Stefan Walter

Structural conditions of natural resource management

Understanding the roles of complexity, control and evolution in societal resource use

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Abstract

The research is concerned with the structural conditions of natural resource management, asking essentially how resources are utilised. This has predominantly been a theoretical inquiry, which resulted in a management model. This inquiry has been accompanied by case studies, focusing here on forestry and other economic developments in the European North. This is a particularly relevant and up-to-date field of study, as forestry is still a cornerstone of the Northern European economy but at the same time under pressure from global developments. Policy initiatives emphasise especially sustainable forestry investment and innovation. Simultaneously, however, the forests also fulfil a significant ecological function, thereby creating a conflict, which is at best explained as a contradiction between the economic logic of providing a short-term return of an investment and the long-term ecological lifecycles required to maintain a complex ecology. Thus, the case studies have been used to understand different elements surrounding this contradiction, upon which, subsequently, a system theoretical approach has been developed and applied, mainly resting on Niklas Luhmann's theory of social systems and general system and cybernetic concepts. The choice on system theory has been made due to its suitability to understand adaptation and the societal capacity to change.

A starting point in this research has been the realisation that a disrupted relationship between societal and ecological times has led to acceleration with the consequence of increasing ecological risks.

These potentially feed back to society, possibly manifesting themselves as overexploitation and lack of sufficient resources in the future. The research has practically focused on understanding time and short- vs. long-term nature from the perspective of the economic system, the need for a reliable economic policy and the recognition that innovation is vital for a sustainable society. A three-tier model – complexity, control, evolution – has subsequently been developed, which explains that – due to the ongoing need for investments and innovation in the economy (in forestry as well as in all other industries) – acceleration has been an ever present phenomenon in society. Trust in particular has to play a major role when it comes to realising the boundaries of change in society: trust appears to be present only when conditions for sustainable development are given. Thus, the sustainability of society appears to be accompanied by acceleration, rendering any thought on 'slowing down' resource exploitation unrealistic. This seems to increase ecological risks.

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Man sagt, unser Zeitalter wäre ein Denken in Bewegung, in Kraft, in Stoff. Gerade dieses Denken muss zum Erstickungstode führen, wenn es sich nicht im gleichen Masse fängt in die ohnmächtigen Zeichen der Urgebärden.

Hugo Kükelhaus, *Urzahl und Gebärde*

Foreword

The plan behind this research, my predominant interest, was in understanding the phenomenon of acceleration and the processes of resource management and sustainable development in society. Concerning the goal of any such research work, is it the task of the scientist to gain understanding or is there further responsibility attached to his work? The answer to this is surely a matter of dispute; it depends on individual standpoint, on personal context. I might not state that I have written this book to make the world a better place. (Though, I'd be happy if it does.) Nevertheless, there was an intention associated.

In either way, whether pure science or moral outlook, assuming that a distinction is really possible, my intention was to offer something of use. In fact, in the context of the theory of social systems, which provides the backbone of this dissertation, this book is a piece of communication. Alike any communication it is going to have an impact, whether a desired or an undesired one.

Having said so, this recognition brings me back to the statement of my intention to do this research and the question if the outcome of research can be planned. One could ask what an undesired outcome would be like. A classical perspective in science is that any given problem can be analysed, studied, dissected in all its details etc. in order to provide a solution. Technically, this means that an expansion of the range of possibilities ought to be achieved. Complexity grows, to use a systemic concept, so that any given system can respond to new challenges. This outcome would be the one in case this book merely contributes to the growing body of research publications.

What, however, can we do if we realise that the continuation of analysis, study and dissection, in other words the growth of complexity, is part of the problem. This continuation process is what I call sustainable development. This brings me to the way a desired outcome of this research could be like. The reader would experience a stimulation of self-reflection in order to raise consciousness over how this process of sustainable development works. How the reader acts as a consequence of this is up to him or her. But, any change, whether positive or negative in the sense of the message given in this book, depends on the individual reader; it does not rely on society or any social collective.

Perhaps some of the readers might have had similar feelings and wondered if maintaining the status quo (a.k.a. sustainable development) is the last word on the subject (*'der Weisheit letzter Schluss'*). If this is the case then this book might help to clarify indeterminacies with the help of theory and concepts. Should this happen then I think the book has served its purpose.

A dissertation might be written solely by one individual but nobody exists independently; research is always the result of cooperation and influence from a myriad of factors, which abscond from designation. Nevertheless, some can be named: I naturally have to acknowledge gratefully the importance of my scientific advisors Monica Tennberg and Seppo Raiski, who provided the necessary guidance, which is so indispensable for any student on his way towards maturity in research. Monica also initiated my first funding and thus paved the way to a successful start and was constantly approachable for helpful talks. I also would like to thank the Faculty of Social Sciences, here particularly Asko Suikkanen, and of course the Arctic Centre, in which I conducted my research, and its director Paula Kankaanpää for providing the variety of resources, whether physical, mental or organisational, without which I could not have succeeded in my research endeavour. Mentioning the resources for success also requires reverence to the ARKTIS graduate school and its coordinator Päivi Soppela. As a member of ARKTIS, which, in addition to funding for research and conference visits, provided the bulk of my research education, I was able to enjoy this special stimulating setting that occurs when people with a variety of scientific backgrounds and (research) cultures come together and dispute actively. This has undoubtedly been very fruitful to me.

Naturally my thanks also goes to my dissertation's pre-examiners Professors Risto Heiskala (Tampere) and Rauno Sairinen (Joensuu) for their constructive comments, upon which this dissertation still experienced an improvement. I furthermore like to thank Risto Kangas (Helsinki) for acting as my opponent and my publisher Tuula Tervashonka from Lapland University Press for her role in getting the dissertation finally into a paper form.

Research can hardly be done without financial backing. This calls for acknowledgement of all funding sources that permitted my work. Main funding body was Kone Foundation, Helsinki, which provided the funding for two years of my research. One year of funding was provided each by the ARKTIS graduate school and the research project 'Governance of renewable natural resources in Northwest Russia' (part of the 'Russia in Flux'-programme, funded by the Academy of Finland). The latter project was led by Soili Nystén-Haarala, Joensuu, who, together with all project participants, provided equally an inspiring environment, which has its acknowledged part in my education as a scientist. Funding has also been provided by the Lapland Fund of the Finnish Cultural Foundation, the Rector of the University of Lapland, Mauri Ylä-Kotola, as part of the Rector's grant for finalising dissertations, and the Director of the Arctic Centre, Paula Kankaanpää. Travel funding was additionally provided by the BANG PhD student network and the Department of Social Studies of the University of Lapland. I am indebted to all funders.

Rovaniemi, June 2010

S. W.

Chapter 1

Introduction

Natural resource management has concentrated on incorporating a wide array of societal interests, ranging from the cultural, social, economic, to the environmental, in order to be 'sustainable'. It is, therefore, closely related to the development concept of the same name, assuming that sustainable development takes place when natural resource management is pursued in the appropriate manner. (cf. World Commission on Environment and Development, 1987)

The strong focus on incorporation has led to this concept of natural resource management and/or sustainable development to be understood as a cooperative and integrative approach. Accordingly, more cooperation and integration most probably results into better natural resource management while permitting the better consideration of interests and stakeholders. (cf. e.g. Margerum, 1997; Bryant and Wilson, 1998; Argent et al., 1999; Bellamy et al., 2001; Duraiappah, 2002)

The approach might also assume that cooperation is never sufficient. For example, the dominant political economy founded on markets appears to foster competition, conflict and hostility even, as can be observed in recent conflicts over oil, gas and other important natural resources. It is, therefore, not surprising that contemporary theories on conflict resolution suggest stronger integration and cooperation. (here for example texts on international environmental and other forms of cooperation Heininen, 2002; Tennberg, 2007)

The meta-theory used in this study and based mainly on the theory of social systems by Niklas Luhmann (1984) but also on general systems theoretical and cybernetic concepts (e.g. Geyer, 1995; Heylighen, 1997) suggests a contrary starting point. It assumes that cooperation takes place, perhaps is continuously increasing – becoming ever more effective and efficient. (e.g. Stewart, 2000) It suggests that any event occurring in society is the cooperation of different parts of society, such as economy, politics, science, and education. How could this research project – a scientific product – be undertaken without sufficient funding (economy), suitable government policies (e.g. permitting me to attend university in the first place) and appropriate previous education (e.g. my Master's degree)?

I like to emphasise particularly the 'meta' aspect in this theory foundation. Systems theory and cybernetics do not primarily aim at making us understand what the 'right' thing to do is, but rather why we do that thing. The theory foundation is, thus, beyond normative statements, it is concerned with *reality*.

This study was, therefore, never interested in understanding how to increase cooperation and integration. Rather, it was interested in understanding the possible consequences of cooperation in modern society, particularly the environmental consequences and potential repercussions for the human ecology. The topic was approached by considering a phenomenon, which has come to reflect in an abstract sense the continuous progress and evolution of society: time-space compression or acceleration. Accordingly, acceleration has led to an ever increasing energy consumption and exploitation of natural resources, leaving the question whether natural resource management can actually exist as environmentally friendly management, concerned with ecological sustainability.

This raises the question whether society can manage (govern, control, steer, ...) the phenomenon of acceleration in societal processes in order to slow down, the societal processes that led to an acceleration of natural resource and energy exploitation. Thus, the subject of the research is the possibilities and limitations of (societal) management in this acceleration context. Over the course of the research the main problem has been broken down into a number of research questions, each assigned with a concrete research task. These questions are dealing with the society-environment relationship, possible management measures and its prerequisites, and the reflection about the probability of implementing effective measures in order to manage acceleration.

The research for this doctoral project was undertaken since 2004 and initially concentrated on the study of forestry in the Barents region as an example of natural resource management in the North within the context of time-space compression. Due to theoretical and practical considerations the focus moved away from the Barents region to the national economy-level and became rather theoretical. Forestry has been merely considered as a case study in some parts of the research. All in all the analysis has taken into account broader elements that concern natural resource management, including forestry statistics, macroeconomic policy and innovation capacities across three Northern countries, which have a stake in the Barents region: Sweden, Finland, and Russia. The mentioned research tasks implement the research through their assigned methods, which include statistical and case study analyses, documentary research and theoretical discussions. The abstractness and generality of the analysis, as will be shown in the main model that has been developed as part of this research, will permit the addition of more case studies.

1.1 Acceleration as ecological risk

Increasing time-space compression or acceleration have not gone unnoticed in the previous, say, two centuries. While acceleration has – in principle, i.e. from an evolutionary theoretical perspective – occurred since the very dawn of society, it is probably only since the onset of the industrial revolution that this phenomenon has become most visible with all its consequences.

Alles veloziferisch! – Johann Wolfgang von Goethe (1749 – 1832), having witnessed the beginnings of 'industrial' acceleration, spoke of the accelerating effect of the widespread application of new machinery with mixed feelings. The increased need and desire for faster communication he described as being – so to speak – the work of the devil, which is reflected in his word creation 'veloziferisch', combining velo=speed and lucifer=devil. This stance is also mirrored in his writings, where, for example, the wandering journeyman witnesses the rythmic noise of a mechanised workshop, fearing the monster-like unknown in it. (cf. Jünger, 1959; Osten, 1999) On the other hand, as a high civil servant in the government of Sachsen-Weimar, Goethe was responsible for introducing the steam engine into public industries, for instance mining. And as a man of letters he welcomed accelerated and global communication opportunities, anticipating greatly the emergence of a world literature and considering the resting in national sentimentalities as provincial. (cf. Osten, 1999)

In his work *Menschliches, Allzumenschliches* (1878) Friedrich Wilhelm Nietzsche (1844 – 1900), in turn, condemned that busy people are all too often valued higher than the resting. Though, Nietzsche writes that busy people most commonly lack what he calls the characteristic of a higher activity: that of the individual activity. In addition, Nietzsche remarks that the contemplative and thoughtful life has decreased; people are ashamed of a life full of leisure and with little purposeful activity. Never before have the active, the restless, been valued more than today. The restlessness of modernity – writes Nietzsche – increases so much that civilisation cannot harvest its fruits anymore due to the lack of time. Lacking this, civilisation will result into barbarianism. Nietzsche also has an explanation why society has become so restless: most people are busy expressing their roles, for instance as civil servants, merchants, or scholars. But with respect to their individuality, they rather should be considered lazy people. In Nietzsche's words, the busy move like rocks according to the stupidity of mechanics and all humans are either slaves or free, those who do not have more than two-thirds of their day for themselves are slaves, and it does not matter whether they are civil servants, merchants, or scholars. The people's individual laziness prevents them, for example, from having own opinions. This, however, is necessary in order to realise freedom. He continues to point out that freedom alike many concepts has no unique definition: what may be freedom for one, is only a means of reaching a deprivation of freedom to the other. (cf. Nietzsche, 1878/2008)

Why could this be important? Nietzsche appears to have had the opinion that the principle of being so active and restless did not really serve the (individual) freedom of the spirit; it rather supported the freedom-antagonistic collective. Could it be that the societal collective exhibits a dynamic that leads to an acceleration of societal processes?

The enthusiasm that continuing industrialisation and technological progress brought led to the turn of the 20th century being labelled as the age of futurism. This excitement is perhaps best expressed in Filippo Tommaso Marinetti's (1876 – 1944) *Futurist Manifesto*, in which he declared that the greatness of the world had been enriched by the beauty of speed. (cf. Marinetti, 1909) This could also be seen as marking a turning point in the perception of records; increasingly performance aimed at breaking (numerical) records. Our time shares the same sentiments on increasing speed and acceleration, culminating into the motto 'faster, further, higher'.

During this age only conservative philosophers, such as Kuehnelt-Leddihn (1943) or Jünger (1959), kept up waiving the flag for the claim that modern society's concern with increasing speed should be perceived negatively. The need for speed is reflecting our feeling of mortality; hence we strive for continuing progress towards increased comfort. Kuehnelt-Leddihn (1943) believed that progress is necessarily connected to the time element because medieval humans' lives were static. To them God stood at the centre of their existence, thus rendering the difference between the ages irrelevant. In our progressive age, however, God has been replaced by the Utopia, which always lies in the future, thus making the compression of time a necessity.

After decades of accelerated exploitation of energy and other resources and generation of emissions the beginning sustainability debate in the 1970's forced attention onto this phenomenon. For instance, the Club of Rome's *Limits to Growth* report from 1972 explicitly points out the emerging ecological problems under an accelerated growth of the human population vis-à-vis a finite capacity of natural resources on earth. (Meadows et al., 1972) One and a half decades later the World Commission on Environment and Development, headed by former Norwegian prime minister Gro Harlem Brundtlandt, published its own report entitled *Our Common Future*, in which concerns on the accelerated deterioration of the environment and its resulting consequences for society's well-being were laid down. (World Commission on Environment and Development, 1987)

Since then many scholars have developed the understanding that the present relation of time and space is somewhat 'unhealthy' and therefore the fundamental origin for the ecological crises that we can identify. (e.g. Adam, 1993; Reisch, 2001; Hofmeister, 2002) In particular the increasing speed of economic activities, which is commonly associated with accelerated consumption and making profits, is seen as being mainly responsible. This is not surprising as our economy is largely characterised by an effective division of labour, with increasing occupational specialisations, which is resulting in productivity increases. When productivity becomes the main focus time becomes scarce. Consequently, we tend to replace older products with new ones of the same function in order to increase productivity and save time; in industrial settings this part is also often represented by the replacement of labour through materials, which are cheaper and so permit a higher return on an investment within a given time period.[1]

[1] These explanations point to the concept of capital turnover, where the time for replenishing one's capital investment capacity is reduced if the amortisation period of an investment can be made smaller. The amortisation can differ greatly, depending on industries, regions or countries. In markets with a comparatively large customer base, there is a smaller need to make a comparatively large profit out of the single customer's turnover and, consequently, a smaller need to reach

The emergence of a common time standard, the introduction of a linear chronology into every day life complements the above elaborations. This is widely considered as an outcome of the dominance of classical economic theory, which sees chronological time as a resource for economic utilisation (e.g. Held, 2001; Hofmeister, 2002). The main purpose of such a common time standard, adjustment and control, has fundamental effects when being applied upon natural ecological cycles; this happens for instance in the case of agriculture and forestry. (Geißler, 2002) Here, the ratio of natural vs. societal harvesting cycles – bound by the economic logic of time compression – is most relevant in the sustainability discourse. After all, natural resource management should not erode the natural capacity for regeneration. (Daly, 1992; Jordan and Fortin, 2002)[2]

The more recent literature also includes Tennberg (2004a,b) who has concentrated on describing the compression of time and space as being a characteristic of a globalising society. Her analysis centred particularly on the changes in the Arctic, especially in the context of the rise of industrial society, globalisation and climate change in Arctic areas. In her work the different rationalities and perceptions of space and time between stakeholders become visible in a regional context, particularly in the disparity between scientific knowledge on climate change and the urgency for counteracting measures on the one side and economic and political time perceptions on the

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the amortisation of the investment quickly. It will become clear that the problem of acceleration is treated similarly in my research, where, however, it is based on the considerations of standard economic models, which take into account the cost for money (as a production factor) as a primary deciding factor.

[2] Of course, under the premise of the sustainable development concept, as it is most widely cited, understood and accepted nowadays, i.e. have present generations meet their needs and use resources in such a way that does not compromise the ability of future generations to meet their own needs, resources should surely be used, otherwise society would eventually break apart. In this sense, resource exploitation is natural to society. However, this does not exclude the possibility that society would destroy its sustenance base; hence, the consideration of this research to 'slow down'. Science, after all, recognises that such conflicts between accelerating and slowing down exist due to differences in prioritising and preferring certain types of information in different parts of society.

other. However, differences also include the abyss between a scientific (technical-rational) understanding of the world, time-space and climatic changes on the one hand and the perceptions of local and indigenous people on the other, as expressed in traditional ecological knowledge.

Thus, the literature on time and ecology agrees on a gap between the time perception of different parts of society, expressed on the one hand particularly in the scientific realisation that ecologies need time to evolve and the socio-economic need to increase the efficiency with which time is utilised for a sustainable society on the other hand. The gap appears to have become more visible over time, in particular since the onset of the 'industrial revolution'. The growing concern is reflected in the amassing of the literature on the topic, making it imperative to investigate the possibility how or whether the 'disorder' of time-space can be dealt with in society.

1.2 Why the focus on economy?

Following the above argumentation it is not surprising that modern society – and particularly its economic system – is perceived as having generated a profound disruption in what can be called the natural alignment of time and space. However, having pointed out in the introduction that acceleration is reflecting society's continuing evolution and progress, this process of disruption has not come about in an instant. It evolved in accordance with the way that humans transformed energy and other resources, guided by the development of technologies, including tools, skills and also money. The latter has by now assumed a central position and is affecting our relationship with space and time, including work, consumption and the accumulation of reserve funds for future use. This way modern society is able to control time and space in a comprehensive way. (Rosnay, 1975/1979; Jordan and Fortin, 2002; Geißler, 2002)

Thus, the economy appears to be at the heart of natural resource management. If we want to understand patterns of natural resource management we have to find an understanding of how humans *do* economy. Human ecology understands that modern natural resource management simply requires dealing with money and its nature in modern society, such as the role of money in the economy. More on this later in the section explaining the analysis model.

Concerning forests – as a case study in Northern natural resource management – it is then most relevant to wonder what happens if the acceleration in economy and the wider society affects possible harvests without consideration of the natural regeneration cycle of a forest. Indeed, the possible consequences of such a configuration have been a concern for several centuries. Forest policies are, therefore, among the earliest guidelines for a rational natural resource management.

As said, this is largely a theoretical inquiry. The forestry and other economic case studies serve here as ways of illustrating particular aspects of the model that has been developed as part of this research. Focusing on economy and forestry, however, also provides a rationale as to why such an inquiry is made in the first place. Given that forest management rates among the early systematic studies on resource management, it shows particularly well the drive towards maintenance of systems and organisations and sustainable development in general as an apparent wider goal in the evolution of society.

Thus, since the age of enlightenment, humans have been involved in making forest policies. Primary goal in this activity has been the securing of a solid base of wood sources in order to meet the demands in raw materials and energy supply. These policies were made as a consequence of diminishing forests as a result of a widespread start of industrialisation in Europe. (Wehling, 2001)

A milestone in the management of forests had been the introduction of the principle of sustainability into forestry. The idea of sustainable forest management as a concept was the result of a mercantilist striving for a forest of common welfare, in which the enlightened absolutistic state ought to prevent negative consequences of adverse forest exploitation. In the spirit of the age, characterised by new scientific discoveries and the belief in progress, the sustainability concept was based on empirically substantiated methods in which a spatial and temporal order in the forests ought to be achieved in order to ensure a stable wood supply. (Höltermann and Oesten, 2001)

The probably earliest account of the use of the term ‘sustainable’ (in the form of the German word ‘nachhaltend’) in the context of natural resource management is by Hans Carl von Carlowitz in his book *Sylvicultura Oeconomica*, published in Leipzig in 1713 (Grober, 1999):

> *Wird derhalben die größte Kunst/Wissenschaft/Fleiß und Einrichtung hiesiger Lande darinnen beruhen / wie eine sothane Conservation und Anbau des Holtzes anzustellen / dass es eine continuierliche beständige und nachhaltende Nutzung gebe / weil es eine unentbehrliche Sache ist / ohne welche das Land in seinem Esse nicht verbleiben mag* (Carlowitz, 1713, 106) (cited in Höltermann and Oesten (2001))

Von Carlowitz realised that it was necessary to develop management principles to ensure a sustained wood yield, for he feared that otherwise the building blocks of society could be disrupted:

> *Wo Schaden aus unterbliebener Arbeit kommt, da wächst der Menschen Armuth und Dürfftigkeit* (Carlowitz, 1713, 105) (cited in Höltermann and Oesten (2001)).

i.e. where there is damage from omitted work, there grows the people’s poverty and indigence.

In its origin, the concept of sustainability in forestry aimed at the sustainability of wood yields. It incorporated the assumption that an exhaustive cultivation of forests would have adverse social consequences. Intergenerational equity was already considered as an important planning principle, as Hartig (1795)’s framework for sustainable forest management states that present and future generations should be informed accurately about potential yields and planned usage of defined forest sectors. (cf. Höltermann and Oesten, 2001) Outside forestry, Adam Smith laid down general principles of resource management in his *Wealth of Nations*, published in 1776. As a work of ideal economics, the interest focused predominantly on the sustainability of yields, but, of course, with the general wealth of the people in mind, stating, for example, that *the wood of the forest, the grass of the field, and all the natural fruits of the earth, which, when land was in common, cost the labourer only the trouble of gathering them...* (Smith, 1776/1999, 152) A stock subjected to private property, on the other hand, has an additional price added to it, the rent, the tax, and so is used naturally more sparingly, with the intention to accumulate the stock so as to derive a revenue from it over time. This way, the accumulation will improve the stock, for example, the *'land, that has been [prepared] most proper for tillage and culture.* (Smith, 1776/1999, 377) Here we find outlined the significant cooperative value of different parts of society, such as state, law, and economy in oder to create an effective and efficient resource management regime as compared to the absence of such societal regulatory systems.

In the course of time the meaning of what constitutes sustainable forestry has changed, transforming from the sustainability of yields via multiple use functions of forests to what is called an ecologically sustainable forest management. (cf. Hunt and Haider, 2001; Kant, 2003; Spieker, 2003; Bowers, 2005) Thus, contemporary conceptualisations of sustainability (and sustainable development) reflect the integrative outlook of development and continuing progress. Still, the concept of sustainability has experienced a remarkable continuity, which is, to some extent, due to the special characteristics of the forestry industry in comparison to other industries. Höltermann and Oesten (2001) include into those special characteristics the longevity of the wood production process. A forest requires between 60 and 250 years to produce sufficiently so that its wood can be harvested. Decision-making is subject to great uncertainty about future developments if consequences can only be felt after many decades or even centuries. (cf. Layton, 2000; Lundmark et al., 2005) Furthermore, on a human timescale the destruction of the productivity of nature is irreversible. Nature productivity essentially describes the ability of nature to reproduce nature's services. (cf. Hilborn et al., 1995; Höltermann and Oesten, 2001)

While the age of robber-baron type forest resource management is gone in the North of Europe, which up to the 20th century has led to widespread exploitation of Nordic and Northern Russian forests (cf. Layton, 1999), it, nevertheless, is of high interest to understand the mechanism that drives acceleration in the economy, for the mere existence of forest or conservation policies does not remove that mechanism.

1.3 What is the aim of this research?

Thus, the primary aim of this research has been to find out how and whether we could control this acceleration that is so apparent in modern society. This exclusively aims at understanding the societal capacity to control such a phenomenon, for instance through policies and laws. Since this is a sociological study, the research also excludes specific biological aspects that could affect the ratio of harvesting versus regeneration cycles; for example global warming might actually increase the speed with which a Northern forest can regenerate and thereby affect the speed that is necessary to endanger the carrying capacity of that forest. (cf. Hilborn et al., 1995) Hence, the study is solely concerned with acceleration as more abstract issue, leaving the advantage of wider applicability outside the otherwise narrow economic perspective.

The existing literature is describing acceleration and the increasing time-space compression merely as a phenomenon, saying essentially that it exists, but also referring to conflicts between varying time perceptions and timelines of different models and parts of society. An example here is the difference between science and, say, politics on the urgency of executing measures to mitigate the effects of global warming, culminating into the general statement that 'we are running out of time'. The literature does lack, however, concrete solutions with respect to guidelines how society could govern acceleration (which is, of course, only relative to other timelines). This has been the starting point of this project. Therefore, this research attempts to understand the origin of acceleration *in* society and whether it can actually be controlled *by* society.

This might appear a bold statement. Of course I am aware that there can be no such thing as a complete model. Moreover, *science never proves anything; science probes, it never proves*, as Bateson (1982) (cited in Goldammer and Kaehr (1987)) points out. Nevertheless, I do make such an attempt to understand the phenomenon in question. In addition to that, the empirical cases, which are presented in the research articles and summarised in this introduction article merely reflect certain aspects of the model that was developed as part of research. By no means should the cases be considered a full test of the model, rather selective evaluations; not more is really possible.

Ecological risks in the context of systems theory are concerned with the consequences for society or the environment of society that originate from the evolution in society. This definition is based on Luhmann's conceptualisation of ecology as being the totality of scientific research that is concerned with the outcomes of society/system–environment differentiation. (Luhmann, 1986, 1997) The outcomes include both societal and environmental consequences. Thus, of relevance to society and its sustainability are possible feedback effects from society's environment. Letting the steering capacity rest in society is founded on the assumption (of systems thinking) that there is no communication and, therefore, no control capacity in the environment of society. Still, the environment of a particular social system (containing other social systems) produces stimuli – perceived as impacts from the environment that have to be processed in that system

In addition, I consider the particularly strong focus on the economy as being responsible for acceleration as insufficient. While I focus predominantly on the economic dimension in my research I understand from applying the theory of social systems that any event or process in society is always the cooperation of different parts of society, for, as already shortly mentioned in the introduction, social systems cannot be made redundant; they each provide a specific function (albeit based on information processing using a diversity of binary codes, making cooperation with a planned outcome a challenge). Hence, this research also aims at offering more insights into the cooperative value of modern society's configuration and its potential consequences for the phenomenon of acceleration.

1.4 What's the value?

Besides the more general contribution to the academic discourse on natural resource management and sustainable development this research will give insights into the origins of acceleration or time-space compression and, therefore, provide the basis for an understanding of environmental impacts and ecological destruction. To a great extent knowledge on these issues is existent or inherent in the theoretical concepts that I apply in this research. Hence, I see my task rather as fostering the understanding of the consequences of existing concepts like observer-dependence – a direct outcome of systems theory – and non-linearity in society's management of natural resources.

Both latter ideas – observer-dependence and non-linearity – have the potential to radically change policy-making. They surely will offer new insights to policy makers about the consequences of their work and decision-making. Thus, this practical aspect of this research could prompt a review of policy-making. At present, the aim of natural resource management policies is commonly to increase cooperation and integration wherever possible, in many cases also to formulate policies that foster innovation in order to increase efficiencies.[3]

[3] An important example is ecological modernisation theory, which aims at increasing efficiencies on the basis of accelerated innovation. (Murphy, 2000; Jänicke, 2008)

The research will show that the linear relationship between policy and outcome is not as simple as it often appears. The particular strength – and its speciality – of this work is that it is able to look at the problem of accelerated energy and resource exploitation not from the viewpoint of cause-and-effect relationships. Rather, it is able to outline a more advanced point of view, the view of a circular causality perspective. Circularity[4] coupled with observer-dependence[5] will give new ideas about the limitations and possibilities in natural resource management and sustainable development.

1.5 Philosophical setting

The driving force for undertaking research in the first place is often pragmatic. Quite commonly researchers state their intention of making the world a better place as their reasoning. In my case, as I wrote earlier, my intention was rather to develop understanding. Still, there is pragmatism in this case, too. This pragmatism has a personal orientation. It is context-dependent, to use a sociological

[4] Circularity implies that the output of a system's operation is the basis for the new input of the operation. The circular nature of society's operations is reflected in them being reproductive or *autopoietic*. For instance, spending (output) by one in the economy constitutes income (input) for another. The monetary economy only functions on the basis of the never ending, reproductive circulation of money. Likewise, truth-generation in science is not a goal-oriented process, but a reproductive one. Since all knowledge is uncertain and the truth only provisional it follows that true knowledge cannot be achieved as part of a finite research programme but is the consequence of a never ending, reproductive endeavour called science.

[5] Observation is the basic operation in social systems (and in society) of making a distinction. The economy distinguishes according to its logic of paying/not paying, whereby the economy is probing and carrying out investment opportunities. This observation activity of the economy impacts on other parts of society, such as science, whose establishment of what is true, changes accordingly. The consequence is a co-evolution of social systems; a system that observes triggers a change in other systems. This makes reality (what *is* happening) dependent on the observer, a conclusion also established by quantum mechanics, after which the observation of a system changes its behaviour.

term, and therefore subjective. Incorporating personal context into theory has been a difficult undertaking, but an absolute necessary one, not least since we know that the *observing organism [e.g the scientist] is part, partner, [and] ... participant in its world of observation* (Foerster (1985), cited in Goldammer and Kaehr (1990)).

Given the statement by Foerster (1985) it seems indispensable to discuss shortly the nature of knowledge, its production and related concepts. To get behind the scientist's position in the production of knowledge and theory but also his or her wider role in making society happen, it makes sense to refer to the foundation of occidental philosophical thinking and its current problematic.

Aristotelian philosophy has been the basis for the rules of thinking and logic, as Flyvbjerg (2001) explains in his book *Making social science matter*. As depicted below Aristotle divided knowledge into three categories, namely *episteme*, *techne*, and *phronesis*. Whereas episteme and techne have contemporary analogies in the concepts of epistemology and technique or technology, phronesis lacks this modern term association. Aristotle is cited in Flyvbjerg (2001) as having put the nature of prudence to the term phronesis. Distinguishing it from science and art to be able to deliberate about what is good, this quality accordingly belongs to those who understand the management of households and states. Remarkably the original meaning of cybernetics refers to the good governance of states and other organisations[6].

The Aristotelian concept of phronesis when being translated as prudence or practical wisdom and the ability to judge what is good or bad for humans, goes beyond (objective) scientific knowledge (episteme) and technical knowledge and know-how (techne). This is where its relevance for knowledge and theory production comes in. Building theory requires after all personality, action-orientation and power to make judgements. Not surprisingly, philosophers have come to expand Aristotle's original categorisation by including questions of

[6]For example Mesjasz (2000) who cites 19th century philosopher Bronislaw Trentowski as having coined the term 'cybernetyka' as *the difficult art of governing a nation.*

Episteme	Associated with what is commonly considered scientific knowledge in the natural science sense, refers to context-independent and objective knowledge, assumes general rationality
Techne	Associated with arts, crafts and know-how, context-dependent and variable, oriented towards production
Phronesis	Referring to ethics, context-dependent and pragmatic, oriented towards action

Aristotle's division of knowledge (Flyvbjerg, 2001, 57)

power, too, as Flyvbjerg (2001) explains.

Flyvbjerg (2001) continues to point out that context becomes central in this discussion. This emphasis on context is contrasted with the influence of objective rationality and the consequential dominance of science, which conveys the image of an objective truth. Criticising this objectivity Flyvbjerg (2001) refers to Nietzsche who wrote that rationality at any costs in opposition to the instincts has itself been no more than a form of sickness. Rationality based on a single value endangers context. Context in turn gives rise to the rule of many values and leads to what Gotthard Günther calls polycontexturality (cf. Paul and Goldammer, 2000).

Given this emphasis on context and personality in the process of producing knowledge eventually leads to the question whether something like a scientific theory is possible when dealing with humans and other social phenomena and processes. To illustrate one influential opinion Flyvbjerg (2001) cites Dreyfus, who suggests that the studies of social phenomena are not and probably never will be scientific in the conventional meaning of what science stands for, i.e. the epistemic meaning of science as offering a path towards objective truth. The idea of theory after all implies that general statements can be made, which demand that the theory is complete and allows future prediction. The so-called natural sciences follow this latter idea;

therefore those natural sciences are cumulative. They are supposed to produce improvements over time. (Flyvbjerg, 2001) I suggest that the influence of natural science rationality is perhaps the reason for the dominance of linearity in our thinking and the influence of the idea of the plan. Given the topic of acceleration as ecological risk in this research this rationality might turn out to be influential in generating this acceleration, as will be laid down in the course of this dissertation.

Of course since about the 1960's or, as Flyvbjerg (2001) puts it, since Kuhn's *The structure of scientific revolutions* (1962), natural sciences are understood to be also subjected to what might be called the hermeneutic interpretation. In other words there is no natural science without humans who produce knowledge within their context. Also for methodology there exists no universal theoretical rationality. So, natural sciences lack objective rationality as much as social sciences do. Natural scientists often do not realise this, however, as they do not study life, but only dead objects. Social scientists in turn have to take into account their own context and the context of the people, groups or social systems they study. (cf. also Goldammer and Kaehr, 1990)

Several characteristics are put forward by Flyvbjerg (2001), which social science theory ought to incorporate. These might or might not make a theory a real possibility. A theory in the very sense should consider abstract context-independent concepts. These however do not exist since all scientific activity is conducted by humans. In addition to that a theory must consider situational self-interpretation. Consequently, any study that leads to a theory can only be as stable, complete and general as such interpretations are. Another problem in the consideration whether theory in the traditional sense is possible is constituted by the understanding that cumulative knowledge is not possible as humans both constitute the scientific activity as well as the objects of study. Having said that it must be considered, too, that natural scientists must study purely dead objects to develop theories, a living nature in turn cannot actually be studied in the traditional self-understanding of natural scientists (cf. Goldammer et al., 1996). In addition to that any scientific activity does only occur within the context of a science system. Since science evolves within its own logic it is not possible to make general statements about true knowledge. Moreover, context-dependence involves open-endedness. This makes general statements impossible, as this would imply the possibility to predict. (Flyvbjerg, 2001)

It has been considered problematic that without believe in the possibility of a theory, the ground is opened for nihilism and relativism (Flyvbjerg, 2001). I like to comment here that a theoretical approach, which takes into account multiple logics (like the mentioned polycontexturality theory), alike many modern conceptions of how knowledge is produced, is by far not relativistic, which would imply that 'anything goes'. Polycontexturality points out however that there is a diversity of rationalities, in the sense of logics, existing, which in their own right all produce true knowledge. Polycontexturality emphasises the existence of logic as the basis for scientific activity, clearly distinguishing it from anything that must be believed to be accepted. This is the distinction between science, what we know, and religion, what we believe. Although a trivial matter, it is by far not very established, at least for the social sciences. While believe has a future-orientation and appears necessary for action-orientation and goal-seeking, theory must be based on what we now. This does not exclude, however, that we consider believe as part of forming contexts. Theory then would state that knowledge and believe alike are instrumental to produce a polycontextural society.

Having written that social theory or a theory of reality ought to be open-ended and that believe and future-orientation must be kept up to continue the search for theory and explanation, it has to be kept in mind that we understand by now that science is a never-ending endeavour. Hence, there can be no such thing as a complete theory. Knowing this might relativise what Flyvbjerg (2001) has called the increased dominance of instrumental-rationality over value-rationality during the last few centuries, which has brought about objectivity and linear thinking.

The consequence of the Aristotelian influence in knowledge production and theory construction is the emphasis on a two-valued logic, i.e. something is either true or false. The absence of any other possibility leads to an objective truth. The shortcomings of this influence have been known at least since the 1940's (e.g. through Warren McCulloch's work), when it became clear that due to the obvious existence of many perspectives, viewpoints and ontological locations, a two-valued logic could not reflect reality. Though, it is possible to trace back early developments of the need to overcome classical logic already in the works of Kant and Hegel, who emphasised the existence of transcendental logic as part of the process of self-reflection. (cf. Günther, 1953, 1954)

Gotthardt Günther considered these issues since the 1930's and actively developed since the 1950's an approach that takes account of context and subjectivity (Günther, 1959). Outcome of these developments was what came to be eventually coined the theory of polycontexturality. Polycontexturality theory implies that a two-value logic is used by those involved in the communication process that produces society, i.e. living, cognitive systems[7]. However, a living reality (in contrast to a dead, never changing reality) can only be understood through the interplay of different logical locations, meaning the relationships of many social and other cognitive systems, culminating into a network of multivalue logics.

Remarkably, polycontexturality makes possible what has been considered impossible or absurd in wider circles of the social sciences. True, polycontexturality lives off context-dependence and necessarily takes into account the open-endedness of contexts, thus also considers the impossibility to make final statements about the future of society. Still, it can reserve for itself the term theory as it indeed makes a general statement about the nature of a living reality. Modern social theory, which is founded on communication, can only be possible with the help of this multivalue-logics network promoted by polycontexturality theory, as Paul and Goldammer (2000) are eager

[7]Social systems are the cognitive systems most significant for our purposes of understanding social theory.

to point out. Moreover, through his major work *Idee und Grundriß einer nicht-Aristotelischen Logik* and others that followed it, Günther (1959) essentially seeks to integrate the division that Aristotle made. This reflects clearly a belief in the possibility of (social) theory, but by considering the concept of phronesis as part of the epistemology that leads to theory.

Thus, personal context has become part of the process of knowledge and theory production. This way single universal criteria, which guided the rationality of earlier societies, have given way to a polycontextural society (Luhmann (1990) referring to Günther (1979)). This society is characterised by an absence of context-independence. Niklas Luhmann, who provided the significant part of the theoretical background to this research, has incorporated important elements of Gotthard Günther's work into his theory of social systems (cf. Luhmann, 1984), thereby making the nature of polycontexturality particularly accessible to social scientists. This includes the statement that modern society establishes many different logics (in Luhmann's work in the form of binary codes and programmes) and what consequently leads to the formation of many different contexts.

Contexts do recognise other contexts' existence, but choose to 'see' the world exclusively from their own context. It is clear, therefore, that there cannot be a context-independent statement of reality; even science is not independent from society but a part of it. A description of reality is, thus, a self-reflection. As a consequence, any scientific analysis is, as Luhmann (1990, 668) puts it, an *observation of observation, a contextualisation of contexts, a differentiation of differences, thus a cybernetics of the observation of the second order*[8].

[8] In the cybernetics of the observation of the first order a system can be distinguished from its environment by an external observer. This is the classical view of science: a system can be studied in detail (cybernetics of observed systems). In contrast, the cybernetics of the observation of the second order is the cybernetics of observing systems. The observing system will always define its sphere differently from how it appears to an external observer due to the

Thus, the point in this research is very much not only to emphasise the prudent consideration about the consequences of contemporary resource management as it happens in modern society. Also, the emphasis is on pointing out the logical basis of system theory and cybernetics. This way of seeing the world is in fact the logical way of describing reality.

❦

different contexts that are applied. This way classical 'monocontextural' logic, which would imply a unique objective truth, is offset. The many contexts that occur in a polycontextural society imply that a cognitive social system always incorporates representing aspects of itself during its observation, hence it is self-reflecting. Thus, classical logic cannot apply to a holistic description of reality. (cf. Goldammer and Kaehr, 1990)

Chapter 2

Analysis framework

The use of natural resources and their potential overexploitation with respect to an insufficient regeneration capacity of the resource in question provides the general context for this research. Thus, a look at the development strategy for some natural resource – in this case forests – in the North – here: Barents region – seemed necessary.

The focus on forestry in the European North is a particularly relevant and up-to-date field of inquiry, as forestry is still a cornerstone of the Northern European economy but at the same time under pressure from global developments. To counteract risks policy initiatives for economic development of the Barents region have been established, including the Forest Sector Task Force, which has been set up by the Barents Euro-Arctic Council, the body for intergovernmental cooperation in the Barents region. The objectives of the Task Force include the creation of necessary conditions for forestry development, environmental care and wood-based industries. Notable focus points are the support of the conditions for sustainable forestry investments and innovation. (cf. Barents Euro-Arctic Council, 2001) On that basis an increase of economic activities founded on the use of the forests in the Barents region should be expected in the future.

Naturally, such a development will prompt questions about the environmental consequences of those investments and related activities as they can have negative effects on the forest ecology and possibly produce repercussions affecting future economic activities and human welfare. Forests, however, also fulfil a significant ecological function, thereby creating a conflict, which is at best explained as a contradiction between the economic logic of providing a short-term return of an investment and the long-term ecological lifecycles required to maintain a complex ecology.

To understand this issue, a system theoretical approach has been developed and applied, predominantly resting on Niklas Luhmann's social theory and other system and cybernetic concepts. The choice on system theory has been made due to its suitability to understand adaptation and the societal capacity to change. Hence, this research is not about normative statements, it is not primarily about providing advice for 'better' management – rather, reality is the foundation upon which we will understand the boundaries of change in society. Moreover, besides system concepts the model is resting on metaphysical terms and cultural historical ideas (cf. Heidegger, 1983; Kükelhaus, 1934/1984).

2.1 Analysis model

Since the starting point in this research has been the realisation that a disrupted relationship between societal and ecological times has led to acceleration with the consequence of increasing ecological risks, the research has practically focused on understanding the source of acceleration and whether this phenomenon can be managed. Management (in a control sense) is, thus, used as the umbrella concept in the analysis framework.

Management in form of (political) governance is commonly contrasted to government by defining it as signifying a change in government, i.e. a new way or method of governing society. Such new ways might include, for example, a minimalist state, corporate governance, new public management, what is known as 'good governance' and socio-cybernetic systems and self-organising networks. (Rhodes, 1996) For this research the two latter governance concepts are of highest relevance.

In the context of socio-cybernetic systems (social systems) governance is understood to be a mutual activity. A political outcome is not considered to be the result of governmental action. Rather, governance is depending on the interactions of a variety of actors, institutions or sectors of society. To produce successful outcomes governance assumes that all parts of society can contribute; in fact, these parts of society represent all the resources there are available to solve a problem. Facilitating such an interaction might be considered the task of governance. This also means that a central government is not supreme; that politics is not a superior system in society, which determines procedures and planning. Society should be seen as being without a centre. (Rhodes, 1996; Kooiman, 1993)

Governance should be understood as being path-dependent. For instance, enacting laws to govern assumes that laws are actually complied with. For if one could not trust that laws are complied with there would be no point to use law for the purpose of governance. Similarly, the use of an eco-tax to artificially increase the price of a commodity, having in mind that a higher price will cause a commodity to be used more efficiently, naturally assumes that money is actually used to obtain the right over the commodity. If money is not used, for instance in cases of monetary surrogates, an eco-tax would be essentially useless. Governance, therefore, assumes that human social behaviour occurs in recurring patterns, which have to be sustained over time – hence, the dependency of governance on these pattern-paths. These patterns are often called institutions; here they are referred to as social systems. (cf. Walter, 2009b, 2010)

Thus, path-dependency is understood as a notion describing and defining states of development, which have proven to cope with environmental factors in such a successful manner that they are difficult to replace, in fact difficult to fall behind. Such states are a result of evolution and can be found in society (e.g. Baecker, 2005) and technology alike (e.g. Berkhout, 2002). The concept of path-dependency is often discussed in the literature concerned with economic development and innovation (e.g. North, 1990; Niosi, 2000; Unruh, 2000). Here, the consequences of certain events or an institutional context determine certain future paths, which will prevail because behavioural choices are reduced and culminate into the question how path-dependency could be broken when undesired paths are pursued. While path-dependencies might be broken, for instance when outdated technologies are replaced by newer ones, technological innovations usually lead to an interlock of local/regional/national socio-economic structures. (cf. Walter, 2007)

Management, then, can be defined as the process of specifying and defining preferred states of affairs and revising ongoing processes so as to move into the direction of the preferred states (Etzioni, 1968). Thus, management has an intentional aspect; it is concerned with the reaching of desired states. System theory contains a control hierarchy based on two flows: energy and information. These are flowing into opposite directions; certain aspects in a system with high information content control those with low information but high energy content. On the other hand, systems with high energy but low information content activate, i.e. create, the function of information control. Generalised media are necessary so that a society-wide exchange of information and energy can take place. (Degele, 1997) Luhmann (1988) considers money to be the generalised medium for exchange and communication in the economy of society. Energy and raw materials are exchanged for money so that the resources can be used for economic purposes. Control, therefore, has two meanings. The intentional aspect implies an acting subject capable of defining a goal, such as achieving sustainable forestry. The control hierarchy, on the other hand, aims at controlling and coordinating social systems; here, control is an integration mechanism. Management in this control sense is an attempt to cope with complexity. (Degele, 1997)

The cybernetics of social systems, or sociocybernetics, has the intention to understand social systems as self-regulated, not externally controlled systems. Social systems, like living systems, have a quasi-will of their own. The main issues involved in this discourse are the possibilities as well as the limitations of rational control. (cf. Mesjasz, 2000) In modern cybernetics (i.e. the cybernetics of second order) the observer and the observant form one and the same system, i.e. the observer is not independent of the observant. This paradigmatic change from objectivity to subjectivity is expressed in the shift of the control capacity from the environment to the system. (Geyer, 1995; Degele, 1997) For example, Luhmann transferred the concept of autopoiesis from the biological sphere (based on Maturana and Varela (1980)'s *Autopoiesis and Cognition: The Realization of the Living*) into social theory. In his theory autopoietic systems (which are self-organising systems) are operationally closed and have the aim of continuing autopoiesis without direct consideration of their environment; all elementary units are reproduced from these units and through this reproduction the system differentiates itself from its environment. (Luhmann, 1984, 1986) The consequence of this self-organisation is that all attempts to access a system externally must be unsuccessful if the measures to access are subject to a different logic than the system logic. Therefore, parts of social systems cannot be unilaterally controlled. It is surely possible to have influence on processes, or have hierarchies, but it is not possible to control a part of a system without being controlled. (Luhmann, 1984)

These thoughts are in line what Luhmann calls the conditions of resonance in social systems. Society's internal self-productive structure-building processes are closed against the influence from outside (the environment). Society only acts on the level of its functional subsystems. Luhmann's theory construction concretises the function of social systems within society and the systems' particular rationalities. A social function system consists of a specific type of communication, characterised through a functional code. While there is communication going on also on a phenomenal life-world level, a response to environmental events can only occur through the function systems. The code is based on the system's mode of information processing; the latter also includes a specialised medium of communication. For example, in the case of the economic subsystem of society, money is the medium that is circulating in the economy, influenced by the code to pay/not to pay. In the political system, on the other hand, issues are concerned with the distribution of power. Who is in a position to exercise power? Who wants power? etc. A further example is the science system, responsible for knowledge production. Its operations are circling around the question of truth; hence, the systems operation code of true/untrue. (Luhmann, 1986)

Consequentially, there are limits as to which extent society can adapt at all to changes. System rationalities have to be accepted and cannot be bypassed when aiming for a successful outcome of a management effort. In line with the idea of path-dependence in the concept of management/governance one must be aware that social systems with their peculiar rationalities represent institutional developments on whose successful operation governance is dependent. This is true not only for Luhmann's functional societal-level systems but also for any system that emerges as part of a technological development, connecting people into a cooperative network. If for some reason the operations of systems and networks cannot be carried out or only under difficulties, for instance when power relationships are unclear due to legal failure or legal inaccuracies or when barter is used instead of money for trading, the success of management efforts will be greatly jeopardised. (cf. Walter, 2009b, 2010)

Having applied a system theoretical approach to understand the possibilities and limitations of natural resource management and its conflict between satisfying human needs and solving ecological threats, I understood that management is characterised by the existence of *complexity*, the possibility of *control*, and the necessity of *evolution*. Complexity implies matters of scale, relation and unpredictability. Control refers to both, possibility and limitation, of interfering and governing. Finally, evolution is associated with the need for progress, a transformation of coordination in society to increase the probability of cooperation. It is also associated with renewal and revitalisation of institutions in society. Figure 2.1 depicts

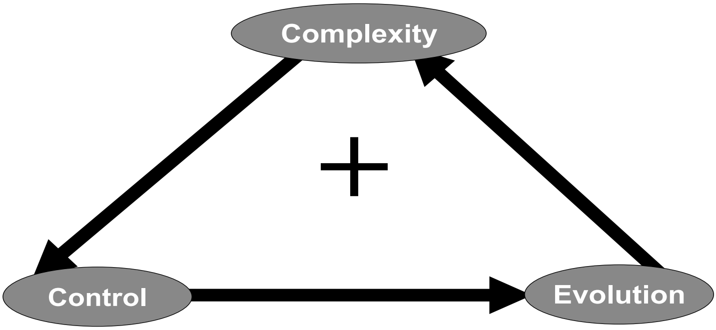

Figure 2.1: Model 'Complexity – Control – Evolution'

the analysis model that I have developed in a graphical way. (cf. also Walter, under review)

2.1.1 Complexity is 'everything'

I have translated the complexity aspect in natural resource management into a scale issue[1]. Scale matters in resource management, whose relation between society, economy and environment can be explained through a certain time relationship. (cf. Daly, 1992) In this sense – and as explained earlier – short-term time horizons, time compression and the ever increasing productivity in the economy are fundamental problems for ecological sustainability. Sustainable development, defined, as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987), is inherently a concept that requires a strong focus on time. After all, the concept aims at allocating resources to generations not yet born and thus necessitates a certain kind of reasoning.

[1] Scale in the sense of a difference between a system and its environment, i.e. the system represents 'downscaling' in relation to its environment.

Due to the regeneration of natural resources taking a long time – if the capacity for regeneration is not already irreversibly destroyed – ecological time scales might be incompatible with the economic logic of time compression. In addition, the economic reasoning is based on a human time scale, in which the capacity for ecological regeneration and recycling might possibly not be achieved. (cf. Walter, 2008)

In a more abstract sense complexity represents wholeness (*Ganzheit*), but also uncertainty and indeterminacy. The world is infinitely complex and society continuously aims at increasing its possibilities to respond to infinite perturbations. Systems are complex when they are neither fully in order nor in disorder. Since this is the case with social systems the literature calls their organisation structural complexity. (cf. Luhmann, 1997) Self-organisational systems reproduce their elements to maintain themselves against their infinitely complex environment. As a consequence social systems, which are self-organisational, increase their own internal complexity. Their complexity is considered to increase when their number of elements – in the economy this is money – increase that can be connected through the system's relations. Relation reflects the networking character of complex systems. Relations are increasing as well but the possible relations have be reduced to a manageable number. The system will select a finite range of relations, which will enable the connectivity of the system's elements and, therefore, the sustainability of the system. (Luhmann, 1984, 1997) The process of increasing possible relations can be called integration, which basically means an increase in dependency. (Heylighen, 1997) This process cannot be controlled by the system's environment, hence the term structured complexity, which illustrates that the system is partly in (predictable) order and partly in (unpredictable) disorder. (cf. Degele, 1997; Dijkum, 1997)

For this research the boundary that marks the difference between a social system and its environment matters most. This boundary is called the complexity gradient. Assuming that a system is always smaller and less complex than its environment, there are no point-to-point connections between system elements and the system's environment. Hence, the time in the system does not run in a synchronised way with the time of the system's environment; system time must run faster.[2] If elements and relations increase and – as a consequence – the system becomes more differentiated internally, the more the system time will become diluted in relation to the time chronology of the environment and accelerates. (cf. Luhmann, 1984) Acceleration is clearly a response to managing the environment's complexity. (Walter, 2008, under review)

Thus, the more complex the social world becomes – for instance as part of globalisation – the higher will be the probability of seeking security through acceleration. (cf. also Walter, 2010) After all, environmental complexity can only be counteracted with increasing own complexity. (cf. Heylighen, 1997) Hence, we understand the relationship between economy, the wider society and environment as being characterised by accelerating communication processes – such as investments – that have a great potential to increasingly affect the capacity of natural resources for regeneration negatively. The problem, then, is concerned with practically understanding acceleration in the economy and controlling it through governance.

2.1.2 Control establishes duality

In general, the control element in this model is aiming at managing complexity. Thus, it addresses the connectivity of the social system by ensuring the reproductive organisation of the system's elements and relations. Again, it must be pointed out that the focus of the control effort is essentially the internal sphere of a system; managing complexity does not mean that the system in question manages its environment. Since social systems are self-organisational, full control over their environment does not exist. (cf. Luhmann, 1984) This suggests, though, that a form of control is partly possible. For instance, while investments as such cannot be controlled, the conditions that

[2] When downscaling, the system realises the ability to run faster if it wants to keep up with its environment, e.g. a scientific model that predicts a future state must run faster than reality, hence it must be much simpler than reality.

make investments attractive might be under control. (Walter, 2009b, 2010)

In an abstract sense control coincides with the emergence of a social system and, thereby, also to an environment surrounding that system. This, then, generates a duality in our social existence. No system is without its environment, society does not exist without a sphere beyond its boundaries. Hence, if it is the task of control to maintain the sustainability of a system, then it is the task of control to maintain this duality. Such a duality is not without meaning, for it is the nature of human thought to distinguish (to turn 'one' into 'two') and, thereby, establish social systems for control purposes.

Controlling the sustainability of a system provides a timeline for it: a future can be defined from present time, assuming of course that the system is going to exist in the future, too. This is achieved through continuous reproduction of system elements. A future in the economy exists when money is going to be continuously used and, consequentially, provides a basis for securing people's needs along a future timeline. (cf. Luhmann, 1984, 1988)

Sustaining the control ability, however, requires trust into a system's elements that are used for reproduction. For a sustainable economy it requires trust into money: lack of trust is expressed as a loss of value, i.e. inflation. Under inflationary conditions the sustainability of the economic system is threatened. On the other hand, deflation reflects the condition where high trust into the value of a currency cannot be transferred into investments. The outcome, however, describes a similar situation. (cf. Luhmann, 1968/2000, 1988) A sustained and sufficiently high lack of trust into a currency can lead to a fragmentation of a economic area's currency regime, in the worst case to a breakdown of the economy. In both cases alternative means of payment will start to emerge, which will undermine (central political) control. (cf. Walter, 2009b)

Thus, the focus of this control feature in the model must be on the maintenance of trust. In the case of the economy this involves any activity that avoids radical effects on the value of money. Concerning (political) governance the most important activity is economic policy.

Hence, control is concerned with the problem of managing trust in a complex world, raising the issue of how to combine acceleration (a response to complexity) and trust management. (cf. Walter, 2009b, 2010)

2.1.3 Adding the dynamics of evolution

The third element in the model adds the dynamics of evolution, change and transformation to the analysis. Evolution is directly connected to the system's elements and relations. As said, elements and relations determine the complexity of a system. The way elements are reproduced and connected through relations will be subjected by evolution. Evolution, thus, increases complexity - the elements and relations of a system - in order to sustain the system. A higher internal complexity will counteract the infinite complexity of the system's environment. A common way of ensuring higher complexity is through differentiation and integration; for example, in the economy this occurred through a differentiation in subsystems, such as enterprises and households, which are integrated to form a whole. (cf. Luhmann, 1984; Heylighen, 1997)

Change and transformation are, thus, necessities in order to maintain the control capacity in society. (cf. also Turchin, 1977; Toussaint and Schneider, 1998) This evolutionary element in the model is particularly reflected in the need for continuous innovation. Innovation contributes to revitalising the economy and associated institutions, e.g. industries, universities, governmental authorities. Innovation is particularly important in a liberalising global economy, since economic performance is strongly connected to being attractive for investment. This effect is vital as it affects trust into the economy and the willingness to continue cooperation in the future. Thus, over time macroeconomic policy will loose its capacity to maintain trust, should innovation not take place. (cf. Walter, 2009b, submitted)

If innovation does not take place the sustainability of the control element in the model is threatened; since only a continuing communication in society – continuous investments in the economy – sustains control. This necessity illustrates the importance of evolution in system maintenance. Evolution has to be understood as an ongoing response to an ever changing system environment so as to permit a continuous autopoiesis – reproduction. (cf. Walter, 2007)

Bringing the focus on evolution also highlights the fact that natural resource management is a process and not a singular state. Hence, time plays a large role, not only from an ecological perspective but also as an aspect of human and societal development. These thoughts illustrate well the cyclic nature of management: management is required to ensure future management. Management could be seen as the element in society, which has to be produced in order to ensure the continuity of the society and, hence, of the capacity to manage. As such, loosing trust in development can have serious repercussions for the possibility to intervene in order to manage, for instance forest resources. The point to keep in mind is that management is in fact not possible without cooperation. It is one task of management to ensure cooperation and, thereby, ensure the possibility of future management. (cf. Walter, 2010, under review)

2.1.4 Simplicity wins

Can a model that incorporates three elements, three dimensions explain acceleration in society and the economy in particular? Jünger (1959) writes that facts that occur as a result of the scientific endeavour require order, which organises the facts. Thus, the more facts occur, the more order is necessary, thereby strengthening the scientific and/or disciplinary collective. The myriad of discourses do not go unnoticed by the rest of society.

With all new knowledge produced and which is diffusing across the world, there is a need to label this new knowledge – to conceptualise it. The more facts occur to a culture - for instance through the large and increased need for scientific innovations - the more there is a need to label. Labelling requires this certain order, which refers here to certain structures, language structures perhaps or organisational rules. Without such an order, the mass of facts that flood society cannot be managed mentally or socially. The accumulation of knowledge starts off a perpetualisation of its own task: the more facts occur, the more there is a need for science to put more order into the flood of facts with the help of theories. Hence, this need to put order drives further the need for science to accumulate knowledge, science becomes a self-perpetuating enterprise (or an autopoietic one, as Luhmann (1990) puts it).

Jünger (1959) shares this opinion about the increasing necessity of order with Kükelhaus (1934/1984) who argues that the more structure there is needed for maintaining control, the more there is a need for numbering. The latter points at an increasing mathematical conceptualisation of our lives and the rule of the number (as for instance in the dominance of majorities over minorities) (cf. Kuehnelt-Leddihn, 1943). Already Nicolaus Cusanus (1401 – 1464) had realised that numbers provide order in the world. Without this order there could be no way to determine relations. (cf. Whittaker, 1925). Relations are used via analogy or proportion, for knowledge only exists as part of an analogy.

However, the more numbering there is, the more substance loss does the single number experience and, consequentially, the greater is the need for numerical rules. Kükelhaus (1934/1984) writes that the increase in numerical rules (which is essentially the same as an increase in control structures) coincides with a loss of actual power. I translate this as a loss of personal power as such – power to make decisions, power to control the complexity that is surrounding the single human. Kuehnelt-Leddihn agrees with this by confirming the victory of the *'worship of size and number'* (Kuehnelt-Leddihn, 1943, 81) and the resulting increase in collective control at the expense of the personal. In a more 'mystical' sense the loss of substantial content of a single number (a single human perhaps) means emptiness of imaginative power. After all, humans are world-creating (*'der Mensch ist weltbildend'*) (Heidegger, 1983). Thus, in a world lacking imaginative power humans often feel dominated by the 'system' but simultaneously have a strongly collectivized orientation.

Nevertheless, more facts add complexity to society, which ought to be controlled precisely by a strengthening collective. Consequentially, a more simple approach, perhaps with only three dimensions, explaining the phenomenon under investigation is superior to a more complicated one. Fewer facts are more suitable to understand and grasp phenomena. In turn, more facts do not necessarily embetter the understanding; the quality does not improve as such. A systemic approach, as presented here, leads to the same conclusion. After all, systems exist to reduce complexity and make complexity comprehensible.

The demand for simplicity in the analysis and description of the problem can also be circumscribed by the call for the essential, which has been most popular with modern constructivists (for instance in design and architecture) and that became most famous with the quote of Ludwig Mies van der Rohe (1886 – 1969): *'Less is more'*. A *Verständnis* of the world demands simplicity.

2.2 Rethinking common assumptions

Adam (1991) shows that time theorising is greatly resting in the philosophical tradition of dualism. As she explains this appears to be due to the fact that distinctions are made. Thus, dualism – as in nature/culture, individual/society, subject/object – has been and is still dominant. Attempts have been made to overcome these distinctions – and also the distinction of knowledge as resting in different disciplines – for example by Norbert Elias (1897 – 1990), to whom Adam is referring to. Adam writes that *'not society or nature, not even human beings in nature but humans in nature and as an integral part of it are to Elias the basis from which to begin the analysis'* (Adam, 1991, 17–18)

Not seeing humans and/or their aggregates as being nature does not merely have 'philosophical' origins. It is also due to the dominance of the paradigms of dualistic science, based on Newtonianism and a deterministic world view. In there, subject controls object. (cf. Adam, 1991) The assumption that we can control everything leads to increasing distinctions and ever increasing resolutions in a never-ending scientific endeavour. Therefore, if classical Newtonian science is not sufficient to understand the position of humans in the world and perhaps neither sufficient to understand time and acceleration, a different perception is necessary. This 'other' understanding is, for example, brought about by the consolidation of physics into quantum physics.

A connection can be made here to Luhmann (1990), who describes quantum physics as an observer-based theory. The observer has an important role in a systemic perception of the world, for it is the observer who allows systems to emerge.[3] A theory focusing on the observer does not care per se for subject/object differentiations, increasing distinctions etc., these might be merely observed. What is significant here is that the 'whole' of what is there is concentrated in the observer, i.e. the observer merges and unites. There is no system and no environment without the observer.

A model built upon observer-based theory yields a differing understanding on movement, change, time and acceleration. The great change that has been brought about by the development of quantum physics is the valuation of the whole. This preference for the whole, holism, is owed to the understanding that fundamentally speaking everything is built upon forms and relationships between elements. The in-between of two strands of options, the so-called quantum, offers the potential that makes life so indeterminable. So, the whole is in motion; it is the consequence of an oscillation and establishes the nature of our cultural existence as a process outside clear cause-and-effect chains. The symmetry of a dualistic structure, such as complexity vs. control, is disturbed by the element of evolution in order to lead to an asymmetry. The whole of a flowing symmetry and asymmetry constructs the form of resource management. In this sense, quantum physics established the periodicity of the reproduction of the whole, the oscillation in other words, i.e. the oscillation

[3]Referring here to the observer effect, which states that something only exists because it is observed. This is analogous to Heidegger (1983)'s principle that humans create the world.

frequency as expressed as a relation of numbers. In addition, a numbering scheme, which values the whole stands in contrast to an arithmetic, dividing mathematical scheme, in which for example the two is valued higher than the one. (cf. Kükelhaus, 1934/1984; Dederich, 1996; Dürr, 2000)

The trinity of the analysis model reflecting the expression of movement has been deeply embedded in our (human) cultural history. In the trinity the *one* represents 'everything', the whole. It does not require anything else to complement the *one*, it is self-sufficient and perfect. The *two*, however, splits up the *one*. It adds polarity, which results in a duality. *Three*, finally, adds dynamics, change and transformation to the trinity. The final element is the result of the interaction of *one* and *two*. (cf. Kükelhaus, 1934/1984) Together *one*, *two* and *three* form the complete 'picture'. Human action divided the whole (*one*) in order to control it (*two*). On its own the resulting duality complexity/control would be typical for a classical deterministic perception of the world in which we can increasingly improve our control of complexity. Taking into account the dynamic element of change and evolution (*three*) changes this. The duality will not work anymore and, consequently, deterministic approaches will fail.

The rethinking of common assumptions essentially points out the importance of wholeness (*Ganzheit*), for instance as expressed in the statement that the whole is more than the sum of its parts. It also refers to the recognition that the nature of an organism is characterised by the completion (the 'whole') of the organism's environment and its inner world. (cf. Heidegger, 1983) Accepting that the outer environment does not control a system (in contrast to Darwinian determinism) but that the system incorporates its environment to the extent that the incorporation makes the system through its inner world sustainable, leaves room for free will in the relationship between the human and society. In social theory free will can be interpreted as the conferring of trust, for it is everyone's decision whether to confer trust or not. But only trust makes society possible.[4] This recognition necessarily excludes the full control desired by collectivist ideologies.

Kükelhaus (1934/1984) writes that an ego-centric world view – a world view concentrated at the observer – is small in space and slow in time. In turn, adding space and, hence, adding complexity when extending to the world surrounding the observer requires more time, which feeds back into acceleration. It appears that the increasing collectivisation (increases in societal control) must therefore lead to acceleration.

[4] A closer look at the concept of trust provided later in the summary chapter leads us to the conclusion that trust should be understood as the 'lubricant' of society. Without trust social processes do not exist; it is important as such and provides an explanation why the continuous management exists. Trust into habits offers one answer, fear of the unknown outside recurring patterns provides another. However, trust as such does not affect the operation logic of society (and social systems); hence, it does not play a visible role in the elements that connect the management cycle.

Chapter 3

Methodology

Following the definition of the basic aim of this research – to understand what generates acceleration in the economy and the wider society and to find out whether acceleration can be controlled – a methodology had to be developed. Even though the analysis model appears to mirror a universalistic and unifying stance concerning the validity of my work, this still is scientific research. As such it is subjected to the nature of scientific work, including the need to make decisions that affected the preference of certain data over other data, which had to be left out and ignored. After all, complexity management implies that not everything can be taken into account.

3.1 Research questions

The basic problem of the research has since the beginnings of the project been concerned with the possibilities of management of that abstract concept of acceleration. More concretely, the problem has been focused on understanding the collective possibilities and/or limitations of management. The idea of management in a societal context is, after all, how to change a certain state of affairs into a preferred state in society.

For practical reasons the research problem had been broken down into a number of more specific research questions. These questions developed over time and adapted to the state of progress of the project.

Research questions are:

1. What is the temporal relationship between modern economy, society and environment?
2. How can we establish whether this time relationship can be affected through the method of management?
3. What conditions need to be fulfilled for management to work, particularly with reference to economic requirements?
4. Reflecting upon the relationship between environment and society (including the economy as its integral part), is it probable that efforts to conserve renewable natural resources would take precedence over activities to maintain possibilities for future management?

The assumption right from the beginning of the project, the hypothesis so to speak, has been that certain economic (and societal) conditions can generate a longer time horizon for economic activities and, thus, produce the prerequisites for a more sustainable management of renewable natural resources, for example a more sustainable forest management. This hypothesis assumed naturally that control is possible to the extent that acceleration (in the form of short time horizons in the economy) can be slowed down. The implication would be that the consumption of a resource (or energy as such) per time unit would be less, hence more in accordance with the capacity of ecologies to regenerate.

The foundation of the methodology is the modelling of the resource management process in society. Modelling should be understood here as providing a description of reality – the way resource management is actually happening, keeping in mind that everything we know only exists as a model. This description is done through statistical and case study analyses, including documentary research, and system theoretical and wider philosophical argumentation.

3.2 Research tasks

To test the hypothesis and to answer the research questions the following tasks were defined and carried out:

1. Based on the elaborations provided in the latter part of the chapter on the analysis framework I considered it necessary to provide an argument for human ecology. Human ecology should be understood here as a unifying approach to understand the role of humans in the world, particularly as being part of nature and not separate from it. This task consists largely of developing a conceptual idea of the role of economy in human history and reflects also my understanding of sustainable development. This is complemented by a case study focusing on major issues that concern the forestry industry in Russia with some comparison to the Finnish situation. Data source has been existing literature and personal observations of current developments.

Article one, in which the cause for human ecology is given

2. Development of an analysis model, which supports the understanding of time horizons in modern economy. This task corresponds to the 'complexity' element in the model. The questions to be dealt with here are how the amortisation period of investments should be understood from the perspective of the economic system of society and how is it possible to influence such a time horizon/amortisation period through (political) governance. My solution to understand this issue is to

suggest an indicator that reflects amortisation period in the economy, comprised by the *real interest rate*, a combination of interest rate and consumer prices inflation. Real interests are influenced by macroeconomic policy and, thus, are a consequence of governance efforts.

The task involved a statistical correlation analysis incorporating on the one hand the mentioned nominal central bank interest rate and consumer prices inflation rate in order to combine it to the real interest rate. On the other hand roundwood (as an example) logging statistics were used. The analysis focused on three countries that have shares in the Barents region and that possess a significant forestry industry, namely Sweden, Finland and Russia. The aim of the analysis was firstly to establish whether there is a correlation between the financial indicator and the forestry industrial activities so as to find out whether the indicator influences the annual rate of logging. This allowed secondly investigating trends with respect to the amortisation period of investments in the economic areas concerned.

Article two, in which the role of time in resource management is analysed

3. Analysing the factors affecting investment conditions. This task corresponds to the 'control' and 'evolution' elements in the model. Generally, causes include monetary policy, market orientation, capacity to innovate and to utilise knowledge, property rights, legal stability and enforcement. This task is required to draw conclusions as to how societal institutions affect investment conditions (including their 'temporal' properties) and how these institutions should be arranged (through governance) to ensure an beneficial management of natural and/or forest resources. Focus in this research has been particularly on macroeconomic policy and innovation capacity. The former

is concerned with directly intervening in the economy and the latter is concerned with renewal, thereby reflecting the nature of process, progress, and development in society.

Data source for both elements, macroeconomic policy and innovation capacity, has been existing literature in addition to policy documents. Focus has been on Russia in both cases. Russia has been especially interesting due to the fundamental changes in economic management during the last two decades. Thus, the Russian focus also helps to test out the extent to which developments in Russia coincide with developments in Finland or other places with a longer history of so-called 'capitalist market' orientation.

The articles providing answers to this task have been written with a view on trust. Trust has been seen in the explanations on the analysis model as a basic requirement for maintaining the capacity for management in society. Thus, policies affecting trust, including economic and innovation policies, must be analysed with respect to their trust maintaining ability.

Article three, in which Russian economic policy is reviewed

Article four, in which the cause for a thoughtful innovation process is given

4. Understanding what consequences a failure to fulfil required conditions, which were mentioned in the previous task, have on governance ability. This task is required to reflect upon the importance of cooperation in society. It also builds up on the concept of trust and to the extent to which societal authorities need to maintain a cohesive regime in order to sustain management power.

   The task can be somewhat considered a conclusive task in this project, taking the results from previous tasks into account and putting them into relation to that fundamental demand of conserving renewable natural resources. The conclusion should answer whether it is realistic that the amortisation time of investments in the economy can actually be expanded through governance. The task will also highlight wider aspects of modern society and, assuming that acceleration could be seen as *the* basic ecological risk, wonders whether society can manage environmental impacts that could threaten the human ecology.

Both articles that provide the answers for this task are conceptual papers. They do not research more data as such but rather argue on the basis of social theory, particularly human ecology and environmental sociology, and thereby develop models that help us to better understand the relationship between humans, society and environment.

Article five, in which the importance of cooperation for management is emphasised

Article six, in which the consequences of cooperation are understood

Article seven, in which the nature of sustainability is presented

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Chapter 4

Summary of the results

Following the introduction that offered the rationale, the model that offered the theory and the methodology that provided a specific guideline, the analysis resulted in seven research articles. Each of the articles deals with a different topic, altogether they form a coherent whole that aims to give a solution to the research problem.

This chapter summarises the results of the research; the results of the seven articles are organised under the four headings, each providing the solution for one research task, which have been defined in the previous chapter. Moreover, the heading titles reflect the main conclusive thesis for each task.

4.1 Society and its economy...

...are integral elements of nature. The solution to task one establishes that human ecology can improve our general understanding of natural resource management by recognising that society is natural. This is achieved by reviewing the changing meaning of time and space in the history of the human economy, the economy's basic working principles and the consequences for the contemporary economy.

Article: 'On the sustainability of economic systems and organisations'

Human ecology has been used to explain phenomena and processes of the social human, communities and social systems. The idea of human ecology emerged due to a theoretical need to explain the relationship between humans, society and environment. It commonly is considered as an overarching framework and not merely as a single niche-filling discipline. As such it is seen as an approach to integrate disciplines and remove boundaries between academic fields. (e.g. Barnes Jackson and Steiner, 1985; Freese, 2001; Frisbie, 2001) As a major characteristic, however, human ecology emphasises the conception of society as being nature and not something unnatural and separate from an environment that would be otherwise called nature (in the sense of a nature/culture divide)[1]. However, this will necessitate to rethink common assumptions on causes and consequences of ecological issues, also including the conceptual understanding of natural resource management and sustainable development.

The arguments laid down above are particularly important as the changes we witness globally and locally today cannot be understood by resting the analysis in one discipline (and not the focus on one isolated social system, for that matter). For example, economics is not sufficient. Rather, such an analysis requires an approach that resolves disciplinary boundaries. (cf. Frändberg, 1991; Lyttkens, 1991; Costanza, 1996) The application of human ecology leads to the conclusion that humans must exploit their environment in order to be sustainable. Given that humans would not exist without society, exploitation by humans is a natural phenomenon. (cf. Rosnay, 1975/1979; Stewart, 2000) Exploitation is subjected to regulatory mechanisms, it is therefore a consequence of cooperation. (cf. Lawrence, 2003) The way natural resources were exploited changed

[1] From a systemic perspective society is all that exists. All knowledge or views we might have on our world, our universe only exist as part of society. There is, after all, nothing else outside our observations.

over the course of human history. (cf. Rosnay, 1975/1979) While for many millennia the focus was on space (resulting in a conquest of territories, invasions etc.) this focus has shifted more recently towards time (allowing control of the future – through the accumulation of money). The control over time and the future permits planning (cf. Luhmann, 1970).

Understanding this cooperation in society is at best done through considering cooperation as a form of communication. (cf. Luhmann, 1984) Cybernetics as the science of systems, communication and control structures is thus a suitable framework to fill the content for human ecology. (e.g. Jungen, 1991) Cybernetics provides a number of system building principles, which on their own appear rather abstract but become clear when applying them to a case study. In this paper recent developments in Northern European forestry were reviewed. Such a study bears high interest as forestry is still considered a mainstay of the Northern economy, the Barents region in particular and by extension also of the Arctic. Focus in this study is on the Northwest Russian and Finnish forest clusters. After the breakdown of the Soviet Union the Russian cluster had difficulties adjusting to new demands, while the Finnish cluster only experienced in more recent years the pressures of heavier competition in certain fields. (cf. Malmlöf, 1998; Nilsson and Kleinhof, 2001; Dudarev et al., 2002, 2004; Mutanen et al., 2005) The application of the system principles allows a breakdown of the case study analysis into smaller parts, including analysing the ability to act in a complex environment and the capacities to manage and innovate. A competitive forestry enterprise is one that is able to act in a complex environment, it possesses the capacities to manage well and innovate. This requires a sufficient infrastructure and also explains the lack of competitiveness of many enterprises in Russia. The Finnish cluster, in turn, has been at the forefront of global competitiveness, but has in recent years lost some of it, particularly in fields that do not require much innovation. (cf. Secretariat of the Economic Council, 2006) The development anyway indicates an equalisation trend between both clusters, the Russian cluster gains, while the Finnish cluster looses some competitiveness.

(cf. Layton, 1999; Wiberg, 1999; Secretariat of the Economic Council, 2006)

The theoretical and practical analyses also show that a management of natural resources has essentially a circular organisation. Management per se aims to control the sustainability of an organisation in a complex environment, i.e. globalisation. This necessitates renewal through continuous innovation. Innovation, however, is the evolution of knowledge, which feeds back as an increase in complexity. This again demands a stricter need for competitiveness. Following system principles this cycle is accelerating, culminating into increased uncertainty about the future.

This insight also affects our conceptual understanding of sustainable development. Commonly it is understood as being about integrating society with environment and economy. (cf. World Commission on Environment and Development, 1987) In system theory, however, society cannot be integrated with its environment, for this would imply a breakdown of society. (cf. Luhmann, 1984) And the economy is already an integral part of society. Environmental impacts with potential consequences for the human ecology are beyond the boundary of society. (cf. Luhmann, 1986) Hence, sustainable development cannot consider as such what is beyond its sphere of communication. It rather ought to be a concept that implies development or progress of society against an environment with increasing complexity that can be sustained. This highlights the conflict between conservation and progress.

4.2 Complexity drives acceleration

Task number two – delivering the content for the ‘complexity’ dimension in the model – establishes a forest economics model as an example of natural resource management in order to show how to understand acceleration vs. slowing down in the economy, i.e. the difference between a short and long term amortisation period of investments, and its effects on natural resource use.

Article: 'Understanding the time dimension in resource management'

Contemporary socio-economic conditions are characterised by tendencies towards high-speed markets. Consequential higher uncertainties result in a mechanism that leads to an accelerating consumption of natural resources. This indicates that the relationship between modern society and its environment can be seen as one typified by fast trade processes with short investment time horizons, posing fundamental problems for ecological sustainability. (cf. e.g. Adam, 1993; Held, 2001; Reisch, 2001; Geißler, 2002; Hofmeister, 2002)

The aim of this task is to introduce a concrete approach to understand the way the economic system perceives time, short- versus long-term nature and how these perceptions feed back into acceleration. Furthermore, the task wants to find out how in fact to control this acceleration using economic policy as a management tool. Based on system theory we understand that there are different rationalities in society (cf. Luhmann, 1984). Economic policy as a management tool can only work when the peculiar rationality of the economy is addressed, which is expressed in the code to pay/not to pay, a binary code. On the one hand, this operational closure prevents a total control of the economy; on the other hand, it also ensures that the economy responds to any stimuli from its environment (which includes the political system) when the code is used. Any other behaviour would be irrational from the system's perspective. (cf. Luhmann, 1984, 1986, 1988) Hence, it is completely rational to use the language of money when attempting to control any acceleration in the circulation of investments.

As was established in the previous task, money is used to create a future timeline for planning. (cf. Luhmann, 1970) Thus, social structure is based on the continuous circulation of money. Any spending of money will generate new structures and expectations. This way the future becomes a horizon where a range of possibilities exist. As a consequence the formerly indeterminable complexity is transformed into a relatively determinable complexity (hence, the validity of the term structured complexity, as explained in the model). The future becomes the outcome of present-day decision-making. This is, however, only possible if a steady capital supply can be ensured. Hence, we continuously seek income, as reflected in the desire to decrease the time between spending (investment) and capital regeneration. (cf. Luhmann, 1984, 1986, 1988) Consequentially, the complexity that the economy has to manage drives the acceleration in the circulation of money in the economy.

Based on this logic I reasoned an indicator that reflects acceleration vs. deceleration in the economic system. The indicator – real interest rate – is a combination of nominal interest rate and consumer prices inflation rate and has been combined with statistics of roundwood logging from Sweden, Finland and Russia in a statistical correlation analysis. The main idea is that investments ought to be discounted over a longer time period, forcing a regeneration of available capital at a later point in the future. This is of course in direct opposition to the desire to renew that ability to spend money as soon as possible. (cf. Luhmann, 1986, 1988) Given that many if not all investment decisions depend on the cost of the investment, i.e. of money, it seems feasible that a central bank could affect the price for money in such a way that seems beneficial for achieving that resource management goal of reducing the speed of harvesting. (cf. also Gilchrist and Himmelberg, 1995; Betz, 2001; Smith and van Egteren, 2005)[2]

The results showed a correlation as expected for Sweden and Finland, i.e. the more expensive money is, the less roundwood is exploited. However, there was no clear correlation at all for the Russian case, indicating that factors outside the economy affected

[2]Given that politics or science can 'know' the code of the economy, it is, of course, conceivable that this code can be used to govern towards a certain outcome. Whether this intention is realistic and not only normative, wishful thinking is a different question, which is left to be answered particularly by tasks two and three.

the statistical values. Understanding the conditions surrounding the Russian economy I can conclude that a confiding, trustful environment is needed for the correlation to work as expected. Thus, in mature economic areas, such as Sweden and Finland, the economic policy (by controlling the indicator) can greatly affect the speed of natural resource exploitation. This also suggests that the economy is in fact no sole player but dependent on the sustainability of systems in the economy's environment.

The question emerges whether a control of the economy in such a way is actually probable. Would a central bank make money artificially more expensive and run into the risk of creating an unsustainable situation? This is where the issue of trust comes into play. Trust would suggest that a lot of restrictions due to environmental policy can be acceptable to the public as long as there is sufficient trust. However, if trust can only be maintained in the case of low interference with money, with relatively cheap money, the issue looks different. The problem of connectivity is everywhere and anywhere present. Connectivity – the sustainability of system structure – must be ensured, it will be of highest priority. After all, only sustainable social systems permit future management.

4.3 Control can be difficult...

...to maintain and EVOLUTION cannot be avoided. Task number three – corresponding to the 'control' and 'evolution' dimensions in the model – establishes that the forest economics model is not on its own realistic but must be seen in the context of environmental factors that affect natural resource management. The choice in this research has been on the factors that allow a direct intervention into investment conditions (which guide the resource use in the model), i.e. economic policy, and the capacity to innovate, permitting renewal and a future perspective.

Articles: 'The task of macroeconomic policy in generating trust in Russia's development' 'Innovation: panacea or curse?'

Given the lack of a correlation between the economic policy indicator and the actual harvesting of roundwood in the Russian case of the results of task number two, it seemed feasible to investigate framework conditions, which might guide investment behaviour and risk perception in Russia. As explained, the two articles providing the answer to task number three are concerned with macroeconomic policy and innovation matters in Russia.

While the results in the correlation analysis are strongly influenced by the negative performance of the Russian economy during the 1990's, the overall performance has been rather striking since about 1999. (cf. BOFIT, 2007) The strong economic growth has been particularly driven by industrial production – and here again by natural resource exploitation. The energy sector, oil and gas in particular, have been among the most important export commodities. (cf. Ahrend, 2006) These favourable conditions are, however, strongly due to currently suitable world market prices for energy. The second reason has been a reform of macroeconomic policy, which allowed the recovery of the Russian economy after the crises of the 1990's.

Nevertheless, the growth of the Russian economy is expected to be lower in the near future than it has been in previous years since the recovery. Even though there are no abrupt changes in sight, there are risks related to development existing, which can be associated with changes in macroeconomic policy (cf. Ahrend, 2006) and innovation capacity (cf. Sutela, 2005). This has to be seen in the light of increasing capacity utilisation not being able to continue forever. To a large extent the Russian economic competitiveness is due to just utilising comparatively cheap resources, such as labour and energy. While the productivity can probably still be enhanced for quite a long time, increasing imports and appreciation of the rouble currency indicate that conditions need to be created that enable a striving of the economy based on investments and innovation.

Macroeconomic policy is one factor, which contributes to the conditions that attract necessary financial capital, both for maintaining required infrastructure and the facilities for production and, moreover, for the further development of new products and production processes. (cf. e.g. Ahrend, 2006) In contrast to classical perceptions of economic policy, which focus on economic growth per se, the function of economic policy in a system context is the maintenance of the motivation to use a certain currency as a means of exchange value. The policies aim at preventing massive changes of the currency value, e.g. inflation, in order to sustain the operations that make up the economy (investments), having in mind to avoid interruptions in the money circulation process, for instance through the use of alternative means of exchange. (cf. Luhmann, 1988) The hyperinflation that Russia experienced in the 1990's is a good example where rouble savings were lost, making it almost impossible to continue trading with roubles. People and enterprises alike turned to barter for exchange and, consequently, made governance through policies very difficult. (cf. Woodruff, 2005)

The other factor required to maintain a sustainable economy in Russia is innovation. Innovation has the aim of securing the attraction of investments by benefiting economic competitiveness. This is becoming increasingly important in a global society in which investments might flow to any destination; hence enterprises and employees alike must ensure that they maintain their attractiveness for investments. Otherwise economic breakdown might occur, leading to bankruptcy and unemployment. Secondly, the securing of investments ensures a sustainable platform for governance, for only a secure timeline allows sustained control, in this case through economic policy (cf. Luhmann, 1984, 1988). By-products of the innovation process are believed to include the reduction of natural resource exploitation and the cutting of emissions through a regular renewing of technology. This way innovation helps to limit society's environmental impact[3] (cf. Rautio, 2000; Hozhina et al., 2001; Moiseenko et al., 2006) Most importantly, however, innovation will strengthen trust into an economic area's currency.

Thus, in the case of innovation alike the case of economic policy, the primary aim is to ensure trust and to maintain trust. Trust has to be understood as the confidence into expectations, which is a basic requirement for society. Trust that people confer does not come automatically, it has to be built up and maintained. Only secured expectations produce that social order upon which policies can operate. (cf. Jalava, 2003) Economic policy, regardless of its specific aim, cannot work if the economy is not sustained. This argument illustrates the path-dependency of management efforts: the path – the timeline based on structure – cannot be maintained without credibility, the ability to fulfil expectations.

To illustrate the trust-generating and trust-maintaining potential of economic policy I have reviewed broad developments in Russian economic policy since the break-up of the Soviet Union and the introduction of a common rouble sphere across a number of former Soviet republics. Creating trust in the economy must primarily be achieved through avoiding a devaluation of the currency (cf. Luhmann, 1968/2000, 1988). While a gradual reduction of the inflation rate has been achieved in Russia, governance affairs have not always been very clear. Particularly the economic policy during the 1990's corresponded to an up (to some extent highly destructive) and down of the inflation rate of the Russian rouble. (cf. e.g. Baliño et al., 1997; Baliño, 1998; Woodruff, 2000) The destructive force of the value loss of the currency lead to a large economy 'outside' the economy, an economy based on alternative means of payment. (Carlsson et al., 2000; Woodruff, 2005) It is estimated that at the height of the economic crisis in 1998 approximately 70 percent of the industrial output was traded using other means than the official rouble currency. (Woodruff, 2005) Today this is estimated to be at least

[3] Here again I like to refer to ecological modernisation theory, which has exactly this in mind.

ten times less (Sutela, 2005, 16). However, the ghost of the crisis is haunting people still years after the major crisis and who have consequently been tending not to trust too much into the continued value and availability of their money, which is reflected in the comparatively low ratio of savings in bank deposits.

The ups and downs of the trust level and purchase power of the currency has been heavily affected by unclear goals of what economic policy ought to achieve. (cf. e.g. Aleksashenko, 2000; Vymyatnina, 2006) Early fiscal policy – the government's economic policy – erased trust through many irresponsible budget allocations, which might have had the best intentions – to maintain the bulk of enterprises and work places – but without consideration for the consequences of high spending and the ability of those enterprises to recover on their own. (cf. e.g. Baliño et al., 1997; Orlowski, 1997; Aleksashenko, 2000; Sutela, 2003; Granville and Mallick, 2006) As such, fiscal policy was highly political, not so much economic. Monetary policy in turn – the central bank's sphere of influence – was characterised for a long time by insufficient instruments to control the amount of money in circulation, which affected the inflation rate. Even towards the end of the 1990's monetary instruments were focusing on controlling the rouble currency as such, not taking into account the widespread use of alternative 'currencies'. Thus, for a long time monetary policy had no effective means of controlling inflation. (cf. e.g. Baliño et al., 1997; Esanov et al., 2004; Granville and Mallick, 2006; Vymyatnina, 2006) In addition, monetary policy developed and executed by the Russian central bank was under strong influence of government authorities, in order to fulfil the goals of socio-political matters. (cf. e.g. Aleksashenko, 2000) This included, for example, the use of central bank credit to finance holes in the government's budget, which obviously fuelled consumer prices inflation.

Observing the Russian economic development suggests that the investment climate has been tremendously improving since the end of the 1990's. This is to a significant extent due to much improved fiscal and monetary policies. Many changes were undertaken to strengthen the trust in the currency, including tightened fiscal policy, which has contributed to producing a sizable surplus in the budget since 2000. In addition to the fiscal policy, the tax code was reformed, which enables the more effective and efficient capturing of taxes from revenues and profits from oil and gas exports. (cf. Ahrend, 2004)

Monetary policy still continued well into the 2000's to support industrial policy and keep the exchange rate at a level that benefited Russian domestic industries aiming at exporting. This goal collided with the ought-to-be goal of decreasing inflation. In practice, then, the central bank opted for a slowing down of the rising inflation rate, culminating into the present rate of about 10 percent. (cf. Vymyatnina, 2006) The continuing economic growth has provided the argument that the inflation rate is not an obstacle for the striving economy. I consider this argument a bit short-sighted. Ignoring inflation is based on quick and easy economic growth whose costs might only be visible much later. There is, thus, a long-term risk of not giving sufficient credit to the importance of trust as long as revenues are flowing. However, a long-term sustainable development perspective should be centred on low inflation and high trust. Thus, it must be designed independent of growth objectives.

After all, it must not be forgotten that the other major factor that produced the surplus is the favourable world market price for energy; for the competitiveness of the Russian industry has been rarely based on advanced, value-added products. (cf. Dudarev et al., 2002) This is true for most industrial sectors, including the Russian forest cluster. Since the beginning of the 1990's it has been based on the extraction of basic factors, namely low priced labour, energy and transport. In the case of the forest cluster also the extensive forest resources available for use are an important factor. However, many of these costs are in the rise. (cf. Dudarev et al., 2002, 2004; Sutela, 2005) The success of Russian exports are weakening the price competitiveness of many products, hence the efforts of monetary policy to support industries through the exchange rate. (cf. Holopainen et al., 2006)

Particularly in the forest cluster high technology has been overwhelmingly of foreign origin, stemming from foreign companies that took over Russian facilities or entered into join ventures with Russian firms. (cf. Dudarev et al., 2004) The Russian government has tried to counteract the lack of innovation and the corresponding suffering of the cluster from an appreciating exchange rate through a tax on the export of roundwood, having effects even on the Finnish forest cluster. It is clear, however, that such a measure can only be of temporary nature. The measure shows, nevertheless, that the Russian capacity to innovate is apparently not very well developed at present. This is confirmed by an analysis of the basic requirements for innovation.

The process of innovation in society can be most easily understood by considering it as the consequence of the interaction of three social systems, namely science, politics, and economy. This analysis scheme is called the triple-helix model of innovation, as elaborated by Leydesdorff and Etzkowitz (1998); Leydesdorff (2000). The triple-helix describes innovation as a synthesis of those social systems. These solve problems of diverse tasks within their sphere of interest and influence. As such, they are, in principle, in competition. Competition is, therefore, considered a condition for successful innovation. Still, innovation must be seen as competition within an integrated whole. Hence, framework conditions must enable such a configuration.

Applied to Russia the model yields mixed information. The model mostly confirms what an overview of industrial output in Russia already delivers, which is a low value-added product range and, consequently, a rather undeveloped innovation scheme. The most visible indicator of a lack of innovative capacity is said to be the very low demand for new innovation by Russian enterprises. Merely the larger conglomerates of the energy industry – due to their larger turnovers – did well in applying new technology. (cf. Boltramovich et al., 2004; Kihlgren, 2003; Kazakova, 2001)

Considering the science system, the resources needed to produce knowledge have remained quite strong, despite a brain drain during the last one and a half decades that did not prevent many scientists from moving away. On the whole, it is the equipment utilised to produce knowledge that is considered obsolete. (cf. Kazakova, 2001;

OECD, 2005) And funding for new research, new equipment and for attracting and keeping the brainpower mostly stems from state sources, which is due – as said – to the low innovation funding from private sources.

Research is mostly undertaken in state research institutes and the Academy of Sciences. As a consequence of the Soviet division of research and higher education into separate institutions, the universities – concerned with providing education – are a rather minor player when it comes to producing knowledge for innovation. For example, only about one-twentieth of the state funding for research is allocated to universities. Generally, funding has been a problem due to the state assuming that the private sector would gradually take over the bulk of research funding. As a consequence of this planning the state decreased its own funding allocations throughout the years. (cf. Boltramovich et al., 2004; Kihlgren, 2003; OECD, 2005) The major challenge for the science sector is, thus, to sustain operations in a changing and more complex environment that involves a reshaping of the institutes' relationship with politics and economy. (Kazakova, 2001)

Science and innovation policy is the most visible political issue that has effects on the capacity to innovate. This policy includes, of course, state funding as well as the regulation and monitoring of state research institutions and their operations. Uncertainties have persisted concerning the regulation of operations and their results, including ownership of intellectual property. In case of state funding, the state commonly became the owner of the research result. Consequently, the bulk of research could not be marketed. (Boltramovich et al., 2004) A new act that transfers ownership to the institute instead of the state has been in development. (OECD, 2005) This is a change that could make a significant difference as more independent institutes are capable of competing better, fulfilling a major condition for successful innovation. Thus, an active governance is a requirement to contribute to the conditions that enable competition within an integrated whole; though, this kind of a governance simply did not receive much attention when other issues prevailed.

Less state-dependent research institutions are also capable of cooperating easier with enterprises, who might be otherwise unable to make use of innovation resources. For too long the number of science-based enterprises was too small for an economic area the size of the Russian one. At the beginning of the 2000's only about 20 percent of enterprises contributed to overall research and development. In addition, the formerly planned economy inhibited cooperation between firms or firms and research centres without any intention by the plan. Thus, the ability to cooperate and create synergies in certain fields that might include research and development had to be learned first by Russian managers. (cf. OECD, 2005)

The above information suggests that Russia has the necessary resources but has been lacking the means and needs to apply them in order to produce sizable innovations. To a great extent this is simply a matter of time as enterprises, research institutes, and state continue to adapt to more complex conditions. In recent years, however, the need for innovation was also overshadowed by the huge profits that Russian firms and the state were able to make due to the situation on the global energy market. With large profits to continue there is often no immediate need to modernise and adjust so that an innovation scheme can successfully operate.

An exception to this are science parks, which already existed to some extent in Soviet times and which continue to be popular places for cooperation and interaction to produce innovations. Science parks are the closest equivalent to a real working triple-helix. (cf. Kazakova, 2001; Kihlgren, 2003) These parks are high tech clusters, often organised around a major university. As such they mostly exist in the proximity of Moscow and the St. Petersburg area and they provide a comparatively excellent infrastructure lacked elsewhere. The parks are in principle facilitated by the government, are increasingly incorporating small businesses and focusing on scientific and technological innovation. (cf. Boltramovich et al., 2004) Remarkably, the concept of science park, which creates the best conditions for a triple-helix, existed in Soviet time particularly in the military-industrial complex, including space technology, precisely the area in which the Soviet Union was affected by real competition. This confirms the need for competition for successful innovation as established by the triple-helix scheme.

On the whole, therefore, we witness a move towards the improvement of the Russian innovation capacity. This is in line with global developments, where, with increasing complexity, there is a growing need for innovation. The competitive advantage lies with those countries that possess advanced technology and that are capable of maintaining this advance (Jiménez and Escalante, 2006). It is not surprising, therefore, that many authorities have concluded that a sustainable economy must involve the transformation towards a knowledge economy. (e.g. Commission of the European Communities, 2005, 3)

However, from the perspective of evolutionary theory the interaction of the scientific, political and economic system drives evolution by increasing complexity. The integrative operation is seen itself as complex, the outcome of the innovation process cannot be fully controlled. Thus, growing 'internal' complexity is the response to compete with 'environmental' complexity. Greater complexity can be understood as making sustainability more probable (Zak, 2007). This is essentially the case with any self-regulating system (cf. Heylighen, 1997). The interplay of the three systems are responsible for technological lock-ins, creating technological path-dependencies and necessitating continuous innovation activities. The global pressure to foster and increase innovation activities is, thus, not surprising. In a complex system, however, any event, such as innovation, can have an infinite number of causes and effects; complexity cannot distinguish between cause and effect in order to prevent possible unintended consequences. It is very well possible that product innovations, for instance intended for cutting resources and emissions, backfire when fewer resources used make a product cheaper with corresponding consequences for overall resource consumption.[4]

[4]This is an important critique on ecological modernisation theory.

Given that all knowledge exists as models – and models are by their very nature uncertain and incomplete – it is never possible to address a certain problem with knowledge and innovation. The reality is, thus, in conflict with the many official documents on innovation and research policies that inform on the need for innovation but fail to give answer to any possible disadvantages. The growth in research and development indicates a break-free of the activities from any specific goal – after all, the fundamental need for innovation is to manage complexity. This development is in line with social theory in which science has been said to have moved away from being tautological (with a goal in mind) to being autopoietic (for the sake of sustaining science) (cf. Luhmann, 1990).

The non-decomposable nature of complex systems reflects the lock-in of established innovation and technology regimes. These create a network of dependency between business management, technology development and policy making. As a consequence, technologies can only be overcome by new innovations. The dependency on a technology regime increases if a locality's innovation becomes globalised, enforcing a continued innovation process. Otherwise deindustrialisation occurs. (cf. Leydesdorff, 2000; Leydesdorff and Meyer, 2006)

While (political) planning is part of the triple-helix regime, the quasi-chaotic nature of the regime cannot predict the precise outcome. Everything appears possible. System theory suggests that there is never sufficient requisite variety – pointing at insufficient knowledge – available (cf. Heylighen, 1992). On the other hand, more knowledge will increase the overall complexity of society, decreasing the probability of any success in planning the consequences of innovation. (cf. Luhmann, 1990)

Thus, the global growing need for more innovation will increase society's complexity and the probability of unintended consequences. Given that innovation is a necessity to maintain a platform for controlling complexity, I like to conclude that the function of trust maintenance is the best justification for promoting innovation. In a tight social regime – an efficiently and effectively running collective – living with increasing uncertainty cannot be avoided.

4.4 Humans cherish their collective

Task number four aims at understanding whether it is now realistic to expand an investment's amortisation period in order to discount natural resource exploitation over a longer time period. The description of the forest economics model suggested in the end that maintaining trust into a currency area's currency could be in conflict with that goal of 'slowing down' the reproduction of the economy by making the means of exchange – money – more expensive. Indeed, the elaborate focus on the 'control' and 'evolution' elements of the analysis model in the previous task description suggests that maintaining trust can be a very difficult matter and involves measures that go clearly beyond the economy as such. It must still be pointed out that trust maintenance is by far not only an 'issue' for countries whose economy is 'in transition'. The focus on 'maintenance' indicates that this is a dynamic process and reflects that it could also be different, i.e. lack of maintenance, discontinuation.

Articles: 'Trust and cooperation as requirements for maintaining environmental governance capacity' 'Can society manage ecological risks?' 'Die Natur der Nachhaltigkeit im Umweltmanagement'

The previous task introduced case studies on the latter two elements of the analysis model complexity–control–evolution. Hence, the practical description of the model as such is concluded. The cycle that the elements form reflects sustainable development in society. Simultaneously, the model shows the process of acceleration as it emerges from managing complexity.

This task now was concerned with developing a conceptual understanding how important trust essentially is when it comes to maintaining cooperation. Moreover, this task also wondered how much politics would be interested in sustaining its position of power at the expense of undertaking measures that might threaten political power. Particularly the latter question appears distant from the actual topic of investigation in this project. However, keep in mind that – as was said already in the summary of the first task – the maintenance of the boundary between society and environment is the essential activity of sustainable development. Hence, maintaining this boundary sustains cohesion in society and provides a power basis. I like to demonstrate that 'Realpolitik' aims at maintaining boundaries and power bases. The question, therefore, is how probable it might be that this cycle of acceleration is broken apart?

Essential issues addressed in this task then are the meaning of co-operation for the sustenance of management capacity and the probability of fundamental change – change that is essential in order to decrease acceleration and ecological risks – against this 'need' to maintain cohesion. The concept of trust emerges in a discussion of probability of change. Not only will 'politics' simply attempt to maintain progress along the path of sustainable development; also the 'people' might hesitate to agree to change, especially in the light of smaller or larger risks and the belief in collectivist ideologies.

The human ecological perspective, which has been introduced in the summary of task one, is concerned with system building principles, i.e. build up and maintenance of cohesive regimes against an environmental background. By referring to the concept of trust it is possible to demonstrate the possible conflict between societal interests and the environment.[5]

Trust is a mechanism that reduces social complexity. Trust is a fundamental resource for the continued reproduction of society. Co-operation or collective agency as a carrier of collective action could

[5] The human ecological perspective stands in contrast to the global ecology – an ecology, which is all comprehensive (global not as a mere geographical designation). Thus, the human ecology might, of course, be destructive – like a parasite, affecting the diversity of species. The human ecological approach applies system principles when a distinction is made between human ecology and an environment, where ecology as a study attempts to understand the consequences of human ecological evolution for the environment of human ecology. (cf. Luhmann, 1986)

not exist. Trust is located in the relations between people; it is not personal characteristic but a social one. (cf. Luhmann, 1968/2000; Lewis and Weigert, 1985) The way trust itself is produced and maintained in society and how it contributes to any collective activity is of fundamental importance to understand the probability of change. This is particularly clear when highlighting the relationship between trust, power and control (and environmental governance for that matter. Without trust there would in fact be only chaos. (cf. Luhmann, 1968/2000)

Trust, thus, works as a foundation for society upon which collective control, planning, or management are possible. (cf. Jalava, 2003) With respect to the economy this means that only trust into money can permit a control of the economy. (cf. Luhmann, 1968/2000, 1988) Likewise, only trust into money provides the basis for politics to exercise power. Also justice, the strain for equality etc. would be impossible without that trust basis. Hence, we require a sustainable economy, a sustainable development to maintain the capacity for management.

Therefore, the limits of change in society are concerned with the generalised communication media, such as money. These permit cooperation over large spaces and across time, allow interaction with people who do not know each other personally. (cf. Stewart, 2000) If the people are unlikely to give up the advantages of this kind of cooperation, it will be unlikely that the boundaries between social systems and environment will be weakened.

The relationship between trust and control is well illustrated when referring to the management of economic matters through economic policy. It is well possible to make money expensive in order to decrease the rate of consumption per time unit, i.e. slowing down consumption. However, keeping in mind that the free flow of money is the best guarantee for trust maintenance, it is not probable that an authority would run into the risk of impeding the flow of this important communication medium. Scholars confirm this by writing that the trust into money is highest if (state) interference is lowest. (e.g. Lewis and Weigert, 1985)

The situation is aggravated by the globalising society, which increases complexity. In such a situation trust maintenance will receive an increased importance, for it will be more difficult to sustain trust and management capacity. (e.g. Misztal, 2001; Bijlsma-Frankema and Costa, 2005) Hence, the threshold to change becomes – in principle – even lower, thus the probability of accepting a slow down of economic activities decreases. Commonly we seem to cherish the dependencies that emerge out of this constellation.

The lack of willingness to change is reflected in the success enjoyed by environmental management approaches that aim at removing or minimising possible conflicts that could emerge out of dealing with natural resource dependencies. Ecological modernisation theory emerged exactly out of this need to maintain trust and cohesion under an accelerated evolution of complexity. (cf. Murphy, 2000; Jänicke, 2008) The theory serves to sustain the development and progress of society through accelerated modernisation. As such it provides a continuing basis for justice and management. Environmental justice also falls into this category, which assumes that environmental problems are based on conflicts and which has therefore been aligned on a course of achieving social justice. (cf. Hornborg, 1998; Becket, 2004; Foley, 2004; Paavola, 2007)

Nevertheless, both approaches, justice and resource use efficiency, do not address that actual problem of dependency on social networks. (cf. Leydesdorff, 2000) A solution would need to address the boundary between society and environment or, more concretely, the boundary between a network and its environment. After all, it is boundaries that produce conflict. However, in the light of the increasing societal complexity – also due to the increased need for innovation (cf. Leydesdorff and Meyer, 2006; Jiménez and Escalante, 2006; Walter, 2007) – it is improbable that politics would develop measures, which address dependencies in order to break them. This is very clear, since politics is itself dependent on the continuation of cooperation through trust into generalised media of communication.

The human ecological approach – expressed through system theory and cybernetics – that I have broadly applied here suggests that these developments – globalisation, increase of complexity, fostering of measures that support sustainable development – are part of a natural process. All these efforts, which are undertaken and that were described, particularly in the two previous tasks, serve the maintenance of trust and control. Thus, these efforts serve system building principles, whose logic reflect the naturalness of the described developments.[6]

The resolution that the probability of fundamental change in society – a change that most likely threatens trust and power bases – is improbable, is in principle confirmed by evolutionary theory. (cf. e.g. Turchin, 1977; Heylighen, 1997; Luhmann, 1997; Stewart, 2000) Progressive evolutionary theory proposes that cooperation is and has been increasing throughout the existence of the social human. The observations made confirm this trend. The increase of complexity accompanied by an expanding culture – globalisation – necessitates the demand for more rules and measures that aim at the maintenance of trust. In addition, dominant collectivist ideologies form a part of this trend to increase the probability of successful cooperation. The focus of these ideologies is on increasing the efficiency and effectiveness of cooperation, interaction and integration on all levels of society.

Such fundamental developments cannot go ahead without the effect of generating feedbacks of unintended nature. The consequential rigidity of our existence due to the introduction of ever tighter rules and limitations of personal freedom permits the emergence of a global regime (or system) that could be circumscribed by the operation logic of the difference contingency/ non-contingency. This system – utilising the same concept of differentiation as Luhmann (1984)

[6]Personal agency through the conferring of trust is of course vitally important. However, social systems must be seen as being more than the sum of the parts they are made of. This leaves the question why humans do what they do that allows the emergence of systems with an own rationality. The existence of trust in the prevailing cooperative regimes provides an answer. These regimes or social systems are subjected to the described system principles (including, for instance, the model presented in the analysis framework of this work). This makes the evolution of those systems natural.

does – circulates cohesive communication throughout global society. The consequences of the rigidity in society have to be understood in the light of the understanding that was gained in task number two, according to which decision-makers aim at reducing transformation times. This refers to the time between investment and the regeneration of the investment capacity, which represents freedom. The rigidity, thus, leads to the decision-maker facing fixed conditions at present and a yet unstructured future, available for disposition; for the future is open. Not surprising, therefore, that we strive to reach the open future as soon as possible.

The above explanations can lead to a certain conclusion concerning the nature of sustainability, the sustainable development of society and the sustainability of the resource management process. Sustainable development is about social systems managing their respective sustainability, ensuring their continuous existence. Thus, sustainable resource management is about coping with the systems surrounding complexity, the latter brought about by the existence of many complex social systems, whose evolution cannot be predicted. As an outcome sustainable development is significant for the continued existence of society. However, acceleration is at the heart of sustainable development; thereby sustainable development appears to exacerbate the potential repercussions for the global ecology by increasing ecological risks.

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Chapter 5

Conclusion

The previous chapter summarised the researched material, practical cases and conceptual studies. It highlighted that acceleration and ever-increasing time compression appear to be natural within the framework of human ecology. While this is the case the presented model 'complexity-control-evolution' demonstrates that the acceleration process runs through a recurring pattern and thereby emerges as a phenomenon.

This chapter will provide a conclusion to the research problem whether acceleration – in society, but in its economy in particular – can indeed be controlled. This necessitates, however, a broader discussion of the phenomenon in question, a discussion of elements, which have not been explicitly named and described so far. A conclusion without this discussion will be incomplete.

The chapter concludes with a tentative outline of a research programme that could continue this research, for all research is naturally incomplete.

5.1 Managing the risk of acceleration

Acceleration is at the core of evolution in society. The elements in the trinity model reflect the recurring process of responding successfully to complexity. In other words, the model mirrors the process of sustainable development as it passes through the different elements and functions – managing complexity and maintaining that capacity for management.

The outcome of the sustainable development process – the increase of complexity in society – is actually the outcome of complexity increase in the social systems that make up society. This has been explained in the chapter on the analysis framework, which stated that systems possess a particular rationality for information processing. The economy does not understand any information that is not concerned with money; likewise, the political system does not understand any information outside the communication of power. Thus, politics is – like all other systems of society – located in the environment of the economy. Hence, an increase in complexity in the economy (e.g. through outsourcing of business functions) – allowing the economy to respond to an increased variety of perturbations from its environment – simultaneously increases the complexity in the environment of all other systems in society (since the economy is in the environment of all other social systems). The mutual responses in the systems generate a positive feedback process of increasing complexity, which takes place with an accelerating speed.

In practice increasing complexity is ensured by continuous innovation (sustaining evolution), as explained in the summary of the research results. Innovation that sustains the management capacity of enterprises – affecting the sustainability of operations of whole industries and currency areas – is taking place with ever smaller time intervals, effectively reflecting acceleration of complexity in global society. Not innovating does seriously threaten sustainability because no self-organising system can know in advance the responses of others (e.g. in the market). Thus, to ensure sustainability, the model cycle must not be interrupted.

Since management is a path-dependent activity, a recurring pattern, such as the model cycle, is a prerequisite for the management of the ecological risk of acceleration. Indeed, a recurring pattern, most often called institution, is a requirement for any control effort, as has been explained. Hence, sustainable development maintains the capacity for management now and in the future to come in society.

The need for sustainable development to maintain management capacity sheds light on the matter of probability in controlling acceleration. The last research task and the corresponding solution in the summary have highlighted that it is probable that a sustainable development regime is going to be maintained, either because it is considered too risky from the perspective of the 'people' or from the perspective of the 'authority' not to continue sustainable development.

So, the question of the possibility of controlling acceleration (as suggested in the solution to the second task) is – as a matter of probability – restricted by the need to uphold a regime, which demands that the increasing complexity of society must necessarily be counteracted by increasing differentiation and growth of internal complexity. This way sustainable development generates accelerated response times.

In practical terms the problem can be rather understood as one characterised by increasing integration. This was made clear particularly in the solution to the third task. For instance, if innovation takes place there will be almost necessarily a need to continue innovation due to the production of a positive feedback. Thus, the more integrated a locality or region, for example the Arctic, becomes, the less probable it is that acceleration does not take place. In fact, the probability of acceleration increases. Given that the Arctic areas alike the Barents region are integrated into the global society, it is improbable that acceleration could be controlled into a slow down leading to a higher probability of a sustainable ecology.

However, not only integration – mirroring higher complexity – is cause for a lower probability of slowing down. Integration can also lead to a loss of trust that is resting in localities or persons.

Hence, globalisation often feeds back into measures that need to be undertaken by regional authorities (e.g. state governments) in order to maintain or regain trust. Moreover, this need often leads to a tightening of control measures, resulting in a reduction of freedom.

As I see it there is a positive feedback loop in existence, connecting the elements *complexity*, *control* and *evolution* into a recurring cycle.[1] Every attempt to control complexity through more knowledge will only increase overall societal complexity and decrease the probability of ever controlling ecological feedbacks stemming from society's environmental impacts. It is understood that control (and the maintenance of control) as such leads to acceleration. Hence, control cannot be expected to slow down, to reduce acceleration.

5.2 Understanding management

The basic function of the economy has been described by Niklas Luhmann (1970) as having the purpose of control over one's future, for the availability of monetary capital permits a certain degree of disposition, a planning timeline. I have myself suggested in the solution to task one that this basic economic function must have evolved in the course of societal evolution from having command over space and territories to the command over time. Space and time provide structure without which management is not possible. But of course, this economic function of providing a timeline or foundation for planning is not isolated from any other part of society. The platform for management is provided by the economy as well as any other social system. Having a future is a societal matter, not an economic one; and the same holds true for management: it is a matter of society as a whole.

Therefore, I see the so-called homogeneous and chronological standard time conception that I mentioned in the introduction chapter as having an origin rested much more deeper and broader in society than merely in the economy. The dominant time perception

[1] Hence, the '+' in the centre of the model (Fig. 2.1).

is not simply the economic standard time but the time concept that has been established by *linear* models. Linear models are based on a positive outlook, a positivistic science paradigm, which assumes that virtually 'everything' can be controlled. Hence, the still dominant idea that 'we' or society can ever better 'adapt' to environmental changes, say, by continuously accumulating more knowledge, rather than accepting that organisms or organisations do not adapt but merely undertake measures that ensure their sustainability against a 'hostile' environment.

The trinity model that I have developed as a framework for analysis could be expanded by a fourth element. The three elements as applied in the analysis and as shown in the case studies reflect the process of acceleration. The fourth element, in turn, complements the trinity by adding *consciousness* (following Kükelhaus, 1934/1984). The consciousness is resting in the observer (you, me or everyone else), the one who creates *environment*. Thus, the number four mirrors the consciousness over the first three elements that describe management and acceleration and, most significantly, the consciousness over the positive feedback loop, which the first three elements appear to convey.

The element of consciousness or rather the lack of consciousness has fundamental consequences for management and policy making. The origin of acceleration can be traced back to the control or management effort as such. And management like policy making requires path-dependency, which is nothing else but a linear outlook. Therefore, policy making fundamentally collides with the infinite complexity of the world, including the high complexity of society, whose evolution is outside full control, thereby generating uncontrollable feedback effects, for example ecological risks. The consciousness over the existence of the trinity in management could be all but decisive. But the consciousness does not rest in the social system, not in the collective, it is a personal trait.

5.3 The trap of collectivity

> Jede Lehre, die behauptet, daß der Mensch a priori für den Staat oder die Gesellschaft geboren sei, ist eine Irrlehre. Der Mensch ist geboren, damit er sein eigenes Schicksal lebt.
>
> Ernst Jünger, *An der Zeitmauer*

Is this going to be a conflict between the 'system' and the 'individual'? The social system, the collective, the community or cooperative regime are prerequisites for human sustainability, they are natural. Virtually everything that we consume, be it services, goods or intellectual material, is the consequence of cooperation. Humans' physical and mental survival is dependent on others. Humans would not exist without cooperation.

While our decision-making is always subject to constraints – physical, cultural, psychological etc. – a dominant school of thought assumes that individuals follow their self-interest. This school might, for example, point at the existence of markets.[2] In this case, there must be a mechanism in place, which incorporates individuals into a common regime. Cooperation does not evolve easily. Many scholars share the opinion that advanced, complex social structure is evolutionary improbable.[3] Consequently, due to the improbability of cooperation, cooperation becomes very important. It moves to the centre of (political) governance efforts, which has been elaborated in parts of my research, particularly in the summary to task four.

The consequence of cooperation goes beyond what has been mostly emphasised so far – that it provides a foundation for control and management. Cooperative regimes also lead to a high sensitivity/-susceptibility to informational stimuli. This phenomenon has been

[2] Stating the existence of markets is, of course, independent of the belief whether markets are considered good or bad

[3] Luhmann (1984) writes in this context that modern social structures are simply more probable than the improbability of human survival without the social structure.

attributed to technological changes leading to increased conductivity (*Leitfähigkeit*) within the social collective; in fact, the societal collective as we know it only exists due to the technological evolution brought about by the developments that began in large in the 18th century and leading to global 'industrial' society. A collective that poses any importance can only be brought into existence with suitable technology permitting a communication (in a concrete as well as in an abstract sense).

Innovations do not only allow the participation on large scale events and decision-making beyond the sphere of personal relationships – for example democracy, the 'nation', standardised language, justice, industrial economy – innovations also lead to a melting of humans into a collective, resulting in the repression of individual representations and personality in favour of system-rationality. (cf. e.g. Jünger, 1959)

Incidentally, this school of thought is identical to system approaches, such as the theory of social systems, describing the formation of global systems with their respective functions and rationalities of operation. Jünger's idea of the comprehensive 'world-plan', which is more dominant than any regional, local or even personal plans, coincides with the idea of evolutionary progress, having the aim of increasing cooperation and leading to a global cooperative regime, a global society. (cf. Luhmann, 1997; Stewart, 2000)

One might even wonder whether the general and constant critiques of the social order, or the wrong social order for that matter, have anything to do with the high and increasing complexity of society and the consequential difficulties in governing society. This question, however, leads to the general critique of the state as such, i.e. the state as an illegitimate organisation. Following such a critique the state is not capable of establishing ethical superiority; it is, however, superior in defining what is ethical, the state possesses ethical competence. The latter does not mean that the state is ethically infallible; it merely is so dominant that it transcends human lives in such a fundamental way that it cannot be a de facto voluntary organisation, but is de jure only ethically competent. (cf. Urban, 1919)

Thus, the dominance of ideologies, which guide the state reason and its image as representing the 'people' and their interests, has a fundamental impact on the perception of the importance of the state and/or collective. Whether the ideology favours the fulfilment of certain societal objectives (e.g. equality) or the prevention of unintended consequences (e.g. risks), it is primarily concerned with maintaining the collective. This maintenance is after all the only way of securing the power needed to pursue the measures that address the objectives of the ideology. Current dominant ideologies are, for example, the need for sustainable development and the risk of climate change.[4]

Emphasising the element of freedom here is quite significant since freedom and the gaining of freedom has been the focus of collective efforts in Europe particularly since the end of the 18th century. Enthusiasm will, however, faint away as soon as is realised that all efforts to create a collective of the 'free' are bought with the creation of an abstract authority, not a personal one. Political liberalism removed the inequality between the master and the servant. The 'master' was separated from the individual servant to be replaced by that abstract entity called state. Social liberalism (socialism) removed the inequality of property distribution between the rich and the poor. Ownership was separated from the person and allocated to that abstract entity called society. Finally, human liberalism put the 'human' at the centre, removing prejudice but also individual, personal spiritualism, and leading to general atheism. However, belief focused on the human as such, a character who will always be beyond achievement by any person (since any person is *different*), therefore *the* human rises to the position of the true God, representing only a metamorphosis of religion. (Stirner, 1845/1972)

What appears to be an overdramatic description of the problem

[4]This is not a statement regarding the qualitative truth of either sustainable development or climate change. But the fact that they exist as (scientific) ideas makes them have strong effects on policy making emphasising the need for tight collectives with little (personal) freedom.

is in fact highly relevant to understand the social theory of acceleration. The increased difficulty of sovereign decision-making and acting 'independently' – in spite of the movement towards more 'liberalism' – highlights the relevance of the collective rationality in the generation of acceleration but also regarding the resistance to any collective effort. It seems often, for instance, that freedom has been reduced to consumer choices; but even this kind of freedom lapses on a closer look. To Stirner (1845/1972) and Kuehnelt-Leddihn (1943) the so-called liberalist movement produced a collectivisation and universal definition of what ought to be 'right' and 'wrong', the ethical competence I was talking about. The consequential emphasis of the collectivisation to simply consider everyone 'equally' (meaning, to integrate everyone, whether everyone desires it or not) has led to the emergence of that feeling of competition, generating increased speed in society. (cf. Kuehnelt-Leddihn, 1943) Social theory confirms this by stating that the 'look how others do things' is the basis for making decisions in a market. People do not buy what is on offer on the market but what their peers consume. (Luhmann, 1970) Therefore, so-called liberalism does not provide freedom; hence, there is not 'too much' freedom that would require control.[5]

The essential consequence of the lack of freedom for modern society is the emergence of a societal system that can be differentiated according to its code non-contingency/contingency. This is an analytical system, not an actual. The actual systems, such as politics, law, economy etc. provide specific societal functions and through their operations lead to the emergence of this overarching regime. So, while any system has contingent elements to help distinguishing between present and future of the system, this overarching system supports the understanding of the pressure of maintaining the sustainable development cycle as explained in the analysis model of this research. This code represents the logic according to which the cyclic

[5]The assumption that there is too much freedom is very dominant. It is apparently founded on this idea that markets – assumed to be without rules – permit unrestrained and excessive exploitation of natural resources. Consequence is a management theory that aims at integrating and reducing personal freedom.

dynamic named sustainable development operates, independently of the varying logics of society's subsystems. The whole is, after all, more than just the sum of its parts.

The system non-contingency/contingency emerges due the need to reduce the amortisation period of an investment. This is nothing else but the need (or desire) to let the future become the present. The future, after all, is open, contingent and permits planning. The present, in turn, is non-contingent. The rigidity of the present accelerates the need to reach the future, particularly as the increasing number of effectively cooperating people globally (due to increasing integration, but also due to increased differentiation) leads to a higher complexity in society. This might also generally explain the strong focus on the future in modern global society. The growing dominance of this system is reflected in the differentiation becoming more emphasised, in other words, as it is mirrored in acceleration. The system reproduces the cyclic dynamic that is so well visible in the analysis model.

The previous elaborations provide an answer to the question why this system persists. Risks and collective ideologies emphasising integration and rigid cooperation are at the centre of the regime, their reproduction in differing forms and their communication through the medium *cohesion* make the system and, therefore, acceleration probable.

The situation we live in is not as pessimistic as it appears from the descriptions in the above paragraphs. The reader should not assume that the sustainable development process that I described here is unchangeable just because I state it as natural. Stating a process to be natural does not mean that the process is subject to determinism. As persons we construct our environments. Hence, we also construct what comes to be seen as natural. Evolution is, after all, dependent on history - indeterministic, changeable history (cf. Luhmann, 1997).

However, in order to be able to construct our environment in any different way we have to give up the idea that society (or the state for that matter) can indeed control anything or ought to control just anything. While it appears determined that the existence of social systems or collectives must necessarily lead to acceleration in society, it is by far not determined that we have to submit our personalities to just any collectivist ideology.

We can slow down and re-establish a more sustainable ecology. This necessitates a refocus on our personalities[6]. The long time influence of collectivist ideologies on the ways we cooperate (the configuration of society so to speak) has made it very difficult to be more sovereign.[7] This leaves the question whether Nietzsche – as mentioned in the introduction chapter – was indeed right. Are we simply too lazy to change anything?

5.4 A final comment

Besides establishing that a collective management – a governance – of acceleration as an ecological risk does not work and only leads to more acceleration, the most important insight that this research has produced is that the overly focus on the 'physical' does not lead necessarily anywhere, not to the 'better' society, the Utopia. The increasing resolution of scientific results, the flooding of our minds with a myriad of facts, does not really produce a higher quality

[6]The concept of the personality is the consequence of us having to trust so that society is possible. However, this trust might be more or less conscious; for most of the time trust exists in the form of habits, because it is convenient. But, importantly, any collective is the consequence of knowledge expressing that 'things' can work 'that' way. Other knowledge might alter this. In this sense, there is 'right' and 'wrong' knowledge, which puts people in dependencies or liberates them. I think that it is a matter of personality to apply knowledge in a certain way. In other words, trust implies that humans are free, but they often do not realise this freedom. Ideally progress could be concerned about raising this consciousness, which is a personal trait, not a systemic or collective one. The idea of personality sees potential in the person, the person as an observer who decides whether and how to participate. Such a person is not 'outside' society, but relies naturally on all resources provided by society. (see also Luhmann, 1995; Kornhuber, 2009)

[7]This makes the probability of slowing down in fact rather low.

of knowledge. In fact, a lot of what we do in science has largely quantitative properties. However, what we need in order to deal with ecological risks of the nature of acceleration is a strengthening of the 'metaphysical', the ability to look beyond simple linear causality. It appears to me that science and other parts of modern society are blind for metaphysical matters.[8] Personality, however, might be the source of metaphysical consciousness[9].

Concerning the management of forests and other natural resources, the present tendency to increase areas under conservation, coupled with developments that affect the efficiency of local, regional or even national investments – making it more attractive to close down production sites in expensive places and move investment capital to other locations – appear at first sight positive for the regenerative capacity of the forest or ecology as such. However, a holistic approach emphasising 'wholeness' yields a different understanding of what constitutes 'sustainable' forestry. Any societal activity concerning a natural resource is the combination of society and environment. Human ecology is an integral part of general ecology.

Alternatives to more traditional activities – such as tourism and all others that imply a greater integration with 'outside' factors – are not per se more ecological. Such an integration means, after all, generating higher complexity – creating greater income opportunities – but also posing the higher risk of uncontrollable developments, making 'the local' much more dependent on global developments than ever before. The integration and dependency on factors outside the North is accompanied by an accelerating effect, laying the foundation for a higher risk potential, a risk for unintended consequences, (global) environmental impacts and ecological feedback effects .

Enforcing cooperative and integrative measures should not be the way to go; it only results in less (personal) freedom and higher po-

[8]Distinguishing here science from philosophy, in a similar fashion as Luhmann conceives a social system called religion. (cf. Luhmann, 1986)

[9]It is what Nietzsche (cited in Flyvbjerg (2001, 24)) meant when saying that the growth of consciousness becomes a danger to that universal rationality, the same rationality that I consider the driving force of acceleration.

tential for ecological destruction. A critic like Stirner (1845/1972) was not against society, he assumed that society would not simply disappear without the 'authority'. Society will continue to be reproduced on the basis of people being able to choose in what way and with whom they want to cooperate to create society. Perhaps a personality might be required like the one Ernst Jünger (1951/1980) has characterised in his essay *The Retreat Into the Forest* (orig. *Der Waldgang*). The forest is timeless or beyond time and the place of resistance. The one who retreats into the forest (the *Waldgänger*) is not interested in the plan. The one tries to escape and resist the plan and wishes to be sovereign. As Jünger writes: 'Decisive for the Waldgänger is the *Now and Here*'.

5.5 More research needed?

Just as in any other work of research, the conclusion provided here is never all-conclusive. There are always new questions coming up. It lies in the nature of research – the epistemological process of knowledge accumulation – that it has to focus on one narrow field with defined boundaries and to ignore most of what exists outside the focus area. This is why a model, such as the one developed and presented in this work, is never certain; knowledge, which only exists as models, is never certain. The natural uncertainty inherent to knowledge drives the scientific enterprise; this is why science became an operation without a goal and turned into a reproductive process.

I suggested that it might not necessarily lead anywhere to increase the resolution of an analysis in order to embetter the quantitative basis of research. Delving into sub-areas of research it is easily possible to loose overview and miss the main point. After all, the main argument behind the demand for a stronger emphasis on metaphysics is the loss of personal creative power and the consequential need for more (social) structure when 'physics' rules. For an academic dissertation it might, however, be a negative matter if it does not consider the limitations of the research or future fields of inquiry that should built upon the research done in order to overcome its shortcomings and insufficiencies.

The following could be considered some tentative points of a future research programme. They build upon the insights that this work has provided, particularly the need for greater personal sovereignty. Hence, its intention is to understand in a more concrete way how to perceive the role of the human and his/her personality in the process of creating society. Moreover, it has to ask what the ways in which the personality could be resurrected are, bearing in mind the fragmentation and functional differentiation of modern society.

One subject in the research programme could be concerned with understanding personal sovereignty. This seems to be a philosophical/metaphysical inquiry. It is not too difficult to create a picture on the basis of existing ideas here, for a variety of thinkers have been concerned with the role of the human in the world during the last millennium (and beyond) or so. Cusanus' human as the creator, Heidegger's world-forming human, Jünger's concept of the 'author' as the creative human, or modern cybernetics' idea of the observer who generates the world through making differentiations, all point at the same phenomenon.

There is probably a lack of theoretical understanding on the role of personality in social theory. Social theory is, after all, concerned with the subjugated social human, not with the sovereign human. This standing of social theory becomes especially visible when considering the common tendency of blaming others, the 'system' or society for identified problems. One hardly turns the finger on oneself. (cf. here for example a critique on the scientific-rationalistic paradigm of science – also implicit in the 'social sciences' – that the structure of the world, society, etc. is determinable, which ought to lead to trustful expert opinions on what is 'good' and 'bad' for us as a collective: Feyerabend, 1980)

Understanding the variety of ways in which the personal sovereignty could be strengthened would be a more practical matter. This analysis could take the differentiation of society into functional systems into account, for example economy, politics, law and education. An economic reorientation towards utilising locally available resources, reflexive development of suitable policies and rules, a reform of educational curricula to bring up sovereign thinkers might all be in the range of the possible. Though, were would this lead to? Luhmann in his *Ecological Communication* (1986) suggested already that if this was all what the problem was about, it would be easy to solve it. In fact, changing only the 'programme' content of the subsystems of society would not change the operation logics; neither would it remove the mechanism that leads to acceleration.

The principle of self-organisation as well as related ideas, such as entelechies (cf. e.g. Conrad-Martius, 1944), seem to suggest that the model, which represents sustainable development in this research, is in its *form* basically also its purpose of existence. There is no reason to assume that the regime would simply cease to exist following changes that are internal to society. Consequently, this research also just plays a part in sustainable development, cementing the cycle.

Thus, I must naturally emphasise that the further development of theory, be it 'social' or of any other nature, which a future research programme might address and consequential practical policy models, should not come about at a price of subjugating and controlling of 'individuals'. Against all probability, in a society of 'free' it is personal reason that must count.

Realising sustainable development without threatening the person is perhaps the problem that one must adhere to. C. F. Weizsäcker believed that a positive, 'good' progress (a necessity after all) is possible when it is subjected to constant philosophical reflection. A possible future programme continuing this research should make a contribution to strengthen this reflexive stance.

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On the sustainability of economic systems and organisations[1]

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Abstract

Not separating social and ecological issues leads to the understanding that a sustainable society maintains the living base of humans. Particularly with respect to the economic system of society, this requires a rethinking of the expected causes of ecological problems and a consequential reconsideration of what should constitute a 'good' resource management.

A case study on Northern European forestry is introduced to illustrate the working of the economic system of society. A theoretical underpinning is provided by exploring basic principles and building stones of the ecology of humans and cybernetics – the science of control structures. The latter is particularly capable of highlighting the complex relationship between social systems and environment.

The conceptual understanding of resource management and by extension sustainable development will be improved and yield knowledge on the conflict between conservation and progress.

Keywords: resource management, sustainability, cybernetics, ecology

1 Introduction

In the sustainability discourse the concept of social-ecological systems has recently gained momentum (e.g. Forbes, 2008) In this con-

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cept identified social problems are not separated from ecological problems. Or, in other words, ecological problems are likewise problems for society. Similarly, the idea of human ecology has been in use for decades to address particularly the relationship of humans – their social processes and organisation – and environment, emphasising the conception of society as being natural. (cf. e.g. Adam, 1991; Stewart, 2000) As such, not separating society from an 'outside' ecology provides a very interesting way to understand resource management and possible feedbacks that might affect the living base of humans. Here, society is *the* social-ecological system.

However, the nature of human thought emphasises differentiations; hence, humans produce social systems, which distinguish themselves from an environment. (e.g. Luhmann, 1984) Thus, in the sustainability discourse this distinction between social system and environment gains significance. This distinction also appears in the predominant understanding of sustainable development, in that society should be integrated with environment and economy, assuming that they all exist separately. Distinguishing system and environment can be done through the perspective of cybernetics – the science of systems and control structures. Cybernetics is highly suitable to explain the complex interrelationships between social systems, such as economy, and environment.

Moreover, cybernetics offers important comprehension about the possibilities and limitations of resource management with respect to sustainable development and adaptation to changes. Due to its focus on the distinction system/environment, the irremovable barrier between environment (the surrounding) and 'society' (the surrounded), it sheds light on the conflict between conservation and progress. Consequentially, the application of a cybernetic viewpoint has advantages for planning and management; it provides knowledge on the feasibility of plans (Barnes Jackson and Steiner, 1985).

Management issues as prescribed by cybernetic principles are illustrated in a case study on the state of the forestry industry in Russia with some comparison to the situation in Finland. This case study bears high interest as forestry is considered a mainstay of the

Northern European economy, including Northwest Russia (Layton, 1999). Moreover, after the fall of the Soviet Union Russian forestry had difficulties adjusting to different societal conditions. Finnish forestry industry is likewise undergoing significant changes, having especially effects on local and regional labour markets and supply and demand of forestry products.

The adaptation of the Russian and Finnish forestry industry and its commercial organisations has to be seen in the light of growing complexity in society. While adapting to more complex conditions (predominantly through gaining of new knowledge), societal evolution has also produced more and more ecological risks. (e.g. Forbes, 2008) Ecological risks appear to emerge as a consequence of managing complexity ever better. Taking into account the adaptive necessities of the economy and its organisations and the understanding that society as a social-ecological system is natural, what does this mean for a conservationist ecological attitude? We will see what the article will conclusively provide to a conceptualisation of sustainable development based on a cybernetically improved understanding of conservatism and progress.

1.1 General trends in Northern European forestry

The general economic trend in Europe has been in recent decades one characterised towards diminishing differences in levels of productivity and the application of technology. This is due to a general convergence and equalisation of social structures. Within forestry organisations the increasing application of technology requires a greater body of people who can actually use and develop them further. This has corresponding effects on the content of educational programmes within countries with forestry industry. The transformation of forestry companies from being located where their main production resource is towards market-orientation and transnationalism is part of this convergence, turning forestry companies into transnational organisations and indicating the change from the economic importance of comparative advantage to competitive advantage. (Wiberg, 1999; Layton, 1999)

There is still a clear difference between the forestry industry in economic areas, which have been managed in a decentralised manner and those that have been managed by central planning structures. The former ones are capital-intensive, while the latter ones are labour-intensive. For example, at the end of 1990's there were 16 larger sawmills in the Barents region. Only three of them were located in the Nordic part of the region. The more capital intensive pulp and paper mills were situated at eleven sites, six in the Nordic provinces of Lapland and Norbotten, three in Arkhangelsk and two in Karelia, indicating that labour intensity is more dominating in the eastern provinces of the Barents region. Eventually, however, those labour-intensive enterprises will move towards being capital-intensive. (Wiberg, 1999)

Layton (1999) summarises the change in the forestry industry as being characterised by internationalisation, which is accompanied by a refocus of the centre of attention of the companies. Furthermore, forestry companies' production is simultaneously accompanied both by diversification (due to uncertainties of future developments) and specialisation (in a product category due to higher productivity and competitiveness when specialising in development and marketing of that product). Expansion and takeovers are undertaken to achieve economies of scale, i.e. cheaper production and higher productivity, and resulting in higher unemployment and out-migration. For example, in Lapland the population in the last decades has decreased from over 200000 to just fewer than 190000 at present. At the same time there is also concentration and integration going on; this process is reflected by the development of the forest cluster and has the same effect as expansion. The move towards greater market orientation demands greater flexibility as supply and demand is adjusted to market demand. Finally, maintaining competitiveness demands an utilisation of new technologies, innovations, and a work force that can produce them.

2 Human ecology and resource management

Conceptualising these changes in Northern European forestry is now the task of human ecology. Ecology, meaning the 'science of the habitat', describes the study of the economy of nature, i.e. the total relations of the animal to its inorganic and organic basis (Costanza, 1996; Lawrence, 2003). Thus, human ecology deals with the interrelationships of humans to their habitat (Wirth, 1945; Jungen, 1991; Lyttkens, 1991; Costanza, 1996; Caldararo, 2002; Lawrence, 2003). The importance given to human ecology today has to be seen in the light of the idea of an apparent ecological crisis that exists in the interrelations between humans and their habitat. The perspective that human ecology provides offers to understand previously neglected elements of the social-ecological sphere. Even though there is a history of bringing nature and society together in a disciplinary effort, the situation has rather been to see society as separate from nature. The field represents in a way a return in the process of the development of sciences (Costanza, 1996). This approach helps us to become aware of the multiple dynamics, which are also inherent to the forestry industry of Northern Europe.

Human ecology is often explained through the use of the concept of adaptation. A significant outcome of conceptualising resource management through cybernetics is the co-existence of many social systems, such as economy, politics and science. These constitute environment to each other. Thus, ecological problems are seen as a question of mal-adaptation and disequilibrium between social systems and their respective environment. Consequence is an approach where the management of resources by modern society becomes a major focus, which is probably the most important issue that human ecology has to deal with. (Frändberg, 1991)

The economy as the centre of resource use influences the ecological cycles through the consumption of energy and raw materials and the generation of waste products. The way and extent as to which energy and raw materials are transformed depends on a complex pattern of interactions among people and their environment. This pattern of interaction changed over the history. The pattern is particularly characterised by a change in the amount of reserve energy that could be stored and the production of waste materials, which is not recyclable. (cf. e.g. Rosnay, 1975/1979)

A social system theoretical elaboration has, for example, been developed by Niklas Luhmann, where he applied theories of cybernetics, communication, and evolution to explain social phenomena with a special view on the central paradigm of systems theory, the relation of system and environment. Society consists of communication between people, which means that society can only be understood in terms of messages that carry a meaning from individual to individual. With respect to the economy, money should be understood as the communication medium, which is circulating in the economy. This way the economy distinguishes itself from its societal environment, which includes, among others, social systems of politics and science. (cf. Luhmann, 1984, 1986, 1988)

In the modern economy money is so central that one can speak of the economy as the totality of monetary operations. Accordingly, forestry as such is not the economic activity – rather, the activity, such as logging, expressed as a monetary value. Payments using money are based on individual decisions: it is possible to pay or not to pay, which becomes the essential decision in the economy. Commonly prices are the deciding factor about whether to spend money or not, for instance whether a sawmill buys wood from Finland or Russia. As complexity in society grows (e.g. in the context of globalisation), investment decisions become prime as they are linked to the restoration of one's ability to pay. Such an evaluation is necessary because there is a time lag between a payment and the restoration of solvability. Buying means of production requires sufficient capital so as to bridge the time gap between the investment and selling of products that restore solvability. (cf. Luhmann, 1986)

Traditional forms of economy are often characterised by low production, trade through barter, and few possibilities to accumulate reserves. The principal purpose of the economy was to produce, to transform raw materials and energy into food and other usable commodities. In such an economy ownership (or access to resources, land etc.) is important, the more one owns the better it is. The significance of ownership is also reflected in the effects it had to other functions of society. For example, ownership, before money was introduced and utilised on a large scale, formed the basis for power (feudalism) (Luhmann, 1986). The more control one had over space, the more power one possessed and the better one's economic situation was.

In the modern economy emphasis has shifted from space to time. It appears that the economy strives constantly to gain time in order to reduce the time lag between payment and restoring solvency and to accumulate capital, which can be provided at any time so as to pretend timelessness. (Luhmann, 1986) One can go even as far and provide a definition about the function of modern economy based on the temporal nature of its operations. Thus, the function of modern economy is to provide the possibility to defer spending at present, to make sure that the money saved can be spend at any time, and thereby utilise the time acquired. The time acquired through this deferral provides a secure future, which can be used for purposes of planning at present. (Luhmann, 1970) This way, humans have gained a degree of certainty concerning their future; control over time so to speak. The higher the probability that society can ensure the circulation of money, the more secure is the future, benefiting those to whom planning, risk minimisation and justice is important.

Hence, the starting point to understand the case study is the need to maintain the boundary, the distinction, between a social system and its environment, in this case in particular the economy and the circulation of money as its communication medium. Boundary maintenance is undertaken so that the system can maintain its autonomy against its environment; this way the system can have a future, a time line that can be utilised by society as a whole for the purposes of (political) planning. Achieving boundary maintenance is subject to a number of conditions – cybernetic or system principles – which ought to be explained in their respective context in the following case study. These principles are not at all exhaustive, but are concerned with major issues that a commercial enterprise, an industry or economic area have to deal with when aiming to be ‘sustainable’.

2.1 Competitiveness – assessing forestry’s state

The cybernetic or system *principle of autocatalytic growth* implies that stable configurations, which facilitate the production of similar configurations, will become more numerous. This principle is concerned with progress, growth, and development and simply states that a stable configuration potentially undergoes explosive growth as its configuration is more likely to be retained in the course of time. Thus, the more robust, stable configuration will successfully outperform less stable configurations. (Heylighen, 1992) Hence, a social structure will be successful (in relation to the competition) when it is sufficiently robust. In our context this is analysed through questioning the competitiveness of the forestry industry.

The forestry industry in Russia is – alike the one in Finland – organised as a cluster, including harvesting, mechanical wood-processing and pulp-and-paper industries. In Northwest Russia the forest cluster is one of the largest industries; it has produced approximately 15 percent of the total industrial output in recent years. The cluster is also more developed than forest clusters in other Russian regions; one advantage is its proximity to the European market. Some cooperation with enterprises from the Swedish and Finnish forest cluster developed and provides incentives for development on the Russian side and produces modernisation and growth. (Dudarev et al., 2004)

However, high value-added products are moderate compared with the world leaders in forestry. This is the result of the formerly Soviet-type economy of the Soviet Union where specialisation was limited and production oriented towards mass production of basic goods in order to satisfy planned demand, not actual demand. (Dudarev et al., 2002, 2004) Due to technological inferiority of facilities the quality of products is not as high as is demanded from export markets. (Malmlöf, 1998; Nilsson and Kleinhof, 2001) Thus, most of the exports are low value-added. While the demand has been receding massively – e.g. up to 1998 production volumes of sawnwood had fallen sharply – the demand for raw wood has increased a lot since 1999, after the devaluation of the rouble. (Mutanen et al., 2005) However, for forest enterprises to be economically sustainable a critical mass of domestic demand for their products is required (Nilsson and Kleinhof, 2001). Due to a weak domestic purchasing power since the early 1990's, demand in Russia has not been very high, though this is improving as there is a growing market particularly in the economic centres, such as St. Petersburg. (Dudarev et al., 2004; Mutanen et al., 2005) In addition, federal housing programmes are supporting the utilisation of domestic wood. One the whole, the Russian sawmilling industry is gaining market share in Europe. The long-term goal of the Russian forestry industry is to promote value-added production and investments and to decrease exports. (Mutanen et al., 2005)

The forest cluster in Finland is undergoing major changes, too, which are connected to the decreasing profitability of its operations since about 2000. While particularly the paper manufacturing section of the cluster has been responsible for much of the exports and has been particularly innovative since about the 1960's, there has been a decrease in demand for paper products in Western Europe and North America. To some extent this is due to higher recycling rates of scrap paper, to some extent also to only moderate developments in the newspaper industry. Thus, the price for special papers has fallen and so has profitability. It is expected that this development will continue throughout the next decade. (Secretariat of the Economic Council, 2006)

For a long time the competitiveness of the Finnish forest cluster has rested on heavy investments into technology and research. This has made the Finnish cluster into a world leader. This competitive advantage is, however, diminishing. This is firstly due to Finnish companies having invested strongly abroad since about the mid 1990's, while simultaneously neglecting the home base. Secondly, the manufacturing of production technology as well as some research capacities has moved together with the investments of the forestry companies. (Secretariat of the Economic Council, 2006)

2.2 Innovation – securing forestry's future

The cybernetic *principle of requisite variety* states that the larger the variety of possible actions there are available to a system, the larger the variety of perturbations the system is able to compensate and manage. Thus, in a market any commercial enterprise must prepare to operate against an environment with uncertainty by building up a model that permits the system's sustainability. However, the model built up in the system is necessarily incomplete. The *principle of incomplete knowledge* implies that an internal model of the world must be less complex. If it would not be less complex, the system would contain the whole world. Also, in order to anticipate perturbations a model must be simpler, otherwise the selection of an appropriate choice to counteract would take as long time as in reality. Moreover, models are constructed by knowledge that is subject to the blind variation process. Hence, it cannot be expected to have reached complete representation of the environment. All these issues do also apply internally, i.e. a system will not be able to represent itself completely in a model so as to know its own actions in all their diversity. (Heylighen, 1992) Thus, enterprises never achieve the knowledge to adequately respond to any possible problem, neither one that is perceived as originating from their environment, nor from problems that originate internally. Decision-makers will never have complete knowledge to make an optimal decision. The same holds true for the whole of society. Consequently, there can never be a stillstand concerning modelling what the market 'wants' and innovation. Innovation ensures sustainability.

The current competitiveness of the Russian forest cluster is based on basic factors, most notably on the utilisation of extensive forest resources, still fairly cheap labour, energy and transport. These costs are bound to rise. (Dudarev et al., 2002) Due to persistent lack of funding not only infrastructure, such as the one for transport, has suffered but also production facilities are to a large extent obsolete. (Dudarev et al., 2002; Mutanen et al., 2005) Requirements for a more solid foundation of the cluster include upgrading of equipment and production facilities, construction of new transport infrastructure and/or maintenance of the existing infrastructure, reforestation measures and other environmental services, and training of specialists and workforce to work with contemporary production requirements. (Dudarev et al., 2004)

The lack of sufficient funding has also affected the availability of personnel in the forest cluster – the very core of sustainable competitiveness and ability to innovate. Consequently, the training of personnel is not seen as having sufficient quality; in addition the quality decreases over time if not maintained. There have been fewer apprentices in the field; generally an outflow of professionals in the forest cluster can be observed. In addition, the tertiary student training in the forestry sector is considered inadequate for today's requirements. The research and development in the forest sector is generally said to lack innovation capabilities. The lack of funding in the last 15 years forced research and development to limit their activities. Consequently R&D has lost some of their best resources; hence the potential of the sector is deteriorating. A revitalisation of industry-research ties should involve focus on strategic planning and improving product competitiveness. (Dudarev et al., 2002, 2004)

A work force related problem was the lack of business competence; a shortage of the knowledge required to ensure an utilisation of funds, raw materials, and energy in order to create a sustainable forest economy (see Carlsson et al., 2000). This can been seen as a negative consequence of the previously hierarchically organised central planning in the cluster, resulting in weak cooperation of enterprises working in the same or related field in order to complement each others capabilities. This is considered one reason for the overall decrease of forest industrial activities during the early 1990's when there was a sudden absence of production plans, which earlier guided the behaviour of workers and managers. (Malmlöf, 1998) A consequence is the replacement of managing staff through younger people, who have been educated more thoroughly in dealing with market expectations.

Overall, the development, including the innovativeness, in the forest sector is highly dependent on factors outside control of the forest cluster, notably the oil and gas industry. Remarkably, there are few incentives to develop other industries, such as the forest cluster, as long as the world market prices for energy are high. (Mutanen et al., 2005) But with the development of domestic markets comes the demand for innovative abilities. Economic centres such as St. Petersburg are not only demanding consumer products, they are also capable of providing resources: there has been a concentration of research and development activities interesting for the forest cluster particularly in the St. Petersburg region. While regional machinery manufacturers produced comparatively outdated machinery many enterprises in the cluster, particularly pulp and paper enterprises, had to import technology from abroad. Only the enterprises, which cannot afford to buy western technology, buy Russian products. (Dudarev et al., 2004) Thus, it is very often the forestry enterprises owned by foreigners, which are most capital-intensive and, hence, most innovative.

Finnish forestry enterprises, on the other hand, have for decades been at the top of innovativeness. Still, given the diminishing competitive advantage the Finnish forest cluster is forced to react to the global changes in the demand for its products. Responses to these challenges include the reduction of overcapacities; this means that some of the production facilities that are regarded unnecessary are shut down and personnel is reduced. Included here are attempts to further increase the cluster's productivity through new labour arrangements, essentially trying to force more flexibility upon people. Besides general productivity increases, networking is a major theme. This means that, within the cluster, cooperation might overcome the competitiveness losses, possibly through a concentration of specific activities, i.e. transferring them from one to another company.

(Secretariat of the Economic Council, 2006)

However, all these measures mentioned are considered only short-term. Long-term maintenance of the cluster's competitiveness can only come from new product development with a strong innovation and research component. New fields are probably going to be explored, such as new applications of the domestically available wood raw material for biotechnology purposes, including bioenergy and other biomaterial purposes. Biotechnology particularly is on the increase in the Finnish forest cluster, but also stronger and more innovative use of information technology and chemical processes, such as intelligent papers, functional packaging etc. Bionenergy has, too, gained strength as part of ensuring the fulfilment of Finland's commitment to reduce the global carbon dioxide emissions so as to control the effects of climate change. Moreover, the cluster is gaining strength on its margins, which includes support companies, maintenance services, consultancy and other services. (Secretariat of the Economic Council, 2006) In any case, the traditional sectors in the forest cluster, sawmills and pulp and paper manufacturing are not increasing their employment base. The trend is towards a decrease of overall numbers of employees. The negative trend on the Finnish side appears to be correlating with the increase of competitiveness on the Russian side in exactly these traditional sectors.

2.3 Governing the forest sector

Cybernetics has the intention to understand social systems as self-oriented, not externally controlled systems. Social systems, like living systems, have a quasi-will of their own, affecting fundamentally the possibilities and limitations of rational control. Hence, social systems are dominant and interested in expanding. Therefore we witness globalisation.[2] The consequence of this self-organisation is

[2]Personal agency is still highly important. But social systems must be understood as being more than the sum of the parts they are made of, i.e. communication actions by humans. This leaves the question why humans do what they do that allows the emergence of systems with an own rationality. Trust into habits

that all attempts to access a system externally must be unsuccessful if the measures to access are subject to a different logic (e.g. concerned with truth) than the system logic (e.g. concerned with investments). As a result, parts of social systems cannot be unilaterally controlled. (Luhmann, 1984)

Cybernetics contains a control hierarchy based on two flows: energy and information. These are flowing into opposite directions; certain aspects in a system with high information content control those with low information but high energy content, and vice versa. (Degele, 1997) For example, the globalising trend that the forest clusters are witnessing is activating a great need for competitiveness, where the maintenance of competitiveness attempts to control the consequences of the complex globalising process. Progress is vital for sustainability as the existing socio-economic structure has to constantly attempt to control complexity. To increase chances, generalised media are necessary so that a society-wide exchange of information and energy can take place. (Degele, 1997)

Money as the communication medium that identifies economy is the integration mechanism whose widespread acceptance establishes a dependency network, on which the forest clusters can rely on. In case of high inflation, as has happened during the 1990's in Russia, the absence of such an integrating mechanism can, thus, provide serious problems for the sustainability of organisations. Consequently, governance of forestry and the economy in general has been quite problematic after the fall of the Soviet Union (Nilsson and Kleinhof, 2001). It must be emphasised that if one parts of the whole fails, other parts are likely to fail to, as systems in society that fulfil major functions cannot be made redundant. Hence, if the economy is on the brink of dissolution due to a lack of valuable currency, politics or law might start failing to fulfil their functions, societal wide planning and regulation. So, several major issues that are vital for a sustainable operation of forestry enterprises had to be dealt with, including a new forest policy, property rights, and industrial policy.

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provides one answer.

A new forest political framework has been under discussion between members of the Russian state administration, the forest industry, and scientific research and development sector. Main principles concern a reform of existing laws and norms governing forestry, the promotion of scientific research and development in the field, the intensification of silvicultural principles and conservation. With these reforms forestry in Russia is aimed to be profitable by 2010. Until then, the Russian federal state will also retain ownership of the Forest Fund, which is the principal owner of forest lands in Russia; although federal subjects can be owners too. (Veijola, 2003)

By 2010, rights to harvest will be transferred to forest enterprises through long-term leases and concessions (Veijola, 2003; Lapin Kansa/STT, 2005). Industrial use of forests would in fact be privatised through granting of leases. However, there is an apparent lack of competition for granting long-term leases, indicated by a fairly low price paid for those permits. The price for short-term concessions, in turn, is much higher (Mutanen et al., 2005). This shows either the inability of enterprises to commit long-term and/or short-term operations with corresponding fast investment returns as the preferred mode (cf. Walter, 2008). Moreover, logging without licence occurs on a too large scale, mostly in areas closed to international markets and in the far east of the Russian Federation, including wood consumption by local people, which disappears in the statistics. Thus, illegal logging is considered a problem. (Mutanen et al., 2005)

Industrial policy has constituted a major barrier for thorough development in the forest cluster as it is characterised by commonly short-term actions and is poorly connected to other societal spheres and prerequisites. Leasing and forest harvesting concessions can serve here as an example, whose deficiencies prevent long-term planning, especially with regard to investment planning by forestry enterprises. Furthermore, inconsistencies between federal and regional level governments impede investment. This is due to a lack of protection rights for investors, which is the largest impediment for a greater influx of finances. (Dudarev et al., 2004) Therefore, a sustainable development in the Northwest Russian forest cluster requires efforts from policy makers and business leaders alike, particularly a commitment to industrial development. (Dudarev et al., 2002)

While in Finland the legal and political environment has supported decade long striving of the forest cluster the government is nowadays hesitant if not unwilling to interfere or counteract adverse consequences of local impacts of global developments. For example, news announced on 25.10.2007 confirmed the problems, which the forestry industry in Finland faces. Stora Enso, in fact the largest integrated forestry company in the world, plans to shut down its facility in Kemijärvi, Finnish Lapland. Reasons for the shut down are varied. Some argue that Stora Enso has miscalculated some of its more recent global investments, making losses and, hence, had to reduce its costs by closing some of its plants, including Kemijärvi. Others argue that the general movement for conserving the forests in Lapland from cutting (e.g. Greenpeace has heavily campaigned) has been a significant factor in deciding that the Kemijärvi plant would no longer be profitable for logistical reasons. The official reason given by Stora Enso is that the Kemijärvi facility – even though it is running fully profitable at the moment – is too small to be competitive in the long-term, even in comparison with other Finnish locations, not only in comparison with global ones. The shut down will mean that 223 work places will be cut, generating an unemployment rate of 45 % for the town of Kemijärvi. (Lapin Kansa, 2007)

The affair is a very delicate one as the Finnish state is one of the major shareholders of Stora Enso. So, while the government is not willing to interfere with the decision taken by the Stora Enso board to close down this and other facilities across Finland, there is, nevertheless, large agreement among politicians across the political spectrum to support the establishment of related industries at the same location. The strong focus on the utilisation of bioenergy – as laid down in the government's globalisation strategy – could play a major role here. (Secretariat of the Economic Council, 2006) It is considered to convert at least a part of the existing facility in Kemijärvi into a production plant for bioenergy based on wood.

Thus, it could be that decision-making institutions, be they management boards in enterprises or governments of states, choose knowledge that turns out not to be the best choice in ensuring an enterprises or economic area's sustainability. In any case the future in society that also affects the global ecology cannot really be predicted. This is supported by the cybernetic *principle of blind variation*, which states essentially that systems do not know in advance what variations will be selected for the further development of their structural configuration. Commonly, trial-and-error-processes build up the knowledge for recurring events. Such inductively gained knowledge forms the basis for this principle, which can be used to explain all cases of non-blindness of system processes. Blind variation and selective retention produce stable building blocks (of knowledge), which can be used recursively to build and recombine increasingly stable configurations. (Heylighen, 1992)

2.4 Ability to operate in a complex environment

The review of forestry activities in the European North illustrated that the conditions in which the Russian and the Finnish forestry clusters operate are basically not so different. Common ground between the Russian and Finnish clusters is the need to sustain production through raising competitiveness in an environment that is characterised by increasing complexity. Competitiveness refers to the ability of an enterprise to control at any point in present time the mentioned complexity. Innovativeness aims at ensuring the continuation of this complexity control in the future, while governance refers to providing useful rules to support the capacity to maintain control. These issues follow the understanding that self-organisational social systems and their operations to sustain their environmental boundaries are futile to planning. This futility leads to the underlining of markets as spontaneous, self-organising, and complex systems, which lead to global dependency networks, and the absence of a supreme political system in society (cf. Kooiman, 1993; Rhodes, 1996; Mesjasz, 2000). Resource management and sustainable development will require the sustainability of all functionally relevant parts of society, such as economy, politics, science, law and education; these parts represent the resources to solve problems for and in society. Hence, continuous innovation is necessary in order to create attractive technology regimes, which raise investments and so provide a sustainable input of energy through investments. Given that we can never know everything we would need to know, there is in fact a growing risk: to avoid deindustrialisation, innovation and knowledge production need to accelerate (Leydesdorff and Meyer, 2006).

Production efficiency – an important indicator of competitiveness – between forest clusters in Russia and other countries will probably decrease in the next couple of years. Therefore, corrective measures are required to overcome the problem of rising prices, which might prevent the Russian forest cluster to continue exporting on a high level. The most important corrective measure is the fostering of innovation in the cluster. Currently the forest cluster lacks prerequisites for modernisation, due to the cluster's present high profitability based on the exploitation of its competitive advantages, i.e. cheap wood, energy, labour. In the long-term, however, this can have adverse effects, even though this might at present economically not yet relevant enough. In the short-term the advantages are likely to diminish and companies have to undertake measure to remain on the market, where modernisation is the most important. (Dudarev et al., 2002)

In Finland the need for innovation has been recognised for a long time. Finland has among the highest ratios of GDP/research and development investments in the OECD – in 2005 the percentage of GDP invested into research and development was 3.48 % (Organisation for Economic Cooperation and Development, 2007). This has in the past led to a large expansion in the research and higher education sector. However, education and research institutes will have to operate in a commercial manner to save costs and cut down on state investments. (Secretariat of the Economic Council, 2006) This is visible in research strategies that increasingly include a stronger focus on providing specific applicable knowledge sought after by funding sources so as to ensure a sustainable operation of research institutes.

It is said that the Finnish forest cluster has lost some of its competitive and innovative capacity, at least concerning traditional sectors of the cluster, into which clusters from other countries might provide increasing competition. This is due, as has been written above, stronger investments since the 1990's by Finnish forestry enterprises abroad, which also included some transfer of research capacities. Hence, there will be a stronger focus on new product development in fields fairly new to the forest cluster, including biotechnology applications and bioenergy production. In addition, services within the forest cluster, such as consultancy, will grow in importance and contribute to the continued operation of the Finnish forest cluster. (Secretariat of the Economic Council, 2006)

The sustainability of an infrastructure for knowledge and technology creation and production facilities is of vital importance for a sustainable operation of forestry enterprises. Lack of funding denies the needed input into maintenance activities, including also the knowledge production and innovation system, potentially leading to a deteriorating infrastructure undermining competitiveness. This demand is in accordance with the cybernetic *principle of selective retention*, which states that configurations, which are more stable, are less easily eliminated than less stable configurations. Configuration here refers to a particular social structure or infrastructure. Generally, evolution in society cannot be explained without distinguishing stable from unstable configurations. (Heylighen, 1992) Moreover, the evolutionary stance means that the structural configuration of society has continuously evolved so as to ensure its sustainability (against environmental pertubations). Hence, the configuration of society (as a whole) is sufficiently stable in order to be retained and not eliminated.

Given the *principle of requisite knowledge* – stating that the larger the environmental complexity of the system, the smaller is the probability that a given action would be adequate for the system to manage an environmental perturbation – the system must also know what actions to select in order to adequately respond. (Heylighen, 1992)

Thus, with increasing globalisation and integration on all levels of society (i.e. complexity increase), it gets less and less probable that decision-makers who aim to govern actually are capable of choosing the right knowledge to do so. Consequence for (forestry) enterprises and all other organisations in the context of economy is the probable acceleration of operations that sustain the enterprises' development, including smaller time-spans between different product innovations that spam their respective market.

Nevertheless, society (in the European North) appears to be stable and unlikely to dissolve.[3] The large-scale dependencies lead to the technological level in a locality unlikely to being replaced by a lower level; rather technologies are replaced by an evolutionary superior technology. This also means that local or regional societal structures are dependent on the available technology regimes. This dependency can be a problem, e.g. the shutdown of the pulp mill in Kemijärvi is indeed a problem for the families involved. As a consequence, the state might take over certain responsibilities, e.g. by attracting new technology regimes or trying to continue the old one through incentives, or the state might simply start paying unemployment benefits. But society as such is unlikely to simply shut down as long as there is a sufficient energy input from the environment.[4]

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[3] Of course there is a continuous evolution but this constitutes a kind of stability

[4] Consider here additionally the cybernetic *principle of asymmetric transition*, implying an asymmetry in evolution and dealing with the concept of entropy and increase of disorganisation. Generally, systems go to an equilibrium, which means that they go from a larger number of possible states to a smaller number of possible states. Consequence is an increase in negative entropy, which is called self-organisation. As a result, social systems cannot be closed but engage in a continuous energy exchange with their environment, exploiting a higher order form of energy from their environment and release a lower order form of energy (waste) to their environment. (Heylighen, 1992)

3 What does this now mean for sustainable development?

Operations of any organisation in the forest cluster aim at continuing themselves and the cluster. In a globalising society this means that they have to maintain or increase their respective competitiveness through being attractive for investments, this is usually done by innovating. Thus, sustainable development has to be understood under the premise of system maintenance. A system cannot control its environment, which is beyond the system boundary. The system is self-oriented, sustainable development concerns the measures that are necessary to sustain the system.

For the sustainability of any system and society as a whole progress is vital. Progress maintains the boundary between the social system and its environment. If acceleration of production (and resource use) due to the need to maintain competitiveness is the price for sustainability, then this is acceptable to progressive thought. Sustainable development as we commonly know it (e.g. stemming from the report by the World Commission on Environment and Development (1987)) stands for the integration of different societal aspects into an overarching regime. This continues to be true also under a cybernetic perspective, where the cooperation of different social systems, including economy, politics, or science, are required to sustain society as a whole.

However, this does not prevent the economy to aim at sustaining itself against a rather uncertain environment containing other systems with the same sustainability interests. Preparing for the uncertainty through speeding up responses is the condition for sustainability. Thus, the social-ecological system, the human ecology requires an accelerating society, with consequences of potential feedbacks difficult to determine. Hence, sustainable development should be much more understood as a frame that ensures the sustainability of society's social systems 'against' their respective environment. Boundary maintenance counts for social systems. Thus, ecological risks that emerge out of this process of sustainable development can be expected to increase.

Interestingly, environmental policies that aim at being conservative, meaning conserving resources or energy, thus aiming at efficiency increases, are at their core progressive. Such policies are likely to have accelerating effects, when, with more efficient technology, more can be done within a given time. Similar developments are underway in Northern Europe, such as in the Finnish province of Lapland. Increasing conservation of forest areas has led to the population concentrating more on the development of tourism, which is also increasingly mass-scale (e.g. winter tourism). Hence, livelihoods in the Arctic become more integrated and dependent on global developments. The integration is reflected in greater uncertainties concerning future income and accelerating energy consumption. (cf. Secretariat of the Economic Council, 2006) Consequences are increases in ecological risks.

Given the dependencies that are involved with the sustainable development of society, it is unlikely that society would dissolve itself or parts of itself; technology regimes are usually only discontinued when they can be replaced with functionally compatible technologies. This is even truer as, due to globalisation and decentralisation, collective authorities have fewer abilities to control at all; hence, the decision is not necessarily theirs. The responsibility for change rather rests with the individual.

4 Conclusion

The changes that can be observed in the forest clusters can be understood as being natural to the evolutionary development in the economic system and beyond. The process is subject to control structures, including policies, rules, scientific, economic and other social. These structures are required to achieve a sustainable development of society.

The analysis also conveyed that acceleration is a central consequence of progress. The ability to control time and space has changed over the history of human evolution. Whereas historically, emphasis was put on controlling space, this focus has changed towards time. Thus, the task of the economy is to secure the future – the future of society. Otherwise society does not have a future timeline available for planning.

When aiming to understand society and its resource use, communication becomes central. The selection of cybernetic principles aimed at giving an understanding of the societal configuration necessary to ensure a sustainable communication. As a consequence of applying the principles, it appears that the control of resource use has essentially a circular organisation. Maintaining competitiveness with the help of 'good control' in the presence ensures a sustainable development and control capacity in the future. This cycle is likely to accelerate with globalisation and the corresponding increases of complexity.

The comparison of the Finnish and Russian forest clusters shows that there is a globalisation and equalisation trend taking place, confronting both clusters with an evolving complexity. Competitive forestry enterprises aim at controlling this complexity. However, the maintenance of this control capacity is based on renewal, otherwise deterioration occurs. Hence, the large extent of deteriorated infrastructure in Russia is still a burden for many forestry enterprises to reach competitiveness.

The limitation to control in cybernetics is also reflected in the meaning of sustainable development in human ecology. Sustainable development ought to be a concept that explains the development of social systems so that they can be sustained. It does not, however, concern the environment of those systems. All models of the environment that are produced are, of course, limited and only serve the sustainable development of the system. Following the analysis in the article the initially mentioned disequilibrium between social systems and their environment is normal. From the perspective of the system this is not a mal-adaptation, but rather the basis for continuous change and evolution.

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Understanding the time dimension in resource management[1]

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Abstract

Purpose: To present a concrete approach of understanding economic time and how acceleration might be controlled based on the application of operation logics of social systems.
Methodology: Following the reasoning of an indicator that reflects acceleration/deceleration in the economic system and based on the economy's operation logic, a correlation analysis has been undertaken where interest rate and inflation rate statistics from Sweden, Finland and Russia are combined with statistics of roundwood logging from the three countries.
Findings: Analysis shows that a confiding environment of the economic system is needed for the control measure to work. Furthermore, given that for complex systems control is limited, not only the question whether control is possible is important but also whether this possibility is probable.
Practical implications: Informs policy makers about the need to maintain a confiding and trustful environment for the economic system to maintain control possibilities.
Originality/value of the paper: The paper contributes to the research on the management of time and acceleration, the management of the economic system in general and the wider sustainable development discourse.

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1 Introduction

The relation of space and time and its apparent unhealthy separation as a result of modern economy has been the focus of many works in the sustainable development discussion. The present unsustainable relationship of space and time is considered to be the origin of the ecological crisis the planet is facing (Reisch, 2001; Hofmeister, 2002) and the perceived cause for this separation is the increasing speed particularly in economic activities (Adam, 1993). Speed is associated with profit calculation and the acceleration of consumption. Modern economy is characterised by a division of labour and resulting increases in productivity. As a consequence time becomes scarce and, hence, expensive. (Reisch, 2001; Adam, 1993) Materials, in turn, are rather cheap and can replace, for example, labour in order to increase productivity, or older products of the same function (Reisch, 2001). The ecological implication is clear: consuming more resources can be much cheaper as it safes time. Furthermore, speed is commonly tied to the use of energy. The faster one moves across space, the more energy does one require (Adam, 1993).

The rise of the industrial economy appears to have brought about the emergence of a common time standard, linear and homogenous clock time. In classical economic theory time is considered to be chronological time and is available as a resource for economic utilisation. (Held, 2001; Hofmeister, 2002) This has obvious implications for the perception of time as time can be considered a social construction (Tennberg, 2004). Chronological clock time has the function of controlling and common adjustment and resulted in increasing acceleration (Geißler, 2002). This has lead to a culture of temporal compression during the 20th century (Albert, 2002). At the same time the mechanisation of resource management, such as agriculture and forestry, through industrialisation has forced this culture of temporal compression upon natural ecological cycles (Geißler, 2002). What counts in natural resource management is the ratio of natural regeneration cycles and the harvesting cycles, which is tied to the economic logic of time compression.

The ratio of natural and cultural times appears also in the discussion of scale. Daly defined a good scale in the resource management as one that does not erode the capacity for regeneration (Daly, 1992). The idea of scale is based on the understanding that there is a temporal dimension associated with natural resources. This temporal dimension also incorporates the variation that is so common to natural phenomena as well as cycles. The time inherent in cycles constraints the possible consumption by humans. Depending on how large these regeneration cycles are we commonly differentiate between them by defining resources as renewable or non-renewable (on a human lifetime scale). (Jordan and Fortin, 2002)

In this respect modern society with its economic system is perceived as having produced a disruption in the natural fabric of time and space (Rosnay, 1975/1979; Jordan and Fortin, 2002). This has been a long process that did not come about quickly. The way and extent as to which energy and raw materials are transformed depends on a complex pattern of interactions among people and their environment. This pattern of interaction changed over the history of humankind. Initially, when humans lived as nomads, this lifestyle did not allow much of exploiting resources or maintaining reserve energy. Later, when tools and skills improved and with the development of agriculture, craft production and trade, humans had acquired wide control over natural space and were able to reserve significant amounts of reserve energy. With the rise of industries and the increasing consumption of natural resources and the production and utilisation of non-natural materials, humans produced growing amounts of waste. This was accompanied with money assuming a central position in the modern economy. Money is used on a large scale and changes human relationships with space and time, affecting work, consumption, and the accumulation of reserve capital. With the use of money on a large scale, two flows come into being: the flow of energy and the flow of money, each moving into opposite directions. Economic growth and further acceleration entail a growth in production and consumption. Production and consumption are also facilitated by the possibilities of accumulating monetary reserves for re-investment. Modern industrial economy is characterised by two flows, energy and money, which have greatly accelerated and affected an increasing area of the human existence. (Rosnay, 1975/1979) Present day society allows humans to control time and space in a comprehensive way unprecedented before (Geißler, 2002). Modern economic processes operate in more space and faster time than could be permitted given our knowledge on natural constraints imposed by ecosystems. Hence, it is suggested that more traditional forms of economic activities existed more in accordance with natural time and space relationships (Jordan and Fortin, 2002).

So, would a deceleration of economic action be a way to respond to this growing problem of increasing time compression? And how could this be achieved? The sustainability discussion has provided many insights into the prerequisites of ecologically, economically and socially compatible resource management regimes. Sustainable development is inherently a temporal process. Sustainable development, defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987), is inherently a temporal concept. It requires, for example, an enlarged scope of reasoning and planning since the concept aims to allocate resources to generations not born yet. This enlarged scope of reasoning applies of course also to forestry and other sectors concerned with the development of natural resources.

1.1 Time management as a collective problem

The paper uses systems theoretical concepts as its meta-theory to explain societal organisation. Thus, given that economy is understood as a social system – a collective – the paper's analytical viewpoint is to understand the dealing with time acceleration as a collective response. Hence, essentially any attempt to steer economic processes – investments – must be considered as a collective problem. Moreover, the problem is to be understood as one of governing time in the economy.

Accordingly, I assume that a deceleration – a slow down – in the economy would have positive effects for natural resource management. In this paper I will firstly provide a theoretical background to how time is generated – in general as well as in the economy – based on the social theory of Luhmann (1970, 1984, 1986, 1988). Secondly, I will present the framework for the analysis of temporal horizons in the economy, which is founded on Luhmann's thoughts as well as justified through a review of literature. Finally, the framework will be applied to forestry by using a case study of roundwood logging statistics from three Barents region countries, Sweden, Finland, and Russia.

2 System principles

2.1 Introduction

Society consists of communication between individuals, which means that society can only be understood in terms of messages that carry a meaning from individual to individual. Niklas Luhmann (Luhmann, 1984) has developed a social systems theoretical elaboration, where he combined certain cybernetic concepts with communication theory and evolutionary theory in order to explain social phenomena with a special view on the central paradigm of systems theory, the relation of a system to its environment. Thus, a basic theoretical concern is how a system distinguishes itself from its environment (Gershon, 2005). The distinction is the boundary of a system and the boundary is used by the system to regulate this distinction (i.e. difference). In this sense, social systems are not only adaptive but could not exist without their environment; they are structurally dependent on their environment. Producing and maintaining the distinction of a system to its environment is the basic constitutive act of a system. Therefore, boundary maintenance is system maintenance. (Luhmann, 1984, 35) An important consequence of this distinction in systems theory is that systems, in contrast to structures, are assumed to have boundaries. Thus, systems assume that there is a 'beyond' – an environment. The boundary is not only separating the system from its environment, it also connects it. (Luhmann, 1984, 52)

Luhmann calls such systems *autopoietic*, which means reproduction. The term has been borrowed from Maturana and Varela, who have coined this expression in biology to describe how systems utilise own (i.e. system internal) elements to maintain themselves (e.g. Maturana and Varela (1980)). Systems are, thus, the product of their own processes; they use their own tools and materials to reproduce themselves. (Luhmann, 1984, 60) Furthermore, systems use an own, internal logic of how they distinguish themselves from their environment and of what elements they utilise to maintain themselves. This logic is built on self-observation. This is nothing else but an application of a distinction. A system observes and thereby applies its own logic of distinction that separates the system from its environment. (Luhmann, 1984, 63) The logic is based on a binary code, which allows filtering stimuli from the environment in order to turn them into an order that is acceptable to the system. Thus the stimuli are turned into the type of communication, which the system understands and uses for its own reproduction. Codes are dependent on the type of medium that is used to communicate. Such media have emerged in evolution since they, due to generalisation, motivate and increase the probability of communication. These media are referred to as symbols because they use generalisations to symbolise the relationship of a communication-motivating symbol and systemic distinction. Examples are the media power for the political system (coded in power/opposition) and money for the economic system (coded in solvency/insolvency).

Important characteristics of social systems are their asymmetrical and circular nature (Luhmann, 1984, 10). Their condition of existence is asymmetrical because systems built up order on the basis of filtering information that they can understand and utilise. The majority of communication that is occurring in the system's environment is unordered from the perspective of the system. Thus, the basis of the system's existence is the reduction of the environment's complexity. A system is always less complex than its environment; an asymmetric condition. Furthermore, a system uses its own elements for its reproduction; it does not import these elements from its environment. Thus, its maintenance is dependent on 'circulating' these elements. Circulation can be easily explained by referring to the economic system where its medium money is circulating. In order to spend money, one has to earn it first, i.e. someone has to pay money to oneself. Solvency is turned into insolvency when paying, which can only be turned into solvency again when getting paid. When no one would spend money anymore the system would eventually 'run out' of the medium, thus the economy could not continue the circulation.

2.2 Complexity gradient

The asymmetric condition of the difference between system and environment is produced as a result of a lack of point-to-point connections between a system and its environment. The system is always a reduction of the complexity that is associated with the system's environment. Thus, the boundary of system and environment can be considered a complexity gradient. The gradient is the mechanism that generates a certain time identity within a system: given that there are no point-to-point connections, allowing all possible combinations of system elements in order to respond to environmental stimuli requires necessarily a transformation from simultaneousness to succession – not all combinations can be realised at once – and thereby generating a timeline.

In the course of evolution a system becomes differentiated internally in order to respond more efficiently and effectively to changes in the system's environment. The more differentiated a system becomes, the system's own time understanding will be increasingly diluted in comparison to its environmental chronology. System time becomes an important factor for the reduction in environmental contacts and influences very often the orientation towards technical preferences. This is probably the reason why in modern society we seek for acceleration and technology that 'saves' time (Luhmann, 1984, 253–256).

2.3 Connectivity

Due to the gradient systems become temporalised and consist of chains of events. System elements, i.e. a payment in the economy, can only be events due to existence of time. System structures have their primary connection to time in the function of providing the possibility to connect events to chains of action. Without this ability to connect events, structures would disappear with the last event. Due to the time link, every event has a unique identity. This uniqueness produces novelty in the system and insofar insecurity. However, this insecurity about the future structure of a system is in a way also necessity since it is the function of structure to ensure that operations can be continued autopoietically in the face of the infinite complexity of the environment (Luhmann, 1984, 390).

Thus, if events pass by, new events must connect to old ones; the problem of connectivity emerges. Connectivity is essential to the maintenance of a system. In the case of a social system, communication must be continuously motivated. Otherwise the system would disappear after the last event. Connectivity is also at the core of a system's timeline. Through a continuous connection of communication events to chains, the timeline can be continued indefinitely, providing an infinite future time horizon to the system. However, the success of creating a continuous event chain, forming the system structure, is dependent on expectations towards the future. Expectations are essentially created due to the reduction of the possibility range for the behaviour of the system. As elements exist in time only as communication events, there is no other ways to produce structures than through expectations. The consequence of this is that expectations are the form of time within which structures are built. The time horizon of a system appears as a result of expectations. As soon as we know what to expect, we can estimate from this point past and future (Luhmann, 1984, 398, 411–412, 419).

A way of increasing the expectations about the future is to allocate them to something, which is not chains of events themselves, hence, something that does not exist in time. We can establish identities to which we allocate expectations. Through this, expectations stay quasi identical, are basically fixed in time. In the economy these identities are, for example, markets and prices. In addition, the ability to learn allows increasing the space of security and, hence, provides an actor with a longer time horizon.

3 Economic time

3.1 Introduction

The introduction has already provided insight that the purpose of economy is and has been to gain and maintain command over space and time. Whereas for a long time in history of humankind the space dimension had utmost importance – space, i.e. territory, provided wealth; therefore space was conquered – it has only been since economy became fully monetarised that the time dimension has become more relevant. In fact, territory and direct access to natural resources does not matter anymore; what matters is access to monetary resources. This explains the so-called resource curse problem where some countries have difficulties to profit from their abundant natural resources.

Accordingly, the problem that the economy is concerned with is not simply the accumulation and distribution of resources. Rather, the function of modern economy lies in the deferral of present needs for the sake of satisfying future needs, while in any case assuring the satisfaction of present needs. If money is available for spending it is possible to save it for the future, thereby opening up a future time horizon. However, money must be scarce to retain its value for the future. Thus, the economy generates and regulates scarcity, thereby removing the problem of the future satisfaction of needs. (Luhmann, 1970, 206–207) (Luhmann, 1988, 64–65)

3.2 Generating time

Since a system utilises its own elements for its reproduction, the system can only be maintained by 'recycling' the elements. In the economy – as said – money must circulate continuously. Solvency is turned into insolvency when paying, which can only be turned into solvency again when getting paid. When no one would spend money anymore, the economy could not continue to exist, leaving the economy and society without a future. Thus, the organisation of solvency and insolvency cycles generates time (Luhmann, 1988, 147). This is the time that one would like to reduce (e.g. through the loan mechanism, bridging the time between spending and regeneration of spending ability), so as to have money available as often or as much as possible. Because payments allow further payments in a cycle, the continuation of the economy means an infinite future time horizon (Luhmann, 1988, 65).

Thus, money bridges time. It allows access to scarce resources in a relatively time-stable manner – only subject to inflation. Decisions about spending can be deferred – the basis requirement to maintain money for future spending. In fact, the time-stability of money is only possible if money is not always spent altogether right away, thereby keeping money available and scarce and valuable to other people. This is the reason why money is subject to a constant stimulation to be spend, for instance through advertising. (Luhmann, 1970, 214–215) (Luhmann, 1988, 253–254)

Due to the system elements being temporalised elements there is the problem of connectivity. As a consequence one has to expect a high security of spending opportunities for the future. This is achieved through arbitrariness – there is no particular spending purpose associated with money. This high security is, however, offset by a high insecurity for all others who do not know what the owner's money is going to be spent on. This combination of security and insecurity generates a complex economic system, which is characterised by chronic instability. (Luhmann, 1988, 20–21) It is, therefore, highly dynamic – connectivity or the problem of continuity is a permanent issue.

3.3 Prices

Prices provide information about payments, which are events and, therefore, time-fixed. Unlike money, which can bridge time, payments have no duration. They constitute the actual system elements, which have to be reproduced in order to maintain the economy. Payments are associated with a certain point in time because it is important to know who has certain payment possibilities at particular points in time available to him or her. (Luhmann, 1988, 20–21) Knowing the possible behaviour of others is a basic requirement for social interaction – when thinking of double contingency – and reduces uncertainties.

Prices themselves represent in fact the programming of the economic system (Luhmann, 1986, 104). Prices are the guidance for people when deciding where and how much of their freedom of choice they should exchange. If prices are high one might decide not to buy or to simply pay more than anticipated. If prices are low one might just decide to buy more than originally planned. Generally, it seems that higher prices reduce consumption of resources. In theoretical terms this means that if one has to give away larger parts of one's freedom of choice one is probably more reluctant to do so as it reduces further possibilities to exchange this freedom. Although, the advantage is that this also reduces complexity and makes life simpler, but not necessarily easier. In any case, reducing one's freedom of choice is the same as reducing one's ability to pay money for goods. Therefore, the effect of reducing this, i.e. less consumption of resources, strongly depends on one's ability to regenerate income. Regenerating income is, of course, connected to exchanging one's ability to work on a labour market against the freedom to choose goods and services to buy.

As a result modern economy requires a formation of capital, which can then subsequently be used for future spending. Capital formation maintains the ability to pay in the future – based on budgeting – and thereby defines a specific time horizon for organisations in the economy, i.e. enterprises and households. The budget reflects the future expectations and possibilities on the basis of incomes and expenses. (Luhmann, 1970, 211–212) (Luhmann, 1988, 307) Therefore, one tends to buy cheap – low priced – in order to broaden the budget so as to increase the future time horizon. This is surely not universally the case, but can be observed on a large scale, for example economic globalisation is the direct outcome, where investment opportunities with a high return – extending the budget – are sought and production capacities are transferred to countries with low production costs. Thus, it appears that there is a tendency to seek out spending – investment – opportunities that are characterised by a short amortisation time. Amortisation time reflects the period between insolvency due to a spending and the point in time in which solvency is regenerated. A continuous attempt to reduce this amortisation time is the cause for the perceived acceleration in modern economy. Prices, therefore, affect the amortisation period and, hence, the dynamics of acceleration.

Here one can suspect that – given that lower and lower prices reflect an acceleration – higher prices, particularly more expensive money (through loans), possibly enlarges the amortisation period of an investment. Moreover, one conclusion is possible: acceleration through enforcing short amortisation periods goes hand-in-hand with a long-term economic time horizon through budgeting.

4 Formula for analysis

Although it can be said that there are four basic markets in the economy (Luhmann, 1970, 220): a market for procurement of all the material resources needed for the production process, a market for labour, a market to sell the company's produced goods or services, and further a market for financial capital, I will concentrate in this analysis on the latter one. This is justified due to the economy consisting of the totality of payment/investment operations. Therefore, the financial market reflects directly any interference on money. It will show most adequately how interference – management or governance – can affect the amortisation period of investments and the dynamics of acceleration.

Based on Luhmann's theoretical descriptions on time and the temporal consequences of economic action I propose the following framework for understanding and analysing time in the economy. From the theoretical elaborations of Luhmann's theory of social systems it is clear that any interference – any governance effort – must necessarily utilise the economy's code of operation. How does the economy distinguish itself from its environment? Through monetary operations – payments. Therefore, no other attempt to influence the money cycle will work.

Governance – as explained in the introduction – is in system theoretical terms first and foremost *self*-steering. This is due to social systems being self-organising and organisationally autonomous. Thus, any attempt to simply interfere from outside the economic system – say, through politics – conflicts fundamentally with the self-organising principles and the resulting limited capacity of politics to govern other parts of society than its own system. If aiming to influence a system outside politics, politics must take into account the other system's way of distinction, the way of how that system differentiates itself from its environment.

In the case of the economy, the difference is, as has been introduced before, the difference between liquidity and illiquidity or solvency and insolvency. Any effort to establish a political programme that ought to affect the economy must be based on this difference. Governance in this case means to reduce that particular difference. Reducing the difference is essentially what activates a system. In the economy, all economic activity aims to balance liquidity with illiquidity. This principle has to be utilised by politics. It is in fact the only way to govern. Thus, a difference expressed in a money amount and established in a political programme can affect how profitable an investment is. For example, an ecological programme – aiming at decelerating natural resource consumption – might introduce a tax on a raw material, thus, increasing the price and reducing the profit. Consuming more will be a less profitable activity. Though, it is not possible to reduce the difference to zero. The difference will always be there, it can only be minimised; in the case of complete reduction, the logic according to which the economic system distinguishes itself from its environment would be removed, leading to a destruction of the system. (Luhmann, 1988)

Accordingly, the model uses economy level – meaning currency area – data. The model does not take into account industry or enterprise level data. The objective of such an analysis is not to give an answer as to how long exactly a certain time horizon is, such as the future time horizon of a forestry enterprise. Rather, the formula aims to give an answer to what condition should prevail in order for economic organisations to undertake investments with a longer term amortisation period as opposed to a shorter term period. As said, reducing this amortisation period is the cause for the perceived acceleration in modern economy.

Condition for a longer amortisation period of investments (as opposed to a shorter period):

Capital market: Real interest rate $\geqq 0$

The above formula reflects the condition of the market for financial capital. The real interest rate incorporates the nominal interest rate set by central banks and the inflation rate, i.e. nominal interest rate minus inflation rate equals real interest rate. This real interest rate should not be negative, rather positive. A negative real interest rate would imply a high inflation rate and a nominal interest rate too low. The consequence of this constellation would be cheap loans and a desire to spend the capital in one's possession. In fact, it would not make sense to save – to accumulate any capital – as the savings would loose their value over time. A negative real interest rate supports the desire to get a loan for immediate investments since it can be expected to pay the loan back within a short time span. This is due to the loan loosing its value over time as well. The lower the real interest rate, the higher can be the investments due to the costs for them being lower. (Hyman, 1989, 643) A positive real interest rate, however, implies a lower inflation rate and a higher nominal interest rate. A positive real interest rate makes taking a loan more expensive. If a company takes a loan for a larger investment purpose it has to consider to discount the costs for taking the loan over a longer time span in case of a positive real interest rate.

Therefore, I propose the real interest rate as a measure reflecting the time for amortising investments. Of course, a consequence of high priced loans could be that investors transfer to currency areas with low priced loans and/or high returns. This is, after all, what economic globalisation is all about. However, emphasis must be on 'could be', not on 'will be'. The formula and this paper do not aim to speculate – to predict – on investments, they merely aim to provide an understanding of time in resource management.

4.1 Further reasoning for formula

As said, under certain conditions, i.e. a negative real interest rate, it is possible to amortise investments fast. Independent on what money is invested on (e.g. raw materials, office equipment, labour, money), the consequence will be that, within a given time unit, more resources can be consumed. Relative to other conditions, i.e. a positive real interest rate, this has to be seen as a compression of time – acceleration. It follows that a stretching of time – deceleration – has positive effects for resource management since resources consumption will be amortised over a longer time period. This is illustrated by the figures in table 1.

4.2 What about connectivity?

Generally, a low real interest rate is only desirable from a short-term perspective, for example to reflate an economy during an economic slowdown. A central bank allowing itself to reduce the price of money follows an expansive monetary policy. Problems of long-term nature, however, require a monetary policy orientation focusing on long-term development (Betz, 2001, 1). On the opposite site, an expansive monetary policy is characterised through a real interest rate, enforced by the central bank, which falls behind the balancing requirements of the financial market (Betz, 2001, 11). One consequence of a higher inflation rate is the loss of purchase power of a currency. In other words, the currency looses its value. Evidence suggests, however, that a stable currency attracts more investments with the result that, over the long-term, the economy with a stable currency increases its wealth (Betz, 2001, 18). Also, even so a lower real interest rate with a corresponding higher inflation rate is meant to be expansive only in the short-term, it has long-term consequences. It is suggested that the experience with inflation contributes to future expectations of inflation for about one decade (Anderson, 1999, 5) and that the history of inflation of a state contribute with other factors to long-term real interest rates (Orr et al., 1995, 97). This, however, is the opposite of the conditions considered to be better, conditions aiming at the long-term discounting of borrowed money.

Supportive of the argument that low inflation rates and interest rates that take account of the requirements of financial markets are better suited for long-term planning is the opinion that infla-

Year	Interest rate	Capital + Interests	Inflation rate	Capital + Inflation	Real interest	Capital value (%)	Amortisation period (days)
Sweden							
2002	3.75	1037.5	2	1020	1.75	101.72	371.26
1992	11	1110	1.3	1013	9.7	109.58	399.95
Finland							
2002	2.75	1027.5	2	1020	0.75	100.74	367.68
1992	10.51	1105.1	3.3	1033	7.21	105.98	390.48
Russia							
2002	21	1210	15.8	1158	5.2	104.49	$\frac{1210*365}{1158} = 381.39$
1992	80	1800	1526	16260	-1446	11.07	40.41
Investment		1000		1000			

Table 1: Amortisation period in days under different interest and inflation rates
Capital + Interests: amount to be paid back after one year; Capital + Inflation: amount needed to buy the same number of goods as with the invested amount of money a year earlier; Capital value: value of the invested capital in % needed to pay back the loan after one year; Amortisation period in days: relative number of days needed for amortisation of the investment against the value loss of the capital due to inflation, Source for interest and inflation rates: see appendix
The figures under 'Amortisation period in days' are relative numbers with respect to an investment period of 365 days. The figures show the days needed for amortisation of the 'Capital + Interests' against the value loss of the capital due to the inflation. All other factors being equal – ceteris paribus – a positive real interest rate requires a longer time period to amortise loans than a negative real interest rate.

tion firstly distorts the allocation of investments in a company and secondly reduces the real value of accumulated capital (Smith and van Egteren, 2005, 1284). Generally three competing uses exist for companies to allocate their funds to: dividends, current investment, and capital accumulation (Smith and van Egteren, 2005, 1283). Obviously the accumulation of internal funds would be most positive for a long-term investment time horizon in a company. However, as internal funds' value is eroded by the inflation, the dependence of a company to outside funds increases the higher the inflation rate. And these distortions are even true for anticipated inflation (Lintner, 1975, 265). According to Smith and van Egteren, both anticipated and unanticipated inflation act as a tax to the real value of accumulated capital in companies and, as a consequence, increases companies' reliance on external financing, i.e. on financial markets. Inflation furthermore increases friction in financial markets and reduces actual investment. Of course, as discussed, inflation does also distort the incentive to actually start accumulating internal capital (Smith and van Egteren, 2005, 1294, 1298).

Gilchrist and Himmelberg show that the dependence of investments to cash flow is highly correlative. The correlation generally exhibits in models of capital market imperfections (Gilchrist and Himmelberg, 1995, 542). One reason for the correlation is that some firms are more dependent on internal funds due to credit rationing. Shocks to companies' earnings, for instance through high inflation, affect the future terms of credit for companies. This makes obtaining funds for investment more costly. If however, a company is unable to obtain funds at any price, internal cash flow becomes more important for current investment (Gilchrist and Himmelberg, 1995, 543). Hence, dependence of companies to internal cash flow is largely based on the degree of their access to markets for financial capital (Gilchrist and Himmelberg, 1995, 564). In turn, Gilchrist and Himmelberg find no excessive dependence of companies' cash flow for investment purposes when companies have easy access to publicly traded debt, such as issuing of shares (Gilchrist and Himmelberg, 1995, 566). Consequentially, under conditions of high inflation, companies, which are more dependent on internal cash flow have to deal with investment problems as their internal funds loose their value. On the other hand, in case of a high nominal interest rate, i.e. a positive real interest rate, the willingness to invest decreases (Lindström, 1998, 5). This is clear as it corresponds to the idea discussed above that a positive real interest rate provides an incentive to accumulate capital and not to invest it. While investments are nevertheless necessary (to ensure connectivity) this literature suggests that under conditions exhibiting a negative real interest rate, it is easier for larger and more established companies to undertake investments because they face less constraints regarding the access to the capital market. Smaller businesses, however, will face more problems under those conditions. I argue, therefore, that a positive real interest rate is not only better for the future time horizon of an economic actor, as investments have to be discounted over a longer time span, but also for the economic sustainability of smaller companies in an industry, as they can count on increasing their internal funds over time and then investing it.

5 Case analysis and discussion

The formula will be applied to forestry case study by using roundwood logging statistics from three Barents region countries: Sweden, Finland, and Russia. Forestry in the Barents region has been and still is of substantial importance. As a major industry it has declined in relative importance in the region since the end of the Second World War. However, the forest sector is still considered a cornerstone in the localities as well as the national economies of the Barents region. (Layton, 1999) Policy initiatives, such as the forest sector programme issued by the Barents Euro-Arctic Council's Forest Sector Task Force, emphasise major fields of development in the forest sector. Besides mere cooperation, investment and the conditions for investments will get special attention within forestry. (Barents Euro-Arctic Council, 2001) This is particularly important as unstable

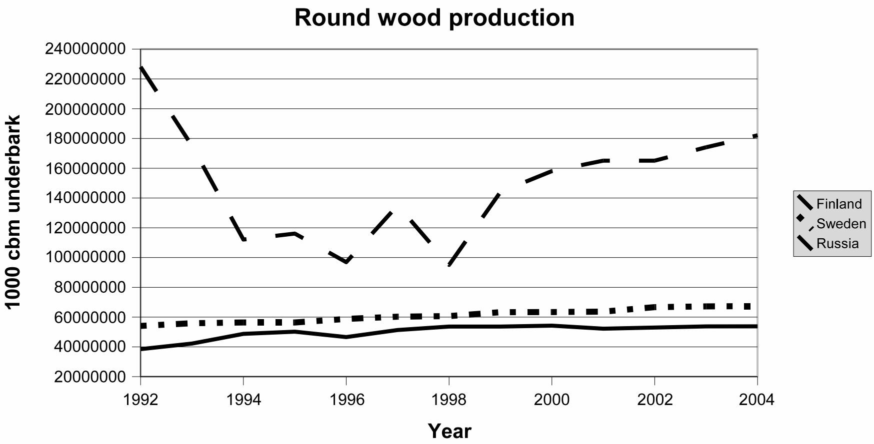

Figure 1: Roundwood production: Finland, Sweden, Russia, 1992 - 2004
Data source: Food and Agricultural Organisation of the United Nations (2005), see table 2

institutions in the Russian part of the Barents region have deterred investors from becoming active in the forest sector (Barents Euro-Arctic Council, 2001). Given the policy intentions, it is important to understand the possible ecological effects of investments – a task that I aim to support with this case study through considering the temporal properties of investments.

Figure 1 (see table 2 for the data) shows the production of roundwood for Finland, Sweden, and Russia for the years 1992 to 2004. While Finland and Sweden have experienced a slight increase over this period, Russia's roundwood production has fallen significantly, while stabilising somewhat during the mid 1990's and rising again – albeit on a smaller level than at Soviet times – to a threshold one-and-a-half times higher than the combined production of Finland

Year	Finland	Sweden	Russia
1992	38482000	54000000	228000000
1993	42244000	55830016	175000000
1994	48745000	56300000	112000000
1995	50219000	56300000	116000000
1996	46597000	58700000	96814000
1997	51329000	60200000	135000000
1998	53659979	60600000	95000000
1999	53637000	63200000	144000000
2000	54261855	63300000	158000000
2001	52210000	63600000	165000000
2002	53011000	66600000	165000000
2003	53779000	67100000	174000000
2004	53799662	67300000	182000000

Table 2: Roundwood production cbm (under bark): Finland, Sweden, Russia, 1992 - 2004
Source: Food and Agricultural Organisation of the United Nations (2005)

and Sweden.

The situation on the financial markets (see table 3) was analysed by obtaining central bank interest rates and inflation rates of consumer prices for Sweden, Finland, and Russia (1992 – 2004). As stated, real interests show the difference between interest and inflation rates. Exploring the development during the 1990's until 2004, Sweden and Finland exhibit a decreasing real interest rate. In contrast, the data from Russia shows a positive trend over the same period, away from a highly negative real interest rate beginning of 1990's towards a positive rate up to present day.

Causes for the varying situations with regard to the real interest rate are changes in monetary policy. Central banks have to govern the value of their currency by adjusting the interest rate appropriately during economic boom or recession periods, which drive the development of consumer price increases. After the breakdown of the Bretton Woods system that had ensured fixed exchange rates between the most important currencies of the Western sphere beginning of 1970's, both the Finnish Markka and the Swedish Krona were fixed against other, stronger currencies. A worldwide recession during the 1970's resulted in expansionistic fiscal policies causing high inflation. The commitment to a fixed exchange rate did not allow responding appropriately to the rising inflation, causing a negative real interest rate. After having overcome this recession, the capital markets of Sweden and Finland were deregulated during the 1980's. The liberalisation of capital flows led to rising inflation once again, at which end a recession awaited both countries. The large pressure on the value of the Markka and Krona eventually forced both currencies out of the fixed exchange rate system in 1992. New guidelines for monetary policy were developed, i.e. keeping the inflation rate at about two percent. (Pikkarainen et al., 1997, 28–42); (Gottfries, 2002)[2]

[2] A currency is depreciated when the currency supply increases. To keep a currency in a fixed exchange rate system, interests need to rise so as to reduce the supply of that currency in order to keep the exchange rate on the predetermined value. However, if this operation fails, e.g. to prevent import costs from becoming

Year	FI-Infl.	SWE-Infl.	RUS-Infl.	FI-Int.	SWE-Int.	RUS-Int.	FI-Real	SWE-Real	RUS-Real
1992	3.3	1.3	1526	10.51	11	80	7.21	9.7	–1446
1993	3.3	4.8	875	6.18	*	210	2.88	–4.8	–665
1994	1.6	2.9	311.4	5.55	7.6	180	3.95	4.7	–131.4
1995	0.4	2.7	197.7	4.25	8.91	160	3.85	6.21	–37.7
1996	1.1	0.8	39.2	3	4.1	48	1.9	3.3	8.8
1997	1.2	1.8	0	3.25	4.35	28	2.05	2.55	28
1998	1.4	1	16	3	3.4	60	1.6	2.4	44
1999	1.3	0.6	85.4	3	3.25	55	1.7	2.65	–30.4
2000	3	1.3	20.8	4.75	4	25	1.75	2.7	4.2
2001	2.7	2.7	21.4	3.25	3.75	25	0.55	1.05	3.6
2002	2	2	15.8	2.75	3.75	21	0.75	1.75	5.2
2003	2.3	2.3	13.7	2	3	16	–0.3	0.7	2.3
2004	0.1	1	10.9	2	2	13	1.9	1	2.1

Table 3: Inflation, Interests, Real interests: Finland, Sweden, Russia, 1992 - 2004
Sources: Eurostat (2005); Bank of Sweden (2005); European Central Bank (2005); Central Bank of the Russian Federation (2005); Deutsche Bank Research (2005)
* Value missing in the data material)

The highly negative real interest rate in Russia at the beginning of the 1990's is the direct consequence of the breakdown of the Soviet type planned economy. In 1992, price fixes for goods and services were essentially removed and the inflation started soaring. Money plays only a passive role in centrally planned economies because all decisions about production and consumption have been planned in advance. In market economies the role of money becomes central; it becomes vital in securing needs. (Kim and Pirttilä, 2004, 297) Beginning of 1990's, the supply of goods could not satisfy the demand. However, monetary means were available since already in Soviet times people were not able to spend all their income, but could save some of it. Rising prices demand more money, which will often be made available through issuing of money through central banks. When comparing the central bank rate with the inflation rate, it becomes apparent that the highly negative real interest rate between 1991 and 1995 was an invitation to borrow money in order to increase the amount of money in circulation. (Issing, 1993)

Russia was forced to devalue the rouble after the 1998 economic crisis in Asia that affected the world economy, including Russia, very severely. The steady stabilisation, however, continued. (Kim and Pirttilä, 2004, 300) This resulted in a positive real interest rate since 2000. Given all other factors being equal (ceteris paribus) these preliminary results indicate that the premises for sustainable forestry investment have worsened since the beginning of 1990's in Sweden and Finland, but have improved since then in Russia.

Looking at the results of the correlation analysis in figure 2 and table 4, the Finnish case exhibits a fairly clear negative correlation between the height of the real interest rate and the removal of roundwood in Finland – the exact figure is –0.793 where –1 represents a perfect negative correlation. This indicates that the higher the real interest rate was, the lower the quantity of roundwood removals were.

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too high, a currency might be forced to leave the fixed exchange rate system and to float freely on the currency market. Likely consequence will be devaluation and the currency needs to regain strength on its own, usually by allowing the central bank to focus on price stability.

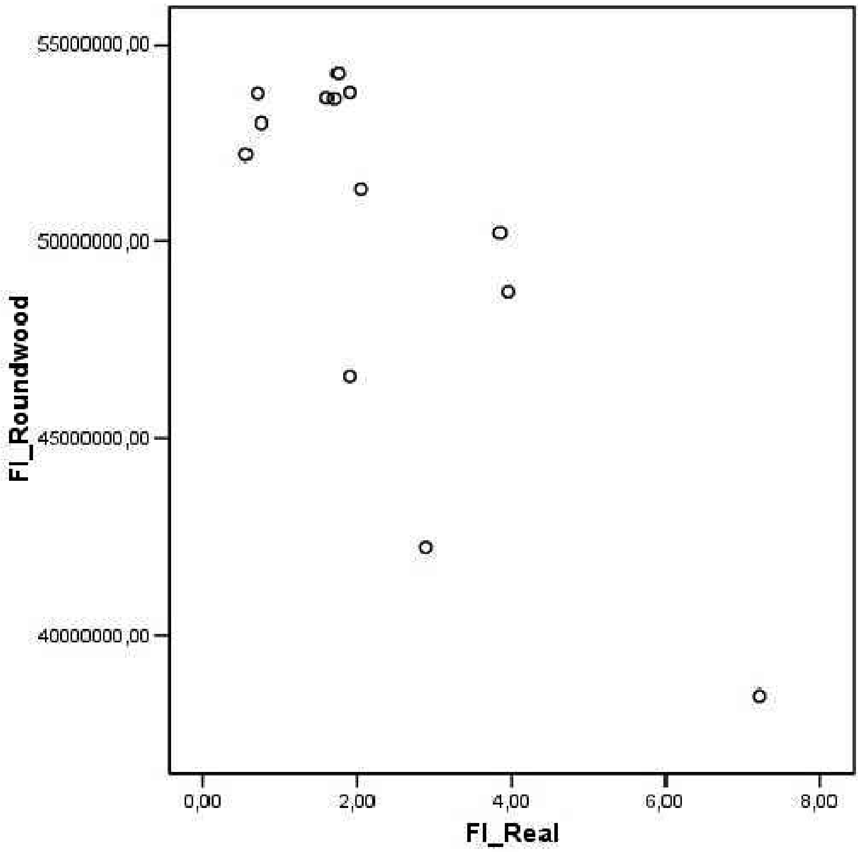

Figure 2: Roundwood – real interest rate correlation: Finland

Correlations

		FI_Roundwood	FI_Inflation	FI_Interests	FI_Real
FI_Roundwood	Pearson Correlation	1	-,501	-,848**	-,793**
	Sig. (2-tailed)		,081	,000	,001
	N	13	13	13	13
FI_Inflation	Pearson Correlation	-,501	1	,652*	,253
	Sig. (2-tailed)	,081		,016	,405
	N	13	13	13	13
FI_Interests	Pearson Correlation	-,848**	,652*	1	,898**
	Sig. (2-tailed)	,000	,016		,000
	N	13	13	13	13
FI_Real	Pearson Correlation	-,793**	,253	,898**	1
	Sig. (2-tailed)	,001	,405	,000	
	N	13	13	13	13

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlation analysis: Finland

Even stronger is the negative correlation between Finland's interest rate and roundwood – –0.848 – indicating the desire to keep activities low when money is more valuable.

The Swedish case in figure 3 and table 5 shows an even clearer negative correlation between roundwood loggings and real interest rate in the Swedish currency area, which is –0.818. As on the Finnish side, this reflects a slow down of investments, mirrored in reduced roundwood removals, under conditions of high real interests. Similarly, as in Finland, the Swedish roundwood logging activities decrease, the higher the nominal interest rate is. Not unexpectedly, in both countries the negative correlation between the inflation rates and roundwood loggings is lower than in the case of the nominal and real interest rates. This is somewhat clear as a high inflation rate reduces the incentive to accumulate capital and rather invest it. But due to the existence of interest rates, the correlation between inflation and roundwood removal is not positive, as indicated by the relationship between inflation and nominal interest rates, which is in both countries positive (0.652 in Finland; 0.422 in Sweden, where 1 represents a perfect positive correlation).

The Russian case in figure 4 and table 6 appears less clear due to the high inflation rates at the beginning of the 1990's. Although analysing the data at hand there is a negative correlation between real interest rate and roundwood loggings (–0.648), there is a very low negative correlation – tending towards zero – between interest rate and roundwood removals (–0.175). In turn there is a positive correlation between the roundwood figures and the inflation rate (0.58). This is clear as – when looking at table 4 – the nominal interest rate has never been sufficient to lower the inflation rate. Therefore, roundwood removal had to continue even under inflation. The analysis also indicates that the Central Bank of Russia attempted to follow the inflation rate – reflected by the positive correlation between nominal interest and inflation rate – but never managed to control it.

For further understanding I have removed the two outliers, clearly visible in figure 4. The result – to be seen in figure 5 and table 7 –

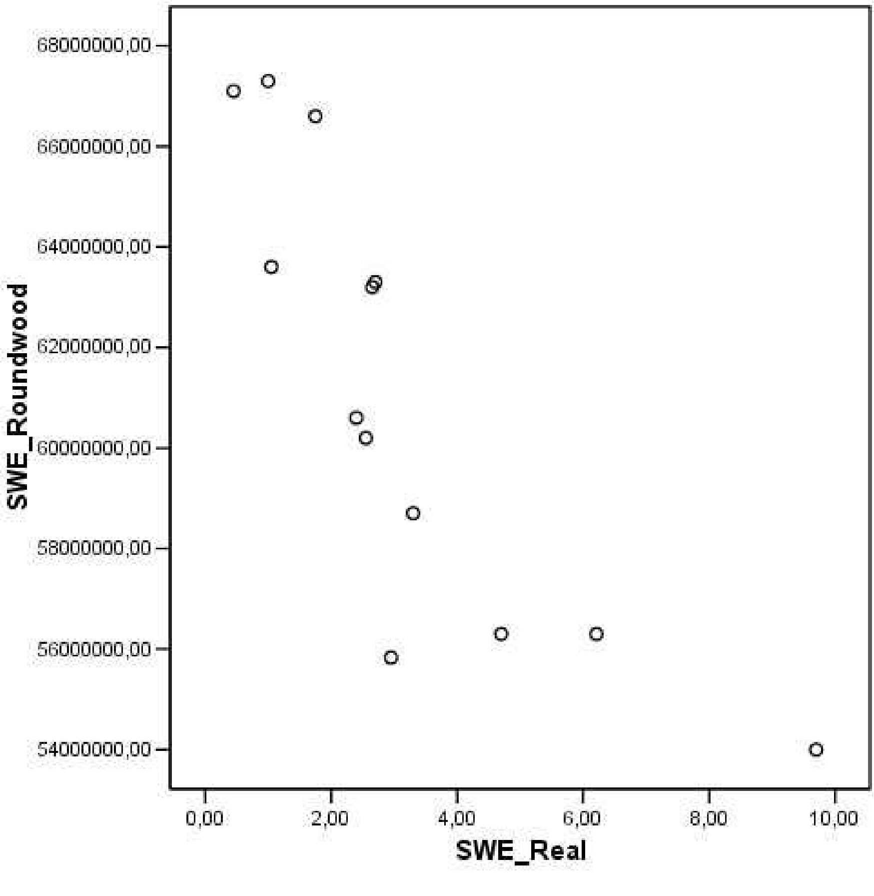

Figure 3: Roundwood – real interest rate correlation: Sweden

Correlations

		SWE_Roundwood	SWE_Inflation	SWE_Interests	SWE_Real
SWE_Roundwood	Pearson Correlation	1	-,332	-,880**	-,816**
	Sig. (2-tailed)		,268	,000	,001
	N	13	13	13	13
SWE_Inflation	Pearson Correlation	-,332	1	,422	,000
	Sig. (2-tailed)	,268		,151	1,000
	N	13	13	13	13
SWE_Interests	Pearson Correlation	-,880**	,422	1	,907**
	Sig. (2-tailed)	,000	,151		,000
	N	13	13	13	13
SWE_Real	Pearson Correlation	-,816**	,000	,907**	1
	Sig. (2-tailed)	,001	1,000	,000	
	N	13	13	13	13

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Correlation analysis: Sweden

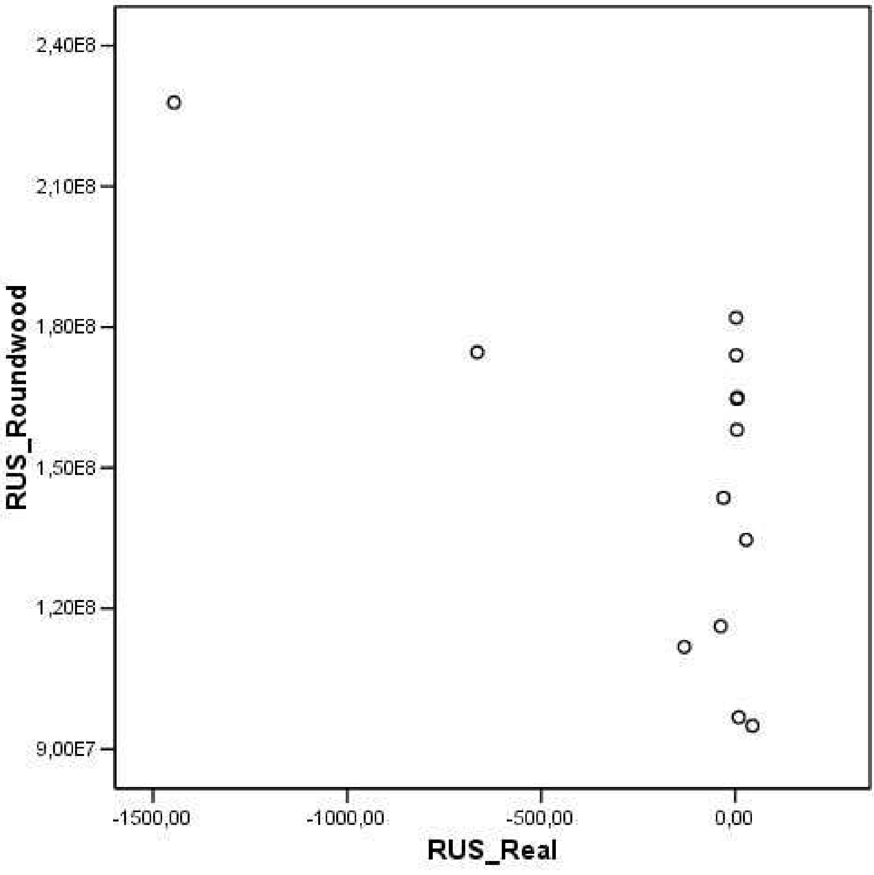

Figure 4: Roundwood – real interest rate correlation: Russia

Correlations

		RUS_ Roundwood	RUS_Inflation	RUS_ Interests	RUS_Real
RUS_Roundwood	Pearson Correlation	1	,580*	-,175	-,648*
	Sig. (2-tailed)		,038	,568	,017
	N	13	13	13	13
RUS_Inflation	Pearson Correlation	,580*	1	,489	-,990**
	Sig. (2-tailed)	,038		,090	,000
	N	13	13	13	13
RUS_Interests	Pearson Correlation	-,175	,489	1	-,363
	Sig. (2-tailed)	,568	,090		,223
	N	13	13	13	13
RUS_Real	Pearson Correlation	-,648*	-,990**	-,363	1
	Sig. (2-tailed)	,017	,000	,223	
	N	13	13	13	13

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlation analysis: Russia

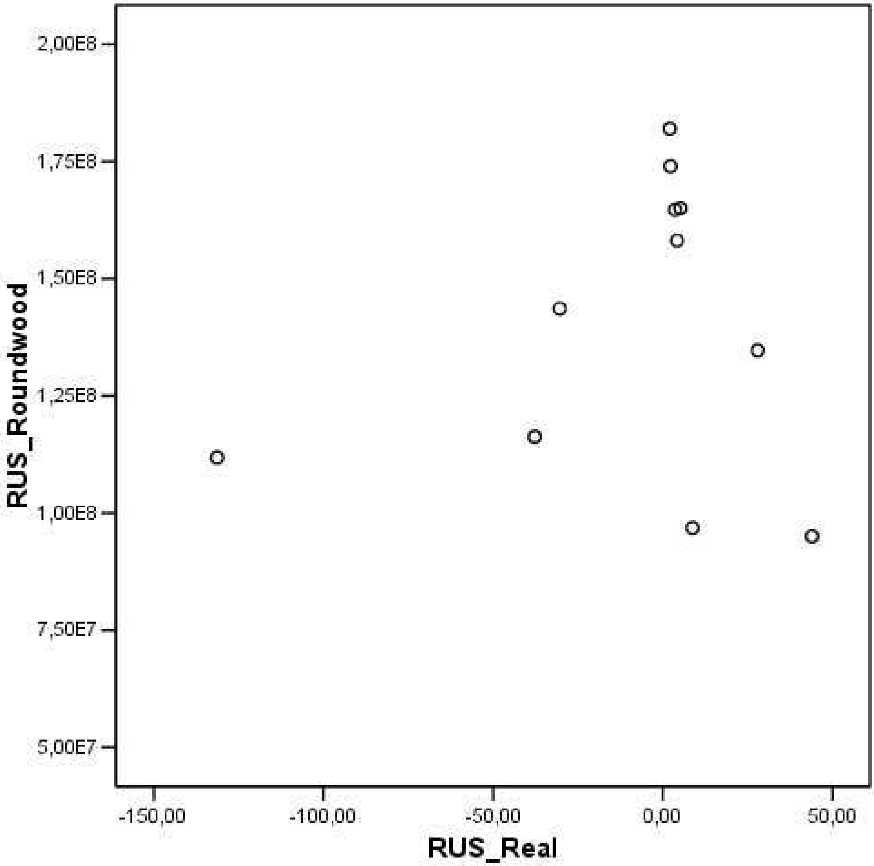

Figure 5: Roundwood – real interest rate correlation: Russia (without outliers)

Correlations

		RUS_ Roundwood	RUS_Inflation	RUS_ Interests	RUS_Real
RUS_Roundwood	Pearson Correlation	1	-,436	-,606*	,170
	Sig. (2-tailed)		,180	,047	,618
	N	11	11	11	11
RUS_Inflation	Pearson Correlation	-,436	1	,958**	-,934**
	Sig. (2-tailed)	,180		,000	,000
	N	11	11	11	11
RUS_Interests	Pearson Correlation	-,608*	,958**	1	-,792**
	Sig. (2-tailed)	,047	,000		,004
	N	11	11	11	11
RUS_Real	Pearson Correlation	,170	-,934**	-,792**	1
	Sig. (2-tailed)	,618	,000	,004	
	N	11	11	11	11

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7: Correlation analysis: Russia (without outliers)

is a very small positive correlation between roundwood loggings and real interest rate – 0.17, showing that the real interest rate is almost irrelevant. On the other hand, there is a higher negative correlation between interest rate and roundwood figures (–0.608) – appearing normal in comparison to Sweden and Finland, where similar correlations prevail. This is due to the interest rate decreasing after a period of very high interest rates, just at a time when roundwood removals increased as well, after leaving a several-year trough. Similarly, the negative correlation of inflation rate to roundwood (–0,436) is in the range of the Swedish and Finnish cases. The relationships of inflation to real interests and nominal interests to real interests are, in comparison, completely reversed. Whereas in Finland and Sweden inflation rates have no or almost no relationship to real interests and interest rates show an almost perfect positive correlation (the higher the nominal interest rates, the higher the real interests), the Russian side shows both negative correlations between inflation and real interests (–0.934) and nominal interests and real interests (–0.792). The figures indicate a lack of control of inflation rate through interest rate. Thus, the higher the interest rate, the lower is the real interest rate; same goes for the inflation rate. Consequentially, real interests have no correlation and cannot be used as an indicator for analysing acceleration vs. deceleration in Russia. In contrast, in Finland and Sweden the real interest appears to be a much more suitable indicator for acceleration vs. deceleration of resource extraction.

6 Conclusion

There are different forms of rationality existing in society. The economy will react to stimuli from its environment using the code the system uses to differentiate itself, i.e. payment/non-payment. This operational closure ensures that only information, which is relevant to the economy's code, is dealt with. This behaviour should be called rational systems behaviour because any other behaviour would destroy the economy's identity. Any other system applies a different code to achieve rationality. Thus, managing an acceleration of resource extraction – having in mind that a slow down would extract less – must necessarily be geared towards the language that the economy talks: money.

Structure and time are closely related. Any communication will generate structure and, therefore, expectations. Thanks to the monetary mechanism the future becomes a horizon within which a range of possibilities are pre-selected. The formerly indeterminable complexity of the future becomes transferred into a relatively determinable complexity. Future becomes contingent and the outcome of decision-making in the present. Contingency gives us many possibilities but forces us to select. This force requires us to ensure a regular capital supply for disposition. Consequence is the desire to decrease the time between investment and capital regeneration.

The main idea conveyed in this article was that investments have to be discounted over a longer time period. Generally, this objective stands in firm opposition to the structural desire of renewing one's ability to invest as fast as possible. The analysis framework provides interesting insights into the possibilities of governance of natural resources. Clearly, many if not all investment decisions depend on the costs of investment. These costs are determined to a significant extent by the ability of central banks to steer inflation and, as a consequence, to set an adequate nominal interest rate that charges appropriately for borrowed money. The preceding descriptions have shown that this could make all the difference.

The statistical analysis showed that the correlations as expected do not come automatically. Even when focusing on processes internal to the economic system, other subsystems of society are required to ensure the economy's continuation – to ensure connectivity. Hence, it appears that a somewhat 'mature' economic environment is needed to make the resource management objective work. Moreover, the analysis provided some evidence that investments are about risk reduction, rather than mere profit making. The relation of inflation to interest rate at the beginning of the 1990's in Russia was so extreme that a massive profit could have been made out of borrowing money.

That this was not reflected in the logging statistics indicates that the risk of doing so was far too high.

What is, furthermore, interesting to note is that the long time horizon available for planning and disposition in the economy – and for society as a whole – is bought with a reduction of the amortisation period of singular investments. This appears like a paradox: long term secure expectations exist because of short-term thinking, leading to acceleration. This short-term thinking does not take into account the possible depletion of resources from a system's environment. This simply cannot be taken into account – perhaps by an individual – but certainly not by a collective dynamic, which the general time reduction phenomenon in the economy represents. The economy does not understand a logic beyond its borders. It only understands its own.

It appears that a lot of pressure stemming from environmental policy can be acceptable to people if there is only sufficient trust. It is very well possible to make money expensive – fulfil the environmental policy goal – in order to generate longer amortisation periods. The question, however, is what is to be done if keeping money low-priced is a requirement to maintain trust – in other words, if a low interference into monetary affairs is necessary to have the highest possible trust level. This is where the issue of connectivity becomes important. The correlation between real interest rates and roundwood loggings in Russia confirm that system maintenance – meaning, to permit connectivity – is of high priority. The system of money circulation is to be maintained through trust into the currency. Without trust, resource management through economic policy is not possible.

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Chapter 3
The Task of Macroeconomic Policy in Generating Trust in Russia's Development

Stefan Walter

Introduction

The overall performance of the Russian economy has been striking and is now in its eighth year of expansion. Russian Gross Domestic Product (GDP) grew by about seven per cent per annum during the period 1999–2006 (BOFIT 2007). This is much more than could have conceivably been expected after the strong contraction of the Russian economy in the 1990s and the 1998 crisis. The economy was driven particularly by growth in industrial production and export volumes. Natural resource extraction especially has contributed to this trend – around 70 per cent of the industrial growth between 2001 and 2004, with the oil sector accounting for 45 per cent. Oil is also the most important export commodity and thus mainly responsible for the growth in export volumes (Ahrend 2006).

Russian exports will remain large in the foreseeable future, as the main export commodity is oil. The favourable oil market price has resulted in a strong surplus in Russia's current account; a large surplus has been the norm since 2000. Governmental spending was cut around the same time. A stabilization fund has been put into place that receives a large part of the surplus from windfall revenues and ought to assist in coping with economic shocks. At the end of 2005, this fund was calculated at about 50 billion US dollars. The recent success of the Russian economy is estimated to be 50 per cent due to the development in the price of oil and 50 per cent to responsible economic policy, price competitiveness generated by the rouble depreciation after the 1998 currency crisis, institutional changes and a general recovery from the economic trough of the 1990s (Sutela 2005).

In contrast to other industrial sectors, the forest industry is less dependent on oil and gas. The industry is organized as a cluster that includes harvesting, mechanical wood processing and the pulp-and-paper industries. The forest cluster as a whole is one of the largest industries in Northwest Russia, producing approximately 15 per cent of the total industrial output in recent years. Moreover, the cluster is more developed than in other Russian regions; one advantage is its proximity to the European market (Dudarev et al. 2004).

The forest cluster has somewhat suffered from a lack of investment. Consequently, its range of high value-added products is modest compared with that of the world leaders in forestry. There is great potential for growth in the Russian forest cluster, but this is very much dependent on a growing domestic economy, which ought to provide the financial capabilities for an upgrade of the product range. In any case, so far the forest cluster has been dependent predominantly on exports made up mostly of low value-added products, such as roundwood, sawn timber, and paperboard, but it is more evenly balanced in Northwest Russia than in other Russian regions. However, the domestic market demand in Russia on the whole has been decreasing throughout the last decade, which had a marked effect on sales in general, not only in the forest cluster. Nevertheless, there has been some growth and development of prices and product segmentation in the forest cluster, particularly in the St. Petersburg region, which is a major centre of consumption in Northwest Russia (Dudarev et al. 2004).

The competitiveness of the Russian forest cluster has been rarely based on advanced, value-added products. Since the beginning of the 1990s it has been based on the utilization of basic factors, most notably the extensive forest resources, cheap labour, energy and transport. However, these costs are bound to rise in the not too distant future (Dudarev et al. 2002). The success of Russian exports in recent years is going to weaken the price competitiveness of Russian forestry products. The strong dependence on exports makes products more expensive and less desirable; although, if new technologies are applied – and new technologies are overwhelmingly of foreign origin – a higher exchange rate can provide an advantage for the forest cluster, provided that the cluster produces more for the domestic market (Holopainen et al. 2006). One incentive to make wood available to the domestic market is the recent policy of the Russian federal government to tax the export of roundwood – an attempt to protect the Russian domestic industry from the appreciating exchange rate.

On the whole, production facilities, infrastructure, and training of workforce date mostly from Soviet times. However, these important input factors are largely depleted due to insufficient investments. Requirements for a more solid foundation for the cluster include upgrading of equipment and production facilities, construction of new transport infrastructure and/or maintenance of the existing infrastructure, reforestation measures and other environmental services, and the training of specialists and labour to work with contemporary production requirements .(Dudarev et al. 2004) Hence, one of the most urgent issues for the further development of the forest cluster is the improvement of the investment and business climate in order to increase the level of investment, including foreign direct investment. Unfavourable investment conditions prevent an inflow of capital. At present, investment focuses on urgent activities necessary for maintaining the existing operations in the cluster. Furthermore, regional development in the form of concentration and specialization is a major trend anticipated in the forest cluster of Northwest Russia (Dudarev et al. 2002). Sooner or later prices for input factors will rise and will increasingly lead to a loss of competitiveness of enterprises in the forest cluster.

Yet there will remain differences in the rate of development between regions. It is envisaged that production efficiency between forest clusters in Russia and other countries will probably decrease in the next ten years. Therefore, corrective measures are required to overcome the problem of rising prices. One such measure is the fostering of innovation in the cluster. Currently the forest cluster lacks the prerequisites for modernization, due to the cluster's present high profitability being based on the exploitation of its competitive advantages, i.e. cheap wood, energy and labour. In the long term this will have an adverse effect, but this is at present economically not yet relevant enough. However, the advantages are likely to diminish and companies will have to undertake measures to remain on the market, where modernization is the most important consideration. (Dudarev et al. 2002).

The situation in the forest cluster reflects the situation overall in Russian industry. On the whole, exports, albeit successful and rising, appear rather one-sided. The prevailing opinion is that this is not due to an overvalued currency; rather, the currency is still sufficiently undervalued to continue to drive exports. Lack of competitiveness is considered to prevent many sectors from exporting more than they do. (Sutela 2005). This can even be observed in the most successful sector, the oil industry. The largest contribution within this sector to economic growth and exports was made by the private oil enterprises, which are mostly controlled by the financial sector. These are the ones that have received the much-needed investments and experienced a change towards an efficient business model in order to increase the level of competitiveness. On the other hand, the state oil sector has been rather unable to make a sizable contribution to the overall success of the Russian oil industry (Ahrend 2006).

In any case, economic growth in Russia will be lower in the near future than it has been in previous years. Increasing capacity utilization cannot continue forever. Policies should focus on motivating investments so that economic growth can change from being based on increasing capacity utilization to being based on investments. Even though, as noted, productivity can still be enhanced for a long time, an increased propensity for imports and a consequent appreciation of the rouble suggest that Russia cannot remain a cheap output country for long (Sutela 2005). Good macro-economic policy is without doubt crucial here (Ahrend 2006): it has to create the conditions to provide necessary financial capital, both for the maintenance of infrastructure and production facilities and for the further improvement and development of new products and production processes. However, financial capital is only one factor among those needed to create this favourable investment climate.

In this chapter, I would like to focus particularly on the notion of trust. Trust is basically the confidence in one's expectations and it is a basic requirement for social life. Trust cannot be assumed to exist; i.e. it cannot be assumed that people inherently bestow it. Rather, trust has to be built up and maintained. Secured expectations produce social order through which governance is possible (Jalava 2003). Without sufficient trust in institutions, successful governance, for example, aiming at sustainable development, is jeopardized. Here, I aim to demonstrate that macroeconomic policy has important tasks in generating the trust required to allow healthy economic development in Russia. Therefore, I will delineate broad developments in Russian macroeconomic policy to illustrate its trust-generating potential. First, however, I will start with a conceptual definition of trust and how it relates to the economy and to economic policy.

System Theoretical Concept of Trust

Trust can be understood as a mechanism that serves to reduce social complexity. Trust allows a higher complexity of the human experience; more possibilities of acting and decision-making can be realized in order to allow any increases in social complexity (Luhmann 2000). Complexity is a condition of systems; systems build up complexity in the course of their evolution. Trust is located in the relations between people; it is not a psychological state of isolated individuals. Accordingly, trust must be seen as a property of collective units – of systems. Social relations depend on trust. Trust can be viewed as a prerequisite for the proper functioning of society (Lewis & Weigert 1985). The alternative to trust in social relations is chaos. And no one trusts chaos (Luhmann 2000: 47).

Increases in social complexity and reductions of that complexity through certain mechanisms go hand in hand. Simultaneous increases and decreases can be seen as a necessity of social structure, of the structure of human social behaviour. It allows taking into account multiple decision-making contingencies of the self and the other in an interactive situation. In order to increase the probability of successful interaction, this *social dimension* of trust requires a common communication standard. The symbolically generalized media of communication provide this standard. In the case of the economy, money is the medium of communication (Luhmann 2000).

It is the function of the symbolically generalized media of communication to motivate the *autopoiesis* – the reproduction – of operations in systems. Depending on the success of the motivation to reproduce the system, it is possible that the medium is used too much or too little. With respect to the economic system this can be easily illustrated by referring to the terms inflation (too much usage) and deflation (too little usage). The source of the problem in this case is not a lack of coverage for an underused or overused medium – money – through real goods or gold. Rather there is a lack of trust in relation to the possibility of continuing the use of the medium, that is, the continuation of the circulation of the medium. Inflation occurs when continued communication – payments or investments – require more trust than the medium can produce. In this case the medium (money) becomes devalued (expressed as a price increase). In turn, deflation occurs when the communication leaves opportunities to produce trust untouched. In that case the medium is circulated less, with the future opportunities for using money as medium for payments decreasing. The verge of either inflation or deflation is reached when the conditions for the continuation of autopoiesis in the system become so strict that they do not permit further autopoiesis. These conditions are called hyperinflation and hyperdeflation, respectively. They reflect the situation before symbolically generalized media of communication emerged and they reflect the improbability of successful cooperation. The difference between now and then is that modern society is not prepared structurally to deal with the case of the improbability of autopoiesis. This can have serious repercussions for trust in other systems, for instance, the political system (Luhmann 1997).

Thus, in conditions where trust is eroding, there is a serious threat that society could disintegrate. There is, therefore, a risk involved – a risk generated by the lack of trust. Risk would not exist if there were a functional alternative to trust. The risk becomes clear when thinking about planning – a task for the political system of society. Planning would not be possible if the planner had to take into account all possible contingent futures (Lewis & Weigert 1985). This would entail dealing with an infinite complexity, which is something that a system attempts to reduce.

Rational prediction is a possibility to overcome the problem of high contingency. Another solution is to incorporate trust into the planning procedure. Where rational prediction alone would fail, trust becomes in fact vital for planning and decision-making. (Lewis & Weigert 1985). Thus, this confirms the earlier statement that trust reduces social complexity.

Of course, an erosion of trust, or emergence of distrust, might occur, but society is not conceivable without a fundamental basis of trust. In fact, distrust can be helpful in some cases, for example in politics, where a democracy is based on a 'healthy' distrust and change of the parties in power. But even democracy is not possible without a basic trust that politics can actually fulfil its tasks when allocating power to an authority like a government. A betrayal of trust acts as a complete blow to the foundation of a social relationship (Lewis and Weigert 1985). Trust works as a foundation for society upon which social relations, planning, justice, etc. are crucially dependent. Society thus has an interest in maintaining or strengthening trust in systems and institutions – also symbolically generalized media of communication are such institutions.

Trust also affects time. This can be easily interpreted as trust in the future. Trust here is concerned with the future of a certain present; it is the attempt to realize that future and make it present. What appears complicated is planning. Planning is the prediction of a possible future and is highly problematic in a societal setting with rising complexity. Increasing complexity necessitates deferral, such as a deferral of needs; time allows an ordering of decisions and events into a succession because, with higher complexity, fewer possibilities can be realized in a given present. More complexity demands more certainty; trust produces that certainty. It stabilizes the present, which is at the same time associated with a certain past and future, describing what can be almost called an era. This *temporal dimension* of trust, however, is under threat due to the emergence of a social orientation based on a rational-scientific-technological paradigm. This paradigm increasingly dominates social life at the expense of the present. The paradigm produces a general acceleration of social events and a simultaneous strong demand for trust to adhere to a certain present. An attempt to deal with this problem collectively has been the planning and organization of time as expressed through certain ideological orientations, such as socialism (Luhmann 2000).

Modern society, which is differentiated into subsystems fulfilling different functions has a high capacity to solve problems and can see the world in more complex terms. Such a capacity, however, is only possible if certain selections (or contingencies) can be handled in advance; thus, certain decisions should already been made for the decision-maker. High complexity presumes that a large number of choices is possible – too many to be left to the individual. Symbolic communication media, such as money, are evolutionarily successful mechanisms that create expectations and motivations in interactive situations. Such media do not have to fall back on interpersonal trust; in fact, here, personal relationships do not matter. This makes the media increase the probability of successful communication (Luhmann 2000).

Thus, mechanisms like money permit living in a future of high complexity. Money is transferable freedom against a limited choice of goods. Freedom means here that a selection is open to individual decision-making. The social dimension and the temporal dimension of trust converge here: a deferral of present needs for the sake of future consumption (time) is coupled with *not* having to know the multiple behavioural contingencies of the other (social), as long as trust in money exists. The trust in the medium is the trust that the "system works". Thus, trust in the system represents a transformation of personal trust into system trust. One consequence of this is faster learning and information processing; less information is needed for decision-making if money is available (Luhmann 2000).

However, investments have to be evaluated according to their potential consequences. A basic principle is that investments mean a loss of liquidity and, hence, freedom of choice. A possibility to overcome this principle (and to create a 'paradox') is to gain and to lose liquidity simultaneously when investing money and receiving interest on it. This can only be achieved through an increase in the volume of money circulating in the economy. This is followed by an increase in complexity due to the rising volume of money and a resulting threat to the maintenance of trust (Luhmann 2000). Lewis and Weigert (1985) are of the same opinion when they write that any interference – and increase of the volume of money due to interest rates is interference – is bad for the trust in money. The uncertainty associated with the decision to invest or not significantly influences whether trust can be maintained. The uncertainty has two possible effects: it can lead to a lack of investments (deflation) or to a flight into real assets (inflation). This dual effect makes precise control of investments difficult if not impossible. Individual investment decisions are, hence, very much dependent on trust in the economy's currency (Luhmann 2000). From this it follows that trust needs to be maintained through policy – economic policy.

Economic Policy Considerations

Traditionally, economic theory has centred on production. Thus, production and, in some flavours of the theory, labour, as a production factor, have been the focus

(Luhmann 1988). Consequently, one concern of economic analysis has been the expansion of production and economic growth in material terms and, as a result, also of economic policy considerations. For example, economic policy might focus on keeping the exchange rate at a level where it creates favourable conditions for domestic exporters at the expense of currency stability by accepting some inflation. The theory of social systems, in turn, focuses on money as a communication medium. Money is at the centre of the economy, hence the importance of trust in money as maintaining the economy's function, which is to satisfy needs over long time spans. Thus, the stability of money – in contrast to increasing production – should be at the centre of economic policy. In other words, the purpose of economic policy is to maintain trust.

As soon as money emerges in evolution, solvency and insolvency, or liquidity and illiquidity, are generated. These create a double cycle of passing on solvency and insolvency in different directions. This double cycle is managed by banks. Banks have been created due to the interest rate problem; they can solve the problem of how to convert illiquidity into liquidity. And in doing this they possess an exclusive privilege; this has prompted some to call banks parasites since they sell their own illiquidity to others, their customers, at a profit by borrowing money from the central bank. The central bank, in turn, must regulate the management of liquidity and illiquidity, including the extent to which banks can borrow, lend, and charge for money. In other words, the central bank must regulate the extent to which the conversion of illiquidity into liquidity can be a profitable activity, without being itself bound to profitability (Luhmann 1988).

Ecological issues, with which natural resource governance is concerned, make governance of society or its parts, such as the economy, indispensable. Governance, in system theoretical terms called steering, is first and foremost *self*-steering, since social systems are self-organizing and organizationally autonomous. There is, however, a tradition to call for politics to affect societal conditions and to establish social policy. But this conflicts fundamentally with the self-organizing principles and the resulting limited capacity of politics to govern other parts of society than itself. If aiming to influence a system outside politics, politics must take into account the other system's distinctive features, that is, how that system differentiates itself from its environment.

In the case of the economy, the difference is, as noted, the difference between liquidity and illiquidity. Any effort to establish a political programme that ought to affect the economy must be based on this difference. Governance in this case means to reduce that particular difference. Reducing the difference is essentially what activates a system. In the economy, all economic activity aims to balance liquidity with illiquidity. This principle has to be utilized by politics as well. It is in fact the only way to govern. Thus, a difference expressed in a monetary terms and established in a political programme can affect how profitable an investment is. For example, an ecological programme might introduce a tax on a raw material, increasing the price and reducing the profit. Consuming more will be a less profitable activity. However, it is not possible to reduce the difference to zero. The difference will always be there; it can only be minimized In the case of complete reduction, the logic according to which the economic system distinguishes itself from its environment would be removed, leading to destruction of the system (Luhmann 1988).

Any political programme aiming at decreasing the economy's ecological impact would have to address the speed of resource consumption. Scale matters in resource management, as Daly (1992) writes. The idea of scale is based on the understanding that there is a temporal dimension associated with natural resources. This dimension also incorporates the variation that is so common in natural phenomena, as well as cycles. The time inherent in cycles constrains the possible consumption by humans. Depending on how large these regeneration cycles are, we commonly differentiate them by defining resources as renewable or non-renewable (on the scale of a human lifetime) (Jordan and Fortin 2002). Resource consumption is reflected in harvesting cycles and these are tied to the economic logic of time compression. It seems that the economy strives constantly to gain time in order to reduce the time lag between investment and the restoration of solvency. With respect to the forestry industry, one potential consequence is the acceleration of wood harvesting.

Money is a reflexive medium, which means that it can be applied to itself – it is possible to buy money with money (Luhmann 1970). The price of money in relation to monetary inflation (or deflation), reflected in the central bank's policies on interest rates, determines the amortization rate of investments. Other things being equal, a high price for money (again, relative to the inflation rate) requires a longer amortization period – and thus allows less consumption within a given time period – than a lower price for money. Policies that manage money, therefore, have a function in potentially affecting the speed of natural resource harvesting (Walter, 2008).

Politics can still make wrong assumptions when designing such policies. Especially in the context of creating development policies, politics might make the assumption that it is sufficient to provide a high profit to attract investors. However, such a development programme can easily fail, providing evidence that it is not the highest profit that attracts investment (see Walter, 2008, for evidence). Enterprises and households aim primarily at reducing their risk, which is also the purpose of a modern economy.

Function of Macroeconomic Policy

Thus, in sum the primary function of policies to manage money lies in maintaining the motivation to use money as a means of value exchange in the economy. In other words, policies ought to prevent massive changes in the value of money, such as deflation or inflation, to make sure that the economy continues to operate through the usage of money (Luhmann 1984). Ensuring the continuing usage of money is based on the understanding that the flow of money in the economy is of a cyclic nature (e.g. Luhmann 1986; Woodruff 2005). Using money for a payment requires that a payment has occurred in the past, since it is only possible to spend money if one has earned money through someone else's money transfer.

The motivation of the utilization of money has a twofold effect. First, keeping the value of money stable generates trust in the medium and the performance of the economy. Trust is based on expectations; these make the world less chaotic and more predictable. This enables social order, through which steering (governance) is possible (Jalava 2003). Trust, however, is difficult to achieve if institutions have a low credibility. A functioning economy, for example, is fundamental to restore credibility. This is illustrated by the savings ratio of Russians. The combined assets of Russian banks were around 35 per cent of Russia's Gross Domestic Product (GDP) in early 1998. In comparison to other countries, even those that are still considered emerging economies, this is a rather low ratio. A large part of the small assets that banks had was invested to finance the deficit of the public economy. In turn, a comparatively small part of those assets were lent to private enterprises. That means that not enough of the small amount of available capital was used to finance the economy (Komulainen 1999). Furthermore, the use of monetary surrogates on a surprisingly large scale during the 1990s prompted some to call the Russian forest economy a virtual economy. Approximately 50 to 70 per cent of Russian industrial production in August 1998 was exchanged through barter (Woodruff 2005); this is largely an issue of the past and barter, as well as the virtual elements of the forest economy, has gradually disappeared with the transition (Mashkina 2006).

The second effect of maintaining monetary stability is the provision of a structural foundation for resource governance. This is directly connected to the generation of trust; i.e. only through trust is a certain degree of steering possible. This shows that governance is a path-dependent activity. For example, the use of a stumpage fee to artificially increase the price of wood, the rationale being that a higher price will cause a commodity to be used more efficiently, naturally assumes that money is actually used to obtain the right to the wood. If money is not used, as in the cases of monetary surrogates, a stumpage fee would be essentially useless. Governance, therefore, assumes that systems (as path patterns of social behaviour) exist and continue to exist (e.g. through the continued use of money).

Accordingly, governance must be understood as a mutual activity. A societal achievement is not considered to be the result of purely political operations, but, rather, dependent on the interaction and combination of other sectors (systems) of society. To produce successful outcomes, governance has to count on the contribution of all parts of society, where these represent in fact all the resources that are available in society to solve a problem. One could now formulate the task of governance as being the facilitation of the interaction of different societal spheres. One consequence of this view is that politics is not to be considered a superior system in society and that a central government is not supreme. Society is in fact without a centre (Rhodes 1996; Kooiman 1993).

When aiming to integrate the variety of systems into a common endeavour, one has to accept that there are limits on the extent to which society can adapt. These system rationalities have to be accepted and cannot be bypassed when aiming for a successful governance effort. Thus, in line with the idea of a need for system continuity (path-dependence) in the concept of governance, one must be aware that those functional systems with their peculiar rationalities represent institutional developments on whose successful operation governance is dependent. If for some reason the operations cannot be carried out – or can only be carried out under difficult circumstances, such as when power relationships are unclear due to legal failure or legal inaccuracies or when barter is used instead of money for trading – the success of governance will be greatly jeopardized. For example, resource consumption in the informal economy falls either outside the government's monitoring ability or is more difficult to control. It must, therefore, be in the greatest interest of any government to assist the support of formal institutions by the public.

Macroeconomic Policy in Russia

Macroeconomic policy as described in this chapter includes fiscal and monetary policies. Generally, such an analysis might also include the relations of the various institutions involved in managing monetary value and in planning budgets, the different levels of government (federal and regional), central bank, and other stakeholders, including the financial system involving commercial banks. Macroeconomic policy has several important functions with regard to the management of natural resources such as forests.

During the Soviet era, monetary policy had two main roles: One was to ensure the fulfilment of the economic plan; the other was to control the purchasing power of Soviet households. In a centrally planned economy the plan is, of course, the central institution serving as the guideline for production numbers and prices and, at the same time, as the basis for the allocation of credit to producers in order to achieve the production goals. Supplying enterprises were paid through bank transfer; money, in turn, was only used by enterprises to pay wages and salaries to workers and employees. The second role existed to avoid queues and shortages of supplies. To achieve this, monetary policy targeted the amount of cash in circulation. A cash plan existed in which the head organization in the Soviet banking system, Gosbank, established how much cash would be allocated to enterprises so that they could pay their personnel (Baliño 1998).

Gosbank fulfilled the roles which are split between the central bank and commercial banks in states with market economies: to issue the money, to clear transfers between enterprises, to transfer credit, and to formulate the cash plan. Gosbank controlled other banks in the Soviet Union, including several specialized banks that financed different industrial sectors, as well as the Savings Bank, where households could deposit some of their cash savings. Furthermore, an official exchange rate plan existed in which the rate was administratively set so as to ensure that domestic prices would be equivalent to international market prices.

This was achieved through subsidies and taxes (Baliño 1998). When the Soviet Union dissolved at the end of 1991, Russia had to newly create or adapt its monetary institutions to new political and economic realities.

Fiscal Policy

Russian fiscal policy since the early 1990s has been very unstable and unpredictable, partly due to a lack of consensus within the state apparatus as to the role of government in the economy and partly due to a sheer lack of alternatives to compensate for the high fiscal deficits other than using central bank credits (Sutela 2003; Baliño et al. 1997). For a long time, the Russian federal government followed an expansionary fiscal policy course, partly to finance the budget deficit and partly to keep the rouble within the currency band of an exchange rate programme; however, the rate of central bank credit to the government accelerated and slowed down erratically (Baliño et al. 1997). This monetary expansion, of course, fuelled inflation – not only when the actual borrowing occurred, but also thereafter through a delayed impact (Orlowski 1997). The growth of money was thus caused to a significant extent by a need to meet the budget's obligations, not so much by a demanding economy. The variation in fiscal policy illustrates well the problems in overcoming the legacy of central planning where budget and credit financing were not distinguished. The problems reflect the use of macroeconomic policy by authorities as an instrument of social welfare provision, which was reflected in a lack of fiscal regulation (Granville and Mallick 2006). Given the function of financial policies to include the maintenance of an integrated economy by motivating the use of money, it is possible to conclude what the consequences of fuelling inflation were for the industry. The low levels of investment in the forest sector and the extensive use of barter during the 1990s indicated the lack of a valuable currency. Thus, much of the sector had little choice but to 'invest' using relational capital, thus missing out on real investments in physical capital that could have strengthened its competitive position in the market for forest products.

This fiscal behaviour produced great difficulties for the monetary authorities to pursue their policy of controlling the mass growth of money through reserve requirements. By receiving large amounts of money through free credits that were covered by the budget (in 1998 and 1999 these equalled nine and three point three five per cent, respectively, of the Russian GDP) the economy had few if any additional requirements for borrowing money from banks. The banks, in turn, had no need to participate in credit auctions, as they possessed sufficient liquidity (Aleksashenko 2000). For example, at the beginning of 2004 real interest rates were still negative and reflected excess market liquidity (BOFIT 2004). The fiscal behaviour of the government resulted in the Central Bank having fewer possibilities to govern the supply of money to the economy, since monetary aggregates represent the instrument of choice for the Russian Central Bank. The critical point here is that at least until the mid-1990s there was no real independent monetary policy that the Central Bank could pursue as long as its behaviour was programmed to adjust to the government's budget needs. This constellation had to be considered unsustainable (Aleksashenko 2000). It also illustrates that the federal government, irrespective of the Central Bank's goals, had no real interest in controlling inflation. The focus of the government was on sustaining enterprises and their production, which occurred at the expense of maintaining trust and strengthening currency stabilization.

The mid-1990s saw an increasing consensus among previously conflicting interest groups regarding inflation policy. Macroeconomic policy was developed with the intention of lowering inflation by decreasing the rate of mass money growth in addition to cutting the fiscal deficit, tightening monetary policy and further liberalizing trade and prices. One reason why there was suddenly a much stronger consensus on how to proceed further was that the policy-makers had learned about the real costs of unhealthily high inflation rates. For example, inflation led to increasing dollarization and use of barter as alternatives to the rouble. The use of rouble alternatives decreased the tax base in the economy; no government could be interested in this. Attempts were made to finance the budget deficits by other means, for example, treasury bills; these were initially short-term but long-term bills were planned. The federal government made the mistake of continuing to borrow while the yields and attractiveness of the treasury bills were high; it did not attempt to continue balancing the budget. This was not interfered with, as it was believed that although the debt-to-GDP ratio rose dangerously, the ratio would decrease to moderate levels in the time to come, given that the economy had already showed signs of a small recovery. The crisis in Asia then affected the Russian financial system in a catastrophic way. It also highlighted the fact that many reforms had not been undertaken yet that could have helped to improve the situation, including tax reform, bankruptcy law, and land property issues. Lower energy prices and rising rouble interests followed the crisis in Asia, as the financial market became nervous about Russia's capability to deal with the issues. Towards the height of the rouble crisis, debt servicing took almost all tax revenues. This in turn made credit financing from the central bank a necessity. Because the structural reforms mentioned were too slow to revitalize the economy, debt became excessive. In August 1998 Russia had to declare itself in default. This was followed by a devaluation of the rouble by 70 per cent, making import prices four to five times higher than before the devaluation (Sutela 2003).

Luckily the anti-inflationary consensus in Russia held and there was no attempt to raise wages to counteract the price increases. After 2000 the Russian government introduced fiscal reforms, which have produced sizable surpluses based on a steady rise in oil prices. Furthermore, favourable trade conditions and growth contributed to a balanced budget. For example, revenues, including value-added tax, increased moderately in 1998, while expenditures stayed fairly equal and debt service expenditures even decreased; the developments combined to result in a decreasing deficit. Fiscal institutions were reformed, with this including an overhaul of the tax system, the introduction of a natural resource extraction tax, the abolition of turnover tax for enterprises, and a new budget code that demanded more fiscal responsibility and restricted government spending and borrowing (Ahrend 2004).

Monetary Policy

The Rouble Zone

After the Soviet Union was dissolved, it was initially decided to keep up a unified monetary system, the rouble zone, for most of the post-Soviet republics. Gosbank disappeared and central banks were installed in the member countries of the rouble zone as the institutions responsible for monetary policy. In this arrangement, the Central Bank of Russia became the sole issuer of cash. However, all central banks of the participating countries could grant credit. This led to a situation of one monetary zone with multiple money-creating central banks, resulting in incentives for the smaller central banks to expand credit to promote economic development in their respective jurisdictions (Baliño 1998; Woodruff 2000).

The outcome of this regime was monetary inflation that spilled over the whole rouble zone, and developments quickly moved towards a centralized solution. Initially, the Central Bank of Russia confined itself to controlling the internal credit flow between all the central banks. By mid-1993, however, the massive problems in the rouble zone, also exacerbated through the financing of fiscal deficits, prompted Russia to introduce the Russian rouble and demonetize the pre-1993 roubles of the unified monetary system. This marked the emergence of an independent Russian monetary policy (Baliño 1998). Until then the Central Bank was not realistically capable of dealing with inflation; this shortcoming was also due to the lack of a strict hierarchy in the economy with respect to the control of money – a hierarchy which is vital when aiming to control money flows between one centre and business banks, on the one hand, and banks and enterprises and households, on the other. This centralized management of money and the decentralized decision-making on investments is in fact the great advantage of money in the modern economy and one reason for its evolutionary success.

The Fixed Exchange Rate Programme

In 1995 Russia adopted an exchange rate policy after the three-year period of high inflation that followed the break-up of the Soviet Union and the establishment of the unified monetary area. A fixed exchange rate programme, used by many states with emerging markets, is designed to control inflation by linking the domestic currency to an authoritative international currency, which is in most cases the US dollar. The fixed rate, in practice a currency band, is maintained by tying the domestic money supply to the in- and outflow of foreign currencies. After stabilization of the domestic currency, i.e. during an initial boom phase, the domestic economy experiences a first inflow of foreign capital, resulting in an expansion of the domestic money supply and rising prices, both in domestic currency and dollars. However, if the foreign capital inflow is not forthcoming, the domestic economy experiences a domestic currency cost crunch, which expresses itself as rising prices valued in the domestic currency but not in dollars. One response to this situation is a devaluation of the domestic currency; another is that the government offers higher returns for investments in order to attract foreign capital inflow. The latter is very costly since the government has to finance the interest paid on investments; depending on the state's financial capacities to finance investment returns, the final result will probably be devaluation, but at the cost of having far fewer resources than before the attempt to defend the domestic currency (Woodruff 2005).

After the introduction of the rouble currency band, inflation declined and the real exchange rate increased, causing the rouble to appreciate against the dollar and making it more attractive for foreign capital investors. However, capital only entered the country after mid-1996, when Boris Yeltsin strong defender of the market course, was re-elected Russian president. Before that date the political uncertainties were too high. Throughout 1996 and 1997 foreign liabilities grew strongly, in fact dramatically. There was a general development towards dollar-denominated liabilities; for instance many local, regional, and federal governments sought to borrow in dollars rather than in roubles, for which the interests where higher. Also, many exporters borrowed abroad, predominantly in the energy sector. (Woodruff 2005). By that time, inflation had become only a minor problem (Woodruff 2000). The currency band provides evidence, however, that the Russian state did not want to give up the facility to attract investments from abroad in order to drive production and economic growth. Although the policy is risky and only works well when investments continue to flow, in the opposite case the lack of investments jeopardizes the stability of the domestic currency.

The growth of the importance of the dollar in the Russian economy increased the importance of the domestic market for export-oriented enterprises, such as oil and gas companies. The rising purchase power of Russians made it easier for those companies to transform their infrastructure for the supply of foreign markets, whereas previously the infrastructure was geared towards the supply of the domestic market. Clearly, however, not all enterprises benefited from the general appreciation of the rouble during the existence of the currency band. Producers that competed with imports were not very well equipped to adjust to the cheaper products from abroad, especially due to the nominal price-stickiness of many domestic products; producers' costs could not be reduced due to prices being nominally rigid. The state sought to compensate for this problem by intervening in the market, one measure being the introduction of protective tariffs. But, in the light of the general cost pressures in the domestic Russian economy, many producers found their way to monetary surrogates (Woodruff 2005). In the forestry industry, state interventions also found their expression in the involvement of public authorities in local and regional forestry enterprises in the form of exchanging company shares against tax liabilities. Furthermore, state monopolies contributed to infusing money into the quasi-private forest sector (Carlsson et al. 2000). From the perspective of the private enterprises involved, this led to dependencies and maladaptations with respect to introducing market-oriented production processes. Thus, these enterprises lacked important prerequisites for their own sustainability.

A general cost crisis can also be described as a recessionary tendency in the Russian economy. This recession resulted in a conflict of interests between enterprises whose costs and sales were denominated in roubles and export-oriented enterprises for whom the dollar rate was far more important. Furthermore, strains were put on the relations between debtors and creditors. The response to this crisis was a focus on a variety of possible alternatives to a devaluation of the rouble. Alternatives included market interventions to create a downward flexibility of costs in the domestic economy and forbearance in the enforcement of debt repayment and contract fulfilment. The reason for not giving preference to an immediate devaluation has to be seen in the light of the constellation of interests surrounding exchange rates and prices Moreover, the Russian federal government did not have a majority that favoured a devaluation of the rouble; there was a strong desire to support the Russian banking system during the crisis existed. Russian commercial banks had accumulated large rouble deposits, financed with dollar liabilities. To save the banks' solvency the devaluation was delayed (Woodruff 2005). Preserving the fixed exchange rate was also seen as a matter of credibility and fostering market confidence in the eyes of investors (Pinto et al. 2004).

It becomes apparent what the occurrence of the high-risk case of an investment stop meant for the participants of the Russian economy: a massive loss of trust by those who were dependent on the rouble and ignorance on the part of those who were more independent of it. This conflict of interests led to a rapid fragmentation of the Russian monetary system. Monetary surrogates began to dominate inter-enterprise transfers and indeed serviced an alternative system of payment based on trade credit. In addition, Russian governments, local and national, issued surrogates, which created huge problems at a later stage, when the widespread demonetization of the Russian economy led to substantial fiscal deficits due to a reduction of government taxes (Woodruff 2005). The forest sector as a whole was heavily affected by the increase in non-monetary transactions. Many, even large, enterprises in the sector sold only a small share of their production for real money, an estimated ten per cent. Among non-monetary transactions one can also count activities involving so-called relational capital investments; these include performing services for local authorities or incorporating these authorities into the ownership structure of forestry enterprises in order to, for example, offset tax liabilities or negotiate privileges (Carlsson et al. 2000). Issuing monetary surrogates required further borrowing on the government's part, especially in order to meet debt repayment obligations for which surrogate means would not work. Eventually, devaluation became a reality in August 1998 (Woodruff 2005). The crisis had indeed been very costly. The Gross Domestic Product (GDP) of Russia had fallen by four point nine percent in 1998, the annual inflation rate in

December of that year reached 84 per cent, compared to a target of eight per cent, and some $30 billion in foreign exchange had been used to protect the rouble from devaluation between October 1997 and August 1998, when the decision to float the rouble was made. Since then the Russian economy has made striking progress: for example, only a year later, in 1999, the GDP had already grown by five point three percent and the inflation rate had fallen to less than 40 per cent (Pinto et al. 2004).

Monetary Instruments

In the early 1990s the instruments which the Central Bank of Russia had at its disposal in its monetary policy were limited to the control of directed credits (to specific enterprises or industrial sectors) as well as reserve requirements to control monetary aggregates. All commercial banks that had been created since the split of Gosbank's function were subject to strict reserve requirements. A certain proportion of the banks' reserves had to be kept in accounts with the central bank. As inflation soared in 1992, the reserve requirements were increased to a larger percentage of the banks' reserves. The enforcement of the reserve requirement was rather poor, however. Furthermore, the rouble assets in the banks were quite unevenly distributed. A few banks had a large share of all the assets, while a large group of banks had a comparatively small share. Any case of further tightening of reserve requirements would mean difficulties for some banks. The most significant measure which hampered the Central Bank's monetary policy, however, was its allowing commercial banks to obtain short-term credit by overdrawing their reserve accounts. Regional managers of the central bank had virtually automatically provided these overdrafts to the banks in their jurisdiction; even though the charge was twice the refinancing rate, the charge in real terms was still negative in the light of the high inflation in 1992 (Baliño et al. 1997). Thus, initially, the general idea of orthodox economic policy prevailed – fuelling the economy with capital to maintain or to raise production – rather than keeping calm and focusing on currency stability.

After the banking system developed further and economic conditions stabilized around 1994 and 1995, the Central Bank of Russia introduced new monetary instruments. These included the active use of interest rates to reduce the demand for credit from the Central Bank. Market-based instruments were considered after commercial banks had been stabilized to the extent that they could take part in financial market activities. The Central Bank introduced a market-based credit facility that was capable of providing short-term liquidity to the commercial banks (Baliño et al. 1997). In addition, many banks made use of the possibility to trade credit on an inter-bank market, which was an important mechanism as it distributed liquidity from those banks with a surplus to those banks in need of cash (Furfine 2001).

The Central Bank of Russia continuously modified the effectiveness of its reserve requirements. Rates were changed from time to time to allow greater flexibility and to keep costs down for all commercial banks. In addition, compliance with the reserve facility was tightened. Overall, the Central Bank has been fairly successful in developing monetary instruments which inject liquidity into the Russian domestic economy. However, the credit auctions and reserve requirements which provided liquidity to banks were not suitable for absorbing liquidity. Measures were undertaken to manage a surplus of money: the Russian Ministry of Finance sold treasury bills in excess of its financial needs and the Central Bank started to auction deposits. However, the latter measure was not as successful as hoped because the placing of the deposits occurred at an interest rate determined by the Central Bank and not by the market; the rate offered by the bank was significantly below the yield of other options (Baliño et al. 1997).

The implementation of monetary policy by the Central Bank of Russia mainly took the form of using monetary aggregates as a tool, focusing on money supply via the reserve requirements and deposit auctions. Although the target of that policy before 1995 was to decrease the inflation rate, after 1995 the objective was exchange rate stabilization (Esanov et al. 2004). This is due to Russia establishing an exchange rate programme starting in 1995 (Woodruff 2005). Nevertheless, the use of monetary aggregates as an instrument to conduct monetary policy appears in contrast to the experience of other emerging markets, where interest rate policies rule. Given the increasing credibility of the Central Bank of Russia, the development of domestic financial markets, and the policy reforms undertaken in late 2002, interest rate policy coupled with inflation targeting in a floating exchange rate regime should in time be successfully implemented (Esanov et al. 2004).

A fact supporting this argument is that Russia experienced 3500-fold inflation at the same time as a 1500-fold increase in monetary supply. In orthodox[1] monetary policy the control of the growth of monetary aggregates helps to control inflation. The Central Bank of Russia follows this policy. The money supply here is viewed as an exogenous parameter; i.e. it is controlled from outside the economy. Inflation, then, is seen as the result of an excessive money supply. On the other hand, heterodox[2] monetary theory presupposes that the interest rate, which is based on the price of credit, is an effective means to control inflation (Vymyatnina 2006).

1 Bofinger (1996) describes orthodox economic policy approaches as being consistent with a strong focus on controlling the money stock by using fiscal and monetary policy. This can be considered inadequate if the demand for money – especially the case in a transition economy – is unstable. Though, modern central banking is based on orthodox theory, founded on the assumption that a central bank – independent from the state – can exogenously control money in the economy (van Lear 2003).

2 Heterodox economic policy advocates that the central bank's ability to control money is limited because of the endogenous supply of money in the economy. Thus, heterodox policy aims to emphasize the role of the state and considers income and employment policies, arguing that inflation is the result of income distribution conflicts, leading to the use of non-monetary exchange media. (van Lear 2003) Thus, Bofinger (1996: 669) calls heterodox approaches a commitment technology, stabilizing incomes to allow a gradual disinflation.

In mature economies the source of an endogenous money supply is the demand for credit by enterprises to fund their industrial capital and investments. This is different in economies in transition. Here, one can distinguish between an old and new industrial enterprise sector: a new corporate sector operating within the logic of the market and an old sector still operating under the logic of a planned economy. The latter type of enterprises might in many cases operate completely unprofitably. The reasons why these enterprises are still running include their often being the only source of employment in a locality. Local authorities, therefore, are eager to pressure for the continuation of credit provision to those old-type enterprises, with obvious effects on the monetary system (Vymyatnina 2006).

Thus, in today's Russia there are several sources of endogenous monetary growth. One stems from credit demanded by market-operating enterprises, a second from credit passed on to socially important enterprises. Finally, a third source is barter. Barter introduces money that is completely endogenous economically, beyond any control (Vymyatnina 2006). The use of barter was greatest during the height of the currency crises in August 1998, but still stands at about 10 per cent (Sutela 2003). Evidence suggests that the money supply in Russia is endogenous. As said before, Russian monetary policy is based on orthodox theory, which assumes that the money supply is exogenous. Hence, the Central Bank cannot effectively and predictably control the growth of monetary aggregates. Besides, controlling monetary aggregates, which involves reserve requirements for banks, is excessive and might well prevent more effective economic development. Where monetary policy is concerned, the operational goal of the Central Bank is to set the growth rate of the monetary base, since this is the parameter conceived to be completely under its control. Direct control measures that target commercial banks' lending are used. These measures include the control of liquidity and solvency of banks. Regulations state that banks cannot give too much credit to enterprises and also include prescribed interest rates (Vymyatnina 2006).

There is still a tension in monetary policy between lowering inflation and slowing down the appreciation of the exchange rate as part of favourable trade conditions. So far, the Central Bank of Russia has preferred to slow down the appreciation of the exchange rate to provide better conditions for the domestic export industry. This forces the Central Bank to buy foreign currencies from the market, thereby causing inflation. One indicator for this policy is the persistent inflation rate – still around 10 to 12 per cent – which is moderately higher than planned. The apparent policy suggests that interest rate control is not used as an instrument of direct inflation control. As such this is not surprising in Russia, where the present regime of monetary control mechanisms took a long time to be established and to become stable. However, due to the apparent tension and trade-off between exchange rate stability and inflation control, this move towards an interest rate control mechanism should be made (Granville and Mallick 2006). This would necessitate a change in the attitude of Russian monetary policy. As mentioned, the Central Bank of Russia follows an orthodox path. Using the interest rate as an effective control mechanism is the main postulate of heterodox monetary theory (Vymyatnina 2006).

In the light of the requirements for a suitable macroeconomic policy as presented above, the move towards a policy based on heterodox monetary theory would more coincide with the need to maintain trust in an economic area's currency. So far, the priority has been to create favourable conditions for economic growth, at the expense of controlling the currency value. Favouring economic growth via the exchange rate and accepting inflation, albeit moderate, appears to be the prevailing approach in Russia – one which seems to focus on short-term growth rather than long-term trust maintenance.

Conclusion

Certain policy developments suggest that the investment climate in Russia is improving. This is firstly due to the much better fiscal and monetary policies. Early fiscal policy erased the trust that existed in the currency through irresponsible budget allocations, leading to high inflation which could not be controlled by the instruments defined in monetary policy. Furthermore, monetary policy was for a long time too dependent on political authority, leading to a practice where budget holes where financed through central bank credit, which in turn fuelled consumer price inflation.

Many measures have been undertaken to increase the trust in the rouble. These include a tightened fiscal policy, which, as shown, has contributed to producing sizable budget surpluses since about 2000. Around the same time, the federal tax code was reformed and simplified, making it more efficient and easier to capture revenues and windfall profits from oil and gas exports. There are still problems with Russian monetary policy, where there is a perceived contradiction between policy goals. That means either keeping the rouble exchange rate below market prices in order to support exports of domestic industries or decreasing inflation. In practice this has led the Central Bank aiming for a deceleration of rising inflation, which continues at about 10 to 12 per cent per annum.

In addition, financial policy has somewhat changed since 1 July 2006; the rouble is now freely convertible. This has been a political step to indicate that the Russian economy and currency are now strong enough. Naturally, it is hoped that this move will help to increase the level of foreign investment. Thus, it could bring important changes to the corporate sector, while the private sector might experience lower prices for imported goods due to the previously undervalued rouble. Russians themselves are often still suspicious about the stability of the currency and the security of bank deposits. Many do not keep their savings in bank accounts. The ghost of the crash in 1998 is still haunting the country.

Although developing well at the moment, the Russian economy does not have any problems in absorbing the increasing volume of money (M2) in circulation that is denominated in roubles. Even though the current inflation rate is still comparatively high, it does not seem to provide much of a constraint on economic growth at the moment. It does, therefore, provide an argument for those who favour the use of the exchange rate to drive economic development. But this should be seen as short-termism. Quick and easy growth of the economy does come at a cost – after all, 10 to 12 per cent inflation per year is also a 10 to 12 per cent loss of trust per year. A long-term sustainable development perspective should be centred on low inflation, high trust, and be designed independently of growth objectives.

Thus, there are risks associated with the present development strategy. There is the long-term risk of not giving sufficient credence to the importance of trust in the currency and the short-term risk of having to deal with a decreasing level of investments from abroad. Although the latter does not seem apparent, recent arbitrary actions by governmental authorities, ranging from the Yukos affair to Shell's Sachalin case and the instrumental use of the energy infrastructure for political purposes, do not send out positive signals to investors. That such cases which threaten the security of investments are not confined to the energy sector but affect other resource sectors as well, such as forestry, is shown by the other chapters in this book, although the state has admittedly a differing role.

I have attempted to show that governing money badly threatens sustainable development in the economy and society. Firstly, as a consequence of bad governance investments are lacking. As noted, macroeconomic policy has for a decade failed to provide sufficient trust to motivate investments. Secondly, the use of barter has for a long time been quite high, although it is estimated to be a tenth of what it was at the height of the economic crisis in 1998 (Sutela 2005: 16). This should be considered an average figure; it is may well be higher in some regions, industries, and particular enterprises elsewhere in Russia. Accordingly, economic policy has had its difficulties being effective. Governing the economy and sustaining development requires cooperation, which in turn is based on trust. Using money as a general medium of exchange is a form of cooperation. Using the same currency within an economic area allows governance, as governing the value and stability of money in such a way that monetary alternatives, such as barter, are not interesting, establishes the required trust. Otherwise, macroeconomic policy fails to provide a structural foundation for future governance. In addition to having a cooperative social dimension, trust has a temporal dimension that affects confidence and expectations into the future. On the basis of the existing inflation and the careful dealing with banking facilities one can conclude that full confidence has not been restored as yet. It is these social and temporal dimensions of trust in the economy, which, I believe, are most important here; they are more important than any "economic" dimension of trust for the purpose of achieving, say, economic competitiveness.

The ideas presented in this chapter also illustrate well the nature of politics as the governing system in society. Just like money is circulating in the economy and causes problems for sustaining the economy when absent, the political system in Niklas Luhmann's theory of social systems is of a cyclic nature. In a self-reproducing political system, governance could be seen as the element which has to be reproduced in order to ensure the continuity of the political system. Thus, future ability to govern requires good governance at present. If not, the power to steer might be lost and sustainable development jeopardized.

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Innovation: panacea or curse?[1]

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Abstract

An innovation framework is made up of the interaction of three different societal spheres: science, politics, and economy. Called the triple-helix model of innovation, it describes how innovation is produced through a synthesis of social systems that provide the solution of diverse tasks under differing interests and opposing operating principles.

Innovation has several important consequences. Innovation benefits the economy by maintaining competitiveness. By renewing production technology, it can reduce natural resource consumption, cut emissions and contribute to limiting society's ecological impact. Finally, through maintaining economic competitiveness, innovation will strengthen trust, more specifically trust in an economic area's currency. Trust in the value of a currency maintains not only the economy for its own sake but will provide a structure (trust basis) for political governance. For instance, economic policy, with whatever aim, cannot work if the economy is not maintained. For illustrative purposes, this paper presents the innovation system of Russia – along with reasons to innovate.

However, the interplay of science, politics, and economy drives evolution and is responsible for technology lock-ins, necessitating continuous innovation activities. Society's complexity does not allow an exclusion of any unintended consequences of innovation. In

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a complex system, any event, such as innovation, can have multiple causes and effects; complexity implies the inability to distinguish between cause and effect and to prevent unintended, unplanned consequences. Thus, product innovations, having in mind to cut the input of natural resources, can backfire as fewer resources used make the product potentially cheaper with consequences for total resource consumption.

Keywords: innovation, triple helix, systems theory, complexity, Russia

1 Introduction

Knowledge is power! – Francis Bacon's declaration, albeit originating at the end of the 16th century, appears today more valid than ever. Modern economic life has come to be represented by knowledge, and technology, as reflected by terms such as information society and knowledge economy. In the era of globalisation, where people's development is based on the way they apply knowledge, the competitive advantage lies with those countries that possess advanced technology (Jiménez and Escalante, 2006). Authorities formulating common efforts to produce knowledge and technology have concluded that in order to achieve a sustainable economy, there is 'no choice but to become a vibrant knowledge economy' (e.g. Commission of the European Communities, 2005, 3). Thus, knowledge seems to have become equivalent to economic power.

The following article aims to highlight the process behind knowledge and technology production – the innovation process. It introduces a model to understand innovation, including the specific functions of innovation in modern society. Then, as a case study, it reviews the innovation system of Russia. This example is particularly interesting as Russia possesses much of the resources to be innovative but is still – as many countries with a former command economy – somewhat in transition.

Furthermore, the article points out that an innovation system can produce outcomes that might be completely unintentional. The innovation model presented here also gives insights into possible risks and limitations of predicting adverse effects – a task that is influential when designing new innovations according to their potential social and ecological impacts. Taking into account the adverse consequences of innovation becomes especially relevant when realising that many of the official documents on innovation and research policies inform enthusiastically on the need for and the advantages of innovation, the factors influencing innovation success and the need for removing barriers to innovation and research. They fail, however, in giving adequate answer to any possible disadvantages. Thus, it appears that innovation is considered as a universal remedy – a panacea – and, above all, it indicates a break-free of the innovation system itself, requiring a sustained effort to innovate. This will have consequences.

2 Triple helix model of innovation

Innovation can be described as the interaction of different functional social systems, namely politics, science, and economy (Leydesdorff and Etzkowitz, 1998). While social systems (or societal spheres – helices) distinguish themselves from their respective environment by building up boundaries, these borders overlap in the innovation activity – creating multitask organisations, e.g. enterprises that also do research, thereby undertaking a scientific and not only economic activity. The boundaries are, thus, in flux and build up a constantly evolving network of communication – an emerging regime that is called a triple helix. Hence, innovation is a highly dynamic process. (Leydesdorff, 2000)

The distinction between a system and its environment is maintained through a system specific way of operation. Consequentially, one system – e.g. economy – produces a communication beyond understanding to another system – e.g. science (Luhmann, 1984). Lack of understanding creates uncertainty. Therefore, the interaction of many social systems generates complexity, leading to a quasi-chaotic evolution. This complexity-associated uncertainty is a requirement for innovation as it generates the required competition between social systems – competition is another expression for uncertainty. (Leydesdorff, 2000; Leydesdorff and Meyer, 2006)

The interaction produces a pattern of its own – the innovation system. The continuing evolution of the innovation system is based on continuous reflexivity taking place within the social systems and expressed in their particular way of operation. Thus, continued uncertainty is generated, providing an ongoing basis for innovation in the future (Leydesdorff, 2000). New science policies take account of this – they ask for and support reflexivity and collaboration. (Jiménez and Escalante, 2006)

3 Reasons for innovating in modern society

Potential effects of innovation can be divided into ecological and social effects. On the ecological side, innovation – through adopting modern technology and management attitudes – can ensure less exploitation of natural resources and fewer emissions (Rautio, 2000; Moiseenko et al., 2006). For example, outdated industrial facilities in Russia have long caused air and water pollution, but also simplification of ecosystems, which negatively affected animal and human health and food supply. (Hozhina et al., 2001; Moiseenko et al., 2006)

On the social side, innovation increases an economy's competitiveness. For instance, despite the striking economic progress in Russia since the end of the 1990s, a continuation of this development is at risk, which can be related to a lack of innovation. The largest share of this success is due to responsible economic policy and price competitiveness (Sutela, 2005). To avoid diminishing advantages for the industry – exports are weakening price competitiveness – corrective measures to maintain competitiveness must be undertaken, where innovation is the most important.

Another social effect of innovation can be seen in strengthening trust. Trust is a requirement for cohesion and a precondition for governance of any sort (Jalava, 2003). Trust is difficult to maintain or to achieve if there is a low credibility into societal institutions; e.g. if trust into an economic area's currency is low, alternatives, such as barter, become more attractive, preventing an effective resource governance. Thus, innovation is vital to strengthen credibility – in the economic sphere this means that the task of innovation is to attract money, making it valuable and trustworthy.

4 Russia's innovation system

Up until now, Russia's innovation performance has been modest since the early 1990s (OECD, 2005). The export branches – such as oil and gas and other resource sectors – have been more successful in applying innovations due to the increased global economic importance of energy and raw materials. Still the overwhelming majority of their products are non-value-added (Boltramovich et al., 2004). The domestic branches of the Russian economy have been much less innovative due the domestic market demand having only developed in recent years (Kazakova, 2001). Thus, there is a great perceived need overall for innovation in the Russian economy (Boltramovich et al., 2004).

The economic element of the innovation system includes funding sources as well as industrial enterprises. The state is responsible for the bulk of financing research activities, although budget allocations have fallen sharply since the early nineties (OECD, 2005). An increasingly significant contribution is made by foreign sources (Kihlgren, 2003). Major problems of innovative enterprises in Russia are – besides their relative small number – the lack of financial capital, and risk taking ability and cooperation; these were not supported by the central planning of the Soviet economy. Consequentially, industry-science relationships are fairly weak. (OECD, 2005)

If the industry faces an innovation crisis, heightened importance must be given to scientific institutions. While universities are not so much involved in research yet, they and other research institutes retained most of their potential for research. However, universities also must now operate in a completely different socio-economic setting, involving the reshaping of their relationships to politics and economy. This is not an easy task as their degree of autonomy has been tightened again after a short period of higher autonomy during the 1990s. (Kazakova, 2001)

A major political issue affecting innovation is the state funding and science policy, which are not well integrated. The different funding sources that exist within the state apparatus are not coordinated to allow an effective funding of strategic innovation goals. Moreover, there is a persistent inconsistency between development policies, which might include such goals as removing risks and creating incentives for enterprises and research institutes to produce innovations. An obstacle is that the state retains ownership of state-funded research results (OECD, 2005). Thus, those institutions that produce such results cannot realise their apparent market potential (Boltramovich et al., 2004).

The issues that delay an integration of economy, science, and politics in order to generate a triple helix indicate that Russia is lagging behind but has the resources to produce innovations. A consequence of enterprises' lack of innovation resources are science parks, which already existed in Soviet times. They continue to be popular as they provide the best infrastructure for doing business and development (Kihlgren, 2003; Boltramovich et al., 2004). Science parks allow close cooperation between enterprises and research institutes. These parks are often organised around a major university. Although it has been sometimes hard for enterprises to finance their involvement, science parks constitute the closest equivalent to a triple helix and reflect progress in Russia towards multi-task organisations. (Kazakova, 2001)

5 Innovation as a driver of evolution

Evolutionary achievements are techniques that are more suitable to deal with life's complexity. Any particular set of techniques – technology – allows more complex social structures to emerge in order to be more effective in extracting and utilising energy. Due to the widespread use of technology in modern society innovation has become a concept through which recommendations on how to achieve better results are transferred to the whole of society. In this way, existing procedures are often considered faulty and in need of improvement. (Luhmann, 1997)

Complex systems, including any innovation regime, are nearly decomposable. Technology regimes will produce a lock-in – or stabilisation – of business management, technology development, and policymaking. New innovations will trigger new lock-ins, creating new dependency structures (Leydesdorff, 2000). Lock-ins are strengthened if old technologies are phased out or if new ones start to fulfil certain functions that require their use in order to participate in social communication. The dependency on innovation also increases if a locality's innovation becomes globalised, thus forcing to be continuously innovative. Otherwise, deindustrialisation occurs. (Leydesdorff and Meyer, 2006)

Although politics is part of the innovation triple helix and necessary for a continued stimulation of the regime, politics cannot control the evolution of innovation. This leaves the potential for unintended consequences (Leydesdorff, 2000). For example, while technology can cut input resources and make production more ecological, it might actually drive resource exploitation as has happened during the 20th century where due to the application of knowledge and technology long-term resource prices have been stable (Wils, 2001). The introduction of information processing technology in the forest cluster of northwest Russia suggests similar developments; while having in mind to increase competitiveness, technology allows more efficient production. (Dudarev et al., 2002)

The question arises as to whether it is possible to avoid unintended consequences. For instance, environmental management and environmental impact assessment address this issue. However, given the quasi-chaotic evolution of the complex innovation regime, planning does not work. There is – to use a systems theoretical concept – not enough requisite variety available (Heylighen, 1992). This indicates insufficient knowledge. Still, more knowledge adds to complexity and uncertainty and thereby decreases the probability of successful planning (Luhmann, 1990). Consequentially, while innovation policies promote a knowledge economy to achieve sustainable development, the risk of unintended consequences increases.

6 Conclusion

There appears to be an insistence on innovation, which is reflected by the need to continue innovating once there is a technology regime, as stated by the triple helix model. The description of the Russian innovation system replicates this need as well. Although the Russian innovative capacity has not reached that of the leading industrialised countries, there is a movement towards higher integration of the different social systems that make up the innovation system. This is exemplified by science parks, which reflect closest a triple helix.

However, based on the potential negative effects of the innovation process, it cannot be deducted that the present inability of the Russian innovation system to produce sizable innovations is harmful and unacceptable. This statement has to be understood in the context of the unintended consequences that a complex society may produce. If it is unlikely to find out about possible negative effects of innovation, it is also unlikely to determine whether innovation benefiting the Russian economy's competitiveness is overall more positive for society than negative. Nonetheless, innovation appears to be necessary in order to maintain trust and cohesion. I believe that the function of trust maintenance is the main justification for innovation, the possible lack of competitiveness is merely a symptom, which is then mirrored in the use of alternative payment methods. Any ecological advantages as a result of innovation should be considered coincidental, particularly as achieving any more resource efficiency – based on the belief that it will cut resource consumption – is not proof for overall ecological friendliness.

Those involved in the innovation process must be aware that unintended effects cannot be pre-determined on their full scale and diversity. Even though approaches such as environmental management indicate the wish to do so. Hence, living with the uncertainties is a necessity. On the other hand, renouncing the need for novelties on an almost constant basis would have a much stronger impact on the demands set by innovated regimes. This depends on individual decision-making, i.e. people's investment behaviour and it would best be done by persistently investment into local enterprises. This might lead to a stabilisation of the local economy without the threat of loosing competitiveness. However as shown, this cannot be modelled with certainty.

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Trust and cooperation as requirements for maintaining environmental governance capacity[1]

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Abstract

Trust can be understood as a mechanism to reduce social complexity. Trust is located in the relations between people, making it a property of social systems. Trust is a prerequisite for the functioning of society, providing a foundation upon which sustainable development, environmental justice etc. are only possible. Consequently, there is a great interest to maintain or strengthen trust in systems and institutions, e.g. in money as an exchange medium.

The requirement of trust for environmental governance sets the boundaries for social change and reduces the probability of implementing measures that might undermine trust and social cohesion, e.g. environmental policies that threaten investments in the economy. Contemporary socio-economic trends, including the acceleration of market processes, globalisation, and the consequential growing complexity in society make it more difficult to maintain trust. Thus, it is questioned whether efforts that potentially improve the society-environment relationship are actually desirable in society.

Keywords: trust, cooperation, environmental governance, social systems, social change

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1 Introduction

The study of cohesion and cooperation is philosophy's field of investigation *par excellence*. The human interest in the collective is perhaps as old as philosophy itself and the relationship between the human collective and its environment represents one of the most important elements in the endeavour into human ecological theory. One stream of thought is concentrating on the meaning of cooperation for providing the necessities for life, be they physical or mental, and culminating into the conclusion that without cooperation, we would not exist (Stewart, 2000). Another stream of thought focuses on the study of community as offering insights into its limits of modifiability. Finding out about the boundaries of possible change is vital in understanding strategies for changing social structures for the greater good of society, for 'man is interested in its [the community's] nature because he usually wishes to change it' (Urban, 1919, 547).

What becomes additionally significant in the analysis of change of social structures is the probability element. We have to ask what change is realistic; also, what change is desired by society. Reflecting on these questions is particularly relevant when thinking about potential feedback effects that collective activities – addressing a problem – can have. Consider the case in which society wishes to deal with adverse ecological impacts it produces. The intensity of ecological impacts today could be considered due to a general acceleration in society, which has affected the speed of exploitation from society's environment (cf. Walter, 2008). A control of this exploitation requires society; in turn, society causes the exploitation. Is this an irresolvable conflict?

In this context it is interesting to consider a major theoretical approach in the sociology of human-environmental relations, which is concentrating on solving ecological problems through modernisation of industries and infrastructure. The foundation for this approach lies in ecological modernisation theory, which has gained high prominence since the beginning of the 1980's and is now part of many environmental policies and state strategies across Europe. (Murphy, 2000) Hence, it is a leading theory as it enjoys broad support among political and economic elites. Understanding why ecological modernisation theory has been so successful will be one aim of this article.

Looking at the environmental governance issue from the perspective of human ecology, which focuses on the build up and maintenance of cohesive regimes against an environmental background, I like to demonstrate the possible conflict between societal interests and environment through the introduction of the concept of trust into this discussion. Trust, as a resource, is of fundamental importance for the production and maintenance of society. Trust is, so to speak, the lubricant of cooperation and without it collective action or agency as a carrier of collective action would not have the foundation to exist. (e.g. Jalava, 2003) Therefore, I will inform about how trust is produced and maintained in society and how trust contributes to collective action. The latter will be shown through highlighting the relationship between trust, power and control. By means of the economy as a collective entity I want to point out how the maintenance of that social system yields the power that politics requires to establish binding decisions on a societal level. Showing these interrelationships between economy and politics will give important insights into the nature of political control and is most interesting to understand the probability element in environmental governance that aims to provide the basis for resolving society's ecological impacts.

The discourse on globalisation has highlighted many evolving elements of society and social life, ranging from increasing global trade to global strategies in managing ecological issues. In an abstract sense this can be summarised in the concept of increasing complexity of society. In such conditions the trust element in maintaining society will receive heightened importance (e.g. Misztal, 2001; Bijlsma-Frankema and Costa, 2005). The questions concerning the degree of change and desirability of change in society are addressed here. Thus, under increasing complexity it is very relevant to consider whether it is probable that any serious measures concerning ecological sustainability are realised. In the light of maintaining future governance capacity it is also highly relevant to ask if any radical changes that environmental policies could bring are actually desirable in society.

Hence, the article will also shed some light on the feasibility of ecological modernisation concerning the improvement of the environment-society relationship. Incorporating a complexity element into the feasibility analysis might yield contrary information when considering that modernisation through innovation might lead to dependency-increasing technology regimes and uncertainty of outcomes (e.g. Leydesdorff, 2000). Consequentially, is there a contradiction or is there a solution inherent to environmental policies?

2 Some theory of cooperation

2.1 Reasons for cooperation

A major stream of philosophical thought concerning the community is concentrating on the assumption that without cooperation humans could not exist. Pretty much everything that we consume – be it goods, services, or intellectual material – is the product of cooperation. Hence, our physical and mental survival – i.e. our sustainability – is dependent on others. Cooperation is, for example, achieved through the division of labour, which is essentially a functional division. People specialise in certain trades so that they do not have to perform just any economic activity. (Stewart, 2000) Through this general specialisation, people are also motivated to cooperate. Functional specialisation creates a network of dependencies, which can very well be considered an evolutionary mechanism to promote cooperation between humans.

Divisions or functional differentiations in society have significant evolutionary advantages. Cooperatives can adapt to much more complex conditions. (Stewart, 2000) Differentiations in society are adaptations to environmental complexity as much as they are adaptations to complex conditions in society. Adaptations are necessary to ensure a continued survival of the cooperative regime. (Luhmann, 1984) Of course, cooperation also enables humans to influence their environment on a much larger spatial and temporal scale. Although in the context of managing ecological impacts, this is not to be necessarily regarded as a positive element. It rather gives insight to the characteristic of society that has to be addressed when dealing with society's relationship to its environment.

Socio-cultural evolution is characterised by continuous improvements in cooperation between humans and it produces mechanisms that incorporate self-interested individuals into cooperative regimes so as to reduce conflict. (Stewart, 2000) An interesting comment by Wuketits (1993) states that biological constraints that humans are subjected to, can inform about the possibilities for human social organisation. Given that morality and values are not part of biological evolution, biological constraints are also constraints for the values guiding cooperation: morality is relying on evolution. One might speculate whether evolution generates a morality that aims at increasing cooperation.

Niklas Luhmann considers the role of society to transform the improbability of survival of the individual into a higher probability of the maintenance of a certain social order. Thus, the probability of sustaining a cooperative regime is higher than the probability of survival of an isolated human. (Luhmann, 1997) Evolution is adaptation to evolving complexity, within the system (internal) and environmental (external). In Luhmann's viewpoint cooperation is a response to life's complexity where specific cooperative regimes or mechanisms evolve to manage complexity.

2.2 Limits of change

Cooperation does not evolve easily: Luhmann (1984) writes that social structure, or, more advanced, functional differentiation, is evolutionary improbable. Barriers to cooperation appear to exist for all reproductive organisations, thus also for social systems. Self-interest is the most significant barrier to cooperation in society. The consequence of the improbability of cooperation is that cooperation becomes highly important (Stewart, 2000). This seems somewhat paradox, but it essentially means that cooperation is in the centre of efforts to maintain cooperation, e.g. of policy.

Basic mechanisms to support cooperation include kin-selection and reciprocal altruism, which are, however, ineffective for cooperation over wide spatial and temporal scales. Therefore, a mechanism is needed that permits trusting in complex, uncertain situations. Generalised media of communication represent such a mechanism that have been evolutionary successful because they are capable of providing trust in a complex world, over wide spatial and temporal scales. These generalised media, such as money, have their function in permitting cooperation among people who might not know each other; precisely this is the case in modern society with its global trade links. All one requires is trust in the media; trust that they fulfil their function in supporting cooperation. (Luhmann, 1968/2000)

Given the limits of change in society, any policy dealing with ecological impacts – any environmental governance effort – must keep in mind the mechanism that supports cooperation, i.e. the generalised media of communication. Modifying social order cannot mean to dismantle elements (systems) of society. Precisely this would be the case if the policy objective would be to take apart the communication media that make humans cooperate – connect and interact – in the first place. (e.g. Luhmann, 1986) Any more radical change is not out of sight, however it must be remembered that a break-down of society's connecting mechanism would leave individual humans behind who are used to cooperation. They have adjusted to it, for instance through occupational choice. A radical change would, thus, leave many possibilities unrealised – a matter most likely unacceptable for society.

Moreover, while evolution has brought about great improvements concerning cooperation mechanisms, trust itself cannot be replaced. Trust is, as I have pointed out already in the introduction, of fundamental importance for the community and social order. Whether in person-to-person relations or society-wide cooperation, trust is the basic connector.

3 Trust and cooperation

3.1 The function of trust in society

Trust can be understood to be a mechanism that serves the reduction of social complexity (Luhmann, 1968/2000). Complexity is a condition of systems; systems built up complexity in the course of evolution. Trust is located in the relations between people; it is not a psychological state of isolated individuals. Thus, trust must be seen as a property of collective units – of systems. Trust can be viewed as a prerequisite for the proper functioning of society. (Lewis and Weigert, 1985) The alternative to trust in social relations would be chaos. And no one trusts chaos (Luhmann, 1968/2000, 47).

It is the function of the mentioned symbolically generalised media of communication to motivate the continuity of social systems. In relation to the success of the motivation to reproduce the system it is possible that the medium is used too much or too little. With respect to the economic system this can be easily illustrated by referring to the terms inflation (too much usage) and deflation (too little usage). The cause of this problem is a lack of trust in relation to the possibility of continuing the circulation of money. Inflation occurs when continued investments require more trust than the medium can produce. In this case the money becomes devaluated (expressed as a price increase). In turn, deflation occurs when the communication leaves opportunities to produce trust untouched. In that case money is circulated less – the future opportunities for using money as medium for payments decrease. The edge of either inflation or deflation is reached when the conditions for the continuity of the system becomes so strict that they do not permit further 'reproduction' of the system's activities. These conditions are called hyperinflation and hyperdeflation, respectively. They reflect the situation before symbolically generalised media of communication had emerged and they illustrate the improbability of successful cooperation. The difference between now and then is that modern society is structurally not prepared to deal with the case of the improbability of cooperation. This can have serious repercussions into the trust of other systems, for instance the political. (Luhmann, 1997) The hyperinflation in Russia during the 1990's is a good example, which led to a strong fragmentation of the currency regime. However, a regime based on alternative means of exchange – barter – does not provide a common basis for governance, rendering politics ineffective. (Walter, 2009)

Thus, in conditions where trust is eroding, there is a serious threat that society could disintegrate. There is, therefore, a risk involved – a risk generated by the existence of trust, which would not exist if there was a functional alternative to trust. But without this trust that works as a foundation for society social relations, planning, justice etc. are not possible. Planning is only achievable when the planner does not have to take into account all possible contingent futures. (Lewis and Weigert, 1985) The opposite would entail dealing with an infinite complexity, which is something that a system attempts to reduce. An erosion of trust or distrust might occur, but eventually society is not conceivable without a fundamental trust basis (Lewis and Weigert, 1985). Consequently, society has an interest in maintaining or strengthening trust in social systems and its cooperation-enabling symbolic media.

3.2 Trust and control

Control is based on several premises. Control has a need for codification, which means that rules and expectations can be merged into a common code. (Bijlsma-Frankema and Costa, 2005) In systemic thinking, social systems differentiate themselves from their respective environment through an individual logic based on a code; the code, in turn, is the way the systems control environmental stimuli. It is this common code, communicated through the symbolically generalised media, which provides the needed cohesion to achieve control.

The common expectations that this communication yields forms at the same time a source for trust.

Furthermore, control requires the ability to monitor. Monitoring is needed to identify whether rules have been breached. (Bijlsma-Frankema and Costa, 2005) Systems observe and thereby apply their logic of distinction, for example distinguishing between solvency and insolvency or between power and opposition. This is known as a first-order observation. Additionally, a system is also capable of observing the way other systems and their ways of distinction operate. This is called a second-order observation. First and second order observations are continuously carried out since observing and distinguishing is the requirement for the system's continued existence. (Gershon, 2005)

Moreover, effective control requires a way of enforcing rules and to sanction deviant behaviour so that a realistic threat can be made. Social systems theory acknowledges the existence of the possibilities to sanction behaviour in trust relationships (e.g. Luhmann, 1968/2000, 38-47). Negative sanctioning has been sometimes seen as being in conflict with the very nature of systems theory (e.g. Borch, 2005). A social system is in control and observing; consequentially its environment cannot simply exercise control of the behaviour of that system. Hence, sanctioning does not seem to be permitted. Luhmann, for example, has conceptualised power in a functional way, within the political system of society, as a symbolically generalised medium of communication. Just like the economy circulates trust-enabling money, the political system circulates trust-enabling power. The understanding of power as a medium is based on the evolutionary orientation of Luhmann's framework, meaning that power is among those means that emerged as a consequence of the need to cope with increasing complexity. (Borch, 2005)

Moreover, any occurring event may, in a complex world, have an infinite number of causes and effects. Hence, was sanctioning and control of a system by another really possible then the future could be projected from the past. Consequentially, the future would not hold any alternatives to choose from. In the course of evolution the environmental causes that can be associated to certain effects within a system can become very complex. (Luhmann, 1984, 40) This complexity is a measure for indeterminacy (Luhmann, 1984, 50). Thus, the lack of information to determine what is going to happen is in conflict with that classical idea of power where future appears determined. In addition, there can also be no hierarchy in society. (Luhmann, 1986, 202) Control power is exercised only over free people. The power to govern is the result of cohesion (through trust) on the basis of freedom of choice.

3.3 Governing through trust

The previous elaborations on trust, control and power are confirmed by Misztal (2001) who sees a natural relationship between trust and democracy, since the preferable democratic order is one that is rooted in trust relations among citizens. It is freedom that allows learning the trust required for social cohesion, which is the same as arguing in Luhmann's terms that freedom is a condition for power to emerge. Trust is between power and freedom; hence, trust connects ('lubricates') systems.

There are a number of major advantages, which trust has in the connection to democracy and related spheres. For example, besides being the key to participation in democracy and markets, trust is a vital prerequisite for democracy's capacity for stability and renewal. (Misztal, 2001) This becomes clear when seeing Misztal's statement in the context of the functioning of the political system of society and its future orientation in planning. Planning necessitates the existence of trust. Moreover, renewal involves changes. In the economy this might entail innovation, changes in production capacities, reorganisation of work relationships etc. Renewal necessarily requires trust to maintain social cohesion.

Nevertheless, Bijlsma-Frankema and Costa (2005) suggest the existence of at least two varying theoretical strands. One strand represents a substitution perspective while the other strand stands for a complementary perspective of how trust relates to control.

A substitution perspective implies that trust and control are inversely related. This means that more control results in less trust, and vice versa. Trust provides motivation to cooperate, increases communication and reduces uncertainties. Thus, the more trust there is available in a relationship the less control is required, saving costs on mechanism to control and monitor. The substitution perspective is consistent with traditional views where trust and control are actually seen as equivalent mechanisms to cope with uncertainties.

On the other hand, the complementary perspective states that trust and control can actually be mutually fortified. For example, clear rules as control mechanisms can increase trust when providing a framework of secure objectives and measures. Thus, trust and control can both add to strong cooperative relationships. Bijlsma-Frankema and Costa (2005) inform that so far empirical studies have not made any results available that would support a particular perspective over the other. Thus, the theoretical understanding of how trust relates to control is not clear yet.

Following systemic ideas a substitution perspective to understand the relationship between trust and control power is unsuitable; this has to be seen in the light of the earlier finding that only free people permit control. Neither can the complementary perspective fully explain the relationship adequately; for example, can the need to sanction jeopardise trust in this complementary relationship? I suggest that a combination of both appears more suitable to understand the trust-control relationship. Particularly the meaning of negative sanctions in social systems theory becomes clear when we ask what the purpose of society and cooperation is in the first place. The answer: to increase the probability of survival. Thus, control power should motivate cohesion. The negative sanction comes about when thinking about the alternative to social cohesion: disintegration and a corresponding decreasing probability of survival. This threat clearly acts as a negative sanction and, therefore, provides an incentive to act in accordance with the request of the one who holds power. Hence, it is fear – as in ‘risk’ society – that generates cohesion.

My approach (figure 1) is illustrated by focusing on controlling the economy from the political system's perspective. The approach takes into account that both politics and economy are autonomously operating social systems, with money circulating in the economy and power circulating in the political system. The value of money is central to maintaining trust, as has been shown earlier. Inflation erodes trust, while deflation does not make use of the trust base; in both cases investments decline, perhaps to the point where the economy collapses.

Undertaking investments, however, is the precondition for producing cohesion. The more attractive it is to use money for trading the more people will entrust the system's medium and, therefore, reproduce the system. The decision whether to use the 'official' currency for trading is a free one, though, it is in the interest of the political system to keep money attractive through appropriate macroeconomic policies. These policies are split up into fiscal (government) and monetary (central bank) policies. The central bank is normally associated with the economy and, in many but not all cases, independent from the government that formulates fiscal policy. Nevertheless, the central bank observes the economy in pretty much the same way as politics does; hence, it makes sense to construct the model as if the central bank would be part of the political system (Luhmann, 1988, 345).

Notice the distinction between the features that can be controlled (monetary value) and that can not be controlled (investments). Investments, which are outside control, represent the element of freedom, which autonomously operating systems require. It is not up to politics to decide whether investments are undertaken or not. The economy must be understood to be in the environment of the political system; and the environment is outside control. If money is governed well, then trust will hopefully lead to investments (ceteris paribus: assuming other factors outside the politics-economy relationship stay equal). Although, in some cases, where governments undertake investments it is up to politics. But then politics takes over the risk for the investments, for example through compensating

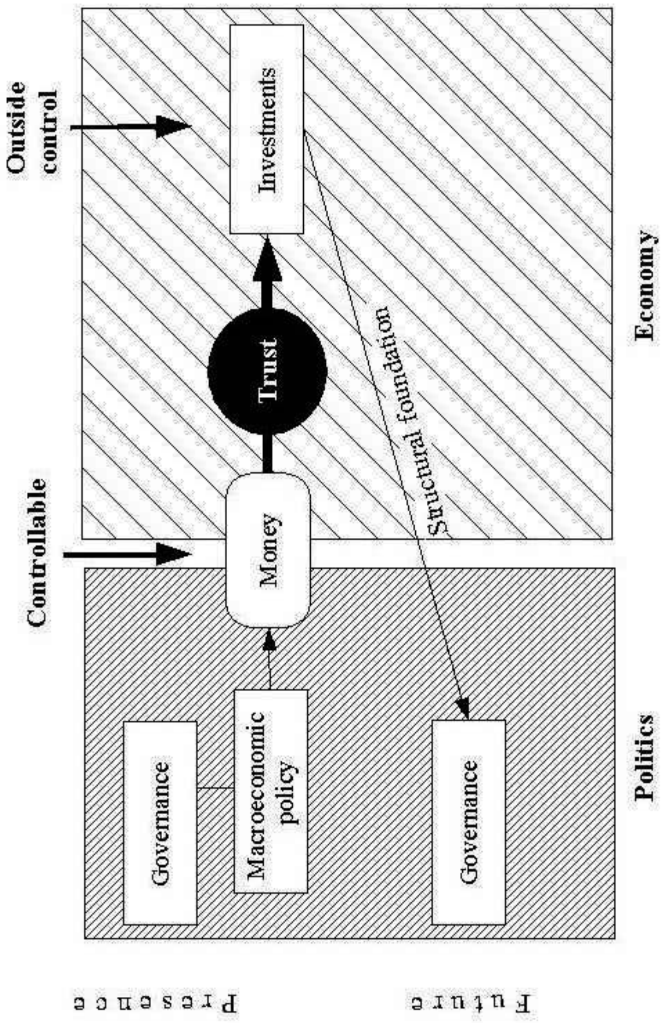

Figure 1: Model of trust-control relationship

possible losses through taxes.

The model of the relationship between trust and control includes on the one hand the substitution strand. The availability of trust leads to a market-type economy where there is no absolute political control over investments. Thus, less control is required from the political system's point of view to maintain cohesion that yields power. However, over time the power to control can only be maintained through trust leading to investments. This is the major difference to Bijlsma-Frankema and Costa's distinction between substitution and complementary strands. Maintenance of control through trust appears more like representing the complementary perspective where control and trust are mutually reinforcing. The more trust there is at present, the higher the probability of having political control power in the future. In addition, the model offers more dynamics since it takes account of possible changes in time.

What is the consequence of undertaking investments? Investments lead to a continuity of the economy and, thus, of the needed cohesion that provides the control power for politics. Investments at present will built up a structural foundation for governance in the future. If investments are not undertaken or barter is used instead of the official currency politics will loose control power, not only over resource flows (when thinking of money as a resource governance mechanism) but also over its foundation. In that case governments will often tighten their grip and centralise functions, with a consequential loss of trust. Similar matters have occurred, for instance, in post-Soviet Russia.

The approach as presented in figure 1 is also supported by Lewis and Weigert (1985) who are of the opinion that most monetarist theories fail to give sufficient importance in their frameworks to the meaning of money as a core social institution. In the course of evolution money has developed into a commodity among others, which is supposed to obey the classical laws of economics. Money, however, functions best when people have trust in it, otherwise it can not work well as a means of communication and a basis for cohesion. Trust is highest when it circulates without any interference. Interferences might include political manipulation of money supply through fiscal or monetary policies, interest rates, or debts financing. Such manipulations undermine trust and are far worse for the maintenance of cohesion in the long-term than any short-term advantages gained from interfering. Note that Lewis and Weigert mention political interference through macroeconomic policies and that it undermines trust. Macroeconomic policies are based on managing the monetary value through control of inflation and interest rate. Interest rates exist due to the reflexivity of money; it is possible to buy money with money. As much as this might undermine trust it also is the only way of directly intervening in the economy from outside. Thus, the goal for macroeconomic policies is to keep inflation and interest rate as low as possible in order to maintain trust. This tension illustrates how difficult it must be to 'do' politics while maintaining the attractiveness of the economy for investments.

4 A platform for conflict resolution?

4.1 Environmental justice as environmental governance

Having elaborately reviewed and developed an adequate idea of the relationship between trust, control and power, what are now the consequences for environmental governance? This is not the place to provide a thorough and accurate definition of environmental governance, only as much as it can be described as the 'establishment, reaffirmation and change of institutions to resolve conflicts about environmental resources' (Paavola, 2007, 94). Accordingly, environmental governance deals with conflicts of interest over any type of environmental resources – renewable or non-renewable – or environmental issues as much as it includes all scales of governance problems.

Given the widespread conceptualisation of environmental problems as dealing with conflicts has lead to governance being focused on matters of social justice, rather than matters concerning the efficiency of natural resource exploitation. Social justice in the context of environmental governance can apply to both distributive and procedural justice. (Paavola, 2007) The latter might address, for example, participation issues, e.g. concerning the distribution of power in administrations in order to legitimate decision-making, while the former commonly concentrates on the distribution of resources (energy) as well as the distribution of pollution (waste) (cf. Hornborg, 1998).

This particular focus of environmental governance on environmental justice – based on equality and democracy – rests on the assumption that social and environmental goals can in fact be met in an integrated way (Becket, 2004). This assumption is opposed to the belief that social and environmental goals are contradictory. Examples for a working relationship include tackling the causes of health problems and poverty, coupled with a general support for jobs and economic progress. This assumes that environmental goals have in fact economic benefits, for instance in terms of energy savings and waste reduction, while at the same time there is a strong connection between environmental degradation and economic underdevelopment. (Becket, 2004) Justice measures might also include environmental measures, which control negative externalities, i.e. the ecological impact of society. A major objective of environmental justice, however, is to design environmental policies that are also socially just. (Foley, 2004) This goal can be considered a trade-off; it contains a potential conflict because it implies that environmental policies could also be unsocial. The message could also be: environmental sustainability yes, but at no great risk for social sustainability. The general idea is, though, that as long as policies are carefully developed, there will be no negative effects on any social groups – stakeholders – involved (Foley, 2004).

A different approach is presented by Hornborg (1998) who combines ecological economics and the tradition of world system theory, based on Wallerstein (1974–1989) and represented, for example, by Chase-Dunn (2005). Hornborg shares the concept of environmental justice as having emerged out of the assumption that environmental problems are socially distributed. Accordingly, the study of justice in the context of environmental governance is about the inequality of exchange relationships, including inequality concerning the distribution of environmental resources and the inequality concerning the distribution of adverse effects stemming from industrial production.

Hornborgs way of understanding this inequality problem is based on the exergy concept, which refers to the quality – not quantity – of energy. Exergy is about the physical fact there is no consumption of energy as such, but merely a transformation of energy, resulting in a change of its quality. (Hornborg, 1998) A related concept is that of negative entropy and dissipative structures (Heylighen, 1992). Dissipative structures are systems that maintain themselves against the entropy suggested by the laws of thermodynamics. Accordingly, systems must exploit energy from their environment – a higher quality of energy – and release waste to their environment – a lower quality of energy. In other words, systems exploit order and release disorder. Social systems are alike those systems described here. Thus, this relationship between a system and its environment is naturally in an imbalance.

Whether justice refers to the equal distribution of material resources, energy, or opportunities is not relevant. One can go as far as Hornborg (1998) and proclaim that ecological issues and distributive inequalities are inseparable. In any case a collective effort is needed to achieve equality and justice, which is based on a common regime, a social system. The need for an elaborate and sophisticated regime becomes even more apparent when demanding justice between humans across the globe and across generations. Simultaneously, considering the global human population, now and in the future, is associated with a complexity that can hardly be comprehended. Given global tendencies that continuously increase complexity, it is conceivable that maintaining social justice will proceed at the expense of collective efforts that aim at addressing ecological damages.

4.2 Governing environmental justice in a globalising society

Many authors have observed several trends in recent times which will make it increasingly difficult to maintain trust. Such trends include the speeding up of market processes and globalisation. These trends are accompanied by a diminishing capacity to control those changes. For example, markets which operate at a great speed do not easily allow a prediction of the outcome. In other words, under high complex conditions, investments and all their consequences cannot be predetermined. This entails higher risk and less formal control possibilities, requiring a higher decentralisation. Trust, in turn, becomes increasingly important in facilitating cooperation. This is clear: as control diminishes, another mechanism must come into play. (e.g. Misztal, 2001; Bijlsma-Frankema and Costa, 2005)

Misztal (2001) identifies the trends as being ongoing bureaucratisation, an expansion of formalism and legalism; in other words, a globalisation of social systems. This expansion and globalisation of dominant regimes is characterised by an increase in everyday life's complexity. More complex conditions are confirmed by Blunden (2000) who describes the globalising world as being accompanied by a growing disorder.

These trends have led to an increasing individual autonomy and an extended demand for negotiation. This is somewhat obvious as an expansion of democratic and market structures simply demand active participation and negotiation. (Misztal, 2001) Higher selectivity and a need to make more choices are due to the expansion of the range of the possible, enabled e.g. through technological developments (Blunden, 2000). These changes make the world less predictable and, consequently, there is a higher need for trust since more technology-widening possibilities lead to higher risk of unintended consequences (cf. Walter, 2007).

A less predictable world will reduce the power of governments; thus, state authorities will have difficulties to maintain people's trust. For instance, to maintain stability and power for governance, the focus of economic policy should be on the maintenance of trust. But such a policy is constrained by the pressure to accommodate accelerated economic growth, often accompanied by trust-eroding inflation. (e.g. Walter, 2009) Similarly, alike the economic field, environmental policy is constrained by what is possible so that trust is not threatened (Blunden, 2000). For example, making money expensive in order to decrease resource exploitation would be a considerable environmental policy to manage natural resources ecologically. However, the policy might undermine trust in the economy as investments fail to be made. (Walter, 2008)

The difficulty of authorities to exercise power in order to predict outcomes of their policies has led already to the emergence of new modes of governance where the state is emphasising a rescaling of its activities (e.g. Secretariat of the Economic Council, 2006). Over time this could lead to a higher pressure to relocate more and more functions from the state to other actors, be they regional authorities or private individuals. This has to be understood under the premise that if the state does not function well others have to take over its tasks. (Agrawal and Lemos, 2007) Thus, the globalisation process constitutes a positive feedback loop for the erosion of centralised power, a source of power, which is perceived as the guarantor for equality.

4.3 What about ecological modernisation?

What remains to consider in this section is the situation with environmental policies, which address other than justice issues. The other large group, besides environmental justice policies, is policies aiming at efficiency. Generally speaking, the globalising tendencies, which have conquered the economy perhaps more than any other societal sphere, make it rather easy to implement efficiency measures into production processes. More efficient enterprises are more competitive since they can produce at lower costs. And competitiveness is one of the most eminent issues that organisations face in a global society. Research and development departments are particularly concerned with this issue.

Ecological modernisation as an environmental strategy emerged out of this context of increasing complexity, which demands a fostering of competitiveness and decentralisation of decision-making (i.e. marketisation). Accordingly, ecological modernisation is based on the need to modernise when operating in markets and is strongly innovation oriented. However, the idea behind it as a strategy is to accelerate the technological progress, but simultaneously founded on the assumption that environmental problems can only be solved through marketable solutions, which aim at increasing the productivity of resource utilisation. The goal is essentially to produce so-called win-win situations, where technological progress is good for economy, society and for the environment. Thus, it is very much a political concept. (Jänicke, 2008) This is even truer given that ecological modernisation does require influence on the direction of progress; though, due to the world's growing complexity, ecological modernisation is relying heavily on the market as a regulating factor where uncertainty drives progress. (Murphy, 2000)

The model on the relationship between trust and control shares the assumption of ecological modernisation theory that environmental policy is only possible through marketable solutions, which means nothing else than as part of a continuously trustful society. Thus, ecological modernisation is the most probable way to go ahead because it has the strength to maintain trust and cohesion. This is not surprising as it is the goal of the state/polity to maintain a cohesive regime, for instance to ensure a platform for justice etc. Hence, environmental policy measures are only acceptable in so far as long as such a governing platform can be sustained.

The success of ecological modernisation can be explained by its orientation as a collectivist strategy. It does not challenge the basic established regime of networks and dependencies and the efficiency seeking societal configuration (cf. Stewart, 2000). Not addressing the individual, society assumes responsibility. Consequentially, ecological modernisation emerges as an approach that maintains trust and cohesion under an accelerated evolution of complexity. It is an effort to remove or minimise possible conflicts that could surface out of dealing with the existing dependencies in society and, hence, provides a continuing basis for social justice. The strategy is – so to speak – sustaining the status quo between an exploited environment and an exploiting society (e.g. following Hornborg, 1998).

This consequential problem is confirmed by Jänicke (2008) who points out that increases in resource efficiency actually might feed back and lead to increases instead of decreases in resource exploitation and possible corresponding emissions. Following systemic considerations in the analysis of innovation provides an important insight into the demands set by technology regimes. Once an innovation becomes accepted a regime starts to stabilise by evolving into a dependency network (Leydesdorff, 2000). New innovations and more knowledge increase complexity, thereby decreasing the probability of planning any outcome. The provisional nature of true knowledge generates a continuous pressure to accumulate new knowledge and to innovate (Leydesdorff and Meyer, 2006). Luhmann has formulated the consequence of this need in writing that science becomes the means through which the world becomes uncontrollable (Luhmann, 1990, 371)

A look at 20th century extraction of non-renewable resources confirms this. In spite of an increased extraction of many such resources long-term prices have been rather stable. This is due to the application of knowledge and the improvement of extraction and utilisation technologies. (Wils, 2001) Hence, innovation can lead to an acceleration of resource exploitation, where acceleration means an incremental increase of resources exploitation per time unit, as happened during the 20th century. Similarly, Braungart et al. (2007) argue that the former East Germany has been – due to its inefficient industry – much more effective in conserving environmental resources than West Germany, which exploited the environment far more due to its highly efficient industrial facilities.

Hence, solving environmental issues on the basis of improving the efficiency of resource exploitation and waste emissions is restricted by the problem of dependency on social networks. Eliminating ecological issues would require a removal of the boundary between society and its environment or, in other words, the boundaries of the mentioned dependency networks; for it is boundaries that produce conflict. Given the globalisation process, under which trust is increasingly difficult to maintain and, thereby, making it already difficult to implement justice policies, it will be increasingly improbable that politics would implement measures that address the dependencies in order to break them. This has to be understood in the light of the conditions of trust maintenance. It is after all due to cooperation between humans through generalised media of communication that trust is bestowed at all.

5 Conclusion

In the course of evolution cooperation has expanded over time and space, necessitating the emergence of mechanisms that would permit translocal cooperation in more complex conditions. Not only allow these mechanisms governance over wider scales, spatial and temporal, they are also a condition for achieving justice. To make it clear, how would it be possible otherwise to achieve justice between large numbers of people if these people would not interact as part of a large scale cooperative regime? Hence, governance necessitates a cohesive society.

However, the limits for change in society reflect directly the discussion on willingness to change. The fragile position of governance capacity based on freedom of choice is clearly depicted in the introduced model on the relationship between trust, control and power since there is a clear choice between bestowing trust and not doing so. This is why it is so important for polity to maintain trust in policies and general societal rules. Otherwise power is degrading. While freedom of choice, so to speak, grants power to the collective, the latter then produces limitations to (societal) change. The collective has its own way of functioning. The whole is, after all, more than just the sum of its parts.

Concerning environmental governance efforts, it appears environmental programmes' different objectives can be put together, incorporated, for instance, into a common framework called sustainable development. Given that sustainable development requires the maintenance of governance capacity, it must necessarily be organised so as to enjoy broad support, for example to emphasise social justice, equality etc. between people. The idea that justice can lead to environmental sustainability is based on the assumption that justice is equal to justified policies – meaning, it is morally correct to protect both environment and people from the unfairness of the world. Moreover, if morality is subject to evolutionary constraints, would it be surprising to find that what is seen as being morally correct is concerned with preserving cooperation?

Social evolution has caused complexity to increase within social systems and, therefore, there are more choices to be made nowadays. More choices naturally entail increases in risk. While the nation-state concept appears to loose meaning, the very functioning of the state depends on the maintenance of trust in it and cooperation. Thus, trust will be increasingly required to maintain cohesion under great and rapid changes. Maintenance is at the centre of a dynamic approach to understand state or political agency addressing the collective; it is a concept that assumes that it could also be different. Disintegration is what can happen if maintenance does not take place. The model framework on trust and control that I have presented offers this dynamism and has a strong focus on maintenance. Moreover, due to the consideration of the complexity increase it sheds light on the need for trust as a lubricant of social relationships and as a provider of power for society-wide planning. Hence, it appears that it will be increasingly less probable that any measures that threaten the trust requirements for translocal cooperation will be implemented.

The trends towards globalisation and rising complexity and their corresponding problems point out the basic conflict that exists, which is the boundary between dependencies and their environment. When viewing society as a regime of dependencies, maintaining trust and cohesion will more and more be the priority of policy making. Any environmental policies that aim to address the reduction of society's impacts on the environment would need to aim at weakening or breaking those dependencies. Hence, it is not surprising that environmental governance of the collective reality is seeking the opposite: the integration of society and environment.

From the elaborations in the article it appears that environmental governance is first and foremost about maintaining future governance; hence, it is about the potential to govern in the future. While environmental governance, for instance as expressed in ecological modernisation, has the good intention of improving the society-environment relationship, the elaborations suggest that this approach, alike other governance solutions, is ensuring that conflicts (always between people) are kept at a minimum. Following the earlier descriptions there is a threat that ecological modernisation results in a cementing of the society-environment difference due to the dependencies it causes. This implies that this strategy (alone) is unlikely to be successful in decreasing environmental impacts.

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Can society manage ecological risks?[1]

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Abstract

Purpose: To present a model that outlines the problems in managing ecological risks by analysing societys pattern of controlling complexity.
Methodology: A three-tier model complexity-control-evolution is developed on the basis of combining data from the existing literature and founding it on systems theoretical concepts in order to explain complexity management. Ecological risk is equalled with the acceleration of societal processes, culminating into the increase of environmental impacts that potentially produce feedbacks.
Findings: Understanding societys complexity management requires a circular-causality approach instead of relying on linear-causality models. Consequentially, the efforts to control complexity result in acceleration. Hence, acceleration and by extension ecological risks cannot be controlled.
Practical implications: Informs particularly policy makers about the problematic in demanding greater control through knowledge over that complex issue ecological risk. However, the focus on higher efficiency and cooperation in policy making makes increases in ecological risk probable.
Originality/value of the paper: The paper contributes to the research on ecological risks, acceleration and complexity as well as to the wider sustainable development discourse.

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1 Introduction

There is an apparent and increasing need for knowledge production (e.g. Allen and Strathern, 2005; Galanakis, 2006; Holford et al., 2008; Paton and s. McLaughlin, 2008). This can be seen as a response to the rising complexity in society. With the help of knowledge, socio-cultural evolution has increasingly well adapted to complexity (cf. Stewart, 2000). Such a process can also be described as an attempt to maintain control: society is supplied with facts in order to maintain the capacity to govern.

Indicators for this greater need are visible in the variety of research strategies on all political levels, be they supranational, e.g. the Lisbon strategy of the European Union, or national/regional, e.g. the Finnish Arctic research strategy. Whereas the EUs strategic plan is founded on the understanding that we have no choice but to be innovative and produce knowledge in order to maintain global competitiveness and control power, the Arctic research plan in Finland recognises the global trends in investment and natural resource exploitation in the European Arctic and suggests that it is the task of research to create the conditions in order to control this exploitation in a sustainable manner. (Korhola, 1999; Commission of the European Communities, 2005)

So, while society is inconceivable without any technology, in modern globalised society there is increased pressure for novel technology and fast scientific innovations (cf. Luhmann, 1990, 1997; Stewart, 2000). Advantages include the maintenance of economic competitiveness, as by-products possible reductions of resource extraction and less waste emissions, and most importantly the maintenance of governance capacity. The latter is a direct consequence of competitiveness and its trust-strengthening capability. (Walter, 2007) This context on the increased need for innovation in a complex environment and its subsequent advantages also led to the emergence of ecological modernisation theory. Its rationale is founded on the acceleration of technological progress under the assumption that ecological risks can only be solved through marketable solutions, thereby producing win-win situations. (Murphy, 2000; Jänicke, 2008)

However, more knowledge and technology create more complex conditions (cf. Luhmann, 1990; Heylighen, 1997; Leydesdorff, 2000). This is, for example, reflected in the increasing selectivity of modern life, i.e. the need to make more decisions (e.g. Misztal, 2001; Bijlsma-Frankema and Costa, 2005). Simultaneously, while adapting through knowledge to more complex conditions, societal evolution has also produced more and more ecological impacts. Thus, ecological impacts emerge as a consequence of managing complexity ever better. Hence, there appears to be a risk in not innovating, which is reflected in the loss of economic competitiveness and possible loss of governance capacity. On the other hand, there is a risk in innovating, reflected in unintended consequences, such as ecological impacts. (cf. Walter, 2007)

Influenced by phenomenological developments which suggest that humans - and society - are natural and the emphasis on distinction in human thought, the focus on ecological impacts should be on the difference between society - and its sub-spheres - and the surrounding environment. (e.g. Luhmann, 1986; Adam, 1991) Accordingly, the ecological impact has to be located in the environment of society. Given the evolutionary context of complexity growth, the phenomenon of acceleration gains significance here as increasing speed is a core characteristic of co-evolving adaptive systems. (Heylighen, 1997) The importance of acceleration is confirmed by many scholars, such as Adam (1993); Reisch (2001); Geißler (2002), who state that the present compressing relationship between space and time is the cause of the ecological crisis we face. Hence, focusing on acceleration as an ecological risk, the article will investigate societys pattern of managing complexity, thereby pointing out the problem in managing acceleration/ecological risk. To do so, a model will be described, supported by observed data, which aims at demonstrating this management pattern.

As part of the growing need for knowledge, the production of knowledge has become somewhat self-perpetual. Knowledge is more and more produced to maintain science, i.e. to preserve the future possibility to produce more knowledge. Thus, the goal of the scientific enterprise has been transformed from being teleological - with a goal in mind - to being autopoietic - for the purpose of reproduction. (Luhmann, 1990) Insights from systems theory and cybernetics suggest that co-evolving systems will increase overall complexity, but with an increasing speed that implies a decreasing capacity of a system to respond to environmental perturbations. (e.g. Luhmann, 1990, 1997; Heylighen, 1997) Hence, the acceleration illustrates a drifting apart between (environmental) complexity, which social structures attempt to control and the actual control capacity. Does this suggest that science strengthens the circumstances under which social structures produce ecological risks?

2 What is an ecological risk anyway?

The term ecology is derived from the Greek words 'oikos' and 'logos' and means 'science of the habitat'. Ecology in its original meaning aimed at describing the economy of nature, i.e. the total relations of the animal to its inorganic and organic environment, and was first used in this way by the zoologist Ernst Haeckel in 1866 (Costanza, 1996; Lawrence, 2003). Ecology, hence, studies the environmental relations of living organisms, which, besides heredity, guide the conditions for sustainability of the organism.

Similarly, human ecology, when it was most notably introduced by sociologists of the Chicago School in the context of community studies, aimed to understand the relations of humans to other humans as influenced by their surrounding habitat. The significance given to human ecology has to be seen in the light of the apparent ecological crises that we identify in the interrelations between society and environment.

An important element in the application of human ecology is the consequential consideration of society as being natural. This poses problems for the allocation of blame who can be considered guilty of causing an environmental impact, a potential ecological risk? For example, the enhanced greenhouse effect, human-induced climate change, is still a natural phenomenon. Hence, it is not useful to discuss ecological issues on the basis that assumes a nature/culture or society/nature divide (e.g. Adam, 1991) Given that human thought seems to emphasise differentiations, it is most useful for the discourse on ecological issues to consider the distinction between society and environment as significant (e.g. Luhmann, 1984, 1986, 1997).

Accordingly, Luhmann defines ecology as the totality of scientific research that is concerned with the consequences of the society (or system-)-environment differentiation, be they consequences of societal or environmental nature. (Luhmann, 1986, 1997) Therefore, ecological risks are about the outcomes for society or the environment of society that stem from the changes over time in society. For instance, evolution generates growth of complexity in society due to society-internal differentiations. This influences societys environment. What are relevant for the sustainability of society in particular are possible feedback effects and repercussions from societys environment.

The growth of complexity appears to be decisive when discussing the ability of society using its science system in producing knowledge to respond to perturbations from societys environment. While higher internal complexity means a higher degree of freedom for a systems possible behaviour, it also means a stricter closure against its environment, hence, potentially generating stronger impacts. The latter is particularly due to the decreasing probability for prognosis about any causality, which is linking system and environment. (Luhmann, 1997)

Acceleration is at the core of co-evolving systems in society. This has to be understood in the light of the variety of evolving systems forming part of each others environments: system A is in the environment of system B and vice versa. Hence, an increase in complexity in system A allowing the system to respond to an increased variety of perturbations from its environment simultaneously increases the complexity in system Bs environment (since system A is in Bs environment). This is a very important issue given that it is often assumed that environment is a stable continuum. Therefore, a systems internal complexity growth is not simply an adaptation to the environments infinite variety, where the adaptation process would then be characterised by a slow down a negative feedback process. On the contrary: the enforced mutual responses in the systems generate a positive feedback process of increasing complexity, occurring with a rising speed. (cf. Heylighen, 1997)

Acceleration has been an issue of societal discussion at least since the 19th century. For example, poet Goethe and philosopher Nietzsche remarked the increasing need for interconnectedness and faster communication opportunities as well as the shift towards increasingly valuing the busy over the lazy. (cf. Nietzsche, 1878/2008; Osten, 1999) However, continuing industrialisation and technological progress led to the turn of the 20th century being marked as the era of modernity and futurism. For instance, in the futurist manifesto it was declared that the splendour of the world has been enriched by the beauty of speed (Marinetti, 1909), indicating the move towards rising speed and reaching other achievements for their own sake of breaking (numerical) records.

Acceleration as an ecological issue gained significance as part of the sustainability debate beginning in the 1970s. For example, the Club of Romes *Limits to Growth* report from 1972 suggested significant ecological and societal problems under an accelerated growth of the global human population under the assumption of a finite natural resource capacity. (Meadows et al., 1972) Likewise, the Brundtland report *Our Common Future* was concerned with the accelerated deterioration of societys environment and the resulting consequences for social and economic well-being. (World Commission on Environment and Development, 1987) Since then the understanding has developed that the present ‘unhealthy’ relation of time and space is the basic cause for the ecological crisis and back-feeding risks we identify (Reisch, 2001; Hofmeister, 2002). This time-space relation is perceived as being particularly due to an increasing speed in economic activities. (Adam, 1993)

Therefore, when we ask whether science can manage ecological risks, we essentially want to know if science's function - to produce more knowledge - can control acceleration. The model presented in the following - and divided into three sections: complexity, control, and evolution - attempts to shed some light on this management problem. It is based mainly on essentials, which are relevant in a social system context, referring, for instance, to the theory of social systems by Luhmann (1984), but also to general system and cybernetic principles. Its particular strength lies in the practical value, the provision of (literature-based) data to show that the trends suggested in theory seem to happen in practice. The model as developed here will permit easy complementation by adding more case studies in order to understand the prerequisites for acceleration and the ecological risk potential in other settings. Supporting conceptual models in systems theory and cybernetics through data is considered rather important as analysing complexity issues outside the traditional linearity of cause-and-effect is made especially difficult when not providing ideas on how to understand complexity evolution and its consequences in practice (cf. Geyer, 1995; Dijkum, 1997; Heylighen, 1997).

3 Understanding acceleration

3.1 Complexity

Complexity is the result of an operation, the operation of observation; hence, without anyone observing anything, there is no complexity. Concerning systems the term complexity is usually used when the system in question is neither fully in order, nor in disorder. The literature, therefore, is often concerned with what is named organised or structural complexity. (cf. Luhmann, 1997) Scholars of systems and cybernetics and their applications refer to two basic aspects in systems when describing complexity: elements and relations. Elements are the parts of systems that are reproduced; Luhmann applied the term autopoiesis for reproduction, based on Maturana and Valera's work in evolutionary biology. (Maturana and Varela, 1980; Luhmann, 1984) Elements, then, emerge out of the environments complexity; they are the system's way of distinguishing itself from an infinitely more complex environment in order to manage (reduce) the complexity.

In turn, relation exhibits the connecting and networking character of complex systems. Complexity is considered to increase when its number of elements increase, which can be connected through relations. However, given that an increasing number of possible relations have to be reduced to a manageable number of possible relations, the system will select a finite range of possible relations of its elements. This is necessary because evolutionary systems do not simply stop growing beyond that point where all elements could be connected to all other elements. Hence, the selection of possible relations is a necessity to enable the connectivity and, therefore, ensure the sustainability of the system. (Luhmann, 1997) Heylighen (1997) calls the process of increase of possible relations integration (meaning: increase in dependency). Given that this process of selection cannot be controlled by an outside force, we speak of structured complexity, illustrating that the system is neither fully in order nor totally in disorder. (cf. Degele, 1997; Dijkum, 1997)

The complexity gradient marking the boundary between a system and its environment becomes important when analysing the source of time construction and acceleration. Given that there are no point-to-point connections between system elements and the systems environment, system time cannot be synchronised with the environment; system time has to run faster. The more differentiated a system becomes internally, the more the internal timeline will become diluted in relation to the environmental chronology. Hence, acceleration has to be understood as the response to managing complexity. The more differentiated a system becomes for instance due to the need for maintaining its own identity against a complexity-increasing environment the higher is the need for an accelerated timeline in that system, relative to its environment. (cf. Luhmann, 1984)

Walter (2008) has offered a practical interpretation of the above by applying those principles to a case study on Northern European forestry. He reasoned an indicator that - on the basis of the economic system's operation logic, to pay or not to pay (Luhmann, 1986) - would reflect the difference between acceleration and deceleration in the economy. Acceleration is regarded here as the potential to increase the return period of an investment, based on the price for money on the capital market, which is - for simplicity reasons - oriented on the real interest rate. Accordingly, a low real price leads to a higher investment with corresponding faster rates of exploitation. In turn, a high price for money - assuming high real interests - leads to lower rates of exploitation.

Money has to be understood here as the element that allows the economy to distinguish itself from its environment. Prices give guidance how the economy reproduces. In an environment with high complexity the investor will want to adapt by preferably investing into an object that offers a fast return on that investment (in order to minimise the uncertainty associated with high complexity). That way the investor can make sure not to be without disposable income for too long, which would otherwise impede the future timeline of the investor. Consequently, acceleration occurs when investments are cheap and/or if they provide a sufficiently fast return. Enterprises use this by continuously feeding the market with innovations; otherwise their attractiveness for investments declines. Likewise, a worker has to increasingly update knowledge and skills to be still attractive for employment. In turn, deceleration occurs if less objects for investment can be found that would provide for an attractive return. Consequently, this might jeopardise the sustainability of some parts of the economy, for instance enterprises.

Nevertheless, making money expensive - a task for a central bank, and a rather common one when thinking of controlling inflation - would have theoretically a similar effect. On that basis, then, a correlation analysis was undertaken, combining interest and inflation rates and roundwood logging statistics from Sweden, Finland, and Russia from 1992 to 2004. While in the case of Sweden and Finland the analysis did indeed show that expensive money correlates to a slowdown of roundwood logging, this was not the case in Russia. The results indicate that the central banks of Sweden and Finland/Euro-area were able to control the monetary value of the currencies in their area, whereas the Russian central bank was not. (Walter, 2008) And this was the case even though the Russian central bank pursued a classical orthodox economic policy, indicating that the cause of the lack of control should be located outside the economy (Walter, 2009). Any event is the cooperation between a system (economy) and its environment. Hence, a 'working' environment is required; in other words, a trustful environment together with an appropriate measures to maintain trust into a currency.

Consequently, a confiding environment is needed, meaning people must bestow a lot of trust into the continuity of the economy, in order to accept a slow down. But, given that control is generally limited for self-organisational systems, the question is not only whether a deceleration could be controlled, but rather whether this is probable. What is to be done if keeping money low-priced is a requirement to maintain trust - in other words, if a low interference into monetary affairs is necessary to have the highest possible trust level? This question is vital when considering the connectivity, the sustainability of the economic system. (Walter, 2008)

3.2 Control

Generally, control is about managing complexity. The mentioned elements and relations form the structure of a system in order to reduce the environment's infinite complexity. Hence, the sustainability of the reproductive organisation of a system's elements sustains the control of that system. It is important to point out that the focus of control is the internal sphere of the system; managing complexity does not mean that the system manages its environment. When talking about social systems - which are self-organisational - full control over the environment does not exist. (cf. Luhmann, 1984)

The sustainability of the system provides a timeline: a future can be pinpointed from present time when assuming that the system is going to exist in the future as well; in other words, when the system's elements are going to be continuously reproduced. For example, money has to be continuously used to maintain the economic system and its peculiar control ability, which Luhmann defines as providing the security of meeting needs along a timeline that stretches into the future (Luhmann, 1986). This, however, requires trust into money; lack of trust is expressed as a loss of value - inflation. Thus, under inflation the sustainability of the economic system is jeopardised. In turn, deflation reflects the situation where the high trust of the currency value cannot be utilised - a rather similar situation. A high and prolonged lack of trust into a currency can lead - if not to a breakdown of the economy - at least to a fragmentation of the currency regime. In such a case alternative means of payment emerge that will lead to a lack of unified control. (cf. Walter, 2009)

These considerations lead us to the thoughts aired in the previous section, when interfering with the value (and costs) of money would offer some form of control on the rate of resource exploitation. Lewis and Weigert (1985), for instance, state that the less interference there is with a currency the higher the trust bestowed on that currency would be. Consequently, this leaves little room for controlling exploitation through slowing down the evolution of the economic system. In addition, an increasing environmental complexity - illustrated through a globalising economy - will still reduce that probability of interfering with the currency value. A high priority in todays global economy is the free flow of investments. Hence, impeding this flow by making investments more difficult will lead to a loss of competitiveness - a much undesired outcome.

A practical illustration provides Russia's macroeconomic policy of the 1990's if analysed with respect to its trust-generating and maintaining ability. Russias rouble currency experienced various up-and-downs with almost complete erosion of the currency value in 1993 and 1998 at the height of the economic crisis in Asia. Consequence was a fragmentation of the currency regime in Russia and an emphasis on alternative means of payment - barter, which reached a height in summer 1998 when an estimated 70 percent of the industrial output was exchanged through such alternative means. This also led to a prolonged lack of trust into the official currency so that in 2005 the use of barter still stood at about a 7 percent (Sutela, 2005).

During this period general economic policy was commonly criticized as being too inconsistent at different state political levels and often too opposed to market principles, preventing long-term planning and adjustment by citizens and enterprises. In fact throughout most of the time Russian fiscal and monetary policy consisted of orthodox policy - a policy orientation commonly followed by all major central banks and governments governing a mature economic area. Hence, it was not so much the ill-designed policies that generated the lack of trust. (cf. Walter, 2009)

This Russian case illustrates the difficulties that arise from aiming to maintain trust into an economic area's currency in a rapidly evolving environment, i.e. the exposition of the Russian economy to the world market. Extrapolated, the case shows the problems with sustaining a system, which is surrounded by an environment whose complexity is almost suddenly and very rapidly growing. It should be clear that the priority of the governing bodies in such a case will be on sustaining the economic system instead of trying to slow down its reproduction for the purpose of decelerating resource exploitation. Furthermore, given the growing complexity of the global society, it can be suspected that government policy will be more and more focused on maintaining trust instead of undertaking any measure that could threaten the trust base, including measures that would be ecologically desirable but socially less acceptable.

3.3 Evolution

In the section on complexity it was already suggested that enterprises and employees alike have to be innovative concerning their product range and personal skills in order to maintain their attractiveness for investments; for only continuing investments sustains the economic system and its control capacity. This demonstrates the essence behind change and transformation, in short evolution, in the maintenance of systems. Evolution, thus, has to be understood as an adaptation to ever changing environmental conditions so as to continue the reproduction of system elements. Evolution permits the continuous concentration on autopoiesis against an environment with an evolving complexity.

Evolution is directly connected to the systems elements and relations. As said, elements and relations determine the complexity of a system. The way elements are reproduced and connected through relations will be subjected by evolution. Evolution, thus, increases complexity the elements and relations of a system in order to sustain the system. A higher internal complexity will counteract the infinite complexity of the systems environment. A common way of ensuring higher complexity is through differentiation and integration; for example, in the economy this occurred through a differentiation in subsystems, such as enterprises and households, which are integrated to form a whole.

The fact that complexity increases is subject to a disputed debate (e.g. Heylighen, 1997). While describing the nature of ecological risks, it has been said that complexity growth is connected to systems co-evolving in relation to each other. While system A is in the environment of system B, and vice versa, system A tries to maintain its reproduction against an evolving environment that contains system B. A's environment is evolving because it has system B, which is itself increasing its complexity against an evolving environment containing system A. As described, the mutual responses are self-enforcing and accelerating on the basis of a positive feedback effect.

While this appears very conceptual, it can in fact be observed. Various disciplines, including ecology, biochemistry, psychology, and sociology provide observations that confirm the increasing complexity in nature. Ecologies are considered to increase in complexity with every new species. Moreover, every new species creates a niche that is likely to be filled with new species (cf. Toussaint and Schneider, 1998). Similarly, laboratory experiments on microRNA organisms confirm the increase in complexity over time, suggesting that evolution leads to a complexity growth (e.g. Takuno and Innan, 2008). The same process also applies in the co-evolution of all our mental abilities, considering that we all have to continuously learn in order to be able to find our ways in a world with increasing complexity (e.g. Heylighen, 1997). Likewise in society, every innovation made opens a niche to be filled by a new innovation. Particularly in science, every further fragmentation and increase in resolution of scientific analyses opens up new needs for further research and knowledge production to which other subsystems of society need to respond in their own ways (Luhmann, 1990).

In the societal context evolution is portrayed as the dynamic interaction of self-organisational subsystems of society. For example, the so-called triple helix model of innovation is founded on the assumption that three organisationally independent subsystems are needed to produce innovations in society, namely economy, politics, and science. Since organisations that are associated with each subsystem, e.g. enterprises, governments, research institutes, overlap in their respective activities, e.g. enterprises do not only finance but also might have own research departments - thereby creating multifunctional organisations, the existing boundaries between the subsystems are in flux and generate a highly dynamic and constantly evolving network of communication. This communication on innovation constitutes the triple helix regime, which is resting, nevertheless, on independent subsystems that process information in their own respective ways. Lack of understanding creates uncertainty and complexity; still, this uncertainty is a requirement for innovation as it is the uncertainty that produces innovation in the first place in order to maintain competitiveness or fitness. (Leydesdorff and Etzkowitz, 1998; Leydesdorff, 2000; Leydesdorff and Meyer, 2006) On the other hand, Luhmann (1986) can make up at least six different subsystems, which he considers relevant and which are decisive in understanding the evolving capacity of society to deal with ecological risks, namely economy, law, science, politics, education, and even religion. Needless to say that the interactions of a larger number of subsystems, which are organisationally independent, create an even larger uncertainty and complexity whose future states surely cannot be predicted. When combined with the information processing and sense making capacity of the world's human population - considering that interacting humans generate increasing complexity in a co-evolution regime - predictable causality becomes pointless. (cf. Heylighen, 1989)

In practice, the potential for the evolution of complexity could be measured by the degree of integration of different societal subsystems. A suitable knowledge infrastructure must be in place (science), in addition to appropriate personnel (education). It includes sufficient funding for the development of knowledge and innovations (economy), as well as fitting policies and laws to facilitate the production of novelties. Coming back to that Russian case study, Walter (2007) has provided some information on the innovative capacity in Russia with respect to the requirements of the triple helix model. While until now the Russian innovation regime has been characterised by a lack of competitiveness vis-á-vis that of advanced industrialised countries, it has gained pace concerning the integrative level that is so important from the perspective of the triple helix. Until the beginning of this decade the innovation regime was still largely determined by a lack of integration, which has to be seen as an outcome of the Soviet organisation of knowledge production. Consequently, the state is still responsible for the bulk of R&D funding. This also indicates that the cooperation between industry and research institutes have not developed so well yet. (cf. OECD, 2005) In turn, universities - traditionally only involved in education - have not been concerned much with research, possibly leading to a track where education does not meet actual market requirements. (cf. Kazakova, 2001) While the government's main task appears to be funding, it has had difficulties to provide for appropriate policy guidelines that motivate the production of knowledge and technology. Particularly, for a long time since the breakdown of the Soviet

Union, the different government levels were unable to remove uncertainties and risks that would restrain enterprises to produce innovations. (OECD, 2005) Consequently, the amount of value-added goods produced by Russian enterprises remains comparatively low outside the energy industry. (Boltramovich et al., 2004)

While these issues have prevented a tighter integration on a broader scale in order to have an effective triple helix regime, the closest equivalent to such a successful innovation regime is science parks. These have already existed in Soviet time and allow a close cooperation between 'member' organisations, i.e. enterprises and research institutes, as they offer very often the best infrastructure for knowledge production. The parks are organised often around major universities and while it has been often difficult for smaller enterprises to finance their involvement, they, nevertheless, constitute the closest correspondent to multifunctional organisations as proposed by the triple helix model. (cf. Kazakova, 2001; Kihlgren, 2003; Boltramovich et al., 2004) Interestingly, these parks are and have been successful especially in fields in which Russian industries and state interests have been in competition already in Soviet times, including military and space technology, indicating the importance of having competition and uncertainty to drive innovation.

However, the difficult and slow integration process in Russia does not mean that the necessary resources would not be available. They are available and the continued interest in science parks as offering the best available infrastructure for integrated working indicates that there is a strong need in Russia for innovations. This conclusion again is in line with global indicators, as mentioned in the introduction, which reflect the strong and increasing need for knowledge production. The accelerating need for innovations and new knowledge also indicates the problematic associated with maintaining the capacity for control and management in society - for as we recall, only continued innovations sustain control. The accelerating need appears to reflect an accelerated growth in complexity. But of course, this is what the theory suggests.

3.4 Consequences

To recapitulate, complexity and its management are at the core of the acceleration problem - and, by extension, also of the ecological risk issue. Complexity, through the complexity gradient, drives the formation of a system-own time identity and thereby generates acceleration. Internal differentiation will enhance acceleration. This is well visible in the economic subsystem of society: if the goal is to construct a future timeline for disposition, the number of roles and markets, for example, will determine the degree of acceleration; this is due to the increased need for fitness (competitiveness) that each participant of the economy is facing. Hence, there is a general desire to maintain or extend one's future timeline by accelerating ones turnover.

The control over monetary resources, then, will determine how well we can manage complexity. Hence, we have an interest in increasing the control over money by strengthening our competitiveness, possibly as individuals in our professional roles, perhaps as collectives in enterprises, industries or entire states. That this can be increasingly difficult within a globalising and complexity-increasing society sheds light on the importance of innovation. The latter has become so important, also turned into an every day concept that penetrates many peoples lives, so that scholars have pointed out that technology and technology innovation are more valuable than money itself (e.g. Jiménez and Escalante, 2006). Consequently, we witness an accelerated need for innovation and an increased focus on attracting necessary resources, such as brainpower.

Control capacity and sustaining this capacity through ensuring evolution characterises complexity management. However, evolution in social and mental systems increases complexity by itself. As a result, it appears that continuing evolution acerbates the conditions against which systems have to maintain their control capacity in the first place. Here, we witness the emergence of a positive feedback loop. The consequences are far reaching.

While there is a negative feedback loop existing in the control capacity of social structures, which aims at maintaining stability insofar as it sustains society, the positive feedback will lead to an accelerated growth in complexity. Traditional views of systems considered the system to adapt to its infinitely complex environment. By doing so, the system might have evolved through increasing its own complexity and over time closed up to its environment, even though it would have never reached the environments complexity. In such a case the process of adaptation and complexity increase would indeed have slowed down at some point instead of speeding up.

However, since we can assume that there are many (complex) systems that co-evolve the adaptation or rather the sustainability of the control capacity becomes a different issue. As written before, evolution will not only change the complexity of the system but will also trigger evolution in the systems environment. The large number of systems involved in this process of mutual adaptation in the societal context make it not only improbable to predict any outcome, the high uncertainty also generates accelerated response times in the systems. A slow down of response time will threaten the sustainability of a system as it cannot keep up to the accelerated growth of complexity in its environment. Since no system can control its environment or a system in its environment, acceleration of the growth of own complexity becomes a matter of life and death for the system.

Some further explanation seems necessary on whether there are limits concerning the growth of complexity. For instance, Heylighen (1997) writes about trade-off points that many systems, particularly biological systems, have. A trade-off point is the situation beyond which the system does not gain any advantage in increasing its complexity. After all, any growth in complexity will make the system slower in choosing appropriate response options when dealing with environmental stimuli. For example, bacteria, as simple as they might be, sustain their existence in an environment with growing complexity. Luhmann (1990) points out social systems have the peculiar characteristic that they do not simply stop growing internal complexity. Hence, social systems reproduction is subjected to a selection process within which fewer combinations are actually realised than would be possible. This is in line with evolutionary theory in which social systems are seen as an extension to the biological basis of human life. Since biological evolution takes usually very long, information processing social systems emerged that allow increasingly fast responses to changing environmental conditions. (Stewart, 2000)

One of the major consequences of the above described model is that, over time, knowledge needed to respond in the most appropriate way to environmental stimuli and actually available knowledge - in other words control capacity - will diverge. Any scientific innovation has to be considered in the context of the complexity gradient (Luhmann, 1990). It will always produce an accelerated growth of complexity in a system's environment. Moreover, given that knowledge exists as models, which contain by their nature a degree of uncertainty - keeping in mind that any model is a reduction of reality and, as such, must construct an accelerated timeline in order to anticipate reality - the ongoing fragmentation of knowledge will by itself increase complexity in science. Not only does this mean that 'science becomes the means to make the world uncontrollable' (Luhmann, 1990, 371), it also diminishes the probability that society can reduce ecological risks: more knowledge makes further acceleration necessary.

Furthermore, the increase of ecological risks comes along with society's strengthening capacity to sustain itself. In other words, societal sustainability is accompanied by an increase in ecological risks (cf. Luhmann, 1997). This insight affects the common understanding of sustainable development, which is generally approached by integrating economy, society, and environment (e.g. World Commission on Environment and Development, 1987). While such integration is not possible from a systems perspective, sustainable development should anyway be understood as a development that sustains society against its environment at a cost of generating ecological risks. How far can this development go? There might not be a definite answer to this question. As there is no limit to complexity growth itself, social systems need to evolve by accelerating as long as energy input can be ensured. (cf. Toussaint and Schneider, 1998)

4 Contingency or not contingency?

Now that we understand the dynamics in managing complexity and acceleration/ecological risks, it is possible to consider the outcome of the above model for social theory. For this reason I want to refer again to Niklas Luhmanns theory of social systems (Luhmann, 1984). As mentioned already, the theory has incorporated the elements of reproduction and differentiation as being special characteristics of complex social systems. Particularly the concept of difference that supports the sustainability of the systems identity shall receive special focus. Examples of differences according to Luhman include for the economic system: paying/not paying - feeding the circulation of the systems own medium money, for the political system: being in power/being in opposition - driving the circulation of power, and for the science system: true/false - thereby circulating knowledge.

Following the model complexity-control-evolution I like to suggest an overarching regime or social system that is based on the difference non-contingency/contingency. While any system has non-contingent and contingent elements to help to distinguish present and future, the description of this system supports to understand the pressure of maintaining this dynamics inherent to the model. This system is, like any other social system, expanding and interested in dominating. With reference particularly to the economy - as made in this article - acceleration can be seen as generated by the desire to have investment objects, which provide for a short-as-possible amortisation period. This desire, in turn, is the consequence of the many choices - the higher selectivity that one faces - in an increasingly complex world. Simultaneously, the complexity increase accompanies globalisation; it is the product of the continuously strengthening cooperation regime of the global collective.

At the same time, dominant ideas, e.g. sustainable development, democracy, and justice, require a cohesive community - a society - as a basis when aiming to be implemented. (Walter, 2010) Cohesion, on the other hand, causes rigidity - fixed conditions, which at any given point in present time are non-contingent. Thus, whether expressed as the desire to reduce the period of the amortisation of an investment or expressed generally as the desire to let the future become the present, there is an increased focus on the future in modern global society; for the future is open. Here, then, it is possible to observe the emergence of a system based on the differentiation between a non-contingent presence and a contingent future. The more people cooperate, the higher becomes the complexity people have to manage by planning a contingent future. The rigidity of the present, however, accelerates the need to reach the future.

Modern society, thus, is producing this system that is concerned with temporal variation between an unchangeable presence and an open future and that is becoming more dominant and expanding the more people are incorporated into a global collective. The increasing dominance is reflected in the difference (non-contingency/contingency) becoming more and more emphasised, thereby developing into a quasi-cyclic dynamic where the non-contingent presence drives the contingent future.

Given that the phenomenon of acceleration is inherent to the control efforts of society, the question has been to some extent answered, why we dont just break this system 'non-contingency/contingency' apart if we can identify it as reflecting the source of acceleration and, therefore, of ecological risks. However, that small part that illustrates the role of the individual perhaps more than anything else in social theory - trust - can complement this understanding. It might be fear, as in 'risk society' (e.g. Beck, 1986), as much as it might be moral obligations, which maintains the necessary cohesion through peoples bestowal of trust in society in order to maintain this system (cf. Luhmann, 1968/2000). Cohesion that provides security is more important to the people than a kind of freedom that offers uncertainty; even though it might be more ecological since freedom would imply fewer structures that produce back-feeding complexity. It must also be kept in mind that power requires cohesion, hence, it is in the interest of those in power to maintain cohesion and to keep up the idea that it is better to stick together by generating the image of risks that exist. (cf. Walter, 2010)

This, in a nutshell, is what makes the expanding system based on the difference non-contingency/contingency probable. Hence, it is cohesion that reproduces that system; cohesion could be considered - in accordance with Luhmanns conceptualisations - the medium that is circulating within society.

In contrast to the functional systems of the theory of social systems, including economy, politics, science, and education, there is no immediate societal function apparent in the described system on temporal variation. The focus on contingency, however, is perhaps in line with the demands laid down by Hans Joas, who emphasises a shift from functionalism towards contingency in social theory. Joas defines contingency as something neither necessary nor impossible. This means that contingency conceptualises the counter-idea to necessity, which is itself dependent on the contemporary understanding of necessity. For example, in pre-modern perceptions of the world, necessity referred to an ordered cosmos in comparison to contingency, which stood for the incompleteness of the physical and sensual world, but also for the creativity of God.[2] In contrast, then, modernity transformed this necessity of ordered cosmos into that of a cosmos determined by causal laws. The metaphysical certainty of the old perception was replaced by the chance and free will of the rational and methodological individual, seeking complete certainty through cognition. (Joas, 2004)

While for Joas contingency is the best explanation for the apparent increasing erosion of morale and character, I refer to contingency as the freedom that the individual strives for. In modern society contingency is collectivized and turned into a non-contingency. As explained, the rigidity of the collectivization generates acceleration. At first sight this appears somewhat paradoxical: why should the human aggregate - society - reduce complexity in the first place when the individual strives for the expansion of the range of the possible? While this could simply illustrate the conflict between the collective

[2] See also Nikolaus von Kues' (1401–1464) writings on pre-modern philosophy, which very often have a remarkable resemblance to a cybernetic perception of the world (e.g. in Whittaker, 1925; Hay, 1952; Morse, 1960).

and individual it might also very well be due to the loss of the holistic world view that comes about with the adoption of a cause-and-effect view. Hence, it is a value matter, here again in line with Joas' ideas; a further examination is, however, beyond this articles focus and intention.

The analysis permits anyway a comment on the theorem by Musés (2000) that greed for wealth and power fosters and multiplies complexities. Although from a circular perspective - as illustrated by the model complexity-control-evolution - this cannot be seen as being false, it is, nevertheless, insufficient; for it is complexity that also drives the need for accumulation of wealth and the maintenance of (control-) power. This is important to consider since the idea that 'the economy' is solely responsible for ecological destruction is a rather dominant idea. This circular relationship is, moreover, due to the emerging risks of not-cohering and the many moral obligations that make the societal collective probable. Any increase in ecological risks and acceleration cannot be regarded as being independent from those obligations.

5 Conclusion

The increased need and pressure to produce more knowledge and technological innovations is founded on the understanding that problems of adaptation and sustainability can be solved by adding knowledge and technology to reach more options and higher efficiencies. While this perception does indeed increase the fitness of single systems relative to others, it also assumes that the linear causality of simple systems has validity across society. However, this leads to the apparent differentiation and fragmentation we witness in society and the consequential increase in complexity. This is not surprising as it appears to lie in the nature of science - with its need to declare boundaries when analysing phenomena and processes - to be incapable of observing the whole.

Hence, to understand acceleration as being the source of ecological risks it is not sufficient to simply look at the complexity gradient, for instance that between the economy and its environment. This would be a too simplistic, linear cause-and-effect analysis. Hence, the correlation analysis as presented in the model is on its own incomplete. The analysis must go beyond to understand the dynamics of complexity generation and increase. Moreover, it must especially include the own position. And ones own position is that of a scientist. Science has an important role to play in when attempting to understand the nature of ecological risks, as illustrated in the consequences of knowledge evolution for society and its environment. Nothing else does cybernetics of second order; it particularly states the dependent role of the observer. Similarly, the acknowledged uncertainty principle implies that uncertainty and indeterminacy are not simply a concern for the observed matter, but already a subject for the epistemological process - the observation - itself.

An analysis that goes beyond linear cause-and-effect will realise that the control efforts and the maintenance of control will themselves increase the complexity that in the first place caused the problem. The model, illustrating circular causality, shows by including empirical material that acceleration cannot be controlled as such. Acceleration is to be considered as emerging as part of the effort to control. Hence, following major cybernetic principles, this implies that environmental impacts and the consequential risks for ecological sustainability must be considered natural and outside control.

The projected system that is based on the difference non-contingency/contingency shows the consequence of this conflict between rigidity and freedom, accelerating and slowing down, ecological and societal sustainability. It is a system with a self-perpetual dynamics. Any more efforts in controlling through knowledge will enhance the dynamics and strengthen the impact and risk potential. This dynamics is confirmed by the observed data, which depicts in the outlined model the trend towards expanding the potential for acceleration. Even taking into account global regional differences, as done here by referring to the Russian example one, which is often considered peculiar in international comparison a general convergence and harmonisation towards higher efficiencies and effective cooperation can be observed that will make an increase in ecological risks more probable.

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Die Natur der Nachhaltigkeit im Umweltmanagement[1]

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Zusammenfassung

Umweltmanagement ist heute hauptsächlich mit der Integration vielfältiger gesellschaftlicher Interessen beschäftigt. Umweltmanagement teilt diese integrative Ansicht daher mit dem verwandten Konzept der nachhaltigen Entwicklung. Darüber hinaus erweitert die Aufnahme zukünftiger Generation das Konzept um einen entsprechenden Zeithorizont. Diese Ausrichtung des Managements führt jedoch zu der Annahme, dass Integration als solche niemals ausreichend ist, was deutlich in vorherrschenden Theorien, wie beispielsweise der Konfliktbewältigung bezüglich der Nutzung natürlicher Ressourcen, hervortritt. Dies spiegelt sich auch in der Evolutionstheorie wider, die aufzeigt, dass Integration in der Gesellschaft zunimmt. Es ist daher von besonderem Interesse, die Auswirkungen der zunehmenden Integration für die Umwelt und mögliche Rückschläge für die Gesellschaft zu verstehen.

Derlei Auswirkungen können am besten mit Bezug auf das Phänomen der Beschleunigung verstanden werden, welches den evolutionären Fortschritt in der Gesellschaft aufzeigt. Diese Beschleunigung hat im Laufe der Zeit zur Zunahme des Energieverbrauchs, entsprechender Emissionen und zum bekannten Problem des Klimawandels geführt. Beschleunigung wird daher auch schon seit einigen Jahrzehnten als Problem für die Gesellschaft-Umwelt Beziehung verstanden. Bemerkenswerterweise ist Beschleunigung jedoch auch

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Kern aktueller nachhaltiger Entwicklungsprogramme, insbesondere der Theorie der ökologischen Modernisierung.

Durch Anwendung von Systemprinzipien, insbesondere derer der Theorie sozialer Systeme Niklas Luhmanns, kann das Verständnis gewonnen werden, dass es bei der nachhaltigen Entwicklung um die zu wahrende Nachhaltigkeit sozialer Systeme geht, die ihre weitergehende Existenz sicherstellt. Daher geht es beim 'Umweltmanagement' darum, die Systeme umgebende wachsende Komplexität zu bewältigen, welche durch die Existenz vieler komplexer sozialer Systeme hervorgebracht wird, deren jeweilige Evolution nicht vorhersagbar ist. Die Nachhaltigkeit sozialer Systeme muss sichergestellt werden, was beschleunigte Reaktionszeiten als Folge der erfolgreichen Fähigkeit zur Bewältigung von Komplexität notwendig macht.

Es wird oft angenommen, dass die Notwendigkeit zu beschleunigten Resonanzen in ein allgemeines Entwicklungsprogramm aufgenommen werden kann, das verschiedenste Interessen vereinigt und zu sogenannten win-win Situationen führt (z.B. Markt - Ökologie). Wenn jedoch das ökologische Risiko im Zusammenhang mit Beschleunigung echt ist, werden die Strategien zur nachhaltigen Entwicklung die möglichen Rückschläge der gesellschaftlichen Evolution auf die globale Ökologie verstärken. In diesem Falle führt Umweltmanagement und die Wahrung der Nachhaltigkeit in der Gesellschaft zu einem Wachstum des ökologischen Risikos.

1 Einleitung

Umweltmanagement (im Sinne der Bewirtschaftung natürlicher Ressourcen) ist heute hauptsächlich mit der Integration vielfältiger gesellschaftlicher Interessen beschäftigt, von kulturellen, wirtschaftlichen und öffentlichen usw. bis hin zu ökologischen Aspekten reichend, die die Vielfalt der Interessensphären an der Umwelt und natürlichen Ressourcen widerspiegelt. Umweltmanagement (wie in der Tat auch jede andere Art von Management) strebt nach Integration zur Schaffung eines gemeinen Fundaments, um die Kontrolle über ein geplantes Ergebnis zu ermöglichen. Umweltmanagement teilt diese integrative Ansicht daher mit dem verwandten Konzept der nachhaltigen Entwicklung, mit dessen Hilfe ja auch verschiedene Dimension unseres gesellschaftlichen Lebens, beispielsweise Umwelt und Wirtschaft, zu einem gemeinen Ziel zusammengefasst werden sollen, um gesellschaftlichen Wohlstand (im abstrakten, nicht ausschließlich wirtschaftlichen Sinne) zu erzeugen. Wie bekannt, bezieht sich die nachhaltige Entwicklung nicht nur auf die gegenwärtig lebende Generation, sondern möchte auch zukünftige, noch nicht geborene Generationen miteinbeziehen, erweitert das Konzept daher um einen entsprechenden Zeithorizont, um einer Ausbeutung der notwendigen Lebensgrundlagen vorzukommen und die Regenerationsfähigkeit bestimmter ökologischer Zusammenhänge nicht zu bedrohen. (vgl. World Commission on Environment and Development, 1987) Nachhaltigkeit als solche besitzt daher eine starke Ausrichtung hin zur gesellschaftlichen Zukunft.

Diese Ausrichtung des Managements führt jedoch zu der Annahme, dass der Grad der Integration zu jedem gegenwärtigen Zeitpunkt niemals ausreichend ist, was deutlich in vorherrschenden Theorien, wie beispielsweise der Konfliktbewältigung in der Politik, im Recht, in der Wirtschaft wie auch bezüglich der Nutzung natürlicher Ressourcen, hervortritt. Solche Theorien sprechen sich daher ganz klar für eine stärkere Integration und Zusammenarbeit in den jeweiligen gesellschaftlichen Problemzonen aus, mit dem Ziel, bestimmte Probleme zu lösen und Konflikte und Meinungsverschiedenheiten zu vermeiden. (vgl. beispielsweise Heininen, 2002) Dieses Phänomen spiegelt sich sogar in der Evolutionstheorie wider, die aufzeigt, dass Integration in der Gesellschaft durch effektivere und effizientere Zusammenarbeit zunimmt, um Managementprobleme zu lösen (vgl. beispielsweise Stewart, 2000). Auch die Diskurse im Umweltrecht wie auch in Sachen der Umweltgerechtigkeit führen zum gleichen Ergebnis (beispielsweise Paavola, 2007).

Wenn man versteht, dass der Grad der Integration nie als ausreichend empfunden wird, so stellt sich die Frage über die Auswirkung der zunehmenden Integration und Zusammenarbeit, nicht so sehr für die Beziehung der genannten Interessengruppen, die sich ja im Laufe der Zeit verbessern soll, wenn sich Konflikte reduzieren lassen, sondern für die Umwelt. Diese Art von Einspruch ist die Folge eines theoretischen Standpunktes, der auf der Systemtheorie beziehungsweise Kybernetik aufbaut (vgl. beispielsweise Luhmann, 1984; Geyer, 1995; Heylighen, 1997). Der Anfang macht hier das Verständnis, dass Zusammenarbeit stattfindet und in der Tat zunimmt, wie auch von der eben genannten Evolutionstheorie ausgedrückt. Von diesem Standpunkt aus gesehen, ist es weniger interessant zu verstehen, wie Integration und Zusammenarbeit verstärkt werden kann, sondern eher, welche Folgen der gegenwärtige Grad und die Zunahme der Zusammenarbeit in der Gesellschaft für die Umwelt dieser Gesellschaft sowie mögliche Rückschläge für die Gesellschaft und der menschlichen Lebensgrundlagen selbst hat. Eine derartige Analyse wird wichtige Erkenntnisse zum Verständnis der Natur der Nachhaltigkeit sowie der verwandten aktuellen Entwicklungs- und Managementmaßnahmen erbringen.

2 Das Problem der Beschleunigung

Die Auswirkungen der zunehmenden Integration und Zusammenarbeit in der Gesellschaft für die Umwelt sowie die Gesellschaft selbst können am besten mit Bezug auf das Phänomen der Beschleunigung verstanden werden, welches den konstanten, evolutionären Fortschritt in der Gesellschaft aufzeigt. Die Beschleunigung (im abstrakten Sinne auch Kompression oder Stauchung von Zeit und Raum) hat im Laufe der Zeit zu einer zunehmenden, bezogen auf die Zeiteinheit also beschleunigten Nutzung beziehungsweise Ausbeutung von Energie und anderen natürlichen Ressourcen sowie entsprechenden Abfällen und Ausstößen geführt. Der Prozess des globalen Wandels, der auch den Klimawandel beinhaltet, kann sicherlich als Ursache die Beschleunigung in der Gesellschaft ausmachen. Die Auswirkungen dieses Phänomens und Gefahren für die Lebensgrundlagen des Menschen sind daher sehr sichtbar und deuten die Beschleunigung als sicheres Risiko für die Nachhaltigkeit der Gesellschaft und anderer ökologischer Zusammenhänge.

Die Beschleunigung ist bereits seit einigen Jahrhunderten Thema in der Literatur, beispielsweise haben sich der Dichter Goethe und der Philosoph Nietzsche beide damit befasst, doch erst die aufkommende Debatte über die Bedeutung der Nachhaltigkeit und der nachhaltigen Entwicklung etwa in den letzten vier Jahrzehnten haben zu einer Neuentdeckung dieses Phänomens als mögliches Problem geführt. Zum Beispiel nennt der bekannte Bericht *The Limits to Growth* des Club of Rome von 1972 das Problem der begrenzten Ressourcenkapazität im Vergleich zum beschleunigten Wachstum der globalen menschlichen Bevölkerung, wogegen der Brundtland-Bericht *Our Common Future* von 1987 sich auf die beschleunigte Degeneration der Umwelt und Ressourcenbasis und die Auswirkungen für den Wohlstand gegenwärtiger und zukünftiger Generation bezieht (vgl. Meadows et al., 1972; World Commission on Environment and Development, 1987). Seit dieser Zeit sind die Beschleunigung und verwandte Konzepte, wie zum Beispiel Folgen der Anwendung verschiedenster Maßstäbe und Inkompatibilitäten zwischen verschiedenen zeitlichen Abläufen, Konstante im Diskurs der Nachhaltigkeit (vgl. Adam, 1991, 1993; Reisch, 2001; Hofmeister, 2002; Tennberg, 2004).

Bemerkenswerterweise zählen jedoch die führenden Entwicklungs- und Managementparadigmen, die auf zunehmende Integration und Zusammenarbeit aufbauen, auf die Beschleunigung. Eine hier führende Entwicklungstheorie ist die Theorie der ökologischen Modernisierung, die, unter der Annahme des Bedürfnisses nach regelmäßiger Modernisierung und Innovation bei der Teilnahme am Markt (einem komplexen System) und der Prämisse, dass Umweltprobleme sich durch vermarktbare Lösungen, die die Ressourcenproduktivität erhöhen, reduzieren lassen, sich mit der Beschleunigung des technologischen Fortschritts befasst. Infolgedessen sollte die Beschleunigung sich also positiv auf Wirtschaft, damit auch auf die Gesellschaft als ganzes, und Umwelt auswirken. (vgl. Murphy, 2000; Jänicke, 2008) Auf ähnliche Weise agieren hier die führenden Ideen, die sich mit dem

Kampf gegen den Klimawandel befassen. Hier wird oft angenommen, dass eine signifikante Stärkung von Investitionen und Wissen, in Kombination mit sinnvollem Regelwerk sowie politischen Handlungsweisen, zu einem beschleunigten Erfolg hinsichtlich der Abnahme des Energieverbrauchs und entsprechenden Ausstößen führt (vgl. beispielsweise Rehn, 2008). Eine derartige Strategie nutzt das sogenannte *Triple-Helix* Rahmenwerk, das den Innovationsprozess beschreibt, wie er in der modernen Gesellschaft stattfindet und der eine Kombination der wichtigsten gesellschaftlichen Träger von Innovation und Modernisierung darstellt, im wesentlichen also Wirtschaft, Wissenschaft und Politik (vgl. Leydesdorff, 2000).

Da jedoch die Systemtheorie (und auch der Triple-Helix Rahmen basiert auf der Systemtheorie) annimmt, dass Integration und Zusammenarbeit stattfindet, sich sogar verstärkt und der Gesellschaft damit das Mittel in die Hand gibt, optimale Innovation zu erzielen, kann man bei dieser Entwicklungstheorie des beschleunigten Fortschritts davon ausgehen, dass es sich hierbei um die gewöhnliche Vorgehensweise, also *Business as usual* handelt. Letzteres versucht man im Allgemeinen zu vermeiden. Nichtsdestotrotz bedeutet dies, dass Maßnahmen zur Beschleunigung des Erfolgs eines geplanten Zieles eigentlich *Business as usual* beschleunigen wollen. Das führt zu der Frage, ob eine Beschleunigung der Entwicklung unter gegenwärtigen Standards in der Tat das Risiko der Rückwirkungen auf die menschlichen Lebensgrundlagen reduzieren.

3 Zum Verständnis der Nachhaltigkeit von Managementstrukturen

Die Theorie, die zur Analyse des Problems herangezogen wird, baut auf Konzepten der systemischen Arbeitsweise und der Kybernetik aufgrund deren optimalen Eignung zum Verständnis von Adaptation und der gesellschaftlichen Möglichkeiten, auf Umweltreize zu reagieren, auf. Systemtheorie und Kybernetik sind die Theorien der Kommunikation und der Kontroll- beziehungsweise Managementstrukturen. Eine prominente Ausarbeitung systemischer und kybernetischer Prinzipien im Bereich der Gesellschaftswissenschaften ist die Theorie sozialer Systeme von Niklas Luhmann. Bei der Analyse der gesellschaftlichen Anpassungsfähigkeit geht es bei Luhmann daher auch nicht primär um Menschen oder Akteure, sondern um die Kommunikation zwischen denselben. (vgl. Luhmann, 1984) Die Theorie sozialer Systeme stellt auch eine Art metaphysischen Ansatz dar: sie erlaubt eine Aussage über die Strukturen der Gesellschaft wie sie tatsächlich produziert werden. Eine gesellschaftliche Systemanalyse beschäftigt sich also mit der Realität, nicht mit normativen Aussagen. Daher geht es hier nicht primär darum, Vorschläge zu unterbreiten, wie beispielsweise eine nachhaltige Bewirtschaftung natürlicher Ressourcen erreicht werden soll. Wer kann wissen, wie sich das Beste, das Optimale darstellt? Die Realität, wie sie von der Theorie sozialer Systeme beschrieben wird, ist daher die Basis, von der aus die Analyse beginnen kann und nicht eine normative Aussage, ein Vorschlag über eine bessere Gesellschaft, die es zu schaffen gilt.

Es folgt, dass die Erkenntnis von der Existenz des Phänomens der Beschleunigung der Ausgangspunkt sein muss. Von da aus kann die Frage nach dem Mechanismus in der Gesellschaft, der die Beschleunigung generiert, gestellt werden. Das Verständnis über den Ursprung der Beschleunigung in der Gesellschaft ist die Voraussetzung für den Gedanken nach dessen Kontrollmöglichkeit, der Möglichkeit, die Gesellschaft zu 'verlangsamen'. Wenn man nun in Betracht zieht, dass dies eine Angelegenheit der gesellschaftlichen Anpassungsfähigkeit ist, der Fähigkeit, Umweltreize zu verarbeiten, dann wird die Angelegenheit der Verminderung des Risikos, das sich aus der Beschleunigung ergibt, eine Sache bei dem die Umwelt eine Anpassung hin zu einer Verlangsamung hervorrufen müsste. Das macht einige Erklärungen über Systemkonzepte notwendig, insbesondere was mit Umwelt und Management im systemtheoretischen Sinne gemeint ist.

Umwelt in der Systemtheorie ist alles jenseits der Grenze eines Systems. Die Umwelt beinhaltet daher auch andere Systeme, auch andere soziale Systeme. Zum Beispiel befinden sich die sozialen Systeme der Politik und der Wissenschaft in der Umwelt des Wirtschaftssystems, wogegen die Umwelt des Wissenschaftssystems, die Politik und die Wirtschaft beinhaltet. Die Tatsache in Betracht ziehend, dass die Kommunikation der Hauptgegenstand der Analyse in der Systemtheorie ist, und die Kommunikation bezieht sich auf die Beziehung zwischen den Menschen, so existiert die Gesellschaft um die Menschen herum. Zusammen bilden System und Umwelt ein Ganzes, da keine Umwelt (das Umgebende) ohne das System (das Umgebene) existieren könnte. So auch nicht der Mensch ohne die Gesellschaft. (vgl. Luhmann, 1984) Dieser Standpunkt kann auch in anderen theoretischen Ansätzen als der Systemtheorie und der Kybernetik wiedergefunden werden, so beispielsweise in den metaphysischen Grundbegriffen Heideggers, in denen die gegenseitige Abhängigkeit der Umwelt und des systemischen Organismus und deren gleichzeitige Unterscheidbarkeit (Differenzierbarkeit) hervorgehoben werden (vgl. Heidegger, 1983).

Eine der herausragendsten Folgen der Unterscheidbarkeit von Umwelt und System (oder des Organismus) ist die Beschränkung der vollständigen Steuerbarkeit des Systems durch die Umwelt (vgl. Luhmann, 1984). Seit Darwin wurde gemutmaßt, dass der Organismus sich an seine Umwelt anpasst, spätere Ausarbeitungen in der Ökologie haben diese Wahrnehmung verändert. Der systemische Organismus passt sich seine Umwelt insofern ein, als dass es den Bedingungen der Nachhaltigkeit des Organismus genügt. Das System fühlt sich also nicht an seine Umwelt gebunden, sondern ist an seiner eigenen Nachhaltigkeit interessiert. Nachhaltige Entwicklung wird letzten Endes für das System zu einer Sache auf Leben und Tod. Die Ganzheit von Umwelt und System ist natürlich wichtig, vor allem auch für die anfängliche Auswahl gegebener Optionen, die das System zu dem machen, was es ist, allerdings wird das System seinem eigenen nachhaltigen Entwicklungspfad folgen. (vgl. Heidegger, 1983; Luhmann, 1984)

Die Beschränkung der vollständigen Steuerungskapazität der Umwelt über das System zielt auf die eigenwillige Art der Informationsverarbeitung im System. Laut Luhmann besitzt somit jedes soziale System ein bestimmte Logik der Informationsverarbeitung, die auf einem Binärcode basiert. Diese Logik ist die Voraussetzung um die Unterscheidbarkeit des Systems von seiner Umwelt zu erhalten. Daher ist die Logik auch die Bedingung der Nachhaltigkeit des Systems. Zum Beispiel besitzt das Wirtschaftssystem den Code zahlen/nicht zahlen. Ein sogenanntes generalisiertes Kommunikationsmedium stellt sicher, dass die Logik in der Gesellschaft kommuniziert werden kann. Im Falle der Wirtschaft heißt dieses Kommunikationsmedium Geld, das erlaubt, dass Zahlungen unternommen werden können. Jede wirtschaftliche Entscheidung, also Investitionsentscheidung, ist daher an die Logik des Zahlens oder des Nichtzahlens gebunden. Preise geben bei diesen Entscheidungen Hilfe. Vergleichbare Logiken sind beispielsweise in der Politik der Code Macht/Opposition und wahr/unwahr in der Wissenschaft. Entscheidungen in diesen Systemen werden zum Beispiel von politischen Parteiprogrammen und wissenschaftlichen Theorien angeleitet. (vgl. Luhmann, 1986)

Es ist durchaus möglich, dass andere Systeme die Logik kennen, die ein bestimmtes System, etwa die Wirtschaft, nutzt, um sich von seiner Umwelt zu unterscheiden. Zum Beispiel ist die Beschreibung in diesem Artikel nur möglich, weil die Wissenschaft 'weiß', wie die Gesellschaft arbeitet. Auf diese Weise baut die Wissenschaft aufgrund ihrer Wahrnehmung Modelle an Wissen auf. Es ist jedoch nicht möglich, die Evolution, die fortschreitende Entwicklung von Systemen mit Sicherheit zu bestimmen. Im Allgemeinen sagt man daher, dass soziale Systeme strukturelle Komplexität besitzen. (vgl. Degele, 1997; Dijkum, 1997). Komplexität selbst würde eine Bestimmung eines Ergebnisses ausschließen. Strukturelle Komplexität erlaubt es allerdings etwas zu wissen. Beispielsweise wissen wir, dass es in der Wirtschaft um Geld geht, wir wissen aber nicht wirklich in welche Investitionsmöglichkeiten Zahlungen tatsächlich realisiert werden. Es gibt daher keine unilaterale Kontrollmöglichkeiten in der Gesellschaft, letztere hat kein Steuerungszentrum, wird daher als Gesamtheit aller Kommunikationen angesehen, das kein Zentrum besitzt (vgl. Kooiman, 1993; Rhodes, 1996). Als Konsequenz muss ein

Staat bei der Regierung, der Steuerung beziehungsweise beim Management diese eigenwilligen Wege des Weltverständnisses, die sich in den jeweiligen Codes der Informationsverarbeitung der verschiedenen sozialen Systeme der Gesellschaft widerspiegeln, berücksichtigen.

Eine unabdingbare Bedingung für die Möglichkeit des nachhaltigen Managements ist daher natürlich die Nachhaltigkeit der Untersysteme der Gesellschaft selbst. Deshalb muss der Pfad der nachhaltigen Entwicklung eines jeden sozialen Systems erhalten werden, so dass das System als Basis für das weitere Management in der Zukunft dienen kann. Beispielsweise muss das Wirtschaftssystem existieren und erhalten werden, also mitsamt seiner eigenen Arbeitslogik einer nachhaltigen Entwicklung unterworfen werden, sofern man jedwede gesellschaftliche Angelegenheit steuern möchte. Management ist daher eine pfadabhängige Tätigkeit, sie baut auf der Erhaltung wiederkehrender Verhaltensmuster auf, auf soziale Systeme. Und diese Aussage bezieht sich natürlich auf die Erhaltung aller sozialen Systeme, zumindest auf funktionaler Ebene, die nicht redundant, also ersetzbar sind. Alle derartigen Systeme erfüllen eine bestimmte gesellschaftliche Funktion, daher funktioniert multilaterale Steuerung, d.h. Gesellschaftsmanagement, ausschließlich mit Hilfe der Zusammenarbeit (und der sinnvollen Integration) aller funktional-relevanten Teile der Gesellschaft.

4 Der Ursprung der Beschleunigung

Da die Vielfalt der sozialen System in der Umwelt eines jeweiligen Systems liegen, können einzelne Systeme nicht das Verhalten anderer Systeme vorherbestimmen und Steuern. Die Leitungs- also Managementfunktion eines Systems liegt ausschließlich bei dem jeweiligen System selbst. In der Systemtheorie ist die Umwelt eines Systems immer komplexer als das System selbst. Dessen Komplexität richtet sich gewissermaßen nach seiner Geschichte, dem Verlauf seiner Evolution. Die Nachhaltigkeit des Systems wird erreicht indem die Systemelemente, die Kommunikationseinheiten des jeweiligen Systems reproduziert werden, beispielsweise Geldzahlungen in der Wirtschaft. Ohne weitergehende Investitionen wird die Geldwirtschaft aufhören zu existieren.

Eine nachhaltige Reproduktion von Systemelementen steigert jedoch die Komplexität eines Systems im Vergleich zu seiner Umwelt, da Systemelemente die Möglichkeiten der Reproduktion durch die Verbindung ihrer Elemente zu relationalen Netzwerken nutzen. Diese Steigerung der Komplexität wird die Systemzeit verändern, d.h. sein Zeitverständnis im Vergleich zu den Zeitverständnissen in der Umwelt des Systems. Hier kann man bereits die Bedrohung ausmachen, die sich daraus ergibt, dass die Systemzeit schneller ablaufen muss, als die Zeit(en) der Umwelt. Dieser Unterschied wird vor allem im Kontext von Wissen deutlich, das aussagt, dass beispielsweise bestimmte ökologische Zusammenhänge gewisse Zeit benötigen um sich zu entwickeln, zu regenerieren usw. als das Zeitverständnis zum Beispiel der Wirtschaft eigentlich zulässt, was den möglichen Konflikt zwischen Wissenschaft und Wirtschaft widerspiegelt. (vgl. Walter, 2008)

Reproduktion findet auf dem vom System gewählten Entwicklungspfad statt. Wie beschrieben findet beispielsweise die Reproduktion der Wirtschaft mit Hilfe von Geldzahlungen statt. Da kein System ohne seine Umwelt existiert, ist Reproduktion jedoch auch die Folge von Reizen, die ein System von seiner Umwelt erhält. Zum Beispiel kann neues Wissen (Innovationen) Investitionen in einer Region hervorrufen. Evolution durch Reproduktion eines Systems tritt daher nie in Unabhängigkeit von seiner Umwelt auf.

In der Gesellschaft mit seiner Vielfalt an sozialen System gibt es deshalb Co-Evolution. Diese Co-Evolution ist die Folge der Aussage, dass, beispielsweise das Wissenschaftssystem sich in der Umwelt des Wirtschaftssystems befindet. Die Evolution in einem System wird die Notwendigkeit der Evolution in einem anderem System hervorrufen. (Heylighen, 1997) Zum Beispiel benötigen neue Innovationen Investitionen der Wirtschaft, was möglicherweise in eine Abhängigkeit hinausläuft, in der Zahlungen nur weiterhin auftreten, wenn genügend Neuheiten (als Wissenschaftsprodukte) den Markt regelmäßig überschwemmen. Daher wird Innovation als zunehmend wichtig empfunden und politische Handlungsweisen überbieten sich im Hervorheben des Bedürfnisses nach vermarktbarer Technologieentwicklung und Wissen. (vgl. Walter, 2007) Andererseits ist es möglich, dass die Wissenschaft sich auf Forschungen spezialisiert, die die bestmöglichen Fördermöglichkeiten versprechen.

Als Folge der Co-Evolution in der Gesellschaft ist die 'Umwelt' eigentlich kein stabiles Kontinuum. Die Umwelt ist vielmehr Teil der Co-Evolution, sie verändert sich ständig. Komplexität steigt mit der gesellschaftlichen Evolution, was wiederum beschleunigte Reaktionszeiten nach sich zieht. Dies ist vor allem im Kontext der großen Zahl an sozialen Systemen in der Gesellschaft der Fall, welche eine hohe Unsicherheit bezüglich der gesellschaftlichen Zukunft hervorrufen. Eine Verlangsamung würde eine Verlangsamung der Reproduktion eines Systems nach sich ziehen, im Falle der Wirtschaft beispielsweise die Fähigkeit in einem bestimmten Zeitraum weniger zahlen zu können (vgl. Walter, 2008). Eine Verlangsamung der Reaktionszeit, also eine verlangsamte Reproduktion, würde die Nachhaltigkeit des Systems bedrohen. Um Umweltreizen in gewisser Weise zuvorzukommen und systemtechnisch zu überleben, muss das System seine Reproduktion beschleunigen. Daher geht es beim 'Umweltmanagement' darum, die Systeme umgebende wachsende Komplexität zu bewältigen, welche durch die Existenz vieler komplexer sozialer Systeme hervorgebracht wird.

Daher erscheint es so, also ob Komplexität die Notwendigkeit zu Beschleunigung antreibt um die Managementfähigkeit des Systems zu erhalten. Das Problem hierbei ist natürlich, dass die folgende Evolution, die ja im Laufe der Zeit auf jeden Fall auftritt, die gesellschaftliche Komplexität insgesamt steigert, dadurch die Anpassungen anderer Systeme hervorruft. Hier, so scheint es, tritt ein positiver Rückkoppelungseffekt auf, der sich in einer Kreislaufdynamik stabilisiert, die die nachhaltige Entwicklung in der Gesellschaft repräsentiert.

5 Weshalb unterbrechen wir diesen Kreislauf nicht?

Das ist die Frage, die sich mit der Fähigkeit der Gesellschaft zum Wandel beschäftigt. Wie schon beschrieben, ist Adaptation nicht einfach eine fortwährende Anpassung, Re-Orientierung des Systemverhaltens auf der Basis einer Umweltbedingung, zum Beispiel eines Gesetzes oder politischen Handlungsweise. Systeminteresse ist die Nachhaltigkeit der eigenen Reproduktion. Diese Angelegenheit zielt auf die fortwährende Verkettung der Systemelemente, die ja die Reproduktion des Systems erst ermöglicht.

Die obige Frage ist stark verbunden mit dem Vertrauen in die generalisierenden Kommunikationsmedien, die für die Reproduktion der Systeme genutzt werden. Zum Beispiel vertrauen wir Geld zum gegenwärtigen Zeitpunkt mehr als der Zeit, in denen Geld nicht allgemein genutzt wurde. Infolgedessen beschäftigt uns der Wert des Geldes (Inflation und Deflation nach Möglichkeit vermeidend), der Erhalt von Arbeitsplätzen usw. Wenn dies nicht der Fall wäre, würden wir Geld nicht nutzen. Vertrauen ist in jedem Fall unabdingbares Element für die Gesellschaft. Ohne Vertrauen gäbe es keine Gesellschaft, sondern lediglich Chaos. Kommunikationsmedien wie Geld traten gerade deshalb auf, da sie Zusammenarbeit jenseits persönlicher Beziehungen ermöglichen. Menschen, die nicht verwandt sind oder sich nicht persönlich kennen, können trotzdem zusammenarbeiten. Folglich steigern solche generalisierenden Kommunikationsmedien stark die Wahrscheinlichkeit von Zusammenarbeit und lassen so die moderne Gesellschaft Wirklichkeit werden. (vgl. Luhmann, 1968/2000; Stewart, 2000; Misztal, 2001; Jalava, 2003)

Wenn der genannte Kreislauf, der die nachhaltige Entwicklung in der Gesellschaft repräsentiert, unterbrochen werden sollte, so müsste die Kommunikation durch die entsprechenden Medien, die die Gesellschaft ermöglichen, aufgeben werden. Dies ist jedoch sehr unwahrscheinlich, da der Mensch von Zusammenarbeit abhängig ist.

Die Gesellschaft ist im Rahmen der menschlichen Existenz natürlich. (vgl. Luhmann, 1984; Stewart, 2000) Davon abgesehen ist es eher unwahrscheinlich, dass der Mensch sich in seiner gegenwärtigen Entwicklung freiwillig auf persönliche oder 'dörfliche' Beziehungen für die notwendige Zusammenarbeit beschränken würde. Die fortgeschrittene Arbeitsteilung, die Anwendung hochentwickelter Technologien, die die gesellschaftliche Zusammenarbeit und Integration hochgradig vorangetrieben haben, haben zu einer umfassenden Verknüpfung in der Gesellschaft geführt. Solche Verknüpfungen müssen als Abhängigkeiten verstanden werden. (vgl. Leydesdorff, 2000). Die überwiegende Mehrheit von uns ist abhängig von dem was wir tun, zum Beispiel in unserem Beruf als Wissenschaftler.

Außerdem stellt die Nachhaltigkeit der sozialen Systeme in der Gesellschaft das Fundament dar, auf dem jedwede Regierung, Steuerung beziehungsweise Management aufbaut, beispielsweise die Verwirklichung von Recht und Gerechtigkeit. Jede Art von Planung ist ebenso nur auf der Basis der Nachhaltigkeit von sozialen System möglich, d.h. auch abhängig von der weiteren Nutzung der genannten Kommunikationsmedien. Die Eigenschaft, die den Aufbau der modernen Gesellschaft am besten widerspiegelt, ist die umfassende Kontrolle über zukünftige Angelegenheiten. Ein Zeithorizont, der in die Zukunft reicht, ist undenkbar ohne die generalisierten Kommunikationsmedien. Geld gibt hierbei das beste Beispiel, da es die Möglichkeit gibt, die Entscheidung über eine Zahlung zu verschieben, damit also das Geld für zukünftige Ausgaben zu sparen. Auf diese Art wird ein Planungshorizont geschaffen. (vgl. Walter, 2008, 2009) Deshalb kann man als die Hauptaufgabe, den Hauptgegenstand von Politik die Erhaltung von Vertrauen bezeichnen. Das ist vor allem deshalb der Fall, da der Mensch sich ja außerhalb der Gesellschaft bewegt, ist daher auch außerhalb der direkten gesellschaftlichen Kontrolle.

In der Praxis scheint es daher auch kein ernsthaftes Interesse daran zu geben, die herkömmliche Vorgehensweise im Fortschreiten der Gesellschaft, also *Business as usual* oder nachhaltige Entwicklung, zu ändern. Stattdessen wendet man sich Methoden zu, die zwar das Ziel haben, Risiken zu vermindern, die aber erreichbar und vor allem wesentlich bequemer erscheinen. (vgl. auch Walter, 2010) Das wichtigste Beispiel gibt hierbei die Förderung des wissenschaftlichen Elementes in der nachhaltigen Entwicklung ab. Diese Entwicklung scheint mit Theorien überein zu stimmen, die die zunehmende Wichtigkeit von Information hervorheben, die zur Informationsgesellschaft führt, auch Theorien miteinbeziehend, die Technologie als solche zunehmend wichtiger als Geldkapital bezeichnen. (vgl. beispielsweise Castells, 1996; Jiménez and Escalante, 2006)

6 Schlußgedanke

Nachhaltige Entwicklung bezeichnet die Fähigkeit von sozialen System ihre jeweilige Nachhaltigkeit zu steuern, zu managen, dabei ihre weitergehende Existenz erhaltend. In diesem Versuch geht es vornehmlich um die erfolgreiche Bewältigung von Komplexität. Die Komplexität wiederum wird durch die Existenz vieler komplexer Systeme hervorgebracht, deren Verhalten nicht vollständig vorhersagbar ist.

Die relative Leistungsfähigkeit eines Systems muss unbedingt erhalten werden, in dem das System quasi an vorderster Stelle der Entwicklungen bleibt. Daher ist die Beschleunigung der Reproduktion eine wichtige Folge der Fähigkeit, Komplexität erfolgreich zu bewältigen. Es wird oft angenommen, dass die Notwendigkeit zu beschleunigten Resonanzen in ein allgemeines Entwicklungsprogramm aufgenommen werden kann, das verschiedenste Interessen vereinigt und zu sogenannten win-win Situationen führt (z.B. Markt - Ökologie).

Diese Entwicklung bestätigt die eingangs genannte Evolutionstheorie in der Art, dass der theoretische Anspruch zu gesteigerter Integration und Zusammenarbeit in der Gesellschaft, bekräftigt wird, der zu Beschleunigung führt. Wenn jedoch das ökologische Risiko im Zusammenhang mit Beschleunigung echt ist, werden die Strategien zur nachhaltigen Entwicklung die möglichen Rückwirkungen der gesellschaftlichen Evolution auf die globale Ökologie verstärken. In diesem Falle führt Umweltmanagement und die Wahrung der Nachhaltigkeit in der Gesellschaft zu einem Wachstum des ökologischen Risikos.

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