and who intervenes with corrective directions and regulations when the events deviate from the plan.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Uhl-Bien, Marion & McKelvey, 2007: 306-307 ○ Burns, 2002: 48 ○ Marion &Uhl-Bien, 2004: 29 ○ Stacey, 2005: 106 ○ Walker, 2006: 108 ○ Taylor, 2005: 131-141, 148 ○ Martin, 2007: 6 ○ Schneider & Somers, 2006: 356 ● Fox, 2001: 102 ● Simpson, 2006: 479 ● Wheatley, 1999: 153 ● Fernandez et al, 2007: 184-186 ● Cole, 2007: 229 ● Griffin & Stacey, 2005: 10, 	3, 13	1 = Newt 5= CT

							<p>25-26</p> <ul style="list-style-type: none"> • Tobin, 2005: 86 • Shiel, 2005: 182-183 • Schwella, 2009: 22 <p>Factor 6: Leadership as system- centered</p>		
50	I think that leadership is an expression of the collective behavior of my organization where I, as a formally appointed leader am a <i>participant</i> .	1	2	3	4	5	Factor 6: Leadership as system centered	3, 13	1 = CT 5= Newt
37	In order to handle complex problems military leaders <i>should</i> have their main focus on the micro-level interactions between people.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Schneider & Somers, 2006: 356 ○ McKelvey, 2008: 3 ○ Burns, 2002: 49 ○ Simpson, 2006: 479 ○ Fairholm, 2004: 375-380 ○ Cole, 2007: 229 ○ Karp and Helgø, 2007: 35 ○ Wheatley, 1999: 39 ○ Sotolongo, 2007: 129-130 ○ Fernandez et al, 2007: 184-186 <p>Factor 7: Building and mending relationships</p>	12, 18	1= CT 5 = Newt
51	A complex problem <i>usually</i> requires complex- and often technical solutions	1	2	3	4	5	Factor 7: Building and mending relationships	12, 18	1 = Newt 5 = CT
38	The <i>most important</i> function of a top-level leader is to provide	1	2	3	4	5	<ul style="list-style-type: none"> ○ Plowman et al, 2007: 347 ○ Schneider & Somers, 2006: 356 	6	1 = CT

	<i>purpose</i> for the organization through the use of inspirational and expressive language.						<ul style="list-style-type: none"> ○ Griffin & Stacey, 2005: 10, 25-26 <p>Factor 8: Sense-making</p>		5= Newt
52	The <i>most important</i> function of a top-level leader is to articulate goals and provide good enough systems to reach the goals.	1	2	3	4	5	Factor 8: Sense-making	6	1 = Newt 5 = CT
39	For me, leadership is <i>in essence</i> directly linked to how I behave and what I say in front of my subordinates. In other words, my actions guide my subordinates' behavior.	1	2	3	4	5	<ul style="list-style-type: none"> ● Marion & Uhl-Bien, 2004: 3 ○ Plowman et al, 2007: 354 ○ Keene, 2000: 16-18 ○ Karp and Helgø, 2007: 35 ○ Fairholm, 2004: 375-380 ○ Parker & Stacey, 1997: 65 ○ Kiel, 1994: 175 ○ Schneider & Somers, 2006: 356 ○ Martin, 2007: 6 ○ Uhl-Bien, Russ and McKelvey, 2007: 308 - 311 ○ Burns, 2002: 49 ○ Simpson, 2006: 479 ○ Karp and Helgø, 2007: 35 ○ Baets, 2007: 108 ○ Praught, 2002: 522 ○ Stacey, 2005: 106 ○ Schwella, 2009: 22 <p>Factor 9: Indirect leadership</p>	10, 11, 14	1 = Newt 5 = CT
53	For me, leadership is <i>essentially</i> about making it possible for sub-units or subordinates to solve their mission, for example through	1	2	3	4	5	Factor 9: Indirect leadership	10,11, 14	1 = CT

	empowerment and facilitation.								5 = Newt
40	A shared vision and strong organizational values are the <i>most important</i> guiding principles to create success in my organization		2	3	4	5	<ul style="list-style-type: none"> ○ Keene, 2000: 16-18 ○ Burns, 2002: 49 ○ Fairholm, 2004: 375-380 ○ Wheatley, 1999: 55, 130-131 ○ Praught, 2002: 522 ○ Stacey, 2005: 122 <p>Factor 10: Vision and values as guiding principles</p>	15	1 = CT 5 = Newt
54	Well planned policies and regulations are the <i>most important</i> guiding principles to create success in my organization.	1	2	3	4	5	Factor 10: Vision and values as guiding principles	15	1 = Newt 5 = CT
41	I accept that processes within my organization create anxiety among the employees.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Edvardsen, 2000: 269-270 ○ Simpson, 2006: 479 ○ Wheatley, 1999: 39 ○ Tobin, 2005: 72 ○ Shiel, 2005: 182-183 ○ Parker & Stacey, 1997: 64 <p>Factor 11: Anxiety</p>	17	1 = CT 5 = Newt
55	If processes generate much anxiety in an organization, it is not worth it.	1	2	3	4	5	Factor 11: Anxiety	17	1 = Newt 5 = CT
42	I believe the following <u>group</u> of metaphors best describe my leadership style:	1	2	3	4	5	<ul style="list-style-type: none"> ○ Wheatley, 199: 165 ○ Karp and Helgø, 2007: 35 ○ Fairholm, 2004: 375-380 ○ Wheatley, 1999: 39 ○ Sotolongo, 2007: 129-130 	19 (and partially a number of other propositions)	1 = CT

	Gardener, steward, servant, missionary, facilitator and convener.						<ul style="list-style-type: none"> ○ Griffin & Stacey, 2005: 6, 25-26 ○ Schwella, 2009: 22 <p>Factor 12: Focus on soft values</p>		5= Newt
56	<p>I believe the following <u>group</u> of metaphors best describe my leadership style:</p> <p>Leader, director, boss, father, problem-solver, doer, pathfinder, navigator.</p>	1	2	3	4	5	Factor 12: Focus on soft values	19 (and partially a number of other propositions)	1 = Newt 5= CT
43	In order to manage uncertainty and unpredictable situations military leaders should <i>always</i> focus on developing the ability to <i>constantly</i> adapt.	1	2	3	4	5	<ul style="list-style-type: none"> ○ Marion & Uhl-Bien, 2001: 395 ○ Martin, 2007: 3, 7, 8 ○ McKelvey, 2008: 3 ○ Burns, 2002: 49 ○ Kiel, 1994: 204-205 ● Griffin & Stacey, 2005: 12, 25-26 ○ Parker & Stacey, 1997: 92, 93 ○ Kiel, 1994: 175 <p>Factor 13: Unpredictable and boundary less system</p>	7	1 = CT 5 = Newt
57	In order to manage uncertainty and unpredictable situations military leaders should focus on detailed planning and automatic responses.	1	2	3	4	5	Factor 13: Unpredictable and boundary less system	7	1 = Newt 5 = CT
44		1	2	3	4	5	○ Taylor, 2005	2	

	I believe the ability to think abstract and “outside the box” is the <i>most important</i> trait of a military leader						<ul style="list-style-type: none"> ○ Wheatley, 1999: 50-52 ○ Fernandez et al, 2007: 184-186 ● Griffin & Stacey, 2005: 11, 25-26 ● Shiel, 2005: 200 <p>Factor 14: Leadership is something intangible and abstract</p>		<p>1 = CT</p> <p>5 = Newt</p>
58	I believe that the <i>most important</i> leadership trait is the ability to follow procedures to solve a mission within the given resource framework.	1	2	3	4	5	<p>Factor 14: Leadership is something intangible and abstract</p>	2	<p>1 = Newt</p> <p>5 = CT</p>

Annexure 3 – General information and guidelines

To

The Norwegian Military Academy w/

Captain Auran

From

Harald Rønn

2 April 2009

GENERAL INFORMATION AND GUIDELINES FOR SURVEY WEEK 18

First of all, I would like to thank the Norwegian Military Academy for the opportunity to make a survey and hope that the Military Academy can make use of the results in the future.

This letter gives general information about the survey and some guidelines for the data collection that is important to follow to ensure data quality.

Background

The questionnaire is a part of my work on the Master's thesis (120 credits) at the school of Public and Developmental Management, University of Stellenbosch, South Africa.

The survey is the most essential part of the thesis and is the culmination of many months with research. I most therefore stress the importance of following the general guidelines described in this document to ensure high data validity and quality.

The thesis investigates the relationship between complexity theory, its implications for leadership and the Norwegian Military Cadets (Army).

Discussion

The discussion is divided into three main categories, general information about the survey, checklist for the day of data collection and what to do after data collection.

General information about the survey

1. The target group for the survey is the Cadets on level 1, 2 and 3 of the Operational line (Norwegian: operativ linje). The other Cadets (Kvalifiseringskurs and Ingeniør) are not a part of the scope.
2. The number of respondents should be as high as possible, thus ensuring a representative basis for the analysis.
3. The survey is in English. There is a simple dictionary provided on the first page of the questionnaire.
4. The survey consists of approximately 60 questions and will take 15-20 minutes to answer (NB! There is no time limit)

On the day of data collection

1. Organize the Cadets in a classroom or equivalent. Optimally all respondents (the different companies) answer the questionnaire at the same time, but I understand that this may cause

some practical challenges.

Please do not issue the questionnaire as “evening work” the one day and take it in the following morning, as this may cause considerable sources of error to the questionnaire.

2. Inform the Cadets that:
 - a. The survey is a part of the research for a Master thesis that will be published at the end of this year and that the results will be issued to the Military Academy
 - b. The Master thesis investigates social science theory and leadership (NB! Do not mention the specific topic for the Cadets, i.e. complexity approach, as this may cause bias). Keep it on a very general level. (page 1 on survey)
 - c. The responses to the questionnaire will be treated anonymous and confidential and will only be used for research purposes (page 1 on survey)
 - d. There is statistically proven that respondents in general lean towards a central tendency, i.e. they answer on the middle of the scale. Please keep this in mind and make, if possible, choices based on preferences (page 1 on survey)
 - e. The questionnaire is individual work and that they are not allowed to cooperate (page 1 on survey)
 - f. They must respond by circling the option. If they want to correct, please make an X over the option and circle the new response (page 1 on survey).
3. Show the Cadets by using the overhead (or equivalent):
 - a. That the survey is built up by statements and that the Cadets must respond by circling either *strongly agree, agree, uncertain, disagree or strongly disagree*.
4. Issue the questionnaires.
5. Be present when the Cadets fill in the survey.
6. If any abnormalities, please note it down as this can affect the analysis. I remember when I was a Cadet we had to answer a questionnaire on the 11 of September 2001.

After data-collection

1. Please take copies of all questionnaires. Unfortunately, some post seems to disappear on the way from Norway to South Africa, something which would be catastrophic in this case. I am sorry for the inconvenience this may cause.

The copies will be collected when I come back to Norway.

2. Please send the questionnaires with DHL to:

Harald Rønn
Robbertsz street 3 (Garden flat)
Stellenbosch

7600
South Africa

Phone number: + 27 722 11 02 84

3. A dispatch with DHL can be ordered at www.dhl.no or phone 81001345 (DHL express).

Conclusion

I appreciate the opportunity of making a survey at your institution and I am looking forward to inform the MA of the results.

I hope the general information and guidelines are satisfactory and that the practical data collection will go through without any major problems.

Please do not hesitate to contact me by mail roenn@hotmail.com or phone + 27 722 11 02 84 if there are any questions.

Kind regards

(sign)

Harald Rønn

1st Lieutenant and International student, Stellenbosch University

Annexure 4 – Letter to Military Academy from Stellenbosch University



SCHOOL OF
PUBLIC MANAGEMENT
AND PLANNING

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Learning for Sustainable African Futures

07 January 2009

Officer Commanding
Norwegian Military Academy

Dear Sir/Madame

H RØNN: RESEARCH TO BE CONDUCTED TOWARDS MPA THESIS

Mr Harald Rønn is registered for the Master in Public Administration programme at this institution. It is expected of him to complete a research thesis in fulfilment of the requirements for his degree. We place a high premium on research that is practice based and, if possible, will make a useful contribution to knowledge of practice matters.

As such, it will be highly appreciated if he can be allowed access to information and also be allowed to execute a survey at the Norwegian Military Academy. Although the nature of the research is not such that it will compromise military security, we are sensitive towards military restrictions and can make arrangements for the thesis to be classified for restricted access, should you consider it necessary.

Please feel free to contact me, should you need further information.

Yours sincerely

Prof. APJ Burger
Academic Head: Postgraduate Programmes in Public & Development Management

Annexure 5 – Letter of gratitude to the Military Academy

To

The Norwegian Military Academy w/

Dean Reidar Skaug

From

Harald Rønn

15.05.2009

CONCERNING SURVEY AT THE MILITARY ACADEMY

A survey was conducted at the Military Academy on the Tuesday the 28th of April, 2009.

On behalf of Stellenbosch University and myself I would like to thank the Military Academy for the opportunity to conduct the data collection in connection with my master thesis. The study is currently in the process of analyzing the responses from the Cadets and will give the Military Academy feedback when the thesis has been made public medio November 2009.

The contact person on the Military Academy, Captain Auran, has been acting very professional something which has been highly appreciated.

Please do not hesitate to contact me by mail roenn@hotmail.com or phone + 27 722 11 02 84 if there are any questions.

Kind regards

(sign)

Harald Rønn