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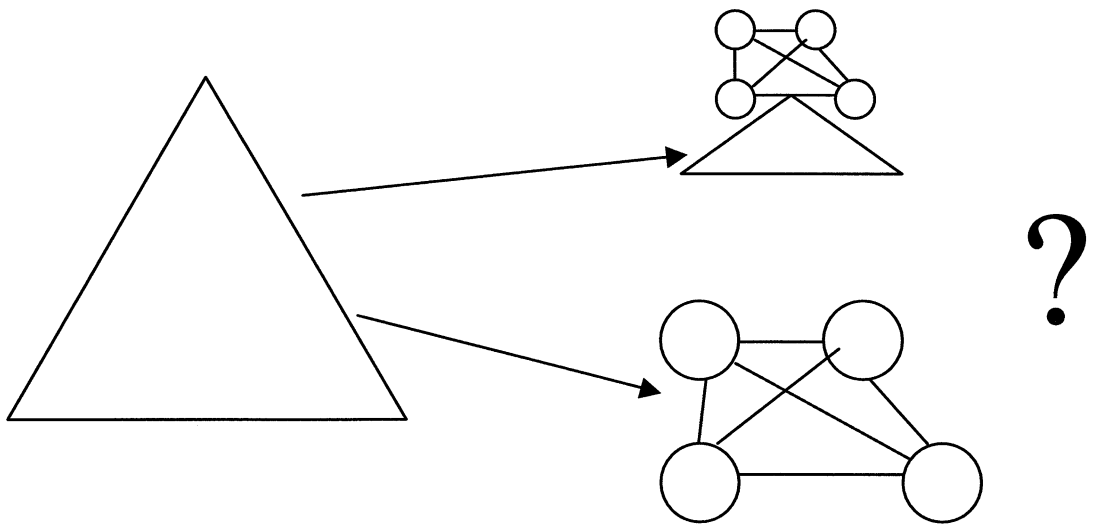
Erik Berglund

Organisational Structure for Future Warfare

The End of the Pyramid?



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Organisational Structure for Future Warfare - The End of the Pyramid?

Abstract (not more than 200 words)

This study constitutes a critical review of some of the current visions of future military organisation, e.g. the concept of Network Centric Warfare, from a perspective based on organisational theory.

The conclusions are that there is an increasing case for the adhocracy (network) organisational structure. However, there seems to be at least three compelling reasons preventing the military organisation from abandoning the pyramid of the machine bureaucracy structure:

- The requirement for external control.
- The need to reduce the angst of killing.
- The need to quickly respond to contingencies.

Another conclusion is that some caution should be exercised before transferring organisational concepts from the world of business enterprise to the military world.

Keywords

Network Centric Warfare, Organisational Theory, Angst

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Organisationsstrukturer för framtida krigföring - Slutet för pyramiden?

Sammanfattning (högst 200 ord)

I denna rapport redovisas en kritisk granskning, gjord ur ett organisationsteoretiskt perspektiv, av aktuella visioner för det framtida försvarets organisation.

Studien visar att det finns anledning för försvaret att utvecklas i riktning mot en mer nätverksbaserad organisation, men att det finns tre viktiga skäl som gör det svårt att helt överge maskinbyråkratins hierarkiska pyramid:

- Kravet på extern (politisk) kontroll.
- Behovet av att reducera dödsångesten.
- Behovet av att agera snabbt i krislägen.

En ytterligare slutsats är att en viss försiktighet bör tillämpas när organisationsidéer överförs från civila företag till militär verksamhet.

Nyckelord

Nätverksbaserat försvar, organisationsteori, ångest

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PREFACE

This thesis constitutes the conclusion of an MBA programme at Stockholm University. I wish to thank Dr. Lillemor Westerberg, who has been my adviser at the University. Her critical reviews and constructive suggestions served well to stimulate further work. I am also grateful to my past and present superiors at the Swedish Defence Research Agency (FOI) for not discouraging me from getting an education in a new field. I furthermore wish to thank all students and teachers involved in the MBA programme for sharing their considerable knowledge, thus providing for an excellent educational experience. In particular my opponents Mr. Jonas Borgardt, Mr. Magnus Geverts, and Mr. Mats Grägg deserve recognition for providing many constructive remarks at the thesis defence seminar.

This FOI report differs from the thesis submitted to Stockholm University in January only by some minor corrections.

CONTENT

1 ABSTRACT

Since the fall of the Berlin Wall in November 1989 and the consequent fall of the Soviet Union two years later, many countries' armed forces have gone through drastic change. However, given the background of increased importance of information technology, greater emphasis on military operations other than war, and possibly decreased funding, the armed forces are likely to experience even greater change in the coming decades. In short one might say that the decades around the year 2000 will see the Western armed forces take the step from the industrial age to the information age.

An important consequence of the technological progress is that it will become possible to co-ordinate the actions of many small and dispersed units through the use of an information network. This so called Network Centric Warfare is the concept that is dominating the visions for the transformation of the armed forces in many countries, not least in Sweden.

The question that is studied in this thesis is:

What military organisational structures are suitable for future warfare?

To answer this question some theories on organisational structure, mainly the theories of Henry Mintzberg, are used. The traditional hierarchical military organisation and the network organisation are assessed against key requirements posed by the changing character of military conflict and by the introduction of information technology.

The conclusions of this study are that there is an increasing case for the adhocracy organisational structure. However, there seems to be at least three compelling reasons preventing the military organisation from abandoning the pyramid of the machine bureaucracy structure:

- The requirement for external control.
- The need to reduce the angst of killing.
- The need to quickly respond to contingencies.

A possibility to combine the machine bureaucracy structure for the operational core, or at least for the "killing part" of the operational core, with the greater flexibility given by the adhocracy is the administrative adhocracy described by Mintzberg. The adhocracy part of the organisation would work with issues like intelligence, research and development, development of tactics, and information warfare.

Another conclusion is that some caution should be exercised before transferring organisational concepts from the world of business enterprise to the military world, as there are significant differences in the activities pursued by a military force and those pursued by modern companies.

2 BACKGROUND

2.1 Winds of Change

Since the fall of the Berlin Wall in November 1989 and the consequent fall of the Soviet Union two years later, many countries' armed forces have gone through drastic change. The main driver behind the transformation of the Western armed forces is the end of the Cold War. The Cold War provided a clearly defined mission for the armed forces, i.e. to deter from and, if necessary, fight and hopefully win an all out war of national survival. The threat was constituted of the sizeable conventional and nuclear forces of the Soviet Union. This clearly defined, large scale threat was countered by a similar large scale, industrialised defence.

The threat of the Third World War has now been succeeded by a much broader and less well defined spectrum of threats and missions. There are no obvious threats to the national survival of Western countries, such as Sweden. However, there are many actors, who could threaten central values of the Western democracies. Threats to the national security can originate not only from nations, but also from organisations or even individuals. Many of the threats fall between what has traditional been a matter for law enforcement and what has been a matter for the armed forces. Even though the military's role of fighting major war remains a core mission, so called military operations other than war have become increasingly important. These military operations other than war can be peacekeeping, humanitarian relief operations, etc requiring close collaboration with civilian and military parties from other nations. (Söderqvist & Berglund 2000, SAIC 2000, DoD 2000, and MoD 2001a)

During the last decade the winds of change in the military field have been of at least gale force and there are no signs of a calm down in the near future. On the contrary, given the background of increased importance of information technology, greater emphasis on military operations other than war, and possibly decreased funding, the armed forces are likely to experience even greater change in the coming decades. In short one might say that the decades around the year 2000 will see the Western armed forces take the step from the industrial age to the information age.

2.2 A Brief History of Military Organisation

Armies and navies are some of the oldest forms of organisations encompassing thousands of humans, preceding business organisations of similar size by several millennia. Consequently many of the traditions and ideas regarding management have originated in the military world. The clearest example of transfer from the military field comes from the introduction of mass industrial production in the 19th century. The ideas of division of labour, hierarchical levels, staffs assisting the commander (or executive), and divisions have all originated in the military field.

Further examples of the strong, but not always clearly recognised, military influence on business management emanate from the fact that a large proportion of the empirical data in the fields of behavioural science and leadership originate from experiments on young, male soldiers.

Military organisational structures have a long tradition and are founded on an extreme division of labour. The "thinking" is performed by the officers at the higher organisational levels, while the "doing" is performed by the soldiers who largely are supposed to blindly follow orders.

The basic hierarchical organisation was well established already at the time of the Roman legions in the last centuries BC. A *legion* comprised of 6,000 men and was divided into ten *cohorts* of 480 men. The cohort was divided into six *centuries* of 80 men. The exception was the elite first cohort, which contained twice as many men in its six centuries (Roman Empire, 2001).

The battle captain's ability to exercise any form of command, when battle has been joined, has historically been severely limited by the difficulties of gaining useful information and of communicating orders. The sub-units thus has had to fight largely on their own relying on standard procedures implemented through extensive drill.

In 1793 France introduced the concept of a mass army (*Levée en Masse*) based on conscription (The Columbia Encyclopedia, 2001). The size of the conscript army made it impossible for the battle captain to supervise the battle in person from his *Feldherrenhügel.* The army was hence divided into divisions and somewhat later the army corps was introduced as an intermediate organisational layer between division and army.

Napoleon's mass army was soon copied by most other countries and the concept reached a climax in the trenches of the First World War, where millions of men faced each other in a highly mechanistic war of attrition. The Gulf War of 1990-91 was perhaps the last of the wars of the industrial age involving mass armies on both sides. Presently most countries have abandoned the concept of mass conscription and introduced smaller and largely professional forces, often using catchwords such as "leaner but meaner" to market the reforms.

Military organisations have traditionally been highly hierarchical with many layers. The large number of layers has been given by the commander's span of control, which is typically "five plus or minus two" (Alberts et.al., 1999, p.77). The typical military unit is thus made up by three or four identical sub-units, support units and a staff to aid the commander. Further reasons for having many layers include the need to have a personal trust, and in some cases perhaps also fear, between commanders and subordinates in highly stressful situations and the difficulties of penetrating "the fog of war" to generate a common situational awareness, thus making the on-site commander more likely to have the most relevant information.

In a large organisation such as the US Army, the fighting units constitute a hierarchy made up by team, squad, platoon, company, battalion, brigade, division, corps and theatre. The Chairman of the Joint Chiefs of Staff and the National Command Authorities, i.e. the President and the Secretary of Defence, make up the tenth and the eleventh tiers of the pyramid. The Swedish Army, which of course is much smaller, lacks only the corps level and thus has ten tiers in its pyramid.

To some extent the military traditions and a desire for "fair play" have been manifested in international law, defining some requirements on military organisations. One of the more fundamental laws of war, the Hague Convention, requires an army (Hague, 1889, I:1):

1. To be commanded by a person responsible for his subordinates;
2. To have a fixed distinctive emblem recognisable at a distance;
3. To carry arms openly; and
4. To conduct their operations in accordance with the laws and customs of war.

There are also requirements on the military organisation posed by the general public and voiced by the political level and by media. A strong external control of the armed forces is a primary concern in almost all countries.

It should perhaps be pointed out that armed forces have a long tradition of fighting in a structure of temporary task forces rather than in the battle order formations. An example of

this is that armoured units often are made up by tank battalions without any infantry, and mechanised infantry battalions without any tanks. However, in battle the units form task forces of battalion size, containing a mix of both tanks and mechanised infantry.

2.3 Introduction of Information Technology

Information technology and telecommunications have a long history both in business and in the military. Information technology can be divided into three areas:

- Technical means, i.e. sensors, of collecting information.
- Technical means of storing and processing information from various sources.
- Technical means of communicating the information.

All three of these areas have seen drastic improvement over the last decades, which is a situation that is likely to continue.

Telecommunications (i.e. communications over distance) in the military have historically been maintained by orderlies, pigeons, buglers, drummers, flags, mirrors etc. The introduction of the Morse telegraph in the 1840s provided the first means of electromagnetic telecommunications. The telegraph was first introduced to the military command and control system in the US Civil War in the 1860s.

Another important development was the radio. Marconi demonstrated the wireless telegraph in 1896 and in 1901 he managed to send the three beeps of the letter S across the Atlantic. The first major use of the wireless in war occurred in the Russo-Japanese War 1904-1905. Radios of increasing sophistication have since played an increasingly important role in military communications.

The historically most important sensor used to detect and track activity on the battlefield has, of course, been the human eyeball. Recently advanced sensors capable of providing high resolution images in near real time have been introduced (SAIC, 1998 and André et.al, 2000). As an example can be mentioned the planned near term performance of the US space based sensors for global surveillance (DoD, 1995):

- Continuous (limited by weather conditions) multi-spectral optical surveillance giving 10 meter resolution and 3 meter accuracy for targeting.
- Continuous targeting of radio frequent transmitters with 10 meter accuracy.
- Images from synthetic aperture radar (SAR) with 1 meter resolution once per hour.
- Fusioned image from multi-spectral optical sensors and SAR with better than 1 meter resolution once per day.

Information technology is today often associated with computers connected by the Internet. Like many important innovations, the Internet has its origins in the military world. In the 1960s the US government had started to worry about a robust command and control system for her nuclear forces to ensure that an effective retaliatory second strike could be launched even after receiving a devastating Soviet first strike. Studies were conducted by RAND, a government controlled institute (Baran, 1964) leading the defence research agency ARPA (presently DARPA) to launch a research programme on "cooperative network of time-sharing computers". What was called the ARPANET was introduced in 1969 and during the 1970s the Internet evolved (Zakon, 2001). Given that the Internet was designed to enable command and

control after a nuclear strike aimed at the command and control facilitates, it was developed as a distributed system without any designated central control nodes.

Information technology presently makes it possible to collect huge amounts of intelligence information in near real time and to transmit the information rapidly over great distances. The ability to process the information and to present it to the human decision makers is, however, lagging.

One of the most important consequences of the technological progress is that it soon will be possible to co-ordinate operations involving many small and dispersed units.

> "The perhaps most important consequence of the technological progress, especially in the fields of navigation, telecommunications, and information processing, is that new forms of network solutions, where mobile units can co-ordinate their actions, will become feasible." (Söderqvist & Berglund, 2000, p.55, author's translation)

2.4 Network Centric Warfare

The debate on the transformation of the armed forces to accommodate both the change in threats and missions, and the development of new technology has been intense, especially in the US. The US perspective (Owens, 1996 and Alberts et.al., 1999) has mainly been on exploiting the developments in information technology. The introduction of information technology is often said to constitute the foundation of a Revolution in Military Affairs (RMA), comparable to previous RMAs, such as the introduction of the phalanx, the combustion engine and nuclear weapons. Some authors even suggest that information technology will initiate greater change than previous innovations.

The progress in information technology has given birth to the concepts of Systems-of-Systems (Owens, 1996), where a flow of information between all systems on the battlefield is expected to increase efficiency, and of Network Centric Warfare (NCW).

> "Network Centric Warfare is the best term developed to date to describe the way we will organize and fight in the Information Age. ... We define NCW as an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace." (Alberts et.al., 1999, p.)

Sweden is currently in the midst of transforming her armed forces to adapt to the new security environment and to new technology. The concept of Network Centric Warfare plays an important part also in the transformation of the Swedish armed forces. In the Swedish documents there is less emphasis on combat power and lethality, and more emphasis on command and control. There is also a desire to follow the trends in the civilian society.

> "The course of developments is heading towards what we now term network-based defence, which means making full use of progress in communications and information technology. To describe network-based defence, we may say that the various information, command and other systems of the Swedish Armed Forces are linked up into a network that allows the exchange of information between the different systems.
>
> Combining the command functions into a single network improves the prospects that command will be exercised from the level that is most appropriate in a given situation" (MoD 2001b, p.2)
>
> "For Sweden, RMA should be seen as a vision and a concept for force development. The concept of RMA is about using modern technology throughout the Swedish Armed

Forces. Thus RMA is an important part of the Swedish defence reform and a natural step in a democracy, which is moving from the industrial era and entering the IT- and knowledge-based era. The concept allows the Swedish Armed Forces to use advanced technology in the same way as other sectors of Swedish society." (Moore, 2000b, p.1)

"In the Swedish perspective, RMA is focused on developing a network-centric force utilising the best parts of the Swedish modern army, navy, amphibious and air-force systems. Sweden will go from independent and singularly optimised systems or units to a network based "system of systems". Information will flow rapidly and freely between all different types of headquarters and units." (Moore, 2000b, p.2)

3 PROBLEM FORMULATION

Currently many of the Western armed forces are transforming to face new threats and missions. The incorporation of information technology also plays an important role in the transformations. The current work to transform the armed forces of the Western countries, including Sweden, is of great importance as it will affect our security situation for many years to come.

The sometimes radical transformations have inspired a lively debate on the future defence. Much of the debate, especially in the US, has been dominated by the technological progress and its impact on the military. This is the case with Owens (1996), Alberts et.al. (1999), and DoD (2000) and is very clear in a foreword written by General Gordon Sullivan[1]:

> "The world is changing and dramatically and rapidly because of the information revolution and influence of the Internet on all aspects of life. Because of these changes, the Army has chosen to change as well..." (Hall, 2000, p.5)

The Swedish studies (Söderqvist & Berglund, 2000 and MoD, 2001a) have been more balanced and although technological progress plays a prominent role in the transformation of the Swedish defence, the main rationale lies in the changing national security environment.

A concept that has dominated the US and also the Swedish debate on the design of the future defence is the concept of Network Centric Warfare (NCW). In NCW all combat units are interconnected through an information network enabling them to achieve what is called information superiority in relation to the opponent and to co-ordinate their actions. The term "network" is widely used both to denote the information network connecting all entities and to denote an organisational structure with greater flexibility.

The visions of a high technological defence have been questioned by many authors. Some authors, like Björeman & Gard (2000) and Hawkins (2001), consider the force structure left after the transformation process insufficient. Others, such as Hall (2000) believe that too much effort is spent on making the defence forces even more superior in a face to face battle against a fairly advanced enemy and that too little attention is paid to the fact that there are no opponents able or willing to face Western forces in that way. Greater effort should instead be spent on countering terror attacks, information warfare (e.g. hacker attacks), and threats of combat in urban areas.

However, neither the proponents of a high technological network centric defence nor the critics seem to have considered the aspects of organisational structure and of different structures' properties in relation to the future requirements on and possibilities for a military organisation.

The field to be studied in this thesis is organisational structures suitable for future warfare. In particular the question to be studied is:

What military organisational structures are suitable for future warfare?

The question implies a restriction to warfighting as opposed to other activities performed by a military organisation, such as materiel procurement, strategic planning, and training. These other activities might well require other organisational forms. This may be an inconvenient restriction as future conflicts will not exhibit a clear dividing line between war and peace. However, given the limited scope of this thesis there were no possibilities of including other

[1] Former Chief of Staff of the US Army and presently President of the Association of the US Army.

aspects. The focus on warfare can also be motivated by the fact that wars, however unlikely they might be, are the *raison d'etre* of the military organisation.

Of particular interest is, of course, the question of future organisational structure for the Swedish Armed Forces, but the study is restricted to Western countries in general rather than to Sweden in particular.

It is useful to remember that the concept of Network Centric Warfare is a vision used in the long term planning. It is furthermore useful to remember that long term planning in the defence community is more long term than in other fields. The Swedish long term planning currently treats 2020 or slightly beyond, while the plans of the US Army cover at least the period up to 2032. The capability and organisation for NCW does not really exist today, but will gradually develop in the coming decades.

4 METHODOLOGY

Methodology is the conceptual framework on which the choice of research methods is based. Most social scientists can be classified into either of two conceptual frameworks depending on whether they assume reality to be objective or subjective.

The objective view is based on the presumption that reality exists independently of our perceptions of it. It is presumed that social systems exist independent of and constraining human actions. If that is the case, it is possible to talk in terms of absolute truth. Science based on the objective view seeks to explain events, to find causal relationships, and to produce general knowledge.

The subjective view is based on the presumption that reality exists only through our perception of it. It is presumed that social systems are a result of human behaviour. In this case reality is a social construction and it is not possible to talk in terms of absolute truth. Science based on the subjective view seeks to understand events and often produces more specific knowledge. (Andersen, 1998 and Orlikowski & Robey 1991)

This thesis treats organisational structures for future warfare. The following sections discuss the concepts of war and organisation, especially in relation to technology, and how they can be related to the theoretical frameworks of social science.

4.1 Perspectives on War

The theory of warfare can, just as social science in general, be divided into an objective and a subjective school. The objective school focuses on issues like control of terrain, quantities of soldiers and weapons, and annihilation of the enemy, while the subjective school focuses on morale, willpower, perceptions, and of winning the hearts and minds of the enemy.

Sun Tzu, who wrote *The Art of War* around the year 510 BC, displays a subjective view when he points out that the objective in war is to affect the mind of the enemy.

> "Hence to fight and conquer in all your battles is not supreme excellence; supreme excellence consists in breaking the enemy's resistance without fighting." (Sun Tzu, 1988, p.17).
>
> "All warfare is based on deception." (ibid, p.6)

Perhaps the most famous of the European war philosphers, Carl von Clausewitz takes a more objective view. In his *Vom Kriege*, which was published posthumously in 1832, war is defined as "...an act of violence intended to compel our opponent to fulfil our will" (Clausewitz 1873, Book 1, Ch. 1, Section 1). Clausewitz develops this definition further by stating that this is to be accomplished by disarming the enemy. This manner of defining concrete objectives, like disarming the enemy in pursuit of the less concrete aim of "compelling the enemy to fulfil our will" is rather typical in warfare. Clausewitz is also famous for introducing the concepts of "fog of war" and "friction" to describe the lack of information and unpredicted events facing the commander respectively.

There are several examples of the objective view being applied to warfare. An obvious example is the Lanchester equations (Parry, 1995) where armed combat is modelled as two simple differential equations giving the attrition rate for each combatant. This mechanistic view had a great deal of validity in the highly mechanistic First World War during which the equations were developed.

Another example of the objective view is the "bean counting" of key hardware, such as tanks, aircraft and nuclear warheads, commonly used to assess military strength. An interesting example of unsuccessful application of quantitative business methods to warfare is provided by the infamous body count in the Vietnam War. Defence Secretary Robert McNamara, who as a former president of Ford probably had the most extensive business experience of any defence executive, introduced killed enemies as a measure of effectiveness. This promoted a mentality of killing and produced expressions such as "the only good gook[2] is a dead gook" and "anything that's dead and isn't white is a VC[3]" were commonly used by the soldiers (Congress, 1971). This was far from a policy of winning hearts and minds.

A common view is to look at warfare from a systems perspective. Clausewitz begins his book by adopting what today could be called a systems perspective.

> "I shall proceed from the simple to the complex. But in war more than in any other subject we must begin by looking at the nature of the whole; for here more than elsewhere the part and the whole must always be thought of together." (Clausewitz, 1873, Book 1, Ch. 1, Section 1)

The system perspective is also obvious in the discussions on systems of systems (Owens, 1996).

Many recent studies (Söderqvist & Berglund 2000, SAIC 2000, and MoD 2001a) emphasise that wars of the future are likely to be highly complex and that they will be waged on many arenas (political, economical, media/opinions) in addition to the battlefield. They emphasise that threats to the national security can originate not only from other nations, but also from organisations and even individuals. All out wars in the name of national survival seem unlikely, while more limited armed conflicts in defence of central, but sometimes intangible, values are more likely. Söderqvist and Berglund (2000) also point out that war often is more of a political and psychological event than a technological, and that greater emphasis is being placed on information warfare[4].

4.2 Perspectives on Organisation

Much of the early work on organisational theory, like most early work in the social sciences, was founded on an objective view. One of the earliest examples of this is Adam Smith's (1776) description of the pinmaking factory where the workers have a strict division of labour and only perform the tasks they are highly specialised in, thus resulting in higher efficiency. Further examples are provided by Fredrik Taylor's (1911) scientific management separating "thinking" from "doing" within the organisation and Henri Fayol's (1916) principles of management, which included specialisation, unity of command, and a clear chain of command.

Orlikowski & Robey review subjective and objective research concerning information technology and organisation. They conclude that "the computer mediated workplace is not entirely a social construction, and that material characteristics may seriously affect use and alter social relationships" (Orlikowski & Robey, 1991, p.146). Although they find the

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[2] Expression used for Asians.

[3] Vietcong (In Sweden better known as FNL, *Front national de libération*, in the language of the colonial power).

[4] Information warfare is defined (DoD, 1996b) as "actions taken to achieve information superiority by affecting adversary information, information-based processes, information systems, and computer-based networks while defending one's own information, information-based processes, information systems, and computer-based networks."

objectivist approach more useful, they state that "the objectivist approach thus overstates the importance of technology's material characteristics and ignores the social interpretations and actions..." (ibid, p.146). Following this dismissal of both the subjective and the objective view, they develop their own theoretical framework resting on the assumption that social reality is constituted by both subjective human actors and by institutional properties. Their model is based on Giddens' theory of structuration (Giddens, 1979) and is illustrated by the figure below.

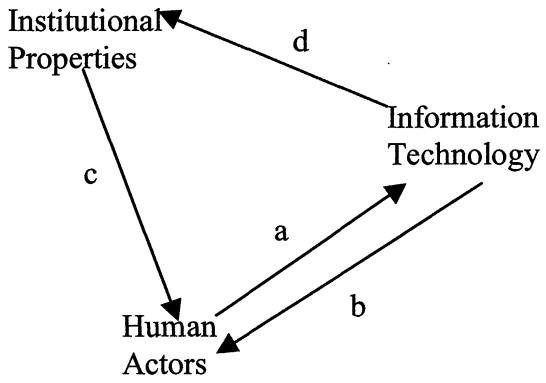

Figure 4.1 Orlikowski's and Robey's (1991) model of interaction between institutional properties, human actors and information technology.

Arrow	Type of Influence	Nature of Influence
a	Information Technology as a product of human action	Information Technology is an outcome of such human action as design and development, appropriation, and modification.
b	Information Technology as a medium of human action	Information Technology facilitates and constrains human action through the provision of interpretive schemes, facilities and, norms
c	Conditions of interaction with Information Technology	Institutional properties influence humans in their interactions with information technology, such as, intentions, design, standards, professional norms, state of the art in materials and knowledge, and available resources
d	Consequences of interaction with Information Technology	Interaction with Information Technology influences the institutional properties of an organisation through reinforcing or transforming the systems of signification, domination, and legitimation

Table 4.1 Nature of influence in Orlikowski's and Robey's (1991) model.

4.3 Research Design

Both wars and organisations, the main themes of this study, are to a large extent social constructions, albeit with a substantial material content. The character of warfare is changing. In all out wars, in particular the two world wars and the threatening third, the objective perspective seems fairly valid. However, wars are becoming more of a social construction and less of a material one, as current and future conflicts are more likely to be highly complex military/political conflicts fought in an environment of global peace rather than a mechanistic war of annihilation.

The model proposed by Orlikowski & Robey with interaction between humans, technology and organisation seems reasonable and applicable also to the military field. The scope of this study includes the consequences of information technology on the organisation, i.e. the arrow "d" in Orlikowski's & Robey's model. While one must recognise that the interaction between organisation, humans and technology is complex, it is not within the scope of this study to include all of Orlikowski's & Robey's interactions, and it is also not possible as Network Centric Warfare is but a concept for the future.

The research design of the study is made up by:

1. A discussion on methodology suitable for studies of military organisational structure for future operations.
2. An overview of applicable organisational theories and a brief characterisation of the traditional hierarchical organisation and the network organisation.
3. An overview of the visions of future defence forces and especially of Network Centric Warfare (NCW) as they are presented in open sources and a summary of some of the key trends and the expectations on organisational properties.
4. An analysis where the key trends of future warfare and the expectations on NCW are compared to the key characteristics of the different organisational structures.

The research design of this study is basically deductive using established theories of organisation to draw conclusions of a general kind. In recognition of the social character of war and organisation, the characterisation of organisations based on established theories will include some of the "softer" issues.

The main reason for this is the fact that the posed problem requires a critical review of a phenomenon, that is currently only a vision of something which could become reality between 2010 and 2020, and that this vision is fairly extensively described in the literature. Further reasons include the possibility that the author has been tainted by his background in the engineering sciences and mathematics.

5 SOME THEORIES ON ORGANISATIONAL STRUCTURE

Much of the early work on organisational theory seems to have been inspired by the established military hierarchical organisation with a strict division of labour. One of the earliest examples of this is Adam Smith's (1776) description of the pinmaking factory where the workers have a strict division of labour and only perform the tasks they are highly specialised in. Further examples are provided by Fredrik Taylor's (1911) scientific management separating "thinking" from "doing" within the organisation, and Henri Fayol's (1916) principles of management, which included specialisation, unity of command, and a clear chain command.

The most well known author treating organisational structures is probably Henry Mintzberg. To be in business, his theories are fairly old, but as they are of a fundamental kind they are almost timeless. He (Mintzberg 1979 and 1983) looks on five different views of how an organisation functions – as a system for formal authority, regulated flows (divided into operating work flow, flow of control information and decisions, and the flow of staff information), informal communication, work constellations, and ad hoc decision processes. He argues that every organisation functions as a complex mixture of these five systems.

Mintzberg (1979) identifies five different components, that are present in all, or at least most, organisations. These components are: operating core, middle line, strategic apex, technostructure, and support staff. Figure 5.1 shows a general organisational structure with Mintzberg's five parts.

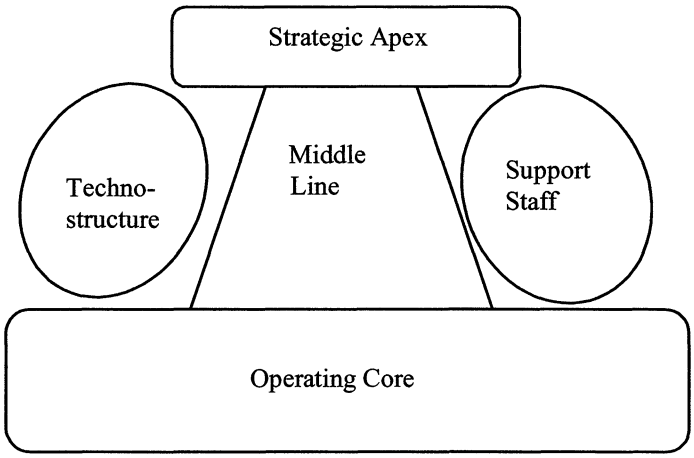

Figure 5.1 The fundamental parts of an organisation. Adapted from Mintzberg (1979).

Unit	**Example of positions**
Strategic Apex	Board of Directors, Chief Executive Officer
Technostructure	Strategic Planning, Personnel Training, Operations Research
Support Staff	Legal Counsel, Public Relations, Clerks, Cafeteria Workers
Middle Line	VP Operations, Plant Managers, Sales Managers
Operation Core	Machine Operators, Assemblers, Sales Persons

Table 5.1 Examples of positions in the five fundamental organisational parts.

Continuing his love affair with the number five, Mintzberg (1979, p.301) lists five structural configurations of organisations and characterises them by some key parameters.

Structural Configuration	**Prime Coordinating Mechanism**	**Key Part of Organisation**	**Type of Decentralisation**
Simple Structure	Direct Supervision and Control	Strategic Apex	Vertical and Horizontal Centralisation
Machine Bureaucracy	Standardisation of Work Processes and Outputs	Technostructure	Limited Horizontal Decentralisation
Professional Bureaucracy	Standardisation of Skills and Norms	Operating Core	Vertical and Horizontal Decentralisation
Divisionalised Form	Standardisation of Outputs	Middle Line	Limited Vertical Decentralisation
Adhocracy	Mutual Adjustment of Ad-Hoc Teams	Support Staff	Selective Decentralisation

Table 5.2 Structural configurations and some key characterisations. (Adapted from Mintzberg, 1979)

The organisational structures have different properties and work best for certain combinations of environmental properties and tasks to be performed. Four of Mintzberg's organisational forms can be fitted into a matrix associated with different combinations of the complexity of the performed tasks and of the pace of change in the environment.

	Simple Tasks	**Complex Tasks**
Stable Environment	Machine Bureaucracy	Professional Bureaucracy
Dynamic Environment	Simple Structure	Adhocracy

The following two sections will treat the two opposites the machine bureaucracy and the adhocracy, which represent the traditional military hierarchy and the network organisation respectively.

5.1 Machine Bureaucracy - Hierarchy

The model of the machine bureaucracy was presented by Max Weber, who characterised this organisational form by:

- A clear horizontal division of labour.
- Extensive use of rules and of documentation to facilitate control.

Mintzberg (1979, p.315) characterises the machine bureaucracy by:

- Highly specialised, routine operating tasks.
- Very formalised procedures in the operating core.
- A proliferation of rules, regulations and formalised communication.

- Large sized units at operating level.
- Reliance on the functional basis for grouping tasks.
- Relatively centralised power of decision making.
- An elaborate structure with sharp distinctions between line and staff.

The Machine Bureaucracy relies on standardisation of its operating work processes for coordination, which implies that the technostructure, which houses the analysts who do the standardising, becomes the key part of the structure. The machine bureaucracy is also very centralised giving the strategic apex a prominent role.

The machine bureaucracy is a structure "obsessed with control" (Mintzberg, 1979, p.319), which makes it well suited for organisations facing strong demands on accountability and control, such as police and defence forces.

The machine bureaucracy is found in environments that are simple and stable. Furthermore machine bureaucracies tend to be mature and large, and to be subject to external control. Mintzberg's examples of machine bureaucracies include the national post office, prisons, airlines, and hotels.

The machine bureaucracy is also a suitable form for what Mintzberg (1983) calls "contingency bureaucracies", such as fire departments, where much time and effort are spent on developing and honing skills and procedures to be used when an event occurs. Each event facing a contingency bureaucracy may be unique, but the need for immediate and decisive action requires the organisation to rely on standard procedures covering a framework of possible events. A contingency organisation rarely has the time to afford an innovation process during an action.

Advantages of the machine bureaucracy include its great efficiency in a stable environment, where it can run like a machine, and its suitability to external control. Disadvantages include its inflexibility to environmental change and a lack of job satisfaction coming from treating people as means instead of individuals. Fundamental change in a machine bureaucracy often requires top managers strong enough to cast aside the bureaucratic system and to, for a time, revert the organisation to the centralised simple structure (Mintzberg, 1979).

5.2 Adhocracy - Network

The adhocracy is an organisation for sophisticated innovation in a dynamic and complex environment. The adhocracy is able to bring experts from different fields together in ad hoc project teams. An adhocracy is characterised by (Mintzberg, 1979, p.432):

- Highly organic structure with little formalisation of behaviour.
- High horizontal job specialisation.
- Grouping specialists in functional units, but deploying them in market-based project teams.
- Liaison devises to encourage mutual adjustment.
- Selective decentralisation.

Mintzberg describes two different sorts of adhocracies: the operating adhocracy and the administrative adhocracy. The operating adhocracy innovates and solves problems directly on behalf of clients. A feature of the operating adhocracy is that it makes little distinction between its administrative and operating work, e.g. planning is done more or less concurrently with execution on a project to project basis. A prime example of an operating adhocracy is a research institute.

The administrative adhocracy makes a sharp distinction between its administrative components and its operating core. The administrative adhocracy is suitable when an organisation needs to be innovative, but also needs to have an operating core that is machine bureaucratic. However, the sharp distinction between the operating core and the administrative component generally results in a loss of importance of the operating core within the organisation (Mintzberg, 1979). Outsourcing of the operating core can be a consequence.

In the adhocracy, power over decision making flows to anyone with expertise, regardless of position. There is no clear chain of command.

Currently the term network organisation seems more used than adhocracy, underlining the communication network enabling the informal contacts of the adhocracy. Advantages of network organisations include flexibility, coordination and exploitation of individual capabilities. Disadvantages include unclear responsibility, which can generate frustration and anxiety. (Jacobsen & Thorsvik, 1998, p.111)

Adhocracies are good for promoting innovation, but they are not very good for doing more ordinary things.

> "The adhocracy is not competent at doing ordinary things. It is designed for the extraordinary." (Mintzberg, 1983, p.277)
>
> "The roots of its inefficiency is the adhocracy's high cost of communication. People talk a lot ... [and] that takes time." (ibid, p.277)

5.3 Organisations and Information Technology

Savage (1996) defines a steep hierarchy as having more than 10 layers of management. He discusses the introduction of information technology in a hierarchical structure and comes to a clear conclusion.

> "The chapter began by asking whether computerization of steep hierarchies will work. The answer is clear: no." (Savage, p.159)

Savage suggests organisations for the "early knowledge era" to be based on five conceptual principles (ibid, p.199):

1. Peer-to-peer knowledge networking.
2. The integrative process.
3. Work as dialogue.
4. Human time and timing.
5. Virtual enterprising and dynamic teaming.

He discusses "peer-to-peer knowledge networking", which he claims is a concept with three aspects: technology, information, and people. The concept assumes that people can communicate directly with all other nodes and that they have access to all information within the enterprise.

> "The most significant change that peer-to-peer networking brings is in the way people in the enterprise interact with one another. The superior-subordinate relationship of the steep hierarchy assumes that higher level is an indication of superiority. It may indicate superior rank, but it does not guarantee superiority of knowledge." (Savage, 1996, p.200)

Johansen and Swigert (1995) propose a flexible organisational structure for which they use a fishnet as a metaphor.

> "Imagine a net laid out on a dock. If you grab a node and lift, the rest of the net lattices nicely under it. A temporary hierarchy appears as long as you hold up the node, with layers consistent with how high you lift the node and the width of the mesh. The hierarchy disappears when you lay the net down. Pick up another node, another soft hierarchy appears. (Johansen and Swigert, 1995, p.15)

The introduction of information technology has resulted in flatter hierarchies controlled by standardised procedures. In the 1980s Jan Carlzon became a forefront figure in a fashionable movement toward flatter hierarchies. He proposed (Carlzon, 1985) a hierarchy where much of the middle management had been removed and where only three tiers remained: strategic management, planning, and business operations. He also described how he frequently used media to communicate directly to the staff at Scandinavian Airlines without passing through any middle management.

Flatter hierarchies and standardised procedures based on information technology do, however, not seem to result in more flexible organisations. Some authors (e.g. Argyris, 1977 and Orlikowski, 1992) suggest that the introduction of information technology makes organisations more rigid and less prone to learning. The reason for this is that while IT facilitates single-loop learning, i.e. making improvements within the existing framework, the double loop learning, i.e. improvements of the organisational framework, which to a large extent is constituted by the information technology, becomes more difficult. The introduction of information technology has a tendency to reinforce the prevailing structures and make them more rigid.

These problems associated with the introduction of Information Technology correspond well with the experience from introducing a "digitized division" in the US Army. As a testbed for new information technology, all combat vehicles in a mechanised division of the US Army have been equipped with computers and communications equipment, to facilitate rapid transfer and presentation of information. The results in field tests have been mixed with many indications of increased time required to reach a decision, increased caution, and more training needed to master the technical system (Wenemark & Tode, 1999) and some indications of improved decision quality (Onley, 2001).

Ohlsson and Rombach (1999) criticise the concept of flatter hierarchies and find that flatter organisations tend to be more centrally controlled by standardised methods and because of this often less flexible. This could fit well with Mintzberg's theory that fundamental change in a machine bureaucracy often requires top managers strong enough to, for a time, revert the organisation to the centralised simple structure. Ohlsson and Rombach thus note a considerable difference between the referred motives to introduce a flatter organisation and the outcome.

5.4 Organisational Structure and Angst

Military organisations are unique as they have to deal with the considerable angst generated by breaking one of the most ultimate taboos, i.e. killing fellow humans. In the Jewish, Christian and Muslim tradition the taboo against killing is clearly displayed as *Thou shalt not kill* as commandment number six is preceded only by the first four, which define the position of the church, and *Honour thy father and thy mother*. (Exodus 20:1-17)

Moxnes discusses angst and organisations. Social structures, made up by traditions, rules, expectations etc, provide a means of dealing with angst. The firmer the structure is, the more it serves to reduce the angst. Moxnes (1989, p.150) lists the four most important structural elements to reduce angst (author's translation):

1. Objective – to have a clear objective founded on a philosophy.
2. Rules – to have a set of rules and procedures.
3. Roles – to have a system of well defined roles set in a hierarchical system defining responsibility.
4. Stable working conditions – to have stable emotional relationships between the individuals.

At least the last three elements correspond well with the conditions in the machine bureaucracy.

Moxnes also observes that a rigid organisational structure makes those individuals who have a need for structure to feel safe, while those individuals who strive for growth and development feel angst generated by constriction. On the other hand a loose organisational structure will make those who need structure experience deep angst, while those who strive for growth can enjoy their freedom.

Grossman (1995) shows that killing fellow humans is something very difficult and that most soldiers through out history have tried to avoid killing, even if that has put their own lives at stake. He refers to the work of Marshall (1946), who found that only about 15% of soldiers in combat actually used their weapons in an effort to kill the enemy. Grossman shows that killing is made easier by physical or social distance between the killer and the victim. Killing is also easier if it is performed as a group activity.

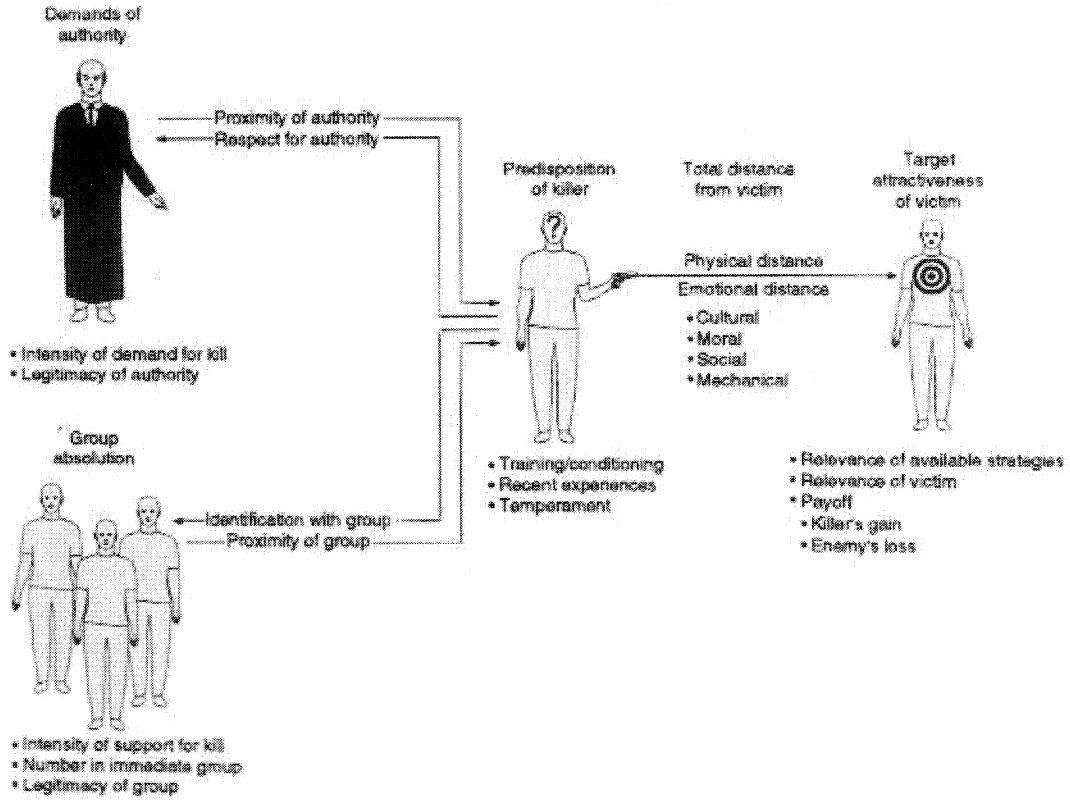

Figure 5.2 Grossman's model of overcoming the resistance to killing (Grossman, 1995). The model shows that killing is easier if it is done in close proximity to a respected authority demanding the person to kill, if it is performed as a group activity, and if the victim is at great physical and emotional distance. (Reproduced with permission of Lieutenant Colonel Dave Grossman.)

In most historical battles, at least up to the 19th century, very few combatants were killed when the armies clashed face to face. As an example can be mentioned that Alexander the Great throughout his campaigns around 330 BC is supposed to have lost only 700 of his originally 48,000 men to the sword (du Picq, 1946 and Rooney, 1999). Most of the killing occurred when one side had broken and attempted to flee the battlefield (Grossman, 1995). It is far easier to kill people, who have proven themselves cowards, from behind without looking them in the face. A battle could thus be similar to a chicken race, where those who first broke were routed. This fact has, of course, underlined the need to maintain strict discipline and drill in an army and to employ an appropriate organisational structure.

The research on the nature of killing has resulted in military organisations adopting extensive conditioning programmes designed to break down the soldiers' barriers against killing and in further reinforcement of the importance of letting soldiers fight in established teams. Through conditioning, the fire rate has increased greatly and exceeded 90% in Vietnam (Grossman, 1995). As Grossman (1999) points out, many of the aspects of this conditioning are also applied to children through television and video games.

Grossman (1995) also stresses the importance of post-combat purification rituals to help the returning warriors deal with their "blood guilt". The highly drilled rituals of weapon and equipment maintenance often serve as a first treatment of the post-combat angst of killing.

The traditional hierarchical military organisation thus serves to alleviate angst by providing rules, roles and stability and by providing opportunities for the soldiers to claim that they "only obeyed orders" or that they did not want to let down their friends.

5.5 Summary

Different organisational forms have different properties and are best suited for different situations. The introduction of information technology makes the organisations flatter, but not necessarily more decentralised.

In this study the main emphasis is on the traditional hierarchical military organisation (the machine bureaucracy) and the network organisation (the adhocracy). Some of the key properties of the two organisational structures are listed below.

The machine bureaucracy:

- is well suited to external control
- is very efficient in a simple and stable environment
- reacts well to contingencies within an established framework
- is inflexible to environmental change
- is incapable of fundamental innovation
- often provides little job satisfaction
- serves well to reduce the angst of the people within the organisation.

The adhocracy:

- is well suited to promote innovation
- is at its best in a dynamic and complex environment
- can handle events outside an established framework

- is not well suited to external control
- cannot serve to reduce angst.

The traditional military organisations are strictly hierarchical machine bureaucracies. However, the main reason for that is not likely an attempt to maximise efficiency in a stable environment. Wars are usually not fought in what could be called a stable environment. The main reasons are more likely to be the excellent possibility to exercise external control, quick reactions to events within an established framework, and good possibilities to reduce the angst of killing. Both the soldiers themselves and society in general are likely to accept that the soldiers are considered "means" and not individuals, and that they do not achieve much job satisfaction when they take the lives of others.

To conclude that military hierarchical organisations are incapable of fundamental innovation is perhaps premature. There are, on the contrary, many examples of major innovations produced by the military system, e.g. tanks and nuclear weapons. It has been difficult to bring clarity to the causes of military innovation, but it has been shown that innovations are more likely in peace than in war (Rosen, 1991).

6 VISIONS OF FUTURE WARFARE

6.1 Changing Character of Armed Conflict

The fall of the Berlin Wall in 1989 and of the Soviet Union two years later meant that the paradigms of national security and military defence had to be reworked. The all out war between fairly equal military powers, in the form of the Second World War and the threatening Third World War, that so long had dominated military thinking was no longer on the agenda.

Concurrent with the dramatic change in national security came the revolutionary development of information technology, in the form of personal computers connected to the Internet and mobile phones, that has affected almost everybody in the Western World.

While the possibility of a major war threatening the national survival of Sweden or other Western countries is not totally ruled out, the dominating threat against our national security is seen more as a threat against central values that our society is based on (Söderqvist & Berglund 2000, SAIC 2000, and MoD 2001a). These threats can come from other nations, but perhaps more likely from terrorist networks, criminal organisations, or even individuals. Many of the threats fall between what has traditionally been the matter of law enforcement agencies and what has been the matter of the defence.

Future armed conflicts are described (Söderqvist & Berglund 2000, SAIC 2000, and MoD 2001a) as being complex with many actors and many conflict arenas (e.g. the regular battlefield, terror attacks, cyberspace, media/opinions, negotiations and economy), having many political restrictions and being fought in an environment of global peace rather than global war. The public acceptance of loss of human lives, not only of own troops but also of civilians and of enemies, has decreased and there is an increasing ambition to fight wars with zero casualties.

The military forces are also likely to be engaged in military operations other than war, i.e. peacekeeping, humanitarian relief operations etc. requiring close collaboration with other agencies, military and civilian.

An important trend, and a consequence both of the global economy and of the wider spectrum of threats, is a greater emphasis on seeking national security through international collaboration. Obvious examples of this include the establishment of a Common European Policy on Security and Defence, and of a European capacity for military crisis management.

Many Western countries are currently transforming their armed forces to accommodate the new security situation, new technology, and reduced funding. The debate on this transformation has been intense, and perhaps most extensive in the US. The US perspective (Owens, 1996 and Alberts et.al., 1999) has, however, mainly been on exploiting the developments in information technology.

Sweden is currently in the midst of transforming her armed forces to adapt to the new security environment and to new technology. The new dimension of Swedish forces taking part of multinational operations plays a major role for the Swedish defence, which, of course, has been marked by the long period of isolated neutrality.

> "The Swedish defence system is about to undergo necessary renewal and modernisation. The reason for this is the security situation in the world at large.

> We can now create a modern, flexible and versatile defence on the basis of national service. The units and systems that will be needed in the future should be capable of being utilised for both the defence of Sweden and participation in international operations." (MoD, 2000, p.3)

The following two sections describe the debate in the US and in Sweden with a special emphasis on issues relating to the organisational structure of the future armed forces.

6.2 USA

The visions of fully exploiting the progress in information technology to transform the nature of military operations originated in the United States during the second half of the 1990s. Chief proponents of the visions have been Mr. Andrew Marshall[5], Admiral William Owens[6], Vice Admiral Cebrowski[7], and Mr. John Gartska[8].

The progress in information technology has given birth to the concepts of Systems-of-Systems (Owens, 1996), where a flow of information between all systems on the battlefield is expected to increase efficiency and of Network Centric Warfare (NCW).

Owens (1996) states that there are three forces propelling the US military toward fundamental change: the fall of the Soviet Union and the end of the Cold War, the decreases in defence funding, and the developments in electronic and computational technologies. The technology driven change is called Revolution in Military Affairs (RMA).

> "What is happening, driven in part by broad system architectures and joint operational concepts, in part by serendipity, is the creation of a new *system-of-systems*. Merging increasing capacity to gather real-time, all-weather information continuously with increasing capacity to process and make sense of this voluminous data builds the realm of dominant battle space knowledge." (Owens, 1996)

Alberts, Gartska and Stein define Network Centric Warfare (NCW) as:

> "Network Centric Warfare is the best term developed to date to describe the way we will organize and fight in the Information Age. ... We define NCW as an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace." (Alberts et.al., 1999, p.2)

Although Alberts et.al. do not give any concrete proposal for an organisational structure of the future, they point out that "sometimes, a change in the very structure of an organisation is necessary in order to exploit increased awareness" (ibid, p. 77). They also give several clues to how this new structure should be:

> "New approaches to command and new command arrangements are needed to effectively flatten hierarchies, free information flow (not orders) from the chain of command..." (ibid, p. 81)
>
> "[An organisation that allows that] responsibility and work can be dynamically reallocated to adapt to the situation. (ibid, p. 91)

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[5] Director, Office of Net Assessment, DoD.
[6] Then Vice Chairman, Joint Chiefs of Staff.
[7] Director, Space and Electronic Warfare, Office of the Chief of Naval Operations.
[8] Scientific and Technical Advisor, Director for C4 Systems, Joint Chiefs of Staff.

> "NCW gives us the opportunity to explore the vast middle ground between the Industrial Age top-down hierarchical command and control approach and the highly decentralized model of small units assigned pieces of the problem with only their organic capabilities." (ibid, p. 162)
>
> "In general one would expect that in an NCW-based MCP [mission capability package], command decisions would migrate closer to the pointy end(s) of the spear." (ibid, p.194)
>
> "It is anticipated that NCW-based organizational forms will be more agile than current ones. Perhaps operational organizations will become virtual ones, formed specifically to accomplish a particular set of tasks for just as long as necessary and then cease to be." (ibid, p. 195)

Alberts et.al. argue for a Command and Control (C2) system less focused on either command or, especially, control and instead focusing on initiative and flexibility.

> "Our current approach to C2 is designed to minimize mistakes and place bandages on potential weaknesses. However, this approach does not translate well into the Information Age, for it is based on limited information flows and restricted initiative, and is an approach that requires (or at least desires) overwhelming force." (ibid, p.163)

Alberts (1995) claims that dominant battlespace knowledge (DBK) will enhance the role of commanders in a number of ways:

1. "The importance of a strategic vision would increase simply because, given DBK, such a vision would be far more likely to be "right" and hence less effort would be spent on "adjusting plans" or "replanning."
2. Commanders would have a much greater chance of having their vision correctly implemented given the automated processing and communications support provided.
3. By freeing commanders from worrying about the fog of war and developing contingencies for a variety of different situations, commanders could devote more effort to thinking creatively about the best way to deal with a situation and to developing options.
4. Commanders will be able to review proposed options both in greater detail and faster than ever before, thus further increasing the likelihood that options selected will be sufficiently well conceived to actually play out in the battle without significant alteration. However, commanders of the future will be required to have a greater understanding of technology and a greater facility to work with automated tools."

Alberts (1995) also claims that "hierarchies will flatten to facilitate the flow of information and decisions while the role of staffs will be greatly diminished, their work being largely automated".

Dunn (1992) expresses great faith in the ability of information technology to provide the commander with new capabilities:

> "Increased battlefield "visibility"—provided by enhanced C3I[9]—allows us to grasp the battle much more precisely and quickly. Thus, technology has made warfare much more certain and precise than was ever thought possible....For all intents and purposes, commanders can get a technological God's eye view of the entire battlefield."

As an example of network-centric operations in the world of business, Cebrowski & Gartska (1998) give a description of Wal-Mart, where all transactions are logged in a centralised information system, which is shared with the suppliers. By using the information system each store's departmental managers are able to adapt inventory and prices within his or her area of responsibility.

[9] Command, Control, Communications, and Intelligence.

The ideas of network centric warfare have since had a great impact on the official policy documents, Joint Vision 2010 and subsequently Joint Vision 2020, of the US armed forces (DoD, 1996a and DoD, 2000)[10]. Joint Vision 2010 is mainly about applying information technology and other technologies to current forces to make them more efficient. Great emphasis is placed on information superiority, defined as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same" (DoD, 1996a, p.16).

In Joint Vision 2020 more attention is paid to command and control and it is acknowledged that the potential for overcentralisation of control and the capacity for junior leaders to make decisions with strategic impact are issues of particular importance.

6.3 Sweden

The impact of the implosion of the Soviet Union has been greater in Sweden than in most other countries. With some exaggeration one can say that the Swedish defence spent two centuries in the trenches waiting for the Russian onslaught. Now as it is clear to most Swedes that there will be no Russian onslaught, the Swedish Armed Forces are struggling for a new identity. Concurrently with this identity crisis, the Swedish Armed Forces have had to face substantial downsizing. Although the budget cuts have been fairly modest, the force structure has been reduced by more than 50% since the mid 1990s.

Sweden is in the midst of transforming her armed forces to accommodate a new security environment with new threats and new missions, and reduced funding. The originally American ideas of Network Centric Warfare have enjoyed significant influence on the Swedish debate and on the current plans.

> "The course of developments is heading towards what we now term network-based defence, which means making full use of progress in communications and information technology. To describe network-based defence, we may say that the various information, command and other systems of the Swedish Armed Forces are linked up into a network that allows the exchange of information between the different systems.
>
> Combining the command functions into a single network improves the prospects that command will be exercised from the level that is most appropriate in a given situation" (MoD 2001b, p.2)
>
> "For Sweden, RMA should be seen as a vision and a concept for force development. The concept of RMA is about using modern technology throughout the Swedish Armed Forces. Thus RMA is an important part of the Swedish defence reform and a natural step in a democracy, which is moving from the industrial era and entering the IT- and knowledge-based era. The concept allows the Swedish Armed Forces to use advanced technology in the same way as other sectors of Swedish society." (Moore, 2000b, p.1)
>
> "In the Swedish perspective, RMA is focused on developing a network-centric force utilising the best parts of the Swedish modern army, navy, amphibious and air-force systems. Sweden will go from independent and singularly optimised systems or units to a network based "system of systems". Information will flow rapidly and freely between all different types of headquarters and units." (Moore, 2000b, p.2)

The recent Swedish defence studies (MoD, 2001a and Söderqvist & Berglund, 2000) outline a defence with increased flexibility to face different threats and missions. This future defence is to rely on advanced technology, not least in the field of information technology.

[10] Joint in this context means that forces from more than one of the three (or four) services of the US military, i.e. the Army, the Navy (incl. the Marine Corps), and the Air Force fight in a co-ordinated fashion under a single commander.

Visionaries of NCW in Sweden include Mr. Folke Andersson and Mr. Eric Sjöberg[11] who in the early 1990s proposed a highly dispersed defence structure made up by many small units interconnected by an information network (Askelin et.al., 1995 and Sjöberg, 1998). Each of the small units would have the capacity to receive and process all available information and to assume the role of commanding the others if necessary.

A leading proponent of NCW within the Swedish Armed Forces has been Lieutenant General Johan Kihl[12], who has initiated many of the recent defence studies.

Major Swedish defence studies developing and exploiting the NCW ideas include Dominant Battlespace Awareness and Dynamic Engagement conducted by the US contractor SAIC (SAIC, 1998 and SAIC, 2000), FoRMA conducted by the Swedish Defence Research Agency (Söderqvist & Berglund, 2000 and André et.al, 2000), and the long term planning studies conducted by the Armed Forces Headquarters (MoD, 2001). These studies outline a defence with increased flexibility to face different threats and missions. This future defence is to rely on advanced technology, not least in the field of information technology.

SAIC (2000) state

> "In fact, with the global power of networking and the integration of technologies enabled by IT, new system of systems capabilities with unpredictable potential and cascading effects in many directions may be anticipated." (p.6)

The most important consequence of the technological progress that is highlighted by Söderqvist & Berglund (2000) is that it soon will be possible to co-ordinate operations involving many small and dispersed units.

> "The perhaps most important consequence of the technological progress, especially in the fields of navigation, telecommunications, and information processing, is that new forms of network solutions, where mobile units can co-ordinate their actions, will become feasible." (Söderqvist & Berglund, 2000, p.55, author's translation)

The Dominant Battlespace Awareness Study is summarised in a leaflet (MoD, 1999) with a foreword by General Kihl. It is stated that new technology enables new approaches to command and control and that the established hierarchies no longer need to be taken for granted. The Cold War mission of defending Sweden against a major assault by the Soviet Union is described as well defined and well rehearsed, thus enabling everybody to play their roles with only a limited amount of real-time command and control activities between the strategic, operational and tactical levels. This fitted well with the Swedish Armed Forces tradition of subscribing to the policy of *auftragstaktik*, i.e. command not by detailed orders but by broader missions and rules. How the new organisational structure will look is, however, not outlined.

On a list of essential capabilities needed by a future defence force Söderqvist & Berglund mention "dynamic command and control", which is defined as "adapting command and control according to the situation – centralised or decentralised" (Söderqvist & Berglund, 2000, p.64).

Moore[13] joins the choir performing the requiem for the hierarchy without really suggesting an alternative.

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[11] Both at the Swedish Defence Research Agency.
[12] Director Strategy, Plans and Policy Directorate, Swedish Armed Forces Headquarters.
[13] Brigader General Michael Moore, military adviser to the Swedish minister of defence.

> "We must work actively to break the existing hierarchies within the armed forces. The concepts of RMA and Network Centric Warfare invites new forms." (Moore, 2000a, p. 17, author's translation)

6.4 Summary

The technological progress will shortly result in surveillance and targeting systems capable of locating most objects on a traditional battlefield with high accuracy. As the progress in information technology provides better means to transmit and process this information, it becomes possible to obtain much better information. It also becomes possible to co-ordinate the actions of many small, dispersed units. The development of fairly inexpensive long range precision weapons also makes it possible to kill detected enemy units with little risk to friendly troops.

The character of armed conflict will continue to evolve drastically from the major war of national survival that has dominated the plans for so many years. The future will see a wide spectrum of threats and missions. Many of the threats against central values of the Western democracies can originate from organisations or even individuals with fairly limited resources. In addition to fighting a major war, the armed forces thus have to be able to handle a wide range of situations, e.g. peace support operations, humanitarian relief operation, counter terrorism operations, and information warfare. Armed conflicts of the future are likely to be complex with many involved parties with different agendas. Furthermore the conflicts are likely to be fought on different arenas, e.g. armed combat, terror attacks, media, information warfare, and negotiations.

The various visionaries agree in their criticism of the hierarchical organisation, although it is difficult to uncover a common vision of what the future organisation will look like. It is clear that most of the visionaries have looked at current business organisations and the adoption of information technology in business for inspiration. It is interesting to note that the military, which was a role model for business organisation during the industrial age, is now looking at business organisations to find inspiration for the information age.

Some of the more important visions regarding what the future military organisational structure should be able to do can be summarised as:

- Exploit information superiority.
- Flatten hierarchies.
- Free information flow from the chain of command.
- Dynamically reallocate responsibility and work.
- Move decisions closer to the "pointy end of the spear".
- Be more agile.
- Facilitate a correct implementation of the commander's vision.
- Facilitate that command is exercised at the most appropriate level.
- Adapt between centralised and decentralised according to the situation.
- Break hierarchies.

A common requirement is for the organisation to become more flexible and adaptive to different situations. However some of the requirements seem contradictory. On the one hand there is a desire for an organisation that can facilitate the correct implementation of the

commander's vision – a vision that has been obtained through the "God's eye view" provided by technology. On the other hand there is a vision to move power and responsibility down to the operating core. Both these contradictory views do, however, agree on diminishing the power of the middle management.

7 ANALYSIS AND CONCLUSIONS

The purpose of the analysis is to assess both the traditional hierarchical military organisation and the network organisation against key requirements posed by the changing character of military conflict and by the introduction of information technology and to draw some conclusions on a suitable future organisational structure. This is done by first identifying some key trends in armed conflicts and some key consequences from the technology trends. These key trends are then put against the characteristics of the two organisational types.

The environmental changes facing military organisations include:

- A wider range of missions in a more complex environment.
- Less emphasis on full scale war and more emphasis on smaller operations, counter terrorism, information warfare, peace support operations etc.
- Technology facilitating much improved information quality and information networks facilitating transfer of all information to all actors.

Key expectations given by the visions of future military organisation include:

- Flexibility to act in a wide range of conflicts from peace to all out war.
- Flexible organisation capable of acting either as a centralised hierarchy or as a decentralised network according to the situation.
- Free information flow from the chain of command.
- Dynamically reallocate responsibility and work.
- Facilitate a correct implementation of the commander's vision.

Key and to some extent unique requirements on a military organisation include:

- Strict external control. The already strong requirement for control seems to increase as conflicts become less "pure" military and as media relations become increasingly important.
- Minimal risk of mistakes. The requirement to minimise the risk of mistakes is strong in restricted conflicts covered by media. It is difficult to agree with Alberts et.al. (1999, p.163) when they state that the need to minimise mistakes does not translate into the information age – it would rather seem that the opposite is true.
- Capability to reduce the angst of killing.

The changing environment facing a military organisation from the early 20th century to the early 21st century can be illustrated as in figure 7.1. During the First World War the military was to carry out fairly simple tasks in a stable environment and up to the Cold War the dominant environment remained fairly stable but the complexity of the tasks increased. Currently we see the environment becoming more complex and the tasks more varied.

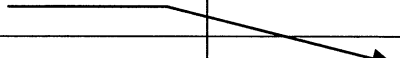
	Simple Tasks	**Complex Tasks**
Stable Environment		
Dynamic Environment		

Figure 7.1 Changing character of military tasks and environment.

However, before we conclude that this arrow of change corresponds to a change in most suitable organisational structure from the Machine Bureaucracy, through the Professional Bureaucracy to the Adhocracy (page 20), a more detailed analysis of requirements and organisational properties needs to be performed.

The key characteristics of the machine bureaucracy and the adhocracy (page 25) can be compressed into table 7.1.

Machine Bureaucracy	**Adhocracy**
Very efficient in a simple and stable environment	Best in a dynamic and complex environment
Inflexible to environmental change	Flexible to environmental change
Incapable of fundamental innovation	Suited to promote innovation
Reacts well to contingencies within an established framework	Does not react well to contingencies within an established framework
Suited to external control	Not suited to external control
Serves well to reduce angst	Cannot reduce angst
Provides little job satisfaction	Provides job satisfaction

Table 7.1 Key organisational properties.

The trend toward a wider range of missions in a more complex environment clearly favours the adhocracy. On the other hand one must remember that war never has provided a stable environment and that the military has proven to be capable of innovation, so even if there certainly is change maybe it is less fundamental than some authors seem to argue.

The capability to react to foreseen contingencies favours the machine (or contingency) bureaucracy. The increased scope of threats and mission does, of course, require foresight of a wider framework of contingencies.

The strong requirement for external control remains and clearly favours the machine bureaucracy.

The requirement to reduce the angst of killing might decrease in importance as less emphasis is put on killing and more on information warfare and other means of affecting the enemy. New technology will also facilitate killing at increased distance, which generates less angst. On the other hand there is a trend toward killing named individuals, as recently seen in Israel and Afghanistan, which is something different than killing faceless beings in the uniform of the enemy. This actually brings the soldiers closer to the historically less prestigious profession of the executioner. In peace support operations the soldiers might experience many traumatic events over long periods of time and lack the authority or resources to intervene, which could cause a lot of stress.

The conclusion seems to be that in the future fewer soldiers need to be in the business of killing, but that there seems to be little change in the amount of stress and angst for those who are.

It is now time to answer the question of whether the armed forces are facing the end of the pyramid. Taking account of all trends in armed conflicts and technology one must conclude that there is an increasing case for abandoning the pyramid and instead turn to the adhocracy

organisational form. However, there seems to be at least three compelling reasons preventing the military organisation from abandoning the pyramid of the machine bureaucracy:

- The requirement for external control.
- The need to reduce the angst of killing.
- The need to quickly respond to contingencies.

A possibility to combine the machine bureaucracy structure for the operational core, or at least for the "killing part" of the operational core, with the greater flexibility given by the adhocracy, is the administrative adhocracy described by Mintzberg (1979). The adhocracy part of the organisation would work with issues like intelligence, research and development, development of tactics, and information warfare.

Due to the introduction of advanced information technology, it seems possible to make the hierarchy of the operating core considerably flatter.

A suitable organisational structure for the future military could thus be as is illustrated in figure 7.1.

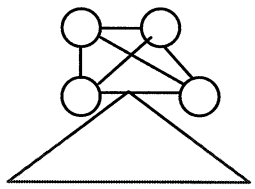


Figure 7.1 The administrative adhocracy in a simple illustration.

A further conclusion is that it seems appropriate to exercise caution when transferring organisational concepts from the world of business to the military world, as the tasks to be performed in some aspects are fundamentally different. A corresponding advice could perhaps have been given to the early industrialists who looked at the military organisations for guidance. The military organisational structure that had evolved through millennia of warfighting to facilitate killing and to prevent breakdown of the frontline units, was perhaps not the ideal role model for business organisations.

REFERENCES

Alberts D.S. (1995), "The Future of Command and Control with DBK", Chapter 4 in *Dominant Battlespace Knowledge*, Edited by Johnson S.E and Libicki M.C., National Defense University, October 1995.

Alberts D.S, Gartska J.J, Stein F.P (1999), *Network Centric Warfare: Developing and Leveraging Information Superiority*, CCRP, Department of Defense.

Andersen I. (1998), *Den uppenbara verkligheten*, Studentlitteratur. (In Swedish)

André T., Isacson T., Kihlström G., Svensson J.E. (2000), *Situationsuppfattning och ledning för rätt insats*, FOA-R—0016-SE, Swedish Defence Research Agency.

Argyris C. (1977), "Organizational learning and management information systems". *Accounting, Organizations, and Society*, 2(2), 113-123.

Askelin J.I., Sjöberg E., Andersson F. (1995), *Försvar 2000 kanske aldrig syns*, FOA-tidningen, 1995:1:09-16, Swedish Defence Research Agency. (In Swedish)

Baran P. (1964), *On Distributed Communications: XI. Summary Overview*, RM-3767-PR, RAND, August 1964.

Björeman C. And Gard H. (2000), "'Det nya försvarets' achilleshälar", *Vårt försvar*, nr 3, 2000.

Carlzon J. (1985), *Riv pyramiderna*, Bonniers. (In Swedish)

Cebrowski A.K. and Gartska J.J. (1998), *Network-Centric Warfare: Its Origin and Future*, Proceedings of the Naval Institute 124:1 (January 1998), p. 28-35.

Clausewitz von C. (1873), *On War*, N. Trubner, London.

The Columbia Encyclopedia (2001), Sixth Edition.

Congress (1971), *Dellums (House of Representatives) War Crimes Hearings, Statement of Robert B Johnson Capt, US Army*, House of Representatives.

DoD (1995), *New World Vistas Air and Space Power for the 21st Century*, Department of Defense.

DoD (1996a), *Joint Vision 2010*, Department of Defense.

DoD (1996b), *Report of the Defense Science Board Task Force On Information Warfare - Defense (IW-D)*, Office Of The Under Secretary Of Defense For Acquisition & Technology., November 1996.

DoD (2000), *Joint Vision 2020*, Department of Defense.

Dunn R.J. (1992), *From Gettysburg to the Gulf and Beyond:Coping with Revolutionary Technological Change in Land Warfare*, McNair Paper No 13, March 1992, National Defense University.

Fayol H. (1916), *Administration Industrielle et Generale.* (In French)

Giddens A. (1979), *Central Problems in Social Theory: Action, Structure and Contradiction in Social Analysis*, University of California Press, Berkeley.

Grossman D. (1995), *On Killing: The Psychological Cost of Learning to Kill in War and Society*, Little, Brown and Company.

Grossman D. (1999), *Stop Teaching Our Kids to Kill: A Call to Action against TV, Movie and Video Game Violence*, Random House.

Hague (1889), *Convention (II) with Respect to the Laws and Customs of War on Land*, 29 July 1889.

Hall W.M. (2000), *The Janus Paradox: The Army's Preparation for Conflicts of the 21st Century*, Association of the United States Army.

Hawkins W.R (2001), *Will the Next QDR Repeat the Mistakes of the Past?*, Association of the United States Army.

Jacobsen D.I. and Thorsvik J. (1998), *Hur moderna organisationer fungerar*, Studentlitteratur. (In Swedish)

Johansen R. and Swigart R. (1995), *Upsizing the Individual in the Downsized Organization*, Random House.

Marshall S.L.A. (1946), *Men Against Fire: The Problem of Battle Command*, University of Oklahoma Press.

Mintzberg H. (1979), *The Structuring of Organizations*, Prentice-Hall.

Mintzberg H. (1983), *Structure in Fives: Designing Effective Organizatins*, Prentice-Hall.

MoD (1999), *RMA – En grund för försvarsmaktens utveckling*, HKV 09 100:63046, Swedish Armed Forces, 14 March 1999. (In Swedish)

MoD (2000), *Short Version of the Government Bill 1999/2000:30*, Swedish Ministry of Defence.

MoD (2001a), *Årsrapport från perspektivplaneringen 2000-2001*, HKV 23 210:62144, Swedish Armed Forces. (In Swedish)

MoD (2001b), *Continued Renewal of the Total Defence*, Fact Sheet, Swedish Ministry of Defence, October 2001.

Moore, M. (2000a), *Revolution i det svenska försvaret*, Swedish Ministry of Defence. (In Swedish)

Moore, M., (2000b), *Executive Summary – Revolution in the Swedish Defence System*, Swedish Ministry of Defence, 16 November 2000.

Moxnes P. (1989), *Vardagens ångest*. (In Swedish)

Ohlsson Ö. and Rombach B. (1999), *Res pyramiderna*, Svenska förlaget. (In Swedish)

Onley D.S. (2001), "Army's First Digitized Division Touts Success at War Game", *Government Computer News*, Vol 20 No 9, Newsweek Media Group.

Orlikowski W.J. and Robey D. (1991) "Information Technology and the Structuring of Organizations," *Information Systems Research*, (2:2), June 1991, pp. 143-169.

Orlikowski W.J. (1992), "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science*, (3:3), August 1992, pp. 398-427.

Owens W.A. (1996), "The Emerging US System of Systems", *Strategic Forum* No 63, February 1996, National Defense University.

Parry S.H. (1995), *Military Operations Research Analyst's Handbook, Volume II, Area 1*, The Military Operations Research Society.

du Picq A. (1946), *Battle Studies: Ancient and Modern Battle*, Harrisburg, PA: The Military Service Publishing Company.

Roman Empire (2001), http://www.roman-empire.net/army/army.html.

Rooney D. (1999), *Military Mavericks*, Past Times.

Rosen S.P. (1991), *Winning the Next War – Innovation and the Modern Military*, Cornell University Press.

SAIC (1998), *Dominant Battlespace Awareness*, Science Applications International Corporation.

SAIC (2000), *Dynamic Engagement*, SAIC No 56244-LB124576, Science Applications International Corporation, December 2000.

Savage C.M. (1996), *5th Generation Management*, Butterworth Heinemann.

Sjöberg E. (1998), *Självupprättande ledningsnät - Stommen i ett mångsidigt och internationellt inriktat totalförsvar*, FOA-R--97-00659-170—SE, Swedish Defence Research Agency. (In Swedish)

Smith A. (1776), *The Wealth of Nations*, Edinburgh.

Sun Tzu (1988), *The Art of War*, Graham Brash Ltd.

Söderqvist O. and Berglund E. (2000), *En visionsstudie om Försvarsmaktens insatsfunktion*, FOA-0015, Swedish Defence Research Agency. (In Swedish)

Taylor F.W. (1911), *The Principles of Scientific Management,* New York: Harper Bros.

Wenemark R. and Tode G. (1999), *Teknisk strategisk studie av det digitala slagfältet. Delrapport 6. TSS-studieresa till USA 1998*, FOA-R--99-01017-201—SE, Swedish Defence Research Agency. (In Swedish)

Zakon R.H. (2001), *Hobbes' Internet Timeline v5.4*, http://www.zakon.org/robert/internet/timeline/.