ONTOLOGY IN MODERNITY RISKS;

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IMPLICATION FOR SOCIETAL RISK GOVERNANCE

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Preface

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The thesis is my final product as a student in Societal Security at the University of Stavanger. For two years, I have concentrated on risk and security. Day after day, hour after hour, I have pondered theories, contexts and conclusions. Some days I have been frustrated at not discovering the big answer right away. Other days I have been so incredibly grateful because I got a few steps further. The process has been amazing and taught me infinitely more about myself, my own mind, my method of working and especially about my discipline.

Risk Sciences has a new place in my heart as a result of this thesis. I have always been interested in relational ontology and I have often questioned why certain hazards are regulated and controlled, while others are not. Through my work with societal risk governance, risk as a phenomenon has lit a fire in me. What is risk? How do we construct risk? How do we construct risk governance? How do we deal with risk? They are all interesting questions which can inspire new answers and generate new questions.

I have always liked to touch the risks in order to move out of my comfort zone. This is how I completed this thesis. With its complicated thematics, demanding analyses, I was constantly wondering how I was going to manage it!

Somehow, I did manage it. My wonderful children let me work all day, all night and given me this opportunity to enjoy life. These theories, analyses, words, thoughts, frustrations and happiness are the fabric of my life.

Thank you, Kenneth A. Pettersen, for your patience and for being my mentor. We have had good discussions and you have your own way of pushing me to go further. I am so grateful for your efforts. I really hope this is not the last time that I can enjoy life like this.

"Man creates his own story, but not at its own discretion."

(Marx: Moe, 2009;155)

Abstract

Societal security is a concept of increasing significance. It is tightly connected to risk, since both concepts deal with the future. The understanding of risk is crucial in risk assessment, because it constitute the basis for legislation, control and regulation. Ontology is essential, because different ontological foundations will be materialized in different understandings of risk, risk assessment, risk management and thus appear as different ontological foundation for societal risk governance. Thus my research questions are "*What is the significance of ontological foundation in risk science? How does relational ontology impact risk assessment and risk management*?"

In socio-technical research, objective or subjective ontology dominates. Relational ontology often is absent, which contributes to reductionistic risk assessment. Modernity risks are, however, a relational phenomenon, and must be understood accordingly. Analysis of the theory of the Risk Society illustrates how different ontologies capture different aspects of modernity risks. Clearly the relational aspect is "visible" by revealing the structuration between the structure and actor; where the structure is internalized in the actor, while the actors produce and maintain the structure. Modernity risks are the products of structuration. This has implications for risk assessment and risk management by connotations to risks. Connotations are a product of structuration and constitute different building blocks with patterns of thoughts about risks which are established by objective physical and social structures, subjective preferences and relational structuration. The size and content of the building blocks connotations consist of depend on what risks are involved and constitute a pattern which is socially constructed and appear as implicit guidelines for how to assess and manage risks. Connotations are thus important to make explicit and understand the constructions of societal regulation and control and to understand the production of modernity risks, which can appear as a result of inadequate connotations of risk. The interesting processes are therefore elements that lie behind and beyond the explicit expressed. These elements are relational and thus have to be assessed in a relational ontology to capture the structuration. Research which catches the structuration can elaborate and make visible the structuration and thus increase the consciousness for how risk appears, as well as the construction of risk assessment and risk management. Of special interest are connotations for important decision-makers in society, which influences the societal risk governance. Connotations as a relational phenomenon are thus essential in risk science.

In brief, ontological foundations in risk science are crucial guidelines for how to understand risk, develop risk assessments, and advance risk management. The relational ontology can capture the structuration between the structure and the actor, and uncover connotations of risks. This can extend the knowledge of how certain risk assessments are constructed and how they affect risk management. For further research there is a need to empirical investigate the significance of connotations in risk assessment, and to develop methods of uncovering these connotations.

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1. INTRODUCTION

1.1 Background

"Nothing is a risk in itself; here is no risk in reality. But on the other hand, anything can be a risk; it all depends on how one analyses the danger, considers the event"

(Edwall, 1991;199, D.Mitchell; Lupton, 1999b, p.;131)

Societal safety is society's ability to prevent adverse events, reduce damage when they do occur, and then return to normal state as soon as possible (Olsen, 2003). Societal safety deals with society's ability to maintain important social functions and safeguard citizens' life, health and needs in times of stress (St.meld.17, 2001-2002, Societal Safety). Societal safety is tightly connected to risk because risks concern future events and societal security concerns the future.

Science produces information about risk which appears as a foundation of decisions in everyday life (Aven, Boyesen, Olsen, & Sandve, 2004). Risk assessment is an important basis of legislation, control and regulation in society. Ontology is thus of great importance in risk management (Aven, 2007). Ontology refers to the basic principle in reality and assumptions about ourselves and social structures around us (Fjørtoft & Lavik, 2008; Korsnes, 1997; Meeuwisse, Swärd, Eliasson-Lappalainen, & Jacobsen, 2010; Svendsen & Såtelå, 2004). It is an abstract notion about mechanisms, structures and relations of reality (Johannessen, Tufte, & Veiden, 2006), which are developed through socialization (Heidegger, 1927/2007; Martinussen, 2008; Svendsen & Såtelå, 2004). Consequently, a dissimilar ontology will contribute to a different risk assessment (Lupton, 1999b; Slovic, 2000).

In technical-scientific research, risks often appear as an objective phenomenon that can be explained causally *or* as subjective heuristics and perception. The social, cultural and historical context has received less attention. Risk, as an outcome of socio-cultural processes is, however, of great importance (Lupton, 1999b). Actors relate to risk and safety according to their understanding of it. In that sense, risk is not a universal concept, but one that is socially constructed (Althaus, 2005; Fossåskaret, 2009; Wadel & Wadel, 2007).

Several theoretical perspectives have been developed to capture the actor and the social aspect of risk (Lupton, 1999b). Barry Turner's (1978) theory of man-made disaster elaborates on relationships among actors in accidents in the technical system (Pidegeon, Karsperson, & Slovic,

2003). Michael Foucault presented the theory of Governmentality. The attention to risk concerns the way in which calculated risk is embedded as social practice. Thus there are institutional constructions of social reality by strategies, practices and institutional structures, regulation and power. Risk is thus constructed by social regulations and control (Lupton, 1999a; Zinn, 2008).

In 1983 Mary Douglas and Aaron Wildavsky highlighted the technological and environmental dangers of risk and culture. Beck's theory of the Risk Society followed in 1986. In the early 1990s, Anthony Giddens described the role of risk in society (Lupton, 1999b). In 1988, Kasperson, Kasperson, Renn, Slovic and colleagues developed the social amplification on risk framework (SARF). Its objective was to examine the social and historical context, and how risk and risk events interact with social, institutional, psychological and cultural processes regarding amplification to risk perception, concerns and thus influence risk behavior. Freudenburg studied the organizational processes of creating, controlling and managing risks. These human and organizational factors are important contributors to risks in complex socio-technical systems. Eugene Rosa has examined the ontological status of risk and the relation between the realist and social constructivist foundations.

Ortwin Renn, Carlo C. Jaeger, Eugene A. Rosa and Thomas Webler (2001) discuss rapid technological development in modernism related to risk, uncertainty and rational action. Paul Slovic integrated the cultural and emotional factors of risk perception (Zinn, 2008).

Nick Fox presented the epistemological considerations related to risks, and John Tulloch demonstrated the complex interrelationship between actors and media in everyday experiences. Stephen Crook argued that the relation among risk consciousness, risk management and socio-cultural elements are at the core of the risk analysis (Lupton, 1999b). Kristin Shrader-Frechette offered the concept of proceduralism (Shrader-Frechette, 1991).

Ortwin Renn has concluded that risk attenuation and amplification can be deliberate subjects of discursive activities in participatory risk management (Pidegeon, et al., 2003). He contributes to the framework *Risk Governance* (2008) with an integrative model of risk governance; criteria for assessing, characterizing, evaluating and managing risk in an expanding way regarding earlier technological or scientific elements that has dominated the risk governance. The framework include such as "facts," actors expectations, concerns, cultures and different associations to hazards (Renn, 2008). Associations reflect specific connotations, which are not objective but reflect values and purposes (Fossåskaret, 2009).

Risk is connected to connotations. Often, connotations to risk concerning danger and threats with uncertain outcome (Beck, 1997; Jaeger, Renn, Rosa, & Webler, 2001). According to Luhmann, connotations can be associated with expectations of risk outcome and therefore influence risk assessment and risk management (Zinn, 2008). Connotations are socially constructed, internalized in practical consciousness, and may therefore also affect action (Martinussen, 2008; Ritzer, 2008). The social construction of connotations includes experiences from an objective and social world, actors' roles and positions in society, subjective perceptions and social conventions about risk (Slovic, 2000).

There is more interest than ever in research on risk and society. This can be linked to the development of modernism, which has brought new features to risk (Lupton, 1999b). Risk plays a major role in theories about modern society (Renn, 2008).

The modern society includes systemic risks in Renn's terminology and modernity risks in Beck's terminology. Modernity risks are accompanied by natural events and economic, social and technological developments and political actions on the international level. These interdependent risks require a new form of risk management (Renn, 2008). We create modernity risks (Jaeger, et al., 2001) because the unintended consequences of our prosperity lead to hazard (Beck, 1997). As Giddens says, the production of wealth produces risks (Giddens, 1990). For example, toxic wastes threaten groundwater with the result that American mothers' breast milk is so toxic that it would not be sold in a supermarket. In India, 88 percent of the forestland has been lost since 1950. These are hazards that also benefit us. Our tolerance can thus be connected to rationality, as a result of lack of an understanding of the relational aspect between actor and structure (Shrader-Frechette, 1991). The knowledge required for science or technology to make informed choices and to control hazards, is thus missing (Renn, 2008; Zinn, 2008). This requires action when there is insufficient knowledge about potential outcomes (Renn, 2008).

Giddens' structuration theory allows us to see how the interplay between actors and social structures (Giddens, 1984), produce modernity risks (Kalleberg, Malnes, & Englestad, 2009; Mythen & Walklate, 2006). Risk therefore appears as a relational phenomenon.

> *"Technical risk managers tell us that the world is measurably safer today than it was only on hundred years ago… …."* (Wilson 1979; Jaeger, et al., 2001, p.:13)

However, with the development of modernity risks we have to recognize that we need more knowledge about risk, more investigation, and more research that can reveal as much as possible how improve societal risk governance. This is consistent with what Zinn says about the need for a better understanding of the socio-cultural processes of risk (Zinn, 2008).

In short, risk assessments will be influenced by the ontological position of actors assessing risk. These ontological foundations to risk seem not to have drawn the notice of risk scientists. This lack of interest may be responsible for the reductionist assessment of risk (Pettersen, 2008), and result in inadequate risk management. Hence, the question of ontological positions in risk assessment is highly relevant in the efforts to improve the foundations for risk management.

1.2 Thesis

The ontological foundation guides the way we understand our world and constitutes perceptional lenses that we use when we perceive the world. Today risk science, has great importance for the constitution of modernity, which means that reflections on theories and new knowledge about risk contribute to shape actors understanding of risk as well as it contribute to the development of society (Giddens, 1990; Taylor-Gooby & Zinn, 2006). The ontological foundation is vital, and should, according to Renn, include both the physical and the social aspects of risk (Renn, 2008). The challenge in this thesis is to illustrate the significance of ontological foundations in risk science. This thesis investigates how relational ontology impact risk governance; risk assessments and risk management.

Research problems:

> What is the significance of ontological foundations in risk science and how does relational ontology impact risk assessments and risk management?

In order to answer the research questions it is important to define a relational ontology and its value to risk science. How do different ontologies affect risk science? What impact will a relational ontology have on risk assessment and risk management?

1.3 Structure of the Thesis and Limitations

The thesis begins with a review of ontology and of ontology in relation to modernity risk. Theoretical ontology will be present in regard to objective, subjective and to the relational ontological foundation. The relational ontological foundation will be examined in terms of Weber's theory of the *iron cage*, Berger and Luckmann's *social constructivism* and Roy Bashar's *critical realism*. This will be followed by a presentation of Anthony Giddens' *structuration theory*. The relational dimension is easy to follow in Giddens' structuration theory and is satisfactory for use in the analysis.

The analysis is based upon Anthony Giddens' and Ulrich Beck's theories about the Risk Society, which illustrate the significance of ontological foundations in risk science. The theory of the Risk Society will be presented thematically. The theory is comprehensive, thus only selected parts will be analyzed. These will be presented in sections with the analysis and reflection incorporated. The analysis and reflection will end in a discussion of ontology in the Risk Society.

The results will then be used to see the implications for modernity risk, risk assessments and risk management. The discussion will illustrate the significance of relational ontology to risk science.

This thesis will focus on the negative consequences of modernity risks that concern societal safety and how the relational ontology affects the understanding and production of such risk.

1.4 Conceptual Framework

The conceptual framework for this thesis is explains the content and uses of the concepts that are going to be used.

Ontology refers to reality not as truth but as beliefs about the characteristics and nature (Malnes, 2008; Moe, 2009; Svendsen & Såtelå, 2004) of society and humanity. It is reflected in researchers (Meeuwisse, et al., 2010) because of its epistemological constraints.

Epistemology is the theory of knowledge that reflect possibilities to present true knowledge of man and society (Fjørtoft & Lavik, 2008).

Ontological foundations have epistemological implications.

Objective ontology is based on rationalism, which claims that knowledge is concerned about the *real* (Svendsen & Sååtelå, 2004). The foundation will used to point out the structural forces that govern the actor with character near realism with an existence independent of us.

Subjective ontology is tied to the actor's cognitive capacity. It includes Individualism or the actor oriented approach. Social reality and processes in reality are just products of processes that take place in the consciousness (Korsnes, 1997); actors are the only important unit in a society.

Subjective ontology is often seen in contrast to objective ontology.

Relational ontology acknowledges realistic risk, values, rationality, knowledge, emotions and power (Zinn, 2008). Thus foundation will used to focus on the relational dualism between the structure and the actor which are important in risk.

Modernity risks are a product of our action because our wealth produces unintended consequences which constitute risks (Beck, 1997; Giddens, 1990; Jaeger, et al., 2001). Characteristic modernity risks are complex, uncertain and ambiguous (Renn, 2008). They appear as invisible, irreversible, unthinkable and have unintended consequences (Beck, 1997)

Connotations are social constructions whose meaning go beyond the inherent properties of a concept or phenomenon. Connotations are not objective but reflect the actor's values and purposes and therefore promote certain associations (Fossåskaret, 2009). Connotations relate to expectations of risk and will affect risk behaviour (Els C. M. Van Schie, Joop Van Der Pligt, & Baaren, 1993; Luhmann, 1993; Zinn, 2008).

Structuration constitutes the dynamics between actions created and the surrounding conditions (Moe, 2009). There is independence between the structure and the actor. The structure are produced, reproduced and maintained by the actor. While the actor uses the structure in reflexive action choice. Modernity risks are a product of structuration, as well as risk assessment and risk management.

Risk governance includes both risk assessment and risk management.

Risk assessment includes both assessment of properties of risk often done by experts and assessment of social concern and risk perception (Renn, 2008).

Risk management consists off policies to control hazards; decision-making and implementation of measures (Renn, 2008; Wildawsky, 1991), legalization, regulation and control (Aven, 2007).

2. THEORY

In this chapter, I introduce the concept of risk and then discuss ontology. The objective, subjective and relational ontological foundation will be presented. The chapter will conclude with a theoretical account of ontology in risk governance; risk assessment and risk management.

2.1 What is Risk?

Risk is an abstract concept with numerous meanings. It can be the potential for damage (Rowe; Wildawsky, 1991), defined as the probability that an event will occur multiplied by its consequences. It can be a combination of consequences and uncertainties (Aven, et al., 2004), or the possibility of damage, destruction or loss (Webster:Slovic, 2000). Risk can also be described as a subjective and social phenomenon (Pidegeon, et al., 2003) which exists only in our minds and cultures and thus appear as theoretical models which, according to Slovic, are not real (Slovic, 2000). It can also appear as "real" because we do not know about a risk before we perceive it (Shrader-Frechette; Rosa:Pidegeon, et al., 2003). Risk in subjective ontology is a self-loading term. There is therefore no true sense of risk (Grimvall, Jacobsen, & Thedèen, 2007). Therefore, there is no risk in the objective sense; we manufacture the risks and uncertainties that surround us (Slovic, 2000).

These definitions of risk ignore the *social actor* as participant in a *social system*. To be significant, the concept of risk must be related to actors and activities (Renn: Zinn, 2008). Renn (2008) highlights a need for both physical and social dimensions of risk (Renn, 2008). This can capture the duality actors are exposed to in an uncertain world that is both natural and actor-made. Social systems enable actors to cope with uncertainty; therefore the risk has a social aspect. Risk will vary according to connotations, which implies possibilities for uncertain outcome (Jaeger, et al., 2001). Socio-cultural and individual values are thus important and in line with Luhmann's idea of risk as tied to expectations of a society (Zinn, 2008). Different social systems will have dissimilar cultural norms that provide insight into why some risks are taken more seriously than others (Douglas & Wildavsky, 1983; Taylor-Gooby & Zinn, 2006). The social context is thus important in interpretations of risk. Definitions of risk could also include power, because those who define a problem also control its solutions (Slovic, 2000). The risk definitions affects realizations and decisions about risk (Beck, Adam, & Loon, 2000), controls and regulation (Zinn, 2008). Theories which are favorable in this respect include real events and constructions around hazards and

incorporate both subjective and objective aspects into risk assessments (Douglas & Wildavsky, 1983; Zinn, 2008).

Risks can be understood and explained in several ways. The definition of risk is intended to explain how to measure uncertainty, unexpected consequences and the underlying understanding of reality (Boyesen, Mathiesen, & Olsen, 2008). They do not contribute to accurate explanations and understanding of the risk or absolute certainty (Luhmann, 1993). What is being considered and who is considering them affects our perceptions and understanding of risk and thus our way of dealing with it (Aven, et al., 2004).

There is no consensus in risk science about the content or understanding of the concept of risk. Objective extremes, on one hand, can be termed as pure realism with reference to the objective properties of the risk. On the other hand, extremely subjective or radical constructivism emphasizes the actor's own experiences in relation to culture and social structures (Pidegeon, et al., 2003; Zinn, 2008). Ontology is therefore crucial in risk science by establishing "*truth"* in terms of risk definitions that will influence our understanding of risk in everyday life (Svendsen & Såtelå, 2004). Ontology represents a specific worldview which Dake (1991) specifies as *dispositions* used to orient oneself in the world, because it guides actors' decisions and response (Slovic, 2000). Clarifying the ontological status of common risk definitions is thus important for strengthening the understanding of the ontological foundation in risk science (Aven, Renn, & Rosa, 2010).

2.2 Ontology

Ontology is a Greek word about the being, and refers to reality, its principles and what exists. Basic assumptions about us and about social structures are central (Fjørtoft & Lavik, 2008; Korsnes, 1997; Meeuwisse, et al., 2010; Svendsen & Såtelå, 2004). Ontology goes beyond what can be sensed directly. It is a reality whether we are conscious of it or not. It does not deal with truth, but with beliefs about reality (Malnes, 2008; Svendsen & Såtelå, 2004). Ontological questions will concentrate on a society's characteristics and nature (Moe, 2009).

A *being* is only a *being* that does not affect us because we cannot sense it. The content is ambiguous and we only notice its attributes (Heidegger, 1927/2007). Ontology is thus an abstract notion of reality and its mechanisms, structures and relationships (Johannessen, et al., 2006). It is established in socialization and is structurally rooted in the social system which is under continuous development through social interaction that forms the common understanding of reality. Ontology

encompasses several realities because dissimilar ontological beliefs characterize different societies. This means that when we meet people whose ontology differs from our own, it can be difficult to understand the phenomenon. Right understanding can be found by detecting the being, and confirming the truth (Heidegger, 1927/2007; Martinussen, 2008; Svendsen & Såtelå, 2004).

The truth is a property of certain statements, assertions or assumptions and are related to basic principles for understanding the world (Johannessen, et al., 2006). It is also related to knowledge in that knowledge can be defined as true and justified belief, which means that if we know something, then we claim it is truth. Aristotle believed the statement could also be true regardless of our belief if it corresponds with reality. In this perspective, the truth is objective (Svendsen & Såtelå, 2004). The question is whether there is an unequivocal truth or if Albert Schuzt is right when he says that the world he knows is the world that is within his reach, and that constitutes the inter-subjective and social worlds he shares with others (Johannessen, et al., 2006). The truth may not be objective, but relativistic in that we see our world from our own perspective. Truth will then lose absolute power and be shaped by the eye of the beholder. A central ontological question, therefore, is whether there is an objective truth that exists independently of us or if we subjectively create and interpret the truth about the world (Svendsen & Såtelå, 2004).

The ontological foundation guides our view. We can relate to an objective ontology that considers actors as passive objects controlled by external influences or to a subjective ontology where the actor is a social being who become an actor though significant others, or relational ontology where we are active participants in creating our own lives within certain limits. Ontological foundation characterizes our humanity and our understanding of society, and is reflected in the research (Meeuwisse, et al., 2010).

Episteme is a Greek word for knowledge, and *logos* means doctrine: epistemology is the theory of knowledge that reflects on whether it is possible to present a true knowledge of man and society (Fjørtoft & Lavik, 2008). An ontological foundation will have epistemological implications for our observations of people and society, because it will determine what we see as information for understanding the world (Meeuwisse, et al., 2010).

2.2.1 Objectivists' Ontological Foundation

Objectivism is based on rationalism, which claims that knowledge is concerned with the *real* (Svendsen & Såtelå, 2004). It is possible to produce objective knowledge about the physical and

social reality that exists independently of the subject because there is an objective truth that does not have to be related to human opinions and beliefs. Positivism is rooted in objectivism and was developed in social science by, among others, Auguste Comte (1798-1857) who in the 1800s with support from John Stuart Mill (1806 - 1873) argued for the use of scientific explanations in the social sciences (Kalleberg, et al., 2009). Emile Durkheim (1858-1917) was inspired by Comte's positivism and wanted to establish sociology upon an objectivist ontological foundation (Moe, 2009). Scientific explanations based on our actions as actors were not satisfactory; Durkheim regarded actors as marionettes controlled by external structures (Moe, 2009). Social facts or social conditions were important because Durkheim saw them as independent, objective things with their own compelling existence that could be studied scientifically. Society, in Durkheim terminology, is more than the sum of its parts in terms of social facts and underlying structures (Ritzer, 2008).

Durkheim wrote social analyses of labor and of suicide. Society was marked by differentiation in several areas, including in the workplace. Traditional society was characterized by mechanical solidarity with close links and strong collective demands in terms of individual actions. Equality, reciprocity, dependence, and strong external social control were controlled centrally; there was no room for individualism. Solidarity, however, became an organic solidarity through work differentiation, where the dependence was linked to functions rather than to collective. Organic solidarity can lead to greater social integration as actors become more interdependent. Durkheim shows that a social phenomenon like social integration may have consequences for the individual because anomie can occur with a breakdown of solidarity because of the lack of external control and controlled regulation. Suicide is central because it is tied to social integration (Moe, 2009; Ritzer, 2008). Egoistic suicide is based on the lack of social integration. Altruistic suicide is related to strong collective integration where the actor sacrifices himself for society. The actor will be overridden by the collective. Anomie suicide is weak regulation of behavior and social control, where social structure is not for the individual, and qualities of society make the individual restless. Fatalistic suicide is where the individual is so limited that he does not see his own future and feels suffocated (Durkheim, 1991).

Durkheim's analysis shows how specific qualities of our society guide individual action. Work differentiation affects social integration and has consequences for individual action (Martinussen, 2008; Ritzer, 2008).

Epistemological implications of objectivism are that our actions are governed by external determinants such as laws or by the actors' positions and functions. Understanding of society will

therefore be deduced from the characteristics of social phenomena to characteristics of the actor. This is necessary because a social phenomenon has distinctive characteristics that cannot be reduced to properties of actors and to our actions. It has its own independent existence. Actors in objectivism are products of their social systems (Grimen & Gilje, 1993/2007).

2.2.2 Objectivism and Risk

Natural disasters were traditionally seen as unwanted, unexpected and unmanageable acts of God (Rosenthal, Boin, & Comfort, 2001). Over-natural forces was naturally and witchcraft was connected to certain risk and hazards (Aven, et al., 2004). Risk consisted of objective existing hazards (Taylor-Gooby & Zinn, 2006). However, discoveries in mathematics, economics and psychology made risk appear as understandable, measured and possible to master (Bernstein; Althaus, 2005). Medical science also saw risk as capable of being controlled and managed. Risk thus became a calculated phenomenon (Althaus, 2005).

Technical and scientific theories of risk have been characterized by a predominance of realism. The premise of objective ontology (Taylor-Gooby & Zinn, 2006) is that it is possible to provide reliable representations of a certain phenomenon (Pettersen & Engen, 2010?)

Risk can also *appear as objective* and thus be unmanageable for the actor. These are risks which are socially constructed as well as they appear as an overwhelming structure that govern the actor. Charles Perrow's normal accident theory can be related to such descriptions of risks. Perrow explains accident as properties of the system regarding kind of interaction and type of link which is essential for system reliability. Complex interactions account for interactions that for actors can be unpredictable. Actors thus lose control over the system. The structure is unpredictable and uncontrollable. The actor is a victim of this structure (Perrow, 1985), and accidents in the system are independent on the actor (Aven, et al., 2004). Such a conception of social structure can be related to objective ontology (Engen, 2009).

Events in objective ontology are objective and knowledge about risk a product of probability and consequence dedicated to calculate risk and demonstrate causality. Potential risk does appear as objective fact and absolute truth (Lupton, 1999a). This is in line with Wildavsky (1988), who argues for an objective risk that includes both observable dangers and observable consequences for actions (Wildavsky, 1988). In objective ontology, hazards have known causal lines and the level of uncertainty can often be calculated (Renn, 2008). Risk assessment is also regarded as neutral and

value free (Shrader-Frechette, 1991), which can be useful because it can help to see where to implement measures to decrease the probability of an accident (Renn, 2008).

Modernity risks are, however, complex, uncertain and ambiguous (Renn, 2008), thus the causal lines are hard to find. It is also wrong to believe that the experts' opinions of risks are of greater importance than lay opinions, as the lay people primarily relate to their own risk perception. So if someone says it is harmless to have a nuclear power plant in the neighborhood the actors will move to achieve security if they perceive it as risky (Aven, et al., 2004). Objective calculations are thus useful but insufficient (Renn, 2008). The actor is centrally related to risk.

2.2.3 Subjectivists' Ontological Foundation

Subjectivism takes the actor as the basic social unit. Reality exists only when the subject discovers it. Actors are therefore not governed by external structures, but have freedom and independence. Social reality and processes in reality are just products of processes that take place in the consciousness (Korsnes, 1997). The society is therefore reduced to the sum of its individuals (Grimen & Gilje, 1993/2007). Max Weber (1862-1920) was concerned with understanding the actor in order to understand social phenomena. According to him, it is pointless to reduce the empirical reality to governing laws. *Verstehen* (understanding) is a key concept in Weber's terminology, associated with hermeneutics and the emphasis on the interpretation and understanding of texts. Weber extends the term to the understanding of actors, social life and history, where it is essential to uncover inter-subjective meaning in order to understand and explain social phenomena. In contrast to explaining social phenomenon by structures, Weber explains the emergence of capitalism in the West from the properties of the individual action (Ritzer, 2008). Weber's findings identify common features in capitalist societies in the West by specific distinctive rationality. He points to Calvinists as a hard-working Protestant group. The Calvinist ethic does not consider the worldly life as the real life. The Calvinist ideal is an ascetic life on earth in order to be one of the elect to life in heaven. It was thus rational to work hard and make money. With time, the importance of religion declined and the pattern of conduct contributed to the development of the spirit of capitalism. The emergence of capitalism can thus be understood by understanding the rational action of social actors and shows how social phenomena can be explained by the those actions (Cuff, Sharrock, & Francis, 1979/1990). Actors' ideas may thus create reality (Moe, 2009).

Epistemological consequences from subjective ontology is that reality and social explanations about social phenomena, must be based on the actor's terms in that they attributed to individual actors' actions and thinking, and perceptions. This is because social phenomena do not exist without the actor and that inferences about social phenomena must always be linked to the properties of the individual (Grimen & Gilje, 1993/2007).

2.2.4 Subjectivism and Risk

Risk arises from the characteristics of an "institutional actor," not from an individual one. The general capacity of being a human is emphasized (Douglas & Wildavsky, 1983). Slovic (1977) supports a psychometric paradigm that emphasizes cognitive models in terms of universal laws by analysis of an actor's conduct in responding to a risk. Mental strategies are primarily related to decisions about risk, and considered by quality of information, knowledge of risk and whether the risk are self-deferred. These are key variables of bias to over- and underestimation of risk. Generally, actors are unwilling to take risks and prefer security to uncertainty (Douglas & Wildavsky, 1983; Renn, 2008). They understand their world and establish a separate ontology through cognitive activities and senses. Their responses are based on their own calculations about risks that affect them emotionally (Lupton, 1999a). There is thus an intuitive understanding of risk established on the basis of several factors that cannot be reduced to an objective understanding of probability and consequence (Renn, 2008) (Douglas & Wildavsky, 1983; Zinn, 2008). Subjective ontology therefore gives maximum freedom and no coercion to the actor in relation to the management of risk (Douglas & Wildavsky, 1983).

Subjective ontology emphasizes properties with the actor. Structures that govern actors are thus absent. Risk perception in such a perspective is rooted in cognitive psychology, mental models and affective processes. This presents difficulties related to different risk perceptions, different understandings of risk and risk management. The cultural aspect is important (Slovic, 2000), and knowledge about risk and risk perception will depend on social and cultural factors (Lupton, 1999a; Renn, 2008).

If hazards are real, risk is socially constructed and risk assessment is mainly subjective (Zinn, 2008), so there is an interaction between objectivism and subjectivism. Risk perception is not independent of ideas, personal preferences, public statements and social structures. Politics and power frame the rational action that is internalized in institutions, and constitute values that

characterize our personality and risk perception. A link between subjective and objective ontology and the dualism between them will lead towards a relational ontological foundation (Douglas & Wildavsky, 1983).

2.2.5 Relational Ontological Foundation

Objective and subjective ontology standing alone would be reductionist in that they only illuminate part of the phenomenon of risk. As Flyvbjerg states, it is important to find the structural factors that influence our actions, to see how they are constructed, and to see their structural consequences (Flyvbjerg, 2001). A relational ontology opens up the "real" risk, the actor's construction of risk, and the dualism between them.

Several theorists are concerned about relational ontology. Some essential concepts will be presented.

Max Weber

Weber often used subjective categories, but was not consistent with respect to the ontological perspective. There are questions as to whether it is appropriate to reduce Weber's theory to subjective ontology (Nilsen, 2003). Weber is concerned about the actors' rational action, and shows how rational action can be irrational when actors create social structures and procedures. Further, unintended consequences take the form of restrictions on our choice of action. Weber describes this as an *iron cage* (Ritzer, 2008). Actors are self-determining. They carry their biological heritage, their socio-cultural environment and historical traditions. This means that actors are both products of the environment and victims of the manufactured reality (Kalleberg, et al., 2009). This represents a relationship between objective and subjective ontology, a bridge between the two ontological extremes and the relational ontological foundation.

Social Construction of Realty

Several theorists have posited theories that encompass both objective and subjective ontology. Berger and Luckmann contributed to the classic *Social Construction of Reality* (1966), which unite objectives macro conditions with subjective micro aspects (Alvesson & Sköldberg, 2008; Korsnes, 1997; Meeuwisse, et al., 2010). Their theory shows how continuous social interaction contributes to a common understanding of social reality. This is meaningful to actors at the same time as the understanding appears to exist objectively in the form of external structures to which actors must relate to (Martinussen, 2008). What actors perceive of social phenomena, structures and institutions

is the actors reality in that it will be a result of their definitions (Korsnes, 1997). This means that the actual objective reality and its subjective meaning creates our reality and will form the structures that have a recurring effect on us (Meeuwisse, et al., 2010).

Critical Realism

Critical realism was founded by Roy Bhaskar (Delanty, 2005). It makes an ontological distinction between actor and structure where the structures already exist when the actors become part of the system. Society is in this theory composed of more than its parts. Actors do not construct the system, but reproduce, sustain and transform it (Pettersen, 2008). Central to critical realism is the stratification and linkage among real reality, actual events, and empirical reality. The *real* is that which actually exists (Delanty, 2005), representing both the natural and social creation (Pettersen, 2008), with specific powers and causality. *Actual* events happen if the powers and capacities in the objects manifest, while the *empirical* refers to what we can observe and the opinions we have about both the real and the actual (Delanty, 2005). Critical realism includes a conscious actor, but most of the reproduction of structures occurs unconsciously. Unintended consequences are central as we reconstruct our lives in relation to the reflexive negotiation of social reality. Both observable and unobservable mechanisms have great influence. This process occurs whether we are conscious of it or not. It lead to intended and unintended consequences that limits our freedom of action (Mythen & Walklate, 2006). Happenings do not have to depend on our understanding, because there are unintended consequences and unknown conditions that occur beyond our understanding (Sayer:Mythen & Walklate, 2006). Central to critical realism is what happens, the mechanisms behind the action and the conditions under which they are present (Korsnes, 1997).

Anthony Giddens

- **Structuration theory**

Anthony Giddens' structuration theory incorporates the same elements as critical realism; bridging objective and subjective ontology is essential to avoid the two reductions. Subjective ontology does not include the action concept in the sense that actors can take independent choices. Objective ontology reduces our consciousness and allows us to be seen as the outer controlled by external structure without the ability to reflect on and control our surroundings. The term which refers to our actions must be related to structural conditions (Giddens, 1984). Structuration theory deals with the

relationship between social institutions and regulators, as well as between actors and our agency (Moe, 2009).

Giddens uses the term *actor* in the sense of an individual and *agent* on the productive actors. Agency includes the production, reproduction and change of social practice (Layder, 2006; Martinussen, 2008) where reflexive monitoring is essential. Reflexive monitoring is an inherent feature that allows us reflexively to monitor our social and physical environment, our own and others' behavior, and to expect others to do the same. In this way we become aware of conditions around action and apply knowledge recursively to replicate the social practices by developing practices that are central to rational actions (Giddens, 1984; Ritzer, 2008).

- **Reflexive action regulation and practical consciousness**

Rational behavior is related to the use of structures in a social system and the adaptation of behavior to be meaningful. Giddens breaks down action competence into three elements: reflexive action regulation, reflexive action rationalization, and action motivation. *Reflexive action regulation* consistent the situational understanding of the basis of reflexive monitoring (Layder, 2006). Reflexive action regulation is linked to *practical consciousness* in Giddens' stratification model, a model of interpretation about actors' consciousness and agency. Practical consciousness is important and is defined as the things actors know about their social conditions of action. This knowledge is implicit. It is not suppressed, but "protected" by practical consciousness. Actors obtain insight into the knowledge when it is expressed explicitly (Giddens, 1984). Actions are often automated as in cycling, where actors do not think on every actions but perform a full automated action (Layder, 2006) rooted in practical consciousness.

Knowledge in practical consciousness makes situations understandable and meaningful (Moe, 2009). Actors regulate their conduct in relation to the current structure (Layder, 2006). Much of their behavior emanates from practical consciousness and is unconsciously motivated by the structural conditions of the social system (Martinussen, 2008; Ritzer, 2008). Giddens therefore believes that it is wrong to separate the actor from the structure when we try to understand social phenomena. Intentions are often unintended and thus produce unintended consequences in the form of structures that may limit action (Layder, 2006). Unintended consequences are not necessarily irrational actions, as these can ensure the continued reproduction of social practices. This can be seen in ceremonies where specific practices such as the rain dance are performed with the intention

of calling the rain. The unintended consequence like maintaining of the social practice in a society is a result of repetitive action. Unintended consequences thus establish regularities as participants in a social practice reflexively perform a regular action. Herein lies the power to change society (Giddens, 1984; Layder, 2006).

- **Actors and power**

Actors' power is related to two dimensions: our *capacity to take decisions* related to action, and the *capacity to balance* institutional structures. Actors' power is thus *reflexive monitoring* and is a dualism between actors and structure (Giddens, 1984), relational because actors power are interdependent. Power must therefore be understood in the context of social practice (Layder, 2006). Power is implicated in all our actions and exercised through the use of resources which appear as routines in social reproduction. The structure is not governing for us in terms that we are forced to act. There is both independence and dependence among actors interacting and different contexts where resources constitute options for action. Capacity to decide and balance within these resources constitute a process which Giddens describes as *dialectical control in social systems* (Giddens, 1984).

- **Structures as both enabling and targets for acts**

Structures are centrally related to the ability to take action and are defined as set of *rules* and *resources* recursively implicated in the reproduction of social systems. This enabling act and are the target for action at the same time as it contribute to the maintenance of familiar patterns. Policies and resources are therefore fundamental to the maintenance of long-term social systems and institutions (Giddens, 1984; Layder, 2006).

Structure exists only as memory traces in actors' knowledge base in form of a virtual order. Relationships are systematized and make the structure understandable and familiar. They underpin their existence and enable action alternatives in different contexts. Although the structure is embedded in social practice, it has no structure, but *structural features*. These memory traces manifests themselves in the social system of institutionalized distinctive traits that reveal the structuration and constitute the process whereby actors review the actions that produce, reproduce and change social practices (Giddens, 1984; Layder, 2006).

Structuration constitutes the dynamics between actions created and the conditions surrounding them (Moe, 2009). Institutionalized draft obtained by structuration constitutes structural principles which will be different in each society. Society is thus a difficult term to define (Giddens, 1984).

Structural duality is central in the structuration theory and constitutes reciprocity between actor and structure, both units in social practice and cannot be viewed remotely from actors' actions. Structures are the inner conditions for decisions around action and actions are a condition for maintaining the structure, conditional to one another (Layder, 2006). Structural constraints like habits and routines emphasized in actors' social practice enable an understanding of codes in the form of rules and procedures within their context. These contribute to the constitution and control of social life and to the maintenance of social system. Structures can be perceived to be beyond actors control in that they constitute institutionalized rules and resources. The structural constraints are not, however, mandatory, but present both limitations and opportunities (Giddens, 1984).

Actors can control structure because it exists only by virtue of the knowledge they possess and actively maintain. One challenge is that knowledge is founded in practical consciousness. The choice of action is not made deliberately, thus actors cannot understand and explain the processes. They can, however, explain the discursive activity, but these descriptions are often reductionist because actors are not aware of the structures that guide their choice of action. These are implicit in practical consciousness. Actors tend to choose actions which are already known. The structure is thus implicit in the actor's free choice of action by limiting and enabling action. An actor's free action can therefore not be explained without some relation to structure, while structure cannot be explained without the use of concepts that include conscious agents and their agency. The actor is therefore free and rational. The freedom does, however, not mean freedom from structures, because structure frames actions and alternative (Giddens, 1984).

Structures are also part of social positions with definitions about rights, responsibilities, and sanctions. Position is a dualism between action and structure and helps them to choose how to live within a given structural framework. When actors repeat internalized routines, they contribute specific features of the system to be maintained. Social interaction is thus central to the system's reproduction (Giddens, 1984).

- **From social integration to system integration**

Social interaction helps actors to develop their interpretation in that new experiences are incorporated into their knowledge base in the practical consciousness (Giddens, 1984). This base is not only a personal one, but also includes the shared knowledge of social practice (Layder, 2006), in a commonsense systems of rules and resources. These are developed through social interaction and are used in interpretation of situations, assessment of offense, including the production and reproduction of social practice (Giddens, 1984; Layder, 2006). A shared meaning system emerges from the social integration by interaction among actors. System integration deals with mutual relations among collectives over a longer period of time (Layder, 2006). The relationship between social integration and system integration demonstrates how routines guiding a social system arise when actors have social interaction with each other through everyday activities. It also demonstrates how this constitute the structural framework around social behavior across generations (Giddens, 1984). Stable interaction processes are important for maintaining ontological security and routines are primarily related to establishing and increasing security (Ritzer, 2008). Extreme crises that prevent routines from being maintained, destroy ontological security (Giddens, 1984).

The epistemological consequences from a relational ontological foundation are that reality and public statements about social phenomena must be based on both subjective and objective factors. These are not contradictory, but complementary and important to comprehend in their entirety. It is also essential to include the dualism between actor and structure. For Giddens, this implies practical consciousness. Inferences about social phenomena must therefore be withdrawn to include both the structure and an active and effective actor (Moe, 2009).

2.2.6 Relational ontology and Risk

Although subjective ontology emphasizes the actor's willingness and determination to choose the safe, in relational-based ontology actors are not isolated beings. It is therefore necessary to see how the social affects risk perception and risk management. Risk perception appears to be less affected by the "individual actor," than by the "social actor" in a social system where the institutions "take decisions." Rational actions which are developed in social interaction constitute *bounded rationality* within the given social system, which influences priorities surrounding risk. A social system possesses only a part of knowledge, and decisions about security are made in relation to the known. The actor is therefore not completely free to choose, but must choose on the basis of the available

knowledge. To understand risk, one must therefore analyze the institutional framework related to the decisions taken and include both actor and structure (Douglas & Wildavsky, 1983).

Subjective ontology emphasizes the individual and the universal physical laws governing cognitive capacity. The problem with such thinking is that it neglects to explain why, for example, some people fear environmental risks more than other kinds of risk. Cultures share beliefs and opinions which deal with both the moral and ethical elements of risk, affect the limits of acceptance (Douglas & Wildavsky, 1983). Risk is therefore negotiated in social and cultural contexts and will never amount to anything objectively. We have a dialectical relationship with our social world, as socially and materially can be perceived as an objective reality, but it is a reproduction of meaning and knowledge through social interaction. This socialization rests on shared definitions acting on the basis of prior knowledge and discourses. No knowledge is value-neutral and therefore the term "risk" is a dynamic concept in which a given social system negotiates the content of the concept and its established meaning (Lupton, 1999a). Knowledge of risk is thus not a finished product, but a social phenomenon under construction (Douglas & Wildavsky, 1983).

Risk is a central cultural and political term that we actors, social groups and institutions take into account in relation to organizing, monitoring and regulating. Risk is a key part of an actor's life and existence, and deals with the individual's subjectivity in that the risk can be handled by the actor by choice. At the same time, risk deals with objectivity because the concept is constructed in relation to actual reality (Lupton, 1999a). Hazards and consequences are socially interpreted in relation to current values and interests (Renn, 2008). Interpret reality within the social environment, such as commonsense, social structures and power-relations are thus important to understand risk (Lupton, 1999a). As well as the dichotomy between object and subject (Luhmann, 1993).

Risk is therefore a product of both objective ontology; elements that appear as objective can threaten the actors, as well as a product of subjective ontology in that it is the cultural and social interpretive experience that makes the object poses a threat (Pidegeon, et al., 2003). Risks that *appear as real* are acknowledged in relational ontology, as are values, rationality, knowledge, emotion and power (Zinn, 2008).

2.2.7 Risk Governance, Risk Assessment and Risk Management

Risk assessment refers to a way to evaluate risk in a given activity or system. It is the basis of risk management (Aven, 2007; Grimvall, et al., 2007). Risk management refers to the creation and evaluation of activities or the structures to prevent harm (Renn, 2008). It can be understood as measures and activities done to manage risk. Ontology is significant in designing risk management (Aven, 2007), because different ontological foundations will direct positions in the theory of risk, risk assessments and risk management. Risk assessments have ontologically been categorized as naïve positivism, cultural relativism and scientific proceduralism (Shrader-Frechette, 1991).

The objective ontological foundation relates to the realist perspective where risks are understood as real events that are pre-existing in nature. It concentrates the underlying real hazards, which can be assessed in objective ontology without including the actor or the social actor (Lupton, 1999a, 1999b; Zinn, 2008). Kristin Shrader-Frechette describes this perspective as *naive positivism*. Different risks will in this perspective be evaluated by the same rule (Shrader-Frechette, 1991). Objective risk assessments are thus neutral and value free (Aven, et al., 2004; Shrader-Frechette, 1991). Risk assessments are concentrated on probabilities taken on the basis of *past* events with the objective to predict hazard in the *future*. Events that are repeated over and over again could be predicted with relative accuracy. The risk then estimates equal to the average (Aven, 2007), and includes a rational actor where expected utility guides the action choice (Renn, 2008). Risk calculation and risk assessment are technical procedures (Lupton, 1999b), and can be quantified cost benefit analyses which can estimate the cost and effect of different risk management strategies (Aven, 2007). Determination of risk acceptance can be Frequency-Number of fatalities; estimated number of causalities in transport. Determination of acceptable limits can be done by As Low As Reasonably Practicable (ALARP) (Aven, 2006, 2007). The idea in technical risk managements is that the world is measurably safer today than it was 100 years ago (Wilson 1979; Jaeger, et al., 2001). The questions, then, are "how safe is safe enough?" and "what constitute clear criteria on the basis of what to decide?" when decisions often become inconsistent because of lack of knowledge (Fishhoff, Slovic, Lichtenstein;Weighing the Risks;Slovic, 2000).

The subjective ontological foundation can, according to Shrader-Frechette's terminology, be termed *cultural relativism* (Aven, et al., 2004). The psychometric paradigm is part of this ontological foundation. Here the actor's attitude and perception are essential. Often in this paradigm, multivariate analysis techniques are used to produce quantitative representations or cognitive maps of the actors risk attitudes and risk perceptions (Slovic, 2000). It also identifies patterns of how lay

people assess and respond to risk (Lupton, 1999a). Factors like visibility, controllable, outcome, disruptiveness, origin, responsibility and seriousness of the risk are measured and generalized to properties of the actors. The approach has strength because the ability to produce broad descriptions. The depth is, however, missing and thus many questions are unanswered. For example; why do we fear radiation exposures from nuclear wastes but not from radon in our house (Slovic, 2000). The challenge is, however, that subjective risk perception can contribute to the over and underestimation of risk (Luhmann, 1993), and also contribute to differences in risk perception. In a study of a flooded location, Kates (1962) found that the floodplain dwellers have completely different risk perceptions from technical personnel. The floodplain dwellers assumed that it was less likely that a flood would occur than the engineers did. This misperception was followed by differences in dealing with the uncertainty (Slovic, Kunreuther, White; Slovic, 2000). This singular focus on the actor and the subjective understanding of risk is thus the major weakness of the psychological perspective (Renn, 2008). The differences in risk perception cannot, however, be explained by the actor's properties. Social context and operations are therefore necessary complements to subjective ontology to see *why* actors react differently to social situations (Luhmann, 1993). The values and political objectives must be included when we weigh consequences and assess risk (Aven, 2007).

Risk assessments cannot constitute value-free assessments because we interpret both the world and the data (Aven, et al., 2004). Technical analysis based on social consensus are thus not sufficient (Renn, 2008). Nor is the risk as socially constructed (Aven, et al., 2004). The risk constitutes consequences which are socially interpreted and linked to values in a specific social system. Reality consists thus of both physical occurrences and socially constructed meanings (Renn, 2008). The relational ontological foundation thus makes the social central to the assessments of risk. Elements as values, knowledge, rationality, power and emotion relate to the culture, as well as risk responses. Social and subjective knowledge is central to localized knowledge and public negotiations. Values influence rationality and thus instrumental rationality is changed by social rationality (Zinn, 2008). Risk is thus socially defined and constructed (Beck; Lupton, 1999b). Shrader-Frechette's term *scientific proceduralism*, emphasizes rationality where predictive and explanatory power must be subject to review by both scientists and by lay people likely to be affected by the hazard (Shrader-Frechette, 1991). Assessments and management of risk should include all known facts and stories. Several risk assessments made with different methodologies can uncover uncertainty related to hazard assessment and increase the compliance between our thoughts about risk assessments and how to act (Shrader-Frechette; Løfstedt & Frewer, 1998).

In a relational ontology, risk is a central cultural and political concept, by which both individual, social groups and social institutions are organized, monitored and regulated. What is considered as risk and its consequences will be perceived depending on the actors belonging to a specific social system (Lupton, 1999b).

Our risk perception influence how we deal with management of security and risk. Risk assessments in objective ontology; risk as a combination between uncertainty and outcome of a specific activity (Aven, et al., 2004), risk assessments in subjective ontology; as cognitive models in terms of universal laws related to responding to a risk (Douglas & Wildavsky, 1983), or risk assessments in relational ontology; as a social phenomenon under constant construction negotiated in social and cultural contexts (Douglas & Wildavsky, 1983) will thus have different influence on risk management. One great challenge is therefore how to deal with modernity risks.

Each innovation brings unintended consequences and new risks, so mechanical thinking as used in the natural sciences cannot correspond to unambiguous hazards. Risk management therefore must be a continuous deliberative and iterative process. The subjective stories and the guiding social constructions for the actors involved are important(Jaeger, et al., 2001).

Ortwin Renn (2008) has developed the theory of risk governance, in order to meet the new requirements for how governments, organizations and individuals will assess and manage risk. The framework is built on the knowledge that modern society needs a more inclusive and integrative method for risk governance. It makes a better management of complex, uncertain and ambiguous modernity risks possible so that the emerging systemic and global threats can be managed more effectively. The framework includes the civilian population in the decision-making process (Renn, 2008).

Renn's theoretical framework elaborate risk governance in modern society as an inter-disciplinary activity that requires that risk assessments must be approached from multiple levels for the society. The theory challenges established risks assessments institutions to not only include the risks physical impacts on technology, natural events and human activity. It also reveals what actors *associate* with the causes of different risks. This is included in the assessment of how risk should be managed and controlled. Thus the social dimension is included in this framework (Renn, 2008).

According to Renn, there are two major challenges of risk governance: generating and collecting knowledge about risk, and making decisions about risk management. These challenges are presented in the four phases in his model. The *pre-assessment phase* includes awareness about

values and specific considerations regarding to monitor or control given risk. The *risk appraisal phase* identifies risk, understands its context, and the consciousness of societal values regarding risk assessment. The *risk characterization and evaluation phase* includes comprehensive assessment and the drawing of lines between acceptable and unacceptable risks. The *risk management phase* identifies management strategies, decision-making, implementation, and monitors the expected effects of implementations. These phases are intertwined and include the societal values and knowledge which appear as facts about hazards, which constitute different associations regarding hazards (Renn, 2008).

Renn also emphasizes involvement, participation and communication. The latter is crucial for how actors face and manage risks. Their confidence is of great importance. Trust will influence actors' risk perception, because the degree of trust correlates with the degree of perceived risk. Involvement and participation will vary by type of risk and who will be affected by that risk. Commitment is important at all levels of risk governance, because stakeholders provide additional knowledge by incorporating their values, interests and preferences into the risk governance process. Such participatory processes could result in better insights and more comprehensive understandings of the concerns of modernity risks (Renn, 2008).

Good risk governance should be based on the best available interdisciplinary knowledge, awareness of limitations and uncertainty and reflect actors concerns, values and visions (Renn, 2008). Interpreting actions and rituals in a given social system reflects the assumptions and abstractions that capture actors' beliefs. Alternative interpretations can be proposed by actors and analysts to develop a mutual understanding (Jaeger, et al., 2001).

In summary, risk is an abstract concept that depends on the connotations of risk. Ontology is a worldview that constitutes dispositions for how to orient oneself in the world and how to deal with risk. We distinguish its objective, subjective and relational ontological foundations. Objective ontology deals with the real or with what appears as real. Subjective ontology pertains to actors' cognitive capacity. Relational ontology deals the duality between the structure and the actor: the *structuration*. Each one of them will contribute to specific assessments of risks; from calculated risk, interpret risk perception to a socio-cultural phenomenon. Relational ontology elaborates social constructions of reality, by a continuous process of structuration. Bounded rationality is a product of structuration, which can appear as iron cage in thus it can influence priorities surrounding risk. Ontological foundations will thus influence for how to assess risk and have implications for risk management.

Within risk science there is no consensus about the understanding and ontology of risk. However, Renn's framework (2008) contributes to descriptions of the ways to assess and manage risk in an inclusive and integrative way which may improve risk governance.

3. METHODOLOGY

3.1 Introduction

The chapter on methodology will describe the design and methods used in this thesis. The aim is to establish methodological transparency by visualizing the methodological construction (Rødne, 2009). The chapter will discuss the way this research was conducted and give a critical analysis of the methods (Blaikie, 2010).

This chapter is partly based on Blaikie's (2010) model which specifies the models for social research design (Blaikie, 2010). The chapter begins by reflecting on the research topic, problem, research questions and purpose. The strategies of the research will be presented, followed by presentations of the research paradigm and theoretical frames used in the analysis. Selection and analysis of data will be discussed. The chapter will conclude with a critical reflection on the study's reliability and validity.

3.2 Research Topic, Problem, Questions and Purpose

Research topic and problem are intellectual puzzles (Blaikie, 2010). The lack of a relational ontological foundation in risk science, especially the socio-technical systems, contributes to reductionistic risk assessment because of the virtual absence of the relational dimension (Pettersen, 2008). The core element, which according to Crook is the relational dimension, remain absent (Shephen Crook; Lupton, 1999b). This can lead to a lack of understanding of the socio-cultural process in risk (Zinn, 2008). The problem reflects on the actor's activities and emphasizes the actor as a social individual in technological systems which intend to overshadow technical or structural conditions. This can result in calculated risk assessments where the social actors remain absent. Both activities and associations to risk are important in risk governance (Renn, 2008). These assessments only highlight some elements of modernity risks.

This raises questions about the cause of such a tendency; however, questions arose about the significance of ontological foundation in risk science. As several researchers in risk science have highlighted the actor as an individual as well as a social actor, this might not be the case in everyday life. The relational dimension is missing (Pettersen, 2008). Causes of this tendency could be lack of understanding of actors' risk perception, structuration, complexity in modernity risks or the significance of a relational ontology in risk assessments.

I found it necessary to explore the processes *behind* ontological foundation in order to understand the dualism between the actor and the structure *beyond* what is visible. I then perceived how the relational ontological foundation could be significantly related to modernity risk.

A research question has great significance in research design (Blaikie, 2010; Repstad, 2007). My research question is *"What is the significance of ontological foundations in risk science and how does relational ontology impact risk assessment and risk management?"*

I want to analyze the *significance* of ontology to highlight elements that can be captured by a relational ontology which objective or subjective ontology cannot. This ontology is a necessity if the main objective is to capture all aspects of modernity risk. It includes elements that appear as objective, individual actors and the social interplay between them. One can therefore avoid reductionism. To answer my main question I will analyze the theory of the Risk Society, and uncover how the relational aspect extends the understanding of risk and make the implicit processes visible and explicit.

My reason for writing this thesis is to extend the understanding of modernity risks regarding ontological foundation (Blaikie, 2010; Hellevik, 1984). Exploratory research is appropriate for this theme because it contributes to new thinking about the processes beyond modernity risks and uncovers the elements that can be useful in further research.

To explore the theory of the Risk Society, I will focus on the analytical categories, extensive and intentional dimension related to the structure and actor, together with objective, subjective and relational ontology. This will simplify the investigation of the Risk Society and my search for basic ontological elements. A table can illustrate the categories.

OBJECTIVE - SUBJECTIVE - RELATIONAL ; ONTOLOGY	
Extensive structure	Intentional structure
Extensive actor	Intentional actor

Figure 1; The ontological foundations will be analyzed in both extensive and intentional dimension regarding both actor and structure.

The explorative strategy clarified my understanding of risk, and has implications for risk assessments and management of modernity risk.

This thesis can lead to further research on modernity risks and relational ontology. It would be interesting to see if the empirical reality matches these theoretical reflections.

3.3 Research Strategy

Research strategy consists of the procedures that lead to answers to the research question. Blaikie (2010) has identified four strategies: induction, deduction, retroduction and abduction. These categories are, however, not quite adequate for my thesis. I will therefore refer to the strategies which have *inspired* my work.

I have been inspired by abduction strategy. This strategy does not focus on *observable* elements but *underlying structures, internal relations and connections behind processes* (Danemark, Ekström, Jakobsen, & Karlsson, 1997). This fits my research purpose: to uncover the processes behind ontology and what the relational ontology can contribute in addition to the implications based on understanding assessments and management of modernity risk.

The unobservable underlying structures, internal relations and connections behind processes are essential. By exploring unobservable processes, categorizing and systemizing them in extensive and intentional dimension, I have uncovered the processes underlying the development of modernity risk, internal relationship between the actor and the structure, structuration between them and the production of modernity risk.

Theory of the Risk Society constitutes the basis for my analysis of the significance of ontology. Based on this finding, the purpose is to see which implications these findings will have on risk assessment and risk management. This process can uncover processes that would otherwise be hard to find in risk science. The strategy can contribute to models and theories on relational ontology and risk (Danemark, et al., 1997), and produces new knowledge about important processes in risk assessment.

Abduction is a research strategy that inspires creativity and fantasy. It affects intellectual processes and creates opportunities to be aware of relations and connections which are not obvious, such as interdependent dualism between the actor and the structure; a structuration that guide development

of modernity risk. Thus, there could be a potential to formulate new ideas about how to analyze risks (Danemark, et al., 1997) .

The research is also inspired by retroduction: a creative process requiring intuitive skills. It is a process of building hypothetical models of structure and mechanism that contributes to the underlying empirical phenomena (Bhaskar 1979; Blaikie, 2010). To visualize my findings, I have built a hypothetical model that includes the building blocks of risk. My claim is that these building blocks must be included in risk assessments and risk management of modernity risk. Abduction has inspired my analysis of the Risk Society, while retroduction has inspired my discussion of the implications of risk assessments and risk management.

This research has also to a very limited extent been inspired by an inductive strategy because my work goes from characteristics of the data sources which is based on the relational elements in the Risk Society, explanations of patterns of risk assessments and risk management of modernity risk. The aim is, however, not to construct universal generalizations.

3.4 Research Paradigm and Theoretical Frames

A research paradigm is a source of usable ideas and assumptions (Blaikie, 2010).

The theoretical chapter starts with a review of general ontology and goes on to specify different ontological foundations and relate ontology to risk. The importance of a thorough theoretical review of ontology is that *ontology* must be well understood for the analysis to have value.

Several theories with foundations in relational ontology are presented in the theoretical chapter. Each captures an essential element needed to explain the relational ontology in risk as social phenomena. Structuration theory is of the greatest importance of my choice of theory (Giddens, 1984), and are essential to understand modernity risk. The characteristics of both structures and actors are well explained by Giddens' theory, and with the concept of *practical consciousness* it contributes to an understanding of essential processes in social systems. Giddens includes reflexive action regulation, power, structuration, dualism and integration. These are all important to understand processes in the Risk Society as well as the implications in risk assessment and risk management.

In the analysis of the Risk Society I will concentrate on the categories of structure and actor. Structuration theory contributes to the understanding of dualism and thus these categories are easily

connected to objective or subjective ontology. Structuration theory also describes the detailed processes around the dualism as important in order to be able to analyze the Risk Society and to uncover processes which can specify and reveal the significance of ontology.

To discuss the implications, assessments and management of modernity risk, it is necessary to clarify scientific theories. Different strategies apply different ontologies, which support my understanding of reductionism related to excluding the relational dimension of risk. The scientific theoretical contribution in connection to the relational ontology, which Shrader-Frechette defines as "scientific proceduralism," illustrates the need for a relational ontology in the form of physical occurrences and as socially constructed based on the meaning of reality (Renn, 2008).

3.5 Selection of Data Sources

My research questions are qualitative because they emphasize the content and meaning of social phenomena (Grimen, 2000; Repstad, 2007). This is consistent with my goal to uncover ontological features in the theory of the Risk Society.

This thesis examines ontology and relational ontology in order to understand and assess risk as a social phenomenon and risk connected to risk assessment and risk management (Figure 2).

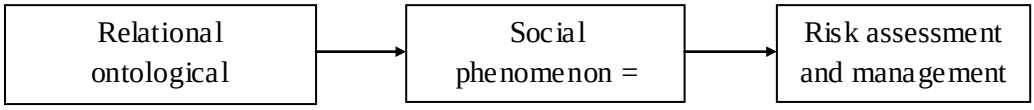

Figure 2; Ontology will influence our understanding of social phenomenon. Risk as social phenomenon will influence risk assessment and risk management in line with given ontology.

This thesis is based on established theory about the Risk Society; secondary date. This theory might be inadequate for further theoretical studies. The thesis is, however, about *theories* of risk, how *risk science* produces new knowledge, and how risk science manages to include the social dimension of risk research. The theory of the Risk Society has had a great impact on risk science and this could be an appropriate study. Although the theory has been criticized as too comprehensive, this strengthens it, because it includes analysis of both extensive and intentional analytical categories.

The ontological foundation should be the same as the one analyzed (Blaikie, 2010). The theories of the Risk Society and reflexive modernity, used in the analysis, are close to Giddens' structuration theory. They are both rooted in relational ontology. This is important because it might be impossible to investigate the significance of relational ontological foundation without a basis in such theory. The theory of the Risk Society can thus be said to be sufficient because of its comprehensiveness, its attention to the extensive and intentional dimension and because of its importance in risk science.

3.6 Data Analysis

In the analysis part of the Risk Society, the reduction of data will be based on qualitative methods in order to concentrate on the depth and underlying elements of interest regarding the identification of phenomena and establishments of connections (Blaikie, 2010).

The analysis of the theory of the Risk Society is concentrated on three driving forces: globalization, individualization and reflexive modernity. During the analysis I was inspired by Turner's (1981) systemized sequences in developing grounded theory. I have not developed grounded theory, but been inspired by Turner's model. My analysis seems to follow some of the same steps.

1. *Developing of categories after exposure the data*

After being exposed to the theory of the Risk Society I found the categories: *extensive* and *intentional* dimension related to the *structure* and *actor* connected with *objective, subjective* and *relational* ontological foundations, which seems to be appropriate to my research question.

2. *Saturation of the categories.*

I reviewed the theories, selected and categorized all items.

3. *Abstraction of the categories.*

I used Giddens structuration theory to analyze and uncover underlying structures, internal relations and connections behind processes of modernity risks in the Risk Society.

4. *Theoretical reflections.*

My reflections were on ontology, structuration, modernity risk, risk assessment and risk management. The aim was to find connections and explain them in detail.

5. *Sensitiveness related category.*

Critical reflection about my own categories has been important, as well as my extending context: modernity risk.

6. *Development of hypotheses link.*

I connected my link to essential concept which emerged from the analysis; "connotations" to risk and assumptions that elaborates connotations as essential in risk governance.

7. *Establishing conditions for the connections.*

The important conditions about the connections presume that the ontological foundation must be relational. Without a relational ontology in modernity risk, connotations become insignificant and will therefore not have any implications for risk science.

8. *Explore implications for the emerging framework.*

The implications direct the discussion towards the significance of a relational ontological foundation in risk assessment and risk management.

9. *Seek to test emerging relationships to test validity.*

My discussion proposal advances empirical research. The main objective should be to link different connotations of modernity risks that affect risk governance and the manifestations in regulation and priorities (Blaikie, 2010).

Dey (1993) describes the analytical process as circular (Blaikie, 2010). The process seems similar to what Wadel describes as a "round dance" (Wadel & Wadel, 2007). This has been a productive strategy, because reflection also needs maturation. Being able to work with several stages with the thesis at the same time has led to maturation.

This thesis only touches the tip of an iceberg. Further researchers might empirically analyze risk assessments, risk management and risk models which might illustrate the implications in a relational ontology.

3.9 Critical reflections

As explained in the chapter of methodology, I have tried to visualize the methodological construction. In terms of my final conclusion, I will follow the sections in the chapter and reflect critically on my work.

- **Research topic and questions**

Reductionism as a consequence of ontology in risk science is illustrated in this thesis. Modernity risks are a relational phenomenon, thus there is no way to investigate modernity risks without including the relational ontology. The topic is interesting and also important to elaborate to gain a more comprehensive understanding of risk as a phenomenon, risk assessment and risk management. There is reductionism in socio-technical research because of the lack of the social and relational dimension which can affect societal risk governance. My research question seems thus relevant.

An interesting question is how to analyze *significance* of the research question. This can appear subjective, because what I see as significance will dominate my discussion. Hence, the discussion of significance will be based on my opinion of what is significant in risk science. However, the significance will illustrate my reflection of the theory and other theoretical reflections in this thesis. Essential structuration will be revealed, systematized and generate different ontological foundations by each of the driving forces.

- **Strategy**

My study does not follow methodological lines, but I use a methodological framework. I have described the steps in which the methodological work can test the validity of this research. At the

same time one has to be aware that a different strategy can contribute to different findings. Hence, another choice of methodology could produce other results. There are also possibilities of discussing whether my choice of strategy has been the most appropriated. Abduction and retroduction are usually used in social studies of actors. My study is a theoretical one. I chose this strategy because by using it, I could do what I intended to do. Thus I assess the strategies appropriately for inspiration. My inductive strategy was that the concept of connotations was not in my mind when I started this thesis. I read the theory but I did not capture its essence. After I had analyzed the structuration theory and started analyzing the Risk Society I saw that these connotations were more than just words. I saw a clear relational aspect and a manifestation of structuration in risk. This connection was new to me, and gave me important insight for my further work. I am still aware that this can appear as natural at first sight for others.

- **Theory**

Concerning the theoretical framework for my analysis, most of my attention has been directed towards relational ontology. Within relational ontology there are many alternatives which could be used. Giddens' structuration theory is the basis of the analysis. My choice of theoretical framework is of great importance. A different framework could give different understanding of the analysis, findings and have other implications for risk assessment and risk management.

- **Methods**

My inspiration for the analysis was based on Turner's process of grounded theory. I used it to gain insight and oversight into my research. I believe that I have understood Turner correctly. The same applies to my use of abduction, retroduction and induction. Abduction and retroduction are developed for use in social context and not in theoretical studies. Thus elements that are important in empirical studies can be less effective when used in theoretical research. On the other side, it has been important for me to clearly explain my methodological steps. Methodological strategies have been useful regarding my description.

- **Generalizations**

In qualitative research, generalization is possible if one can argue that the case investigated is representative of a population (Jacobsen, 2005). I have used the theory of the Risk Society to

capture essential relational elements. These relational elements I therefore claim the necessity of in risk assessments and risk management. The theory from which my data is analyzed is based on secondary data, and not empirical material. This could lead to a discussion of the validity of such a claim. In regard to Giddens' structuration theory, I have tried to illustrate that my finding from the Risk Society concerning the structuration in production of societal structures are elements that seem to appear everywhere in a society. Risk as a social phenomenon is socially constructed and a product of structuration, as are risk assessments and risk management. Thus a relational ontology is needed to arrive at a comprehensive overview of risk and potential to contribute with greater validity in risk assessment and risk management. This generalization is limited to risk science regarding modernity risks in society.

- **Reliability and Validity**

Discussions of reliability and validity are critical to the data selected and the possibility for generalization (Jacobsen, 2005). Reliability refers to the research process (Robson 2002;Pettersen, 2008) and how the process can create confidence in the findings. In this chapter, I describe the processes by which I have arrived at my findings (transparency). Transparency describes the way in which the research was conducted. Obvious errors and incorrect conclusions are acknowledged. These critical reflections also contribute to transparency regarding methodological considerations, and strengthens the reliability.

Validity refers to the research result (Robson 2002;Pettersen, 2008). The conclusions should be strengthened by other research and reflections about one's own (Jacobsen, 2005). I have used categorizations as natural descriptions of the data material used. In the analysis section, I sorted and systematized within these categories. Systematization of large amounts of data can be difficult. Therefore, there may be imperfections. I am also aware that it would have been possible to use other categories that would have led to other results. My categories were appropriate for the analysis. Methodological use of categories can contribute to a systematic interpretation, which thus can be verified by others (Aase & Fossåskaret, 2007). Thus transparency is preserved. However, the conclusion confirms what other researchers have said: that risk is a relational phenomenon. A relational phenomenon must be understood in a relational ontology, and this strengthens my conclusions.

In summary one can ask if theoretical reflections without empirical research have value. The purpose of this research has been to illustrate ontology in risk science. If I had undertaken my own

empirical research, this could have turned out to be a new risk research. A claim about a general need for relational ontology regarding modernity risks could thus be more difficult to make. To gain insight into how theories in *risk sciences* are in need of a relational ontology, I needed large amounts of data. Risk Society is an important and popular theory in risk science. The theory of the Risk Society concentrates on both macro and micro factors in society. Hence, it gave this research a breadth that could otherwise have been difficult to capture.

Given the framework of this thesis, I would not have done this research differently. I will not claim that this research would have been improved by the use of empirical data. There is a lot of work in analyzing both structuration theory and making it useful regarding the analysis of the Risk Society. This analytical work would not be sufficient if it had been completed in less time. Using theoretical data has allowed me to understand the importance of relational ontology in risk science. I understand the processes behind the structurations and the connotations of risk as a relational phenomenon which is important in risk science. I wished to conduct further empirical studies on this topic. This thesis is an important task in itself, and is also the first step in a larger research project. It that can in this sense provide more insight into the relational dimension of risk advance the understanding of how risk assessment is constructed and how its manifestations can be visible in regulation and control. It is therefore important to understand risk governance, regulation and control.

4. AN ANALYSIS

As described in section 1.4, I analyze the theory of the Risk Society in terms of different ontological foundations of risk. The purpose is to see if and how the relational ontological foundations are significant in risk science.

Ontology and the understanding of different manifestations of ontology is a complex subject, thus this chapter combines theory and analysis. Each section includes a brief analysis of how different ontologies have different implications for understanding risk and thus their importance in risk science. I have chosen to structure the analysis around three forces in the Risk Society theory: globalization, individualization and reflexive modernity. These forces will be analyzed according to the objective, subjective and relational ontological foundation.

4.1 Discussion of Important Forces in the Risk Society

Ulrich Beck developed his theory of the Risk Society to understand our contemporary world and the transformation from the industrial society to the Risk Society. This is a new paradigm in a new social era (Beck, 1997). Global stretching across the socio-political system and national cultural order allow the local and the global to get new dimensions and a new character from the industrial society (Giddens, 1990).

Historically, analysis has been conducted in terms of identifying driving forces. Karl Marx (1818-1883) regarded capitalism as the driving force for change; Emile Durkheim (1858-1917) viewed it as the division of labor (Giddens, 1990). Beck believed that capitalism was responsible for the development of the Risk Society in that capitalist actors who produced wealth simultaneously produced the risks of modernity (Beck, 1997). The Risk Society is thus a double-edged sword (Giddens, 1990), because our first priority related to production is production of growth, progress and wealth. Wealthy sources is however a hazard of unintended consequences and contributes to increased modernity risks (Beck, 1997). Capitalism is thus crucial in the production of the Risk Society. Giddens agrees that capitalism is crucial, but that capitalist development is also driven by several factors. It is therefore necessary to look at the development of the Risk Society in a multidisciplinary perspective where driving forces like globalization, individualization and reflexive modernity are incorporated (Giddens, 1990).

The change in the Risk Society is deep, slow, and unnoticed. This change includes dynamic processes where social relations are lifted out of local interaction contexts and restructured into new

pairings globally and constitute a structural break with the traditional culture (Giddens, 1990). Such considerations assume that actors are unconsciously exposed to changes and thus appear to be "victims" of change. This is in a stark contrast to the actions where actors freely drive the trends. If the change is unnoticed, the actors cannot understand the change because the structure govern and manipulate the actor like a marionette (Moe, 2009). With such a representation of reality, the actor has no possibility of free action (Lupton, 1999a). Structural forces are dominant.

Giddens is trying to demonstrate societal development in Risk Society with the metaphor about the Jagannath wagon: a machine with tremendous force. We have only partial control of the vehicle. There is constant danger of losing control. The machine is full of tensions and contradictions. The consequences are unknown and therefore we are not safe (Giddens, 1990). An example is the development of computer technology that contributes to a host of new opportunities in the form of advanced computerized equipment and control systems in technological systems. The challenge is that the technology is advanced and difficult. Thus we are unable to fully understand the processes within the technology. When unintended consequences occur we cannot intervene and manage hazards. Major accidents can then occur as a result of produce technology that we do not have expertise to manage.

This illustration appears as if the actor is left in a society with structures that control and have all the power. The contradiction is however that the actors also are the producers and the one that maintain structures. Production of technology is thus a product of actor's activity. The changing dynamics in the Risk Society can then be said to be the actor in his production of wealth with unintended consequences of potential modernity risk. The actor is not aware of this development and thus appears as a victim. Max Weber describes this as an *iron cage* (Ritzer, 2008). Weber is concerned about the actors' rational action; it is rational to produce technology that contributes to societal development. The problem is, however, that actors do not have full information and knowledge about the system and this can contribute to the development of unintended hazard or in Beck's terminology, modernity risks. The lack of information and knowledge thus convert the rational action to an irrational one, because it involves production of structures and procedures that restrict our risk management. It is therefore possible to say that actors create hazards that appear "objective."

Modernity risk, however, cannot be explained in objective ontology, as it incurs as unintended consequences not possible to understand, predict or explained in terms of causality. Objective descriptions of modernity risks are thus not satisfactory because the lack of possibilities to calculate

and estimate hazards and potential risk. Concurrent with this, modernity risks appear inescapable. Our actions are governed by external structures that do not provide room for free action. Thus it is impossible for us to make predictions and understand the hazard. We are therefore always exposed to great risk, because globalization, individualization and reflexive modernity deprive us of control (Giddens, 1990). The question is thus how we understand the reality; whether we are trapped in a web of structure and faced with objective hazards or whether we as actors have power to act freely and thus control societal development. In a relational ontological foundation the essence is a dualism between these extremes.

In summary, the driving forces in the Risk Society appear to be characterized by structures that have power over actors and thus appear as objective. At the same time the actors are not helpless and have influence in their activity related to production of modernity risk, so the subjective is included. Weber's iron cage highlights the *relation between* the objective structures and the subjective actors that are essential to capture the processes between the structure and the actor. This relation constitutes the argument for the use of relational ontology.

Changing dynamics that contribute to the development of the Risk Society are, according to Giddens, not only capitalism but also *globalization, individualization* and *reflexive modernity*. In the following these driving forces will be analyzed in light of their *extensive* and *intentional* dimensions. The extensive dimension emphasizes the range of change dynamics in the global context in terms of challenges and limitations, as well as new opportunities for global social interconnections. The intentional dimension deals with changes around the intimate and personal traits in our everyday life and the nature of institutions (Giddens, 1990).

4.2 Theory of Risk in Risk Society

The term "risico" has its origins in the Italian language, which describes the *cliffs* along the sea. These cliffs had been a threat to sailors for hundreds of years. Beck defines risk as a virtual reality that is *real*, which has negative connotations of danger and threats. The size of the threat determines the size of the changes required to achieve control. Risk-term, however, also has positive connotations and there is a freedom of being able to take risks and achieve significant gains. The concept of risk therefore includes decisions (Beck, 1997).

4.2.1 Analysis and Reflection of Ontology in Beck's Risk Definition

According to Beck's (1997) definition of risk, in negative impact is a virtual reality that is "real," and has negative connotations of danger and threats. The size of the threat determines the size of the changes required to achieve control.

This is consistent with Slovic's statement that risks only exist in our minds and cultures. In this sense, there is no such thing as objective risk (Slovic, 2000). When Beck refers to risks as virtual reality, it is consistent with subjective ontology. We actors form our world and our ontology through cognitive activities (Lupton, 1999a). At the same time, Beck says that the magnitude of the threat will determine the scope of the changes needed to achieve control (Beck, 1997). Control can only be achieved if the events are real, while one must be able to calculate the size, consequences and demonstrate causality. This is in line with objective ontology, where potential risk does appear as objective fact and absolute truth (Lupton, 1999a). Thus, Beck includes both a subjective and an objective ontology to risk. However, there is a dualism between actor and structure in the Risk Society that are essential in a relational ontological foundation. Beck says that the concept of risk has positive and negative *connotations* that guide our behavior. Negative connotations is related to the size of threat and further influence risk management (Beck, 1997). Connotations, according to Luhmann, are related to expectations associated with risks in society (Zinn, 2008), and to the risks that receive attention (Douglas & Wildavsky, 1983). Connotations of risk affect risk behavior. They constitute a interaction between the periphery and the subjective preferences (Els C. M. Van Schie, et al., 1993). This constitutes an interaction between the structure and the actor. Connotations are therefore rooted in relational ontological foundation.

In summary this can be as follows:

OBJECTIVE ONTOLOGY	SUBJECTIVE ONTOLOGY	RELATIONAL ONTOLOGY
Danger can be controlled	Risk is a virtual reality	Relational ontological foundation take into account objective danger and risk that constitute a virtual reality, which both are important related to *connotations*. Connotations are a product of dualism between structures and actors and are guiding related to actors free choice of action

Figure 3; The risk definition in the theory about the Risk Society.

I will assume that the theory of the Risk Society is based on a definition of risk that is rooted in relational ontology. It includes essential elements in Bhaskar's critical realism; real reality with specific structures and forces that exist, actual events that can be calculated and the empirical reality that include the actors' *assessment* of risk (Delanty, 2005). This empirical reality describes the dualism between the actor and the objective structure (Giddens, 1984), and constitute the essential relational dimension. However, the term connotations related to the relational ontological foundation must be explained better.

As mentioned, actors *freely* choose their actions in relation to various connotations of risk. The issues are whether this constitutes *freedom*. Connotations are related to expectations, as well as the "status" of a particular danger in the community (Douglas & Wildavsky, 1983; Zinn, 2008). They constitute a dualism between the structure and the actor (Els C. M. Van Schie, et al., 1993). The structures are therefore integrated in connotations as well as actors' subjective perception. Connotations of risk can, in relation to Berger and Luckmann's theory about social construction, be seen as *social constructions* which make our reality understandable and manageable. This may appear as objective because it materializes external structures to which we have to relate (Martinussen, 2008). Still this is a product of relational processes that constitute a *reality* which is, a result of our definitions (Korsnes, 1997). Although it is socially constructed, this is the reality to which we much relate. Thus one can draw a link from the connotations against Weber's iron cage (Ritzer, 2008), because it will not be possible to decide connotations based on what is appropriate in a given situation. An illustrated example is regulations in society that decide to build nuclear power

plant on neighboring land next to your house. It is guaranteed from the expertise that there is no hazard by living next door. Risk assessment is completed and calculation of accidents shows a probability that appear to be so small that it is considered negligible. Still we will not be living next door. Although the area is safe, our connotations of risk make us consider it dangerous. Actors are responsible for building nuclear power plants and also for the development of expertise system, risk assessment and calculations procedures. They know that nuclear power can cause serious accidents. Actors' production of expertise system with different techniques to estimate the risk of safety does not contribute to their ontological security. Their connotations of risk and safety around nuclear power plants are established in the practical consciousness and thus constitute implicit knowledge.

In this example, there are many elements of Weber's iron cage. Nuclear power plant are produced by actors, but they do not understand the range of unintended consequences. The system can constrain an actor's freedom and activity. The actor's production of expertise system with the aim to contribute to ontological security based on calculated "facts" appear as an objective risk assessment. The expertise system has a powerful ability to prioritize politics and economy. If there is potential risk by placing a nuclear power plant close to a habitable area and if it is costly and difficult to find a new place, the expert system might ignore the hazard. Actors are thus "lost" in the systems that they have produced. The point here is that connotations of risk are important element of Weber's *iron cage*. They frame the understanding of risk, risk assessment and risk management. Connotations arises from structure and actors perceptions, and form structures that influence risk assessment and risk management, and can be demonstrated in Giddens' theory of practical consciousness.

Practical consciousness is crucial for our choice of action because it is responsible for most of our actions (Martinussen, 2008; Ritzer, 2008). Practical consciousness is the knowledge base we use in action by knowing how to handle situations without thinking (Giddens, 1984). Connotations can be categorized as an element of practical consciousness that make actions practical and meaningful. Connotations are automatic; we know immediately if there are negative or positive and we are able to assess an event as risky or safe. As an example, we can go back to the nuclear power plants which appear as a complex technological system with high reliability because they are under advanced control. Our connotations of nuclear power plants are, however, not consistent with these "facts." We remember the Chernobyl catastrophe of 1986. The photographs are still in our mind and also the fear we felt about how this could affect our life. This subjective experience is a part of our connotations, coupled with elements that appear as objective like medical knowledge around

radioactive substances related cancer. We also have subjective experiences that human error can occur, thus the control in a nuclear power plant cannot be guaranteed safe. We also know that structures like technical systems can fail. Our connotation of risk in relation to nuclear power plants is based on the dualism between objective and subjective elements, and are essential because they affect risk assessment and then our risk behavior (Els C. M. Van Schie, et al., 1993).

The connotations of risk are not only a construction we make as individuals, but it is a social phenomenon. The structure is central, because connotations are, as Giddens states, produced by our *participants* in a society. We reproduce connotations and actors in our social system are *socialized* into specific categories of connotations and unconsciously accept connotations implicit. Connotations are thus a social phenomenon that best can be understood related to relational processes between structures and actors in society.

Connotations of risk are also essential to driving forces of production of risk in the Risk Society. In a relational ontology this process is characterized by dualism, where practical consciousness, such as connotations, constitutes habits and routines patterns that help us to understand our situation and make us secure about how to deal with hazard. Thus we maintain control over social life (Giddens, 1984). Structures are memory slots embodied in practical consciousness and constitute alternative actions for us (Layder, 2006). Connotation appears as internalized structure because of the socialization processes, and thus they guide action. Relational ontology emphasizes duality as an important point. It enables us to draw on familiar elements in the structure and act in line with what feels right in a given context. This structuration is central because we use our common understanding and relate to connotations in an experienced and expected manner, this reproducing them. We use structure in our knowledge like connotations, rules and resources in our social system and our free action is taken within these structures. Our free action is taken within the current connotations which constitute the dualism between actor and structure, when we face a hazard and assess the risk.

If an actor has the opportunity to choose freely or if structural conditions totally determinate action, one could use objective or subjective ontology in the understanding of risk. Risk is however, a social phenomenon that is socially constructed. Understanding and analysis of risk must thus be done on a basis that includes the relational actor. Giddens asserts that the actor has freedom because structures are maintained by our control (Giddens, 1984). This presents a challenge because this knowledge is established in practical consciousness and we therefore act without understanding the processes behind our choices. We are not forced to act in line with a given connotation. It feels,

however, natural and thus we prefer it. Our choices of action related to risk are thus a product of structures in form of connotations to risk. These are established as a dualism between our subjective experiences, structures that appear as objective facts and the interaction between them. The dualism and interaction related to connotations illustrate the relational foundation.

Therefore, the structure is "embedded" in our free choice of action, by connotations, insofar as we are indirectly controlled by it. We choose "known" solutions that offer safety and security, although there may be other desirable alternative solutions. When the actor freely chooses his actions in relation to his connotations to risk, this is not a freedom *from* structure, but a freedom *within* the structure (Giddens, 1984). Relational processes between the guiding structure and the actor are thus essential and constitute something like Weber's iron cage (Ritzer, 2008) where we prefer known solutions. Not because they are the best solutions, but because we have connotations to these solutions *as* the best. These connotations are, however, not facts but a product produced by ourselves in social interaction, constructed to existing structure. We have the opportunity to change them. This is, however, a challenge because we are socialized in a given connotations structure that frames and constrains our room for action. Our reflection, perception and action thus follow from them.

Connotations to Risk in the Risk Society

STRUCTURE	ACTOR
Connotations of risk form structures in that they provide specific guidelines for how the actors experience and understand hazards and assess risk.	Connotations to risk are socially constructed by actors.
Structures constitute rules and resources that the actor use to face hazards.	Connotations to risk are constructed in previous generations, and appear to be bearing structures in that they appear as "*real*."
Structures are established in practical consciousness and the actor therefore is not aware of them.	The actor is free to deal with hazard and assess risk as a free individual, but connotation to risk will guide even free choices.
Structures constitute codes that make situations understandable and actions meaningful.	The actor's free choice is thus within the structural framework.
Structures appear to be established routines that the actor does not reflect on.	The actor maintains connotations to risk by reproducing them.

Figure 4; Dualism between structures and actor-related to the understanding of risk rooted in relational ontology.

There is a mutual dependency between actor and structure in Beck's definition of risk. He uses the term *connotation* in reference to the dualism between actor and structure. This connotation constitutes actors' risk perception. Schematically, we can see that actors are less free than we assume. First, we do not manufacture or construct connotations about risk by ourselves, but internalize them through the socialization process. Second, we are not aware that connotations not are facts, because they are established in practical consciousness. Thus we are not immediately

aware they are dissimilar in different social systems. Connotations about risk appears to be *real* and taken for granted. We actively reproduce connotations as if they were real, with a structure which constitutes guided routines and procedures for how to face risks. We select well-known codes before unfamiliar codes because they seem safer. We thus choose our freedom within the structural framework that exists, and reproduce risk connotations that constitute ontological security in our social system. In addition, we produce and reproduce connotations to risk and have the power to change them.

4.4 Theory of Globalization in the Risk Society

Globalization describes the way in which different social contexts, regions or nations are linked. Network covers the globe with relationships characterized by great distance and complexity that mutually influences modern institutions (Giddens, 1990). Risk in the Risk Society appears as modernity risks and are not limited to acute effects. Unintended consequences contribute to future crises and thus constitute a universal global threat (Beck, 1997). Globalization is a dialectical process where local structures and changes affect globalization at the same time as local social connections expand through globalization. For example, a national economy could affect the world economy, and the world economy provides new opportunities in local contexts (Giddens, 1990).

The Risk Society is a global society (Giddens, 1990) that transcends national boundaries by producing and reproducing transnational risks (Beck, 1997). Global changes affect structural conditions followed by fundamental relational changes among actors, social organization, and the environment (Giddens, 1990). Production and intervention in the society contribute to new hazards because natural phenomena that had previously been external phenomena are linked to living conditions, relational, economic, political and cultural situations. Everyday life is thus a threat to the natural conditions of life and leads to social, economic and global challenges. Destruction of nature is thus an integral part of a social, economic and political dynamic (Beck, 1986, 1997).

4.4.1 Globalization and reorganization of time and space

Globalization processes in the Risk Society reorganize time and space. Traditionally, time was related to a place where life was organized into periods such as the *working day*, and room where linked to a specific geographic location and characterized by the presence. The Risk Society is characterized by global stretching. Space expands to looser connections that are far removed from

that situation. Spaces are linked to the global world and receive social impact of removing geographic relationships. There is a dissolution of traditional institutions that affects habits and practices, which changes the limitations of time and space. The Risk Society opens for multiple opportunities to establish new extended relationships and create new connections between the local and the global. Such a stretching of time and space leads to structural social changes (Giddens, 1990).

4.4.2 Globalization and abstract systems

The Risk Society is characterized by dissolved institutions. The abstract system is important in this process. Giddens describes abstract system as *symbolic signs* and *expert system*, both important factors in globalization, as they separate time from space (Giddens, 1990).

The market has historically been characterized by trade, which evolved into monetary economics. Actors can exchange *money* to meet needs without having to take the recipient into account. Money does not have intrinsic value, but convention assigns it a value. Symbolic signs like the transition to the monetary economy was not only a constitution of relational changes, but also enabled the credit and debt. Money is thus independent of time and space which bridges distances, connects the present to the future, the presence and absence (Giddens, 1990).

Science includes both technical systems and professional expertise. They are crucial as they organize the material and social environment that continuously affect actors (Giddens, 1990) with risk assessment and an acceptance level in relation to tolerance for risk. This is challenging because science does not take account of actors as individual and make calculations on a general basis. The individual participants may thus unconsciously be exposed to multiple influences which constitute hazards. Science is often described, incorrectly, as infallible. Scientists have often made incorrect risk assessments when they lack information that characterizes modernity risks. Living in the Risk Society therefore requires actors to tolerate suspense to the scope of both their actions, what can happen and what they may be exposed to (Beck, 1997).

Expert systems contribute to the removal of social relationships. Thus there is no longer a personal verification of safety. Actors have to rely on experts' remote information by trust which are established if the system is functional and meet our expectations (Giddens, 1990). Trust is still a challenge because of lack of coherence in scientific definitions of risk. Different assumptions and different ethical values create plenty of risk definitions which can complicate the construction of

risk assessment and affects risk management. Economics and politics also affect the risk assessment by limiting risk research and opening for opportunities to hide the risk of high costs. Processes like this develop gray areas of unrecognized risk assumptions that often remain *non - existing* risks, where concealment of risk is the easiest solution. Beck states that we "make up" the truth and fail to see what really happens. This allows risk to grow (Beck, 1997).

4.4.3 Globalization and Risk

In the Risk Society, there is a great danger that the unintended consequences of our prosperity lead to hazard (Beck, 1997). As Giddens says, the production of wealth produces risks (Giddens, 1990). The sources of wealth have unintended consequences and when we continue to produce wealth, make growth and economic progress the top priority, we create modernity risks which are invisible, irreversible, unthinkable and latent risks with unintended long-term consequences. These risks cannot be limited to time or space. They also have structural properties that cannot be explained causally, because the causal connections are invisible. Thus they must be causally *interpreted* (Beck, 1997).

Science also produces risk because uncertainty about modernity has contributed to considerable profit in calculating and analyzing risks. They then establish new markets and new capitalist prosperity, which will contribute to unintended consequences. We therefore contribute the risk to produce risk (Beck, 1997).

It is very difficult to manage the risks and threats that the Risk Society systematically produces. These include the risks we expose ourselves to and those that others create for us (Beck, 1997). Management is complicated because we cannot predict the consequences of our actions and those of others. Thus we produce and reproduce our social system, without ability to verify this completely. Globalization, individualization and reflexive modernity are key influences (Giddens, 1990).

4.4.4 Globalization and systemic risk blindness

Science has the status of infallible truth, while actors are seen as ignorant. However, this is wrong. Our perceptions of risk are not irrational, because our risk awareness and our attitudes about what is acceptable in relation to risk are important to our risk management. Rational action occurs socially. Science fails and is not rational because it produces new risks by producing new knowledge. These

new risks are the product of science and technology. Increased production of knowledge contributes to the development of systemic risk blindness to unseen, unintended and latent consequences. This deprives us of the ability to identify risks because the system presents our knowledge as inferior to the secure knowledge that an expert system possesses (Beck, 1997). Systemic risk blindness is problematic because modernization of risk must be acknowledged before we understand that there is a risk. The knowledge of these risks is to be recognized, as are the collective knowledge and beliefs. In addition, they merit political attention (Beck, 1997).

4.4.5 Globalization and Politics

The Risk Society threatens the social, economic and political system, so it is crucial to acknowledge these risks in order to prevent or manage disasters. By ignoring invisible risk, we conduct a policy which brings increased prosperity and growth. Thus, we produce a society that can develop into an uninhabitable world (Beck, 1997).

The risk society is characterized by globalization and the stretching of space. It undermines not only national borders but also political and economic ones. In relation to environmental policy, for example, we must implement transnational solutions for the threats to which we are all exposed, but cannot define. Such overarching problems cannot be solved in a small arena, but require cross-border negotiations and international cooperation. This is problematic when the pluralistic interests wreak havoc on the negotiations and break established routines. It is also difficult when risks are ignored because hazards become normalized and institutionalized. We then learn to live with risk, even when it threatens our values and our structural foundation. We are then faced with a system-change where change does not happen as a consequence of a revolutionary event. This is a result of a silent development and a consequence of changes in our risk awareness, which are characteristic of reflexive modernity (Beck, 1997).

4.4.6 Globalization, trust and ontological security

Development in the Risk Society contributes to structural change as a result of globalization, individualization and reflexive modernity. Institutions are centrally related to maintain personal relationships that are organized in new ways. Personal life become curtailed and converted, and new pairings occur between the close and distant. A reactor accident in Ukraine could have consequences for a nursing mother in Norway. Local practices associated with globalized social

relations and the global space we are moving in, are very large. The information about what is happening will thus be difficult to obtain and understand. On the basis of this incomplete information and less than transparent process, trust is important. Trust is thus a dynamic process that is fundamental to modernity and to the stretching of time and space (Giddens, 1990).

Trust deals with confidence to actors and systems' reliability in relation to given results, linked to faith in other people's accuracy of knowledge. Trust and confidence are socially constructed and follow the dynamics of modern social institutions. Trust relations were previously characterized by the presence of human beings, but in the Risk Society this has changed. The meaning of what is "foreign" is stretched; we have fleeting interactions with parts of ourselves characterized by confidence and demonstrate courtesy phrases in everyday life. In addition occurs what Giddens describes as *"faceless interactions"* that constitute relationship and confidence to expert systems, which are essential for ontological security (Giddens, 1990).

Life in a globalized society is influenced by expert systems. For example, we have no qualms about going into a house because we have confidence that the house has been correctly built. We do not need to check the construction. We trust the builders and feel secure (Giddens, 1990). Trust in expert system is important because we do not have the expertise to determine the risks related to unintended consequences. We are therefore dependent on expert knowledge and their definitions (Beck, 1997) which we can trust (Giddens, 1990).

Trust is also important in relation to ontological security. Ontological security is the sense about us and our social and material environment. The phenomenon is rooted in the unconscious where trust contributes to a sense of security (Giddens, 1990). Our practical consciousness is established around a security system related to what we perceive as safe and unsafe (Giddens, 1984). Reflexive monitoring is used to develop routines that constitute rational actions in a common meaning system which frames interactions (Ritzer, 2008). Continuous reproduction of routines and procedures in social practice contributes to ontological security. Ontological security is the foundation for all of our activities and is essential for predictability and routines (Giddens, 1984; Layden, 2006).

Reflexive modernity changes ontological security. Traditionally, family was important in terms of stability and organization around the relationships of trust that maintain networks. Globalization changes structural conditions, and ontological security cannot be ensured by close proximity to the traditional and local. Routines are closely associated with ontological security and central for the maintenance. The problem is that they are part of practical consciousness and practical experience

loses its value in the Risk Society because the future is diffuse. The ontological insecurity can thus increase (Giddens, 1990).

4.4.7 Analysis and Reflection of Ontology in Globalization Concerning Risk

The globalization thesis in the Risk Society is marked by a dialectical process between the global and the local, between structure and actor, a process that Giddens links both to the extensive and intentional dimension. The *extensive* dimension focuses on the new global interconnect and its constraints and opportunities, and the *intentional* dimension focus on intimate relationships and institutions inner nature (Giddens, 1990).

- **Extensive dimensions related to structure**

The extensive dimension deals with new global connections and large structural changes. In the Risk Society, the society extends globally. Different social contexts, regions and nations are linked in new complex interactions where national boundaries are crossed. The transnational become important (Beck, 1997). In a transnational society, the global world and transnational policy affect the norms and rules which are determined internationally. The community, therefore, is characterized by the global.

Risk in the Risk Society are hazards with potential for global threats to life (Beck, 1997; Giddens, 1990). This constitutes a challenge to understand and manage. First, these hazards have unfamiliar consequences and opportunities, and unintended consequences beyond national borders. Second, the absence of a common understanding of hazard and risk assessment impedes common global risk management. A good example of the latter is the climate negotiations in Copenhagen 2010, which stalled because there was no consensus on policies or management.

Science, economics and politics are essential factors in the production of risk assessments with following limits of risk acceptance and priority which risks being displaced or acknowledged. Science has previously been held as infallible, but in the Risk Society there are major challenges related to the understanding of risk and the unintended consequences. Therefore, a life in the Risk Society includes a life with the unknown (Beck, 1997).

In the Risk Society, structures in the extensive dimension appear as they control actors because risk appears with new characters as a result of structural changes. They thus appear as "objective." The abstract system also represents structures which construct the reality by construction of risk assessments. The extensive dimension in relation to globalization can *appear as* rooted in objectivist ontology, in that actors lose the ability to protect themselves and become what Durkheim calls *marionettes* (Korsnes, 1997).

- **Extensive dimension and the actor**

The extensive dimension deals with the global interconnect and constraints and opportunities for the actor. Globalization requires new dimensions in time and space (Giddens, 1990). New kind of social interaction and a more flexible space for action opens. Traditional time zones such as the "working day" dissolve and open for new opportunities such as flexible patterns of work. Internet and mobile phone technology liberates social interaction from time and space and constitute structural changes with major consequences for individual actors.

Globalization opens new spaces for social interaction which change the *quality* in interactions. An example of qualitative change is the monetary economy, which shows that interactions previously characterized by the presence, now characterized by greater distance. The same applies to science. Professional expertise as scientists possesses knowledge that actors do not. Actors thus cannot perceive the overview. In everyday life, actors have to relate to *distance* information where experts assess risk and decide limits for acceptance.

Ontologically, this demonstrates how globalization's stretch of time and space influence an actor's room for action and give new options related to the new structural framing. The actor is, however, not totally dominated, but has opportunities for choice of action in production and reproduction of the new structure. Still the guiding appears as dominated as a result of globalizations changing in the fundamental structure of society. The consequences are that actors cannot stop this development of new structural framing. The structures are, however, maintained by actors. Developments in globalization are thus a product of relational processes between structures and actors.

- **Intentional dimension related to structure**

The intentional dimension of globalization is different from the extensive dimension, because it deals with changes in everyday life and institutions' inner nature (Giddens, 1984). Globalization will affect the relational, social and regional circumstances surrounding the actor, and thus present new challenges.

The structure in extensive dimension is influenced by several changes. In the intentional dimension, this change is linked to intimate relationships and institutions' inner nature in the Risk Society. Changing in time and space raise new constraints and opportunities (Giddens, 1990). A social phenomenon is characterized as transnational because structure of everyday life includes more than the traditional society. The everyday environment becomes global and actors have to relate to global events like earthquakes in Japan or the war in Libya. Media, with its role in society, expands "closed" areas by opening up for new opportunities to share knowledge across the world. However, it may also constitute restrictions because the expansion is huge and this complexity can generate fear, helplessness and ontological uncertainty.

Modernity risks are a challenge for all actors in the Risk Society as a result of the unintended consequences of our prosperity (Beck, 1997). The production of wealth leads to the production of modernity risks (Giddens, 1990). Actors are thus involved in production of invisible, unintended and incomprehensible hazard which contributes to potential risks. To mitigate these potential risks, actors produce measures which generate profits and thus constitute new potential risks (Beck, 1997). An ongoing cycle prevents the actor from knowing what he produces, his own contribution to the production, and how to manage the development. The experts are therefore central, because they can convey knowledge to actors about their daily lives. Actors thus depend on experts and relate to them with distance and confidence. Not even science produces truth. There is thus a danger for producing systemic blindness in risk assessment. Experts do not want to acknowledge certain hazards and selectively ignore them. This produces a structural rationality that actors relate to, but which may prove not to be rational after all. Actors may be victims of an unfortunate development.

Political and economic forces in society constitute structures that affect actors' everyday lives, and are centrally related to acknowledging hazard with potential risk (Beck, 1997). Hazard that is not recognized remains non-existent and can escalate. Political decisions are therefore importantly related to prioritizing, regulating and controlling potential risk and to understanding hazards' potential impact on everyday life. In the global world, national politics is important because of its

global affection. In Norway, we still do not know if our lives will be affected by the 2011 nuclear accident in Japan.

The intentional dimensions have structural elements with profound influence on the actor's life. The global world can be large, difficult to follow, and can add to uncertainty. Actors are exposed to producing modernity risks without being aware of it and the systems "take care of" their security by constructing of risk assessment and limits of acceptance. A challenge of these structural changes is lack of skills to understand, manage, and gain insight into hazard and potential risk. Actors thus lack the power necessary to manage uncertainties.

- **Intentional dimension related to the actor**

Intentional dimensions are linked to intimate relationships and institutions' inner nature. The room for action is extended in the Risk Society and actors face new and different choices. Time and space dimensions are different and institutions that were central in the maintenance of personal relationships have been organized in new ways. Everyday life is transformed and new global interconnects emerge (Giddens, 1990). This transformation takes care of private and intimate relationships on a global level by internet, mobile phones and new opportunities for global labor, travel and global knowledge. The removal of geographical borders creates close international relations. Interpersonal relationships that normally are characterized by nearness are characterized by distance.

Increased room for action presents a challenge due to unknown information. Expert knowledge is thus central for the actor to understand everyday lives (Beck, 1997). Actors are thus enforced to establish confidence to *systems* and not to individuals, to maintain ontological security. This reflects a change of quality in relations because it requires confidence with, Giddens "faceless interactions". There are thus requirements to the actor related to maintain ontological trust, which is fundamental to the Risk Society (Giddens, 1990).

Analysis of intentional dimension shows how actors are faced with new challenges when structural conditions changes. Actors are, however, not controlled by structure, but are able to take advantage of what Giddens describes as "structuration," which constitutes the relational link with a dualistic interaction between the structures and actors. This requires, however, confidence and competence to act (Giddens, 1984).

Trust is fundamental in the Risk Society because actors have to deal with "faceless interactions" and expert knowledge to maintain ontological security. Ontological securities imply actors' confidence in the connections between social and material environment (Giddens, 1990). Routines are also essential to maintaining ontological security (Giddens, 1984). However, the problem is that the routines and procedures included in the practical consciousness are based on practice by experiences. When structural conditions change, skills will not be applicable and ontological security can be difficult to maintain (Giddens, 1990). It may thus appear that actors are helpless and that resolution of routines in the Risk Society will increase ontological insecurity (Giddens, 1990). Actors' action skills will not be sufficient to maintain ontological security.

The intentional dimension of globalization shows how structural factors such as stretching of the society to include an international society where the development of new modernity risks and systems like science, economics and politics are essentially related to ontological security. The structure influences actors' lives on a deep and intimate level. Incomprehensible and unintended, actors are active in the production of modernity risk, which affect ontological security. Requirements concerning confidence and competence to act are a challenge in that the structure is constantly changing.

- **Summary of Globalization and Ontological Foundation**

Objectivistic and subjectivist ontological foundation

Dimension / Ontology	**OBJECTIVISM: Structural aspects**	**SUBJECTIVISM: Individual aspects**
EXTENSIVE STRUCTURE	Development of: - Global Society - Transnational politics, economy, expertise. - Modernity risks with unintended consequences of universal character - Abstract systems assess risk	Actors are: - Dependence on systems in order to understand risk and risk assessment
EXTENSIVE ACTOR	Globalization change in time and space; - Expand in actors scope - Relationships change in character from near to distant. - Unknown information is foundation for assessment of hazards - Risk perceptions established on ambiguous information.	Actors: - Produce and reproduce new structure - Select basis for information concerning risk, risk definition and risk assessment - Contribute to a more valid risk assessment than risk assessment produced by the abstract systems.
INTENTIONAL STRUCTURE	Structural changes as globalization, transnationality, abstract system affect the ontological security by being; - Responsibility for recognition of hazards and assess risk - Priority related risk management	Actors: - Confidence and dependence on abstract systems give the actor opportunities to act freely in society.
INTENTIONAL ACTOR	Structural changes for the actor; - Great exposing of new risks - New structure with faceless interactions - Establishing of modern institutions that contribute to new structural conditions	Actors must manage: - Establish confidence to new structures with faceless interactions - Competence to act - Manage the great exposure of risk and still be ontological secure.

Figure 5; Summarized findings related to globalization in objective and subjective ontological foundations.

Analyses in an objective ontology emphasis structural forces in the society and do not include an active social actor. The actor is totally like Durkheim's marionettes and become a victim of

structures. The actor is, however, an individual and must be included. In a subjective ontology, the emphasis is on the *actors as totally free* to construct the individual life if they manage to establish confidence to the system and thus has the opportunity to act freely. Analysis rooted in both objective and subjective ontology highlight important issues of globalization, but there is however a gap. There is a lack of a *social* actor and the interaction between the structure and actor.

Relational ontological foundation

Dimension / Ontology	**RELATIONAL ONTOLOGICAL FOUNDATION**
EXTENSIVE STRUCTURE	- Dualism between the actor and the structure contribute to structural changes; *globalization* that constitute to new societal frames; the Risk Society - Structure appear as dominated because actors not have the possibility to stop development of globalization - Actors produce and maintain this structure, while the structure constitutes the frames which the actor can maintain.
EXTENSIVE ACTOR	- Relationships dominated by distant where confidence and action competence is essential because of changes in time and space dimension. - New scope of action constitute new possibilities, but also challenges because the actor must rely on ambiguous information in their understanding of risk - The actors are not totally dominated by structures or totally free to take action. The structures constitute the opportunities room of action, and the actors' freedom to act is thus within given structures.
INTENTIONAL STRUCTURE	- Global society involves expansion of knowledge - The actor must rely in expert system regarding information needed to manage new global frames and maintain ontological security - The actor is not lost in structures or forced to rely on given information and can thus avoid events perceived as dangerous. - Challenges are production of systemic blindness where some hazards disregard and expand to potential risks. - Lack of knowledge/information by actors and experts allow for production and escalating of potential risks. - Knowledge/information in the interaction between structure and actors are essential to be capable to understand modernity risks and manage hazards.
INTENTIONAL ACTOR	- Interactions changes to faceless and distant "system relationship" - The actor must have action-competence to handle a global world - Confidence between the actor and the structure is essential because the actor must construct understanding of risk based on distant information - The actor is dependent of structuration with the structure to get information - Challenge is that the Risk Society contributes to an unstable world and the routines in practical conciseness are not corresponding on new structures. The actor than become active in production of hazards and potential risks. - The dualism between actor and structure than become even more important and are essential to understand modernity risks.

Figure 6; Summarized findings related to globalization in relational ontological foundation.

Figure 5 demonstrate how ontology on the basis of objective or subjective ontology seems reductionists when they appear separately. They do not capture the important relational dualism; the *structuration* between the structures and the actor. Globalization related to modernity risks in the Risk Society analyzed in an objective ontology can illustrate important structural factors which can appears as "objective" structures govern the actor. Actors thus become marionettes. Analysis based on subjective ontology illustrates an actor in interaction with both a structure that appears overwhelming and at the same time, if confident in the system, is free to act in the society. Both sides can appear as reductionists in relation to the construction of a comprehensive analysis because modernity risks are a social phenomenon and thus should include both the real world and the active actor and the dualism between them.

Figure 6 is based on relational ontology which illustrates the importance of dualism between the structure and the actor in assessment of modernity risk. There are mutual interactions that are essential to understand risk as social phenomenon. In the globalization thesis, the structure changes character to constitute something the actors do not understand. The actors thus produce structure on the basis of the knowledge they have and use the traditional routines. The problem is, however, lack of correspondence between the new structure and the practical consciousness that constitute actors knowledge base to regulate action. The structuration then performs on the wrong basis and contributes to production of modernity risks. As Weber said in his description of the iron cage (Ritzer, 2008), actors are the producers of structures which after can *appear* as objective structural forces. Thus the actor with or without action competence are essential to include in risk assessment because the actors action are essential in production of modernity risk.

4.5 Theory of Individualism in the Risk Society

As the Risk Society evolves, social structures and relationships between actors and structures change. The society is characterized by the conflicting demands of individualization and globalization. Because of globalization, actors must adopt an active and reflective attitude to their own lives. They must reflect and choose among different functions and different storylines, and create the content and direction (Beck, 1986, 1997).

Actors want to control their lives. A key question is whether they can. The Risk Society forces actors to use parts of themselves in different settings. Beck emphasizes that actors are not *individuals* in their conduct in it that they are indivisible, but they are *divided*: as divisible. Thus, the

actor is not integrated into a defined social system, but can be socially active in different places at different times. However, actors do not have total control. Actors socialized into a society are highly institution-dependent. Educational systems, labor or the social state, have clear guidelines in terms of opportunities and constraints for how to live. A life will not be free-floating, individualistic, and under actors fully controlled. Participation in a social community has obligations (Beck, 1997).

Actors therefore must organize their lives within the structural conditions that exist in society. Organizations that contribute to a resolution of old tradition are impossible because old structures are absent. Participation is ongoing in the society, but the collective is hard to find (Beck, 1997). Actors are thus in a personal and lonely area where individual conditions are applied (Beck, 1986). Participation in society requires individual power to act to succeed. This means that there are possibilities of failure if one does not master the requirements in relation to the organization. This is a disadvantage in situations of structural weaknesses and social crises, such as unemployment. The state can put responsibility on actors (Beck, 1997), and social risk become individualized (Beck, 1986). Risk Society thus requires actors to predict, endure, manage and live with risk and cope with a uncertainty that constitute specific action to be possible one day, and not the following day (Beck, 1997).

Globalization and individualization dissolve traditions in the Risk Society. Actors are free to choose the traditions they want to create or maintain (Beck, 1997). This is an opportunity to break from entrenched cultural course units (Beck, 1986). Globalization creates new relationships because the former local now spread globally and affect the world community, while global events affect local ones (Beck, 1986, 1997).

In actors' room and in the Risk Society, life is in a global world which constitutes a society characterized by resolution of tradition, individualization and globalization. Actors deal with these challenges by experimenting in life, create and customize the life according to desired lifestyle. Actors' own life thus constitutes a reflexive lifestyle where they constantly reflect on the requirements, desires and goals to realize themselves in relation to moral perception and social policy. The reflection also includes the social structures, negotiate them, make decisions based on them, justify them and, if necessary, create new ones. Individualization demands that actors create and organize their life. Actors' life will thus include risk that must be reflexively solved by individuals in relation to how they freely want to deal with it. There is power in being able to create their own life in a way that makes it meaningful (Beck, 1986, 1997).

Identity in reflexive modernity is not a finished project, but a way to live in which actors are continually experimenting. They limit their own separate rooms and what is alien. Nevertheless, the alien is a part of actors' life because the global society affects actors and creates their lives. There is also a politicization of actors' lives as they take a decision on *who* they want to be. Giddens describes this process "Life Politics" in which actors reflexively include themselves in selected interest groups, with certain limited framework for internal structure and meaning. Actors' life intervenes therefore both in society and in global life (Beck, 1997). Actors' life does not include a self that is totally free, because freedom can only be played out within the given structural framework that permeates the individual situations. Beck cites Luhmann when he says that man's life history is the sum of the system's rationality. Freedom therefore requires actors to be voluntarily committed to restricting their exercise of freedom for the sake of the society where they adapt to the existing structural framework. Beck calls this the *paradox of freedom* (Beck, 1986, 1997).

There is therefore huge demand on reflection and empowerment related to organizing actors own lives, identity and social affiliation in the Risk Society. This life does not ensure social equality and those who do not meet the requirements fail. New social divisions occur between those who have the cultural knowledge to master to live their own lives and those who do not. This can produce social inequality (Beck, 1997).

Distribution logic in the Risk Society is different from what it was in industrial society, where wealth was divided by class. The Risk Society is not a class society but a society with a basic democratic developmental dynamic in which everyone has the same fate and where modernity risks also affects those who produce those risks. Class is thus less important in the Risk Society, but social inequality could still be amplified. In societies in which basic needs go unmet, actors cannot buy their own safety. Still in developed societies it is possible to see that the unemployed and uneducated are less likely to find employment than the unemployed who are educated. Ability and skills to avoid, compensate for or manage risk are distributed in the community in relation to, among other things, education and income (Beck, 1997).

New modernity risks do not follow the lines of social inequality, as everyone can be affected and no one can fully protect themselves against them. Modernity risks can also have an unintended boomerang effect. Production of unforeseen consequences that constitute hazard where all actors have the same fate give no individual choices in relation to management of risk (Beck, 1997).

4.5.1 Analysis and Reflection of Ontology in Individualization concerning Risk

Individualization is a driving force in the Risk Society by the institutions and relationships that are dissolved or changed and where actors realize their own lives.

- **Extensive dimension related structure**

The extensive dimension is concentrated around the new pairings that globalization brings (Giddens, 1990) which in the Risk Society contribute to the change of social structures and relationships between actors and structures. Individualization means that actors are free to enter into the processes by which they can take advantage of new structures in an expanded scope and shape their own lives. Increased action thereby increases opportunities and action alternatives (Beck, 1986, 1997). The result is that actors have greater freedom of choice. There are also social demands because several areas require actors' presence, and therefore use only parts of themselves in different social settings, as a *divided*, which constitute new demands on how to appear as an individual.

Traditional social practices change in the Risk Society and actors can choose the traditions they want to maintain or create (Beck, 1986, 1997). Action options are influenced both locally and globally, but will still be free in that there are opportunities for "structural freedom." It may therefore seem that all doors are open for actors to freely choose action.

- **Extensive dimension related to the actor**

The extensive dimension that deals with new global interconnect related to the actor demonstrates items that are in contrast to the proposal about a *totally* free actor. Globalization has contributed to an individualized society with new and unknown structural conditions in which the actors cannot organize themselves naturally. The procedures and resources that actors use in the social system are modified and they do not make action possible because it is inconsistent with the new structure.

Unknown situations may present challenges because actors' knowledge base loses its value, while there are high demands on them in terms of understanding and ability to handle situations. In the Risk Society, new institutions are developing to take control and deprive actors of their freedom (Beck, 1997). Two examples are education and labor market institutions, where actors are socialized within structural frames that exist in institutions and the individualistic life loses its liberty.

Globalization also leads to the structural changes in which accountability becomes more diffuse. An individualistic trend opens up a possible societal waiver of liability, for example in relation to unemployment. The actor is here responsible for his own safety, related work, while it is essentially a structural problem. Risk is thus also individualized in the Risk Society (Beck, 1986, 1997).

The extensive dimension in the individualization processes shows that the actor does not have totally freedom as assumed regarded to the development of a new structural framework where individualization include selecting and designing of a free and private life. The free move includes only movements within certain limits (Beck, 1986, 1997). Structural frames will thus affect social phenomenon as risk assessment and risk management.

Ontologically, it may seem like the structure are dominated in the extensive dimension. The relational aspect is, however, important. Actors are the producers of structures and also the one that maintain them. Socialization processes is an example of such structure and constitute social positions with specific rights and obligations (Giddens, 1984), that frames our action room. Still the actors are the one that produce, reproduce and have the opportunities to change such structures. Thus there is an ongoing relational process between the structures and the actors which maintain and have the opportunities to change structures.

- **Intentional dimension related structure**

Extensive dimension concerning individualism illustrate that actors are not free from structures because their choice of action is based on the structural conditions within the social system and internalized in the practical consciousness. Social positions are, however, essential to maintain structures. Social positions refer to the codes within the scope, rights and duties, opportunities and constraints within the given position. By that actors "pull the strings" that are leaders in the society; they maintain the structures and contents of the positions (Giddens, 1990).

Codes can be related to both time and location in social interaction. Actors understand situations from time and place by recognition of common codes, rules and resources belonging to the social system. Together they form an *internal structure* within and manifest the interaction between actor and structure. The place for social interaction has changed in the Risk Society as traditions dissolve and a new affiliation can be selected. Thus there is a politicization of life, where actors choose specific interest groups in society which includes separate structural conditions leading to a free individual life. Actors choose freely to enter groups, and to relate to a given structure. This demonstrates a dualism between actor and structure in the formation of freedom in social life as actors choose free structures that constitute a free life.

Different groups develop what Luhmann terms "system rationality" (Beck, 1986, 1997): a bounded rationality within a given social system. Bounded rationality constitutes a structure that actors use for reflexive monitoring, understanding and regulation of behavior.

Intentional dimension in the individualization of society shows that structures as systemic rationality, group affiliation and politicization make free action *not* free from structures. Action capacity emanates from practical consciousness, *reflexive action regulation*. Here the structure internalized constitutes some choice of action as more relevant than others. In this way, specific analysis of risk and rationality relating management of risk follow structural lines. Actors have the freedom to choose a sense of belonging, which also sets guidelines for the use of action competence. Related to objective ontology the structures are essential and frame actors' life. The structure is, however, produced by actors. A relational ontological foundation is thus a necessity to capture the dualism between the structure and the actor which will contribute to a better risk assessment and thus better risk management.

- **Intentional dimension related to the actor**

The intentional dimension, which deals with relationships and institutions, demonstrates specific requirements for personal characteristics with implications for everyday lives. The Risk Society is characterized by differentiation. Essential features are actors subdivision of themselves from being the *individual* to be partial *divided*. This to avoid too closely socialization into one social system (Beck, 1997). Meeting such demands requires action competence. By "action capacity," Giddens refers to the use of resources within a given structure (Giddens, 1990). Beck claim that participation in the Risk Society required individual empowerment to manage uncertainty and power to solve

challenges. Actors have this power (Beck, 1986, 1997). They have a strong position with opportunity to balance structure with the conduct of action, and the ability to master dualism between themselves and structure: *structuration* (Giddens, 1984). The structure then consists of opportunities that actors can use in their free choice of action.

Challenges related to the free choice of action are that reflexive monitoring and the structure that actors use are internalized in our practical consciousness. Recursive use means that the structure reproduces by actors, and thus they maintain the terms of the practical consciousness. Freedom is not a freedom beyond the structural limits; the structures are implicit in actors choice of action (Giddens, 1984).

Empowerment and action competence can also relate to the production of social inequality in the Risk Society because the actor need to have ability and skills to form a individual life and to avoid, compensate for or manage risk (Beck, 1997). The Risk Society thus constitutes a society with structural forces that demand action competence to succeed in life. This increased hazard for those which cannot prioritize hazard before food. Thus the Risk Society contributes to hazard for increased social inequality.

- **Summary of Individualization and Ontological Foundation;**

Objectivistic and subjectivists ontological foundation

Dimension / Ontology	OBJECTIVISM	SUBJECTIVISM
EXTENSIVE STRUCTURE	Various forms of structure require different parts of the individual- the divided actor	New opportunities are open for the actor in terms of individualism which means that the actor is free to take choice of action
EXTENSIVE ACTOR	Structural changes constitute a gap between actor's skills and those needed. New institutions developed to maintain control over the actor Actor socialized into a given structural framework around risk assessment and risk management.	Actors with competence are free to choose actions, assessment of risk and are thus capable to manage risk and life in the Risk society.
INTENTIONAL STRUCTURE	Social system includes codes and social positions that refer to specific behaviors and space / time and place. Traditions are dissolved and replaced by interest groups Structure has its own system of rationality	The Actor selects its interest group belonging free Actors acting rationally in the face of challenges Actor uses its competence to act and act rationally Actor takes decisions that feel "right."
INTENTIONAL ACTOR	Structural requirement that the actor must take care of themselves and shape their lives. Procedures in society changes Social system has its own structural conditions	The actor uses its competence to act and regulate their own behavior Lack of information can contribute to production of modernity risk Actor act freely

Figure 7; Summarized findings related to individualization in objective and subjective ontology.

Ontologically, an analysis with objectivist ontology will be reductionist because the actor is an active part in creating life because of competence, selecting interest group and free action choice. Still the actor is not totally free, even if the choice taken seems to be individual assessments. A subjective ontology stresses the actors' freedom to construct the life, to belong in interest group, acts rationally and capability to manage risk. What is lacking is that the choice of action is taken within the structure that is internalized in actors by socialization processes. Structures thus interfere with actors' individual choice.

Relational ontological foundation

Dimension / Ontology	**FOUNDATION OF RELATIONAL ONTOLOGY**
EXTENSIVE STRUCTURE	- Structural changes influence the individualization process - New pairing in social structures demand divided individual - Traditional frames dissolves and expand actors possibilities for choice but also make the structure more diffuse - The structure is not dominated and nor is the actor totally free because the choice must be taken within given structural frames. - Risk assessment and risk management thus becomes a product of dualism between structure and actor.
EXTENSIVE ACTOR	- Actors competence for action become inconsistent to new structural frames - We produce institutions where actors are socialized into specific structural frames, and our freedom deprives - Accountability become more diffuse and the actor can be accountable for structural factors - Our own production of expanded globalization produces structures that further influence our lives.
INTENTIONAL STRUCTURE	- Actors understand social world related to social positions, codes, rules in specific social systems - Actors produce and maintain structure in a social system in a process characterized by dualism between structure and actor which contribute to specific risk assessment within given social system - Challenge is systemic blindness which also is produced and maintained by actors.
INTENTIONAL ACTOR	- Structures demand that the actors must use part of themselves in different social areas - Action competence is necessary to regulate action and be in balance with the structures - By reflexive monitoring we can regulate our own practice within the structure - Actor's action competence can constitutes both to manage risk and to production of modernity risks in dualism with the structure.

Figure 8; Summarized findings related to individualization in relational ontological foundation.

Figure 7 illustrates how ontology on an objective or subjective basis seems reductionist when seen separately because they do not capture the important relational dualism that appears as *structuration* between the structures and the actor in the Risk Society. Individualization analyzed on an objective ontology can illustrate the social structures that frame the scope of an actor's life. Analyses in a subjective ontology illustrate actors which freely can construct their own life and their desired lifestyle if they possess the capacity needed for the process. However, the relational dualisms are missing.

Figure 8 is based on relational ontology and illustrates the importance of dualism in form of *structuration* to understand and handle modernity risks in the Risk Society. Actors produce an understanding of risk within structural frames in an interaction between structure and actor which are mutual dependent. A risk assessment will thus be a product of relational processes.

4.6 Theory of Reflexive Modernity

The Risk Society is based on a thesis that reflexive modernity can modernize itself and transform unintended consequences in a way that we do not understand. Its challenges are consequences of previous successful social modernization. Reflexivity includes reflection related to the social structures. It is about negotiating them, making decisions based on them, and justifying them. New structures can be created if necessary. It includes a reflection on science, knowledge, consequences of modernity, risk, resolution of individualization and globalization processes, as well as the insidious unintended changes in society's foundation. This dynamic process occurs slowly, and quietly leads to structural changes (Beck, 1997) (Giddens, 1990) .

Reflexivity characterizes all actors' actions in that the justification for the choice of action is an integral part of what actors do (Giddens, 1990). According to Beck, this is not a conscious or desired action, but an *unconscious* and *unreflective* process which takes place by virtue of its hidden side effects (Beck, 1997). Giddens uses the concept of reflexive monitoring of action to describe this continuous process (Giddens, 1990).

Actors change the Risk Society with their reflection. Actions are often experienced by conventions that make up the practices and habits used in the reproduction of social practices. New information leads to reflection on actions, revisions and development of new institutions. Knowledge, therefore, governs actors' actions. For example, information about the divorce rate in Norway may affect

decisions to marry. Knowledge is therefore active in actors reflections upon or choices of action and thus change society (Giddens, 1990).

Even though actions drive the change, reflexive modernization is not rational compared to management related to desired social change (Beck, 1997). First, actors do not have the same amount of information due to differential power which brings them into positions of power most information. Information will therefore not contribute to general purposeful rational behavior. Second, actors have different values and perceptions of risks that are unstable and there will always be inadequate information and thus it is difficult to prevent unintended consequences. Third; modern reflexivity constitutes a reflection on an increasingly unstable reality and therefore does not lead to more rational behavior (Giddens, 1990). Because the unintended consequences are in control and thus contribute to a reflexive modernity that modernizes itself the production and changes in structure pose a challenge. Actors' action capacity emanates from practical consciousness. Changes in structure make the knowledge base insufficient. Unintended consequences are in control and lack of knowledge about the unintended consequences means that actors fail to see the entirety of their behavior, which can have a boomerang effect (Beck, 1997). Such a lack of information requires trust (Giddens, 1990).

4.6.1 Analysis and Reflection of Ontology in Reflexive Modernity Concerning Risk

The Risk Society is based on a thesis that reflexive modernity can modernize itself by the unintended consequences of past societal modernization successes and thus are produced by society. Reflexivity is a dynamic process that happens transparently and deals with *reflection* on society (Beck, 1997) which Giddens contends as one of the driving forces in the Risk Society (Giddens, 1990).

- **Extensive dimension related structure**

Structures in reflexive modernity are those that constitute unconscious conditions actors have to deal with. The structures impact both the social, relational and individual circumstances (Beck, 1997). Structures have unintended consequences and actors do not have the expertise to understand

or control them, which means that in the extensive dimension the external structures appear as overwhelming.

Actors' production of modernity risks is a key in this dimension. Actors generate hazards even though it is not desirable to do so. Their conscious actions are assessed and regulated on the basis of inadequate knowledge and thus have unintended consequences that entail production of modernity risk. These hazards subsequently arise as objective. Actors are not able to undo previous actions and thus cannot stop production of modernity risks.

Ontological foundation in the extensive dimension related structure appears as objective. Action occurs unconsciously, is externally controlled, and there are no opportunities to prevent the Risk Society and the production of modernity risk. Yet, this happens through actors' actions. The actor is thus essential in creating and maintaining the structure which constitute a subjective ontology. Dualism is characterized by an actor's active and unconscious production of modernity risks with potential unintended consequences, production of a structure that reproduces itself by reflexive modernity.

- **Extensive dimension related the actor**

The extensive dimension related to actors refers to dualism as underlying structures that govern the actor. Still they do not exist unless actors maintain them. This demonstrates actors' *active role* in the production of the modernity risks by reflexive modernity. By monitoring their own and others' behavior in the system, actors understand and regulate action. By recursive action, actors maintain structure and system (Giddens, 1990). The challenge is that knowledge used to assess situations is inadequate and actors actions produce *more* than what they were intended to.

Inadequate information and knowledge contribute to the creation of new structures that lead to unintended consequences and development of modernity risk. This structure appears as objective but the actor is central because it is actor's conscious actions with unintended consequences that contribute to the development of modernity risk. The relational aspects are important because this production is a result of dualism between structure and actor and must thus associate with relational ontological foundation.

- **Intentional dimension related structure**

An intentional dimension related structure may refer to traditional times when the actors oriented themselves in their daily life and acted reflexively to monitor the social system. In the Risk Society, actors are exposed to a structure which they have no basis to understand or reflect upon. Structures change and actors do not have the capacity to assess it. Therefore actors must act on the basis of inadequate information and thus without understanding all of the consequences.

Ontologically, structures we do not understand appear as objective. Nevertheless, the actor is central because of his reflection on the environment and the following regulation of behavior based on inadequate information and knowledge. Actors are therefore active both in inadequate assessment of risk, lack of understanding of risk, risk assessment constructed on wrong foundation and production of modernity risk. The relational aspects are demonstrated by the dualism between structure and actor which illustrate that actors produce modernity risk. This constitutes a structure that for actors is incomprehensive and governs them.

- **Intentional dimension related the actor**

Intentional dimension related the actor confirms that the consequences of reflexive actions are not conscious. Thus actors do not control the development of society's preferred direction and the consequences can hit themselves like a boomerang effect (Beck, 1997). The reproduction of social practices employs the knowledge base established in the practical consciousness. The reproduction is therefore partly automatic because actors use a *known* structure as a condition for actions through reflexive monitoring. These do *not* correspond with the new structural conditions and actors reflexive actions regulation may thus pose risk to them by an unintended production of modernity risk.

Ontologically, it may seem like the structure are representing power and that actor are lost in the structure. The actor has no competence to understand the structure and thus their action do not correspond or are adapted to the structure. The consequences are thus an ongoing production of modernity risk.

- **Summary of Reflexive Modernity and Ontological Foundation;**

Objectivistic and subjectivist ontological foundation

Dimension / Ontology	OBJECTIVISM/ STRUCTURE	SUBJECTIVISM/ACTOR
EXTENSIVE STRUCTURE	We are not aware of the structural conditions Modernity risks produces itself in the form of unintended consequences of our actions Structure reproduces itself by reflexive modernity	The actor takes action reflected the choices, (but lack adequate information) Actor produce "objective" modernity risks
EXTENSIVE ACTOR	Structures and routines change is not accessible. Actor's reflexive monitoring of themselves and others, and control of action are not adapted to new structure. Production of modernity risk.	Actor's rational choice is reflected irrational Production of modernity risk
INTENTIONAL STRUCTURE	Structural conditions change and we cannot orient ourselves in society on the basis of internalized practical consciousness. Information about structure is obscure and unknown, so we cannot assess the situation adequately.	Actor's reflexive action-regulation contributes to the production of modernity risk
INTENTIONAL ACTOR	A new structure requires different action competence	The actor making choices of action that has unintended consequences and contribute to unwanted development.

Figure 9; Summarized findings related to reflexive modernity in objective and subjective ontological foundations.

Analysis of the reflexive modernity in objective ontology show incomprehensive structure where the actor have problem to orientate and assess action. This clearly constitutes structural conditions that affect and govern the actor. Subjective ontology demonstrates that actors without competence produce unintended modernity risk. Structures are often perceived as objective because they often limit our scope of action or constitute frames that appear as strange and unpleasant. The structures

are, however, not a production of objective structures, but a result of an actor's action and production of modernity risks that constitute hazard with potential to development unintended consequences.

Relational ontological foundation

Dimension / Ontology	**RELATIONAL ONTOLOGY**
EXTENSIVE STRUCTURE	- There is an ongoing production of hazard which could constitute risk - Actors are the essential part in production of potential risk which takes place unconsciousness - Unintended consequences can arise as result of past societal modernization successes and thus the production of wealth in the society contributes to an ongoing production unintended consequences - Actors thus produce a structure with consequences they do not understand related to hazard and potential risks.
EXTENSIVE ACTOR	- Actors use reflexive monitoring in regulation of action - The regulation of action is based on inadequate knowledge - Inadequate knowledge contribute that the actor produce more than intended, thus there is a production of unintended consequences.
INTENTIONAL STRUCTURE	- Actors must relate to a structure they cannot monitor or understand adequate - Regulation of action taken on inadequate foundation has unintended consequences; actors unconsciousness produce modernity risks.
INTENTIONAL ACTOR	- Actors reproduction of social practice and regulating action is it based on an implicit competence established in our knowledge base in the practical consciousness - Our knowledge base is in the Risk Society, not up to date and thus there is no correspondence with valid structure - There is thus an ongoing production of hazard and modernity risks

Figure 10; Summarized findings related to reflexive modernity in relational ontological foundation.

Figure 9 demonstrates how structural forces in reflexive modernity contribute to override the actor. There is a lack of information and outdated competence which contribute to unintended consequences. In objective ontological foundation structural forces are overwhelming and reproduce its selves. Actors lack competence in this new structure. The actor is, in the subjective ontology, still free to take action and rational free choice. However, this had to be done on incomplete information and thus contributes to the unintended production of an unknown structure. This structuration is essentially related to the development of modernity risk. To capture the essential dualism one has to highlight the relational aspect (figure 10). Here the dualism between

the actor and structure and the ongoing production of modernity risks that occur in the Risk Society are illustrated. The dualism constitutes a process in reflexive modernity which contributes to enormous serious consequences. Analyses in an objective or subjective ontology would be insufficient to capture this process characterized by dualism. A relational ontological foundation is thus necessary to capture essential features related to modernity risks in the Risk Society.

4.7 Overall Ontology in the Risk Society Theory

Globalization, individualization and reflexive modernity were the driving forces I chose in order to study the significance of ontological foundation in the Risk Society. The analysis illustrates how particular ontologies are represented in different driving forces and methodological limits in use of objective or subjective ontological foundations, while the relational ontological foundation captures the structuration which is shown to be a key in societal risk governance.

Globalization is often characterized by major structural changes which affect society and appear as the external structures that govern actors. A globalized society opens for high range of action room with new opportunities, but also requirement to the actor related to manage a society without adequate insight. The actor is not lost in the system because there is possibilities to determine how to use the extended space. Thus globalizations do not contend objective structures that govern actors totally. The actor are neither free, because action have to be taken within the specific structure. To understand the production of modernity risks which appears as objective, one need to include the actor which produce and maintain the structural factors that are essential for this production. At the same time, to explain an active actor one must include the structural factors because action choice is taken within given structure. The dualism between the structure and the actor are essential to understand to get insight in the development of modernity risk. Objective and subjective ontological foundation will not be sufficient to explain this structuration, and then appear as reductionist by losing the relational dimension.

Globalization, understood in a relational ontological foundation, has important elements such as the production and maintenance of structures in society, actors' free interaction within given structures, confidence related to maintain ontological security, understanding of processes behind systemic rationality and systemic blindness and at least illustrates the need for a more visible interaction between structure and actor because of the lack of corresponds between actors' knowledge base and new growing structure.

The individualization thesis is also affected by structural changes which results in expanded action room where actors use part of themselves "divided" in interaction in society. The individual is by no means free, because the structures are internalized in the practical consciousness. This means that even when we think we take free choices these will be taken within a given structure. Yet we have the opportunity to choose parts of the structure that will "guide" us, as we choose interest groups and membership in the society which is characterized by certain limits. Our competence and rationality of action illustrate how actors in its social environments act as *social* actors. Social acts are thus a product of structures, because actors are socialized into a specific system with specific rules and codes establish in practical consciousness. This knowledge contributes to an understanding of a given system and includes socialized structures related risk. Changes in the structure, however, offer a problem and here we lose some of the control. We develop structures like institutions to maintain control. Yet we are not totally overridden by objective structures because we both produce these institutions and have thus possibilities to change them. Our freedom thus resides *within* the structure. An actor's use of action competence is an interaction with opportunities in the structure. The relational aspect is essential regarding both establishment of structure in the society, as examples, *risk assessment*, and actors' adaption of structure in their free choice of action: *risk management*. Risk assessment is a product of structuration between the structure and the actor. Actors are important in risk assessment, but their assessments are taken within a given structure and thus are establish by guiding from the practical consciousness. Their assessments are thus a product of structures produced by structuration. In risk management the actor takes free choice and establishes certain way to handle the risks. The structure is also internalized in this free choice as possibilities actors can use in their management. Actors adapt the structure and thus take their choice accordingly. The relational dimension is thus important in both the assessment and the management of risks.

Reflexive modernity complicates the dualism and interaction between the structure and the actor. Structure is changing rapidly and we are not able to understand the changes or the new structural conditions. Thus we do not know how to interact with the structure to achieve desired development. Our actions and skills become insufficient because we lose the opportunity to interact with the structure. Our conscious action thus contributes to unintended production of modernity risk. The relational dualism between the structure and the actor thus contribute to development of an unforeseen future we do not understand.

Based on these reflections, an assessment regarded by objective or subjective ontology will not capture the relational interplay between the structure and the actor which are important to understand the development of modernity risks.

Risk and risk assessment are socially constructed. If risk is to be assessed in objective ontology, the risk must have been manifested as facts; possible to measure, calculate and been explained causally. Some elements can appear as objective in the Risk Society, but is still a product of dualism between the structure and the actor. Should the concept of risk be assessed in subjective ontology it would manifest a lot of different risk assessment and there would be no consensus in risk management. This is not the case because as Beck mentions in his definition of risk, it is related to *connotations*. Connotations are not individual but social phenomena and thus the social aspect must be integrated.

I consider the theory of the Risk Society as rooted in relational ontology. The risk definition of the Risk Society has a foundation in relational ontology. This definition is consistent with the fundament in the three driving forces: globalization, individualization and reflexive modernity. There are different degrees of dominance in the balance of structure or actor. The relational ontological foundation is, however, indispensable because the interaction between structure and actor; *the structuration*, would not be possible to assess in objective or subjective ontology. Beck and Giddens therefore manage to capture the objective, the subjective and the relational aspects of risk. It takes into account a established structure with the possibility to calculate hazards and try to uncover potential risks. The actor is included as active, with capacity for action and a subjective perception of risk. The relational dimensions of risks are also included, by structuration and the relational and social production of modernity risk. Structuration is a continuous progress that can be identified in societal risk governance; risk assessment and risk management as connotations.

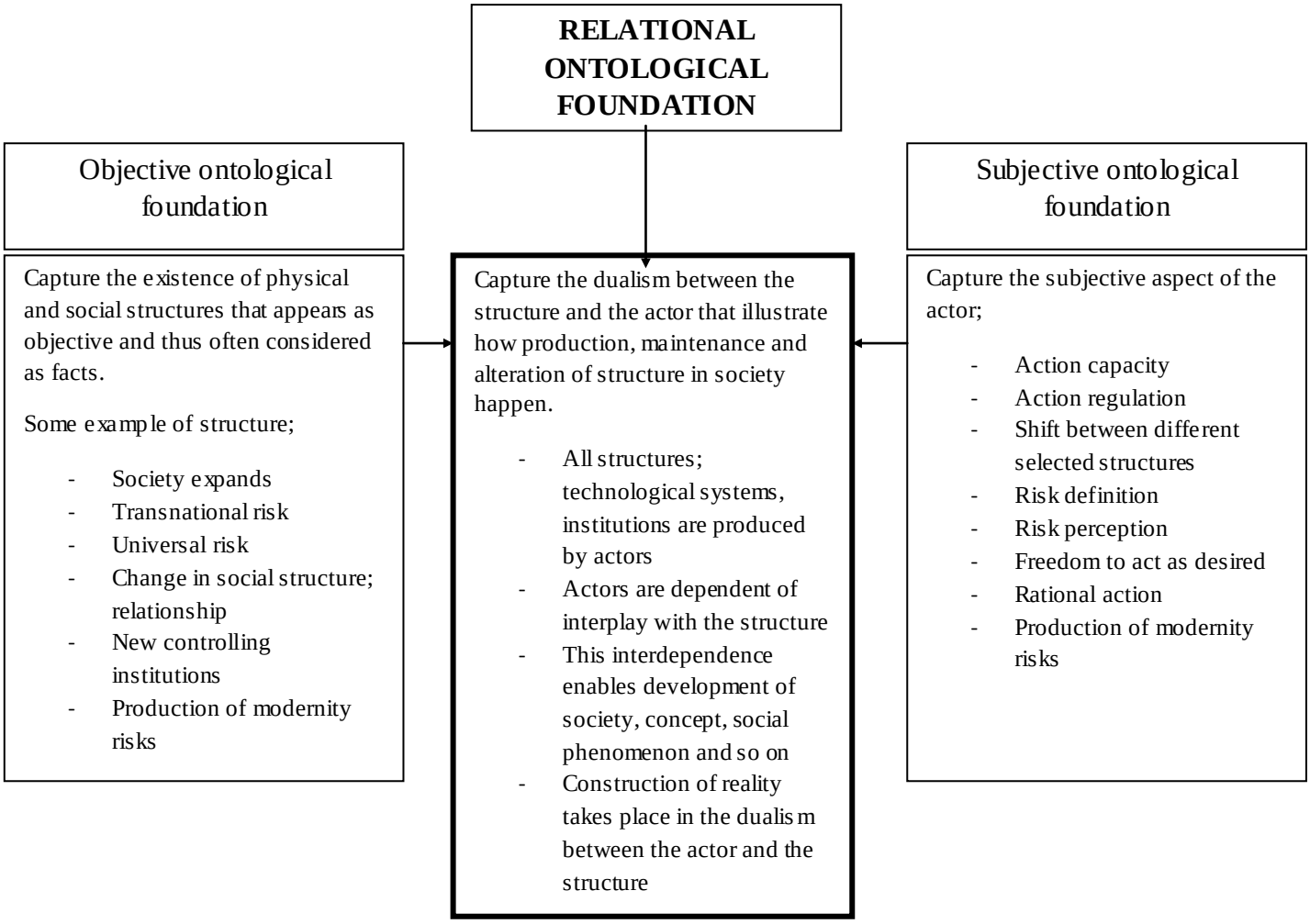

Figure 11; Illustrate the different essential element that occurs in the Risk Society which can be categorized in dissimilar ontological foundations and how relational ontology capture both objective and subjective elements.

To illustrate the significance of relational ontological foundation in the Risk Society we can take a look at development of modernity risks. An example of modernity risks can be climate change. By objective ontology one can in long-term studies observe some physical change in the weather patterns. Example can be degree of extreme weather or global warming. In the beginning this may look like an objective phenomenon that is possibility to calculate and manage. If we look at causes, it is often the actors that are to blame for this development. In subjective ontology one can claim that the actor is free to take free choice of action and if the actor is responsible for this development, it is possible to change behavior and turn the development and prevent crisis.

Unfortunately the challenge is not that simple. How do human activities contribute to this development today? How much has already been done? How is it possible to understand the development of current and potential impacts that can affect human today and the coming years? One essential element related to this challenge is uncertainty. In modernity risks, characterized by complex challenges, there is a great degree of uncertainty about the risk, but also because experts disagree about both the causes and the consequences of the risks.

This illustrates the complex situation of modernity risk. To capture this interdependence between actors' free action choice and establishment of structural forces that can affect all life on earth, objective or subjective explanations are insufficient. There is a dualism here, an interdependence interaction which contributes to this development. The actor is in interaction with the structure, which appears as diffuse and not easy to understand. The dualism between the actor and the structure are *not meant* to produce global warming, but this in an *unintended consequence* of an actor's *conscious action*, because of lack of knowledge. Thus this is neither an objective problem nor a subjective one. This problem arises from *structuration*. Modernity risks are thus a relational phenomenon that must be assessed in relational ontology.

Beck and Giddens capture the *structuration* in their theory of the Risk Society. A related question is what implications this claim will have for the assessment and management of modernity risks.

5. IMPLICATION FOR RISK GOVERNANCE IN SOCIETY

What emerges from the ontological analysis of the theory of the Risk Society is that a relational ontological foundation best can capture essential elements needed to understand the development of modernity risk. Relational foundation captures elements that appear as objective real, the subjective experiences and perception, and the essential dualism between the structure and the actor; the *structuration* that is important for understanding of such risks. Thus governance rooted in relational ontology provide a more comprehensive understanding of modernity risks based on the future threats and dangers we may be caught off.

My reason for such a claim is that the analysis of the Risk Society reveals that modernity risks are social phenomena that cannot be assessed without such a foundation. This will necessarily have consequences for societal risk governance and assessments both on an individual and social level and thereby affect risk management efforts.

5.1 Risk

Modernity risks are embedded in connotations and constitute a *social phenomenon*. If risk were objective, they would constitute objective facts and thus necessarily be able to be handled in such a way. Some of the *uncertainty* that is related to risk is absence in objective ontology and thus one loses an important element. Connotations to risk are not facts but patterns of thoughts about what a hazard can constitute. Actors' thoughts are thus important. A subjective ontology will not relate to facts but to an actor's mind. The problem with such ontology is that risk thus must be understood as only subjective experiences, something that is not consistent either with the social aspect of risk or the connotations as socially constructed and thus shared by several social actors. Connotations to risk are a *relational phenomenon* established though socialization, where the actors internalize structures in their practical consciousness. The connotations constitute specific beliefs and thoughts about hazard, which impact and form risk assessment and risk management in a given social system. A relational ontology may capture the dynamic interaction that interplays between the structure and the social actor. An understanding of the structuration process and construction and maintaining of specific risk assessments is important to gain more insight in constructions of societal regulation and control, as well as insight in why some risk are recognized while others are not. This can contribute to a more deeply understanding of the development of modernity risks as a social phenomenon.

5.2 Risk Assessment

Ontology laid the foundations for our relationship to our reality. It constitutes a conviction that affects societal behavior which guidelines our understanding of risk and how to assess and handle risk. A relational ontological foundation is needed because risk is a social phenomenon and can thus not be fully understood in an objective or subjective ontology.

Several examples follow.

Risk assessment rooted in *objective ontology* demand that risk in a nuclear power plant can be assessed objectively and appear as neutral and value free. Assessments are based on past events to calculate the risk by technical procedures and predict the future;

This is not possible because modernity risks may be characterized by being unknown, invisible, unthinkable and unforeseen. Calculation on past event is thus insufficient regarding prediction of the future. In addition, a nuclear power plant includes actors, because actors control the system. Assessments with objective ontology will thus be reductionist because lack of the social dimension. Finally, an objective assessment oversees the ongoing relational process between a nuclear power plant and the actors. A repairing or previous procedures change contributes to a "new" system. Calculations can thus appear as failure.

Risk assessments rooted in *subjective ontology* focusing the actors' perception of risk and can produce representations of cognitive maps which identify patterns of how actors assess the risk.

This is, however, not sufficient because these maps can highlight *what* one sees as a risk, but not *why*. In nuclear power, assessments of elements as one assumes to control, thereby can contribute to underestimation of the risk. If the cooling system would be defective, this will pose a risk despite the actors risk perception. Structures that appear as "real" risk are missing.

Assessments rooted in a *relational ontology* can include both calculations and predictions where there is adequate information, actors' perception and attitude to risk and also capture the essence to understand why something appear as risk while something are ignored. The latter is about the social, cultural, relational aspect which further is about values, knowledge, rationality, power and emotions which construct connotations to risk.

To understand risk in society, one needs to understand the content in connotations by gaining insight into the processes that lie *behind* the establishment of the concept. There is a need to

uncover the production of the connotations to specific risks and try to see how these are constructed. Since risk is a constructed concept with constructed content it is important to uncover the *various building blocks* that make up the construction. Connotations to risks are built on experience of a "objective" reality that appears as real, subjective perception and preferences, direct or indirect experiences related to different hazards or events in a social world. Social conventions and construction both implicit established in practical consciousness and explicit discussed socially, are included. Hence, connotations to risk are the building blocks needed to uncover the construction of risk and thus assess risk.

5.3 Risk Management

Connotations to risk proceed as risk assessments which affect actors' behavior. Risk assessments are therefore essentially related to risk management. The reduction by use of objective or subjective ontology is also evident in relation to management. We can go back to the nuclear power situation where a new nuclear power plant is going to be built on the neighbor land. Experts have assessed the hazard and explained the potential risk that may arise. They are seen as insignificant and thus the conclusion is that living next door will not pose a danger. This appears as an objective risk assessment which can be calculated.

It is easy to see that this would not be a sufficient risk assessment because it is built only on what appears objective. If we imagine that one of us was in Chernobyl in 1986, we would have our own experience of this crisis and our cognitive understanding and perception would be grounded in that experience. We would never live next door to a nuclear power plant, even though we told it is one hundred percent safe. It would not be possible for anyone to persuade us, because this is our fundamental understanding.

This appears as a subjective risk assessment which emphasizes self-perception. Again only one part of risk is assessed: the one that appears as subjective. The essential part of risk is missing: the connotations to risk which constitute the relational aspect of risk. Imagine a technological breakthrough mastering to construct totally secure nuclear power plants. This security could be proven and there was nothing risky about living next door. It is similar to standing alone on a big field in good weather. Little risk is associated with such an event. Here the essential connotation is crucial.

Risk assessment that appears as objective are diffuse for us because there is nothing "of us" in the establishment. We can rely on expertise or not and handle the risk in different ways. Still it is not the objective element that is guiding our behavior. The subjective risk assessments are very much "us" and we relate to this often unconsciously, because risk often appears as subjective. This is because connotation is established in our practical consciousness which constitute implicit knowledge.

Connotations can be exemplified by going back to the technological breakthrough. Here is no real risk, only subjective risk perceptions that do not correspond with the new reality. Socialization processes contribute to internalization of certain connotations. Our experiences influence these connotations. These are, however, not coherent with this new reality where nuclear power plants do not constitute a risk. Thus there is no coherence between our connotations to risk and the ongoing situation. Risk management thus becomes a challenge.

Connotations to risk, as mentioned above, are constructed by specified building blocks that are essential to include in a risk assessment because they affect risk management and thus societal risk governance. Connotations are guidelines for risk behavior, and thus essential to capture and understand. As Giddens demonstrates in his structuration theory, the knowledge in practical consciousness is implicit until it is explicitly expressed. Connotations are not explicit and thus it is hard to understand the construction of risk assessments that guide risk management. Implementations of risk governance by risk assessment and risk management thus require explicit assumptions around hazard and risks to obtain insight into the building blocks which lay as fundament for connotations to risk, risk assessment and thus will influence risk management.

To assess risk and establish frames around risk management, it is necessary to use a relational ontology by including connotations to risk. It is essential to analyze the different building blocks that constitute the connotations and translate them to explicit knowledge. When the foundation of connotation to risk is uncovered it will simplify the discussions about risk assessments and the establishment of a common risk management strategy which will improve security in technological or social systems and thus improve risk governance.

Risk governance; risk assessments and risk management, should therefore be understood and assessed in a relational ontology by involving building blocks that constitute connotations. This can be illustrated as follows:

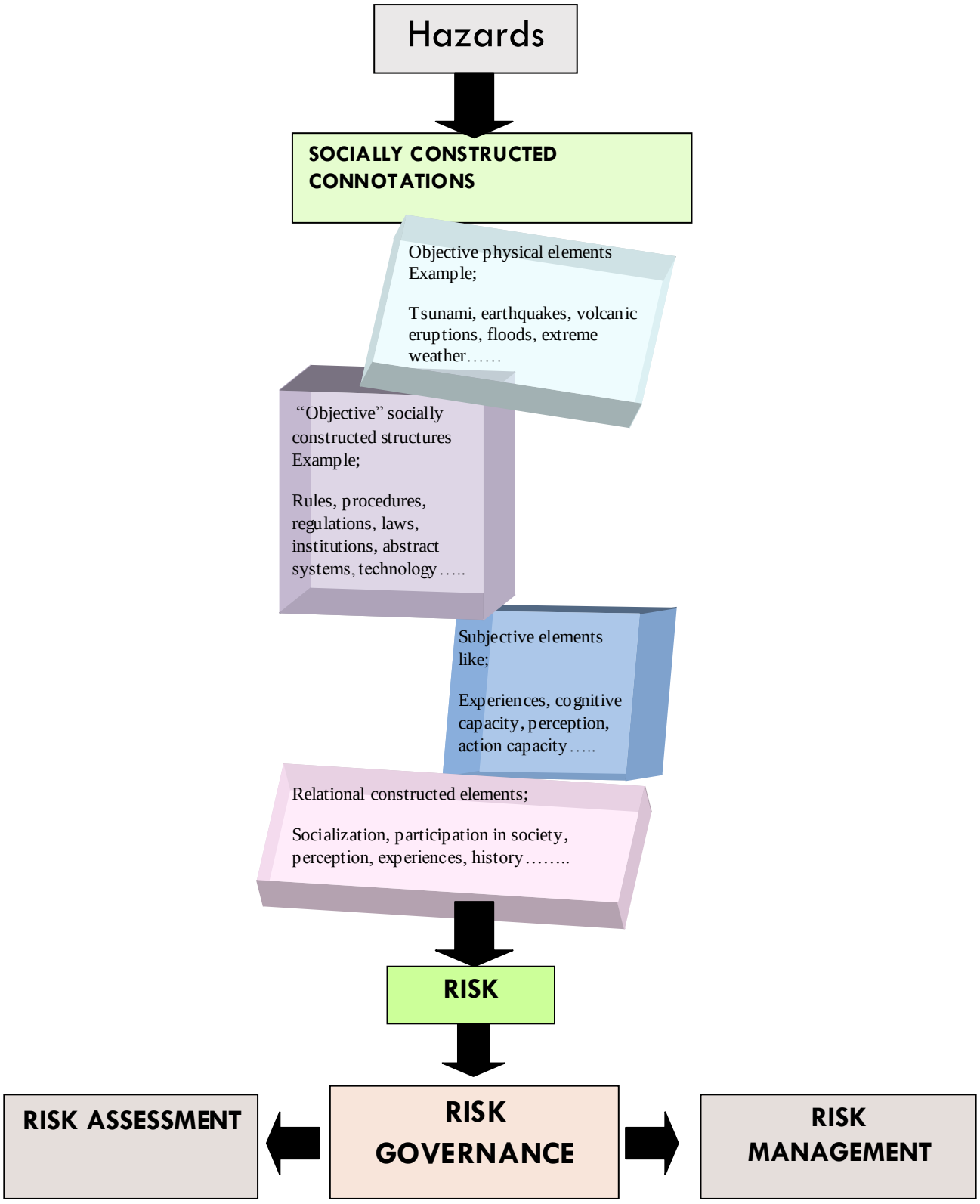

Figure 12; Illustrates how risk is a product of socially constructed connotations grounded in dissimilar building blocks consisting of objective physical and social structures, subjective perceptions and relational processes which further affect societal risk governance.

The illustration of modernity risks as a socially constructed phenomenon is essential in a relational ontological foundation. To uncover the building blocks, societal risk governance is constructed on it is important to look at the dualism: the structuration between structure and actor. Many elements can be presented in these building blocks and these will depend on different systems, situations and events. The balance of which blocks have the greatest influence will thus fluctuate. The importance of this illustration is to show that several elements are included in construction of societal risk governance and that it is important to include all of them.

Risk assessments used in the politics are of great significance. They are often produced by abstract system; specified as expert systems. Unfortunately such an assessment of risk depends more on the experts who have constructed the assessment and frame more than on the items taken into account. This is a problem because politicians will have trouble seeing what really poses challenges and hazards. Thus potential risk can escalate. Such processes can contribute to systemic blindness which allows some risk to be overlooked while others are handled, independent of whether they are more or less dangerous. Another problem is that lack of common risk assessments from expert systems can weaken confidence in the system and thus create ontological uncertainty. Common risk management will then be even more difficult.

It is challenging to facilitate risk management if there is no compliance in risk assessments. To improve societal risk governance, it is important to understand and assess risk as a socially constructed phenomenon in a relational ontological foundation.

5.4 The way ahead

This thesis has elaborated upon the relational ontological foundation of risk. This is not a new case, because several researchers have commented on the importance of a relational dimension of risks. However, one can see a lack especially in how socio-technical systems are managed in society, where the social aspect often is absent. Hence, there is a need for increased consciousness about the significance of a relational ontology. Increased consciousness is important for several reasons. First, awareness of the relational aspect of risk generates new and different kind of reflections about risk. Second, consciousness about risk as a social phenomenon which is socially constructed by structuration will influence risk assessments and thus risks management. Third, when relational ontology is in focus, development of new connections related a specific risk can appear. Fourth, consciousness will by reflection change risk management.

This thesis increases the consciousness of the significance on a relational ontological foundation in risk science and illustrates how relational ontology can capture essential element in risk that should be incorporated in risk governance to improve the societal capabilities and further to improve risk management.

Ortwin Renn's *Risk Governance* (2008) is based on a relational ontology. It is an integrative and relational framework for risk assessment and risk management. The framework includes both civilian populations and expert systems in the decision-making process. It also elaborates actors associations' to risk assessments and risk management. The main challenges; knowledge and decisions, and the four phases elaborated to capture the relational aspect, are essential. Renn explains both detailed relational processes and their meaning for risk governance. Interest, societal values, social context, decisions, expectations are some of the elements that appear as facts about hazards which constitute different *associations* regarding hazards. This is where Renn talks about connotations: associations or expectations grounded in different building blocks which constitute how to assess and manage risks, and thus form the societal risk governance. Renn emphasizes involvement, participation and communication as crucial elements to capture interest, values and preferences. I will clarify by claiming that Renn's key elements are of great significance, but that we need a fuller understanding of *why* particular values, interests and preferences determine societal risk governance.

One assumption is that risk governance is constructed on the basis of certain objective, subjective and relational connotations, that would be specific within given greater or lesser social system. Connotations are thus of special significance because they influence the risk assessments, impact risk management and thus the regulation and control of risks in society. A challenge with connotations is, however, that they are implicit. The foundation for specific understanding of risk may thus be uncertain. It is therefore important to try to uncover the underlying connotations that important decision-makers use to establish an understanding of the nature of risks and transfer the connotations to explicit knowledge. Thus one will achieve expanded understanding in how societal risk governance is constructed. As risk governance constitutes the basis for legislation, control and regulation in society, they are of great importance.

I will conclude this discussion by pointing out the need for further research in terms of developing methods to map the connotations to modernity risks in societal risk governance, analyze risk assessments and risk management of modernity risks in a relational ontological foundation, and

conduct empirical analyses of dissimilar risk assessments and risk management of modernity risks in different sectors and on different levels.

5.5 Critical reflections

By looking at the ontology in risk science and especially relational ontology in societal risk governance, I claim that risk science which are purported to assess modernity risks must rely on relational ontology. Without the relational aspect these assessments will be reductionist. Modernity risks are complex phenomena. One must therefore try to obtain insight into all elements that affect this phenomenon.

My attempt to elaborate the need for a relational dimension may have put too little emphasis on what the assessments of objective or subjective character could have contributed. This is not to say that some ontological anchors are worthless; rather we need objective, subjective and relational ontology in risk science.

I have concentrated much of my reflections on the concept of connotations. This concept may seem strange at the outset. Giddens' ideas on practical consciousness constitute one explanation of the connotations. I believe that the structuration theory can improve risk science because it can refer to the unconscious and implicit processes within us that govern our actions. It is thus important to make these explicit and conscious in order to gain fuller insight into the connotations to important decision-makers and further improve societal risk governance. It is in relation to Giddens structuration theory the connotations get the great importance in my reflections. This because I have concentrated on the underlying processes that forms action and insert this in the context of societal risk governance; risk assessments and risk management.

As I have highlight connotations to modernity risks in my reflections. I am also aware that there are several important issues around modernity risk: uncertainty, complex, ambiguous that can make risk assessments and risk management challenge. Still I consider the connotations and the relational dimension of modernity risks as indispensable.

I have set forth on Renn's framework of Risk Governance to capture the relational ontology and therefore consider it satisfactory in terms of identifying the relational aspect in risk science. This framework includes several essential elements that are significant in relation to understanding the dimensions of modernity risk. However, still within risk science there is a lack of legal framework

which includes underlying structures that govern *why* one has specific interests, values and preferences; why specific connotations to risk are materialized. This is essential because risk governance, risk assessment and risk management, can be founded in connotations that are no longer applicable to the today's world. By having explicit connotations, it is possible to engage in good discussions on the connotations that reflect today's reality and the basis of certain values and interests. Discussion of the underlying causes this will simplify the use of Renn's framework in processes of constructions of societal risk governance.

My conclusions are taken on theoretical foundation. There are thus needs for empirical research to develop methods. It is challenging to gain insight in underlying processes. There is thus a need for analyses of risk assessments and risk management regarding modernity risks to reveal the foundation for specific risk governance. This is not an uncomplicated project. It is, however, very important because it will allow access to important knowledge needed to develop models for how to uncover connotations. It will also raise awareness that connotations are of importance regarding modernity risks because they are developing rapidly and thus connotations can be inadequate. Societal risk governance can thus have an inadequate foundation. I am therefore interested in further research within this thematic which can contribute to improve societal risk governance.

6. CONCLUSION

The main objective of this thesis is answer two questions: *What is the significance by ontology in risk science? How does relational ontology impact risk assessments and risk management?*

The ontological anchors used in the risk science have been illustrated to show that ontology is essential in risk science; Firstly, ontology is a worldview that constrains how one experiences and interprets the world and therefore how one interprets and understands its risks. Risk assessment with foundation in different ontologies will thus appear differently. Secondly, different ontologies capture different parts of a phenomenon, thus there is a risk that risk assessment can appear as reductionist. Thirdly, ontology sets guidelines for societal risk governance, risk assessments, and risk management. If the bases for societal risk governance are reductionist, all of the assessments that follow are taken on a limited basis. Important decisions can thus be taken on the wrong basis and may have unintended consequences.

In relation to the above, a consciousness of ontological foundations will be of great significance in risk science. It will constitute the foundation for both risk assessment and risk management and thus constitute societal risk governance.

Relational ontology in risk science is of great importance, because modernity risks are relational phenomenon, and thus a product of structuration. Risk assessment in relational ontology takes into account the relational aspect which is essential to understand modernity risks. Relational ontology makes it possible to uncover the bearing building block in connotations arising as a result of structurations. Insight into these connotations will increase the awareness of the foundation of different risk assessments, risk management and thus improve societal risk governance.

This is important because modernity risks can be unintended consequences of inadequate risk assessment, which can appear as a result of inadequate connotations. Deeper attention and understanding of why certain risk assessments appear as they are can yield a better understanding of the relational aspect in risks. Increased awareness of the structurations processes, and how connotations are essential to capture to understand *why* certain interest or values are guidelines for risk assessment, is essential. Modern society developed rapidly thus rational justification for specific risk assessment can be inadequate. There is therefore a need for greater awareness of the connotations to risks as well as of the structuration processes where the construction of connotations takes place. Relational ontology in risk science can offer insight into such phenomenon. This may

uncover and prevent potential modernity risks and by more accurate risk assessment and risk management.

Greater awareness of relational ontology in risk science will thus improve risk assessment and risk management. This is important because risk assessments are guidelines for societal risk governance, and used in the economy and in politics, as well as in regulations and control. Comprehensive risk assessments which include awareness of the relational aspect of risks will thus improved societal decisions for how to manage risks. Relational ontology is therefore a necessity in risk science to improve societal risk governance.

7. REFERENCES

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