Unanticipated and Undesirable Consequences of Innovation

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Abstract:
After having been regarded as inherently negative for millennia (Godin 2012, p.37), innovations are now seen as good, a view called the pro-innovation bias (Rogers, 1976). Additionally, the consequences of innovations are only rarely studied (Rogers 1983, p. 377; Sveiby et al. 2012, 61).

This thesis studies the unanticipated and undesirable consequences of innovation that have been studied in academic literature. It is a part of a research project at Hanken School of Economics named “The Future of Innovation” and led by professor emeritus Karl-Erik Sveiby. The study is done as a meta-analysis by conducting a literature search for peer-reviewed articles that have analysed innovation and the consequences of innovation.

The literature search was done on the database Web of Science using two search words: “innovat*” and “technolog*”. Fifteen articles were deemed to be relevant and they make up the data of this thesis. The relevant articles were read and analysed using two meta-matrices.

Based on the analysis, a descriptive model was created. The model categorises the undesirable consequences that innovation was found to lead to, as well as the affected stakeholders. The results indicate that a majority of the negative consequences happen in a work setting and affect employees. In some cases, they indirectly affect also employees’ social circles. Other consequences are health-related problems, most often to the adopters of the innovations, and different consequences to the environment.

Keywords: Innovation, externality, unanticipated, undesirable, consequence, technology
“People know what they do; frequently they know why they do what they do; but what they don’t know is what what they do does”
- Michel Foucault (Dreyfus & Rabinow 1982, p.187)
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INTRODUCTION

The word “innovation” is more popular than ever. Described in newspapers as a buzzword (Green, 2013) that has “begun to lose meaning” (Kwoh, 2012), it is still often seen as highly important for both countries and companies, even as a “determining factor in achieving greater progress” (Ezell, Nager & Atkinson 2016, p. 4). After thousands of years of being seen as negative, innovation is now “a term of honor” (Godin 2012, p. 37).

There can be different kinds of innovations, and even if the word innovation may bring to mind new technological inventions, innovations do in fact come in all shapes and forms. Innovations can be administrative as well as processual, rhetorical as well as technological, and radical as well as incremental.

There are, however, potential negative effects of innovations aside from the positive ones. Popular culture has been instrumental in highlighting these problems, from Aldous Huxley’s *Brave New World* to *The Terminator*, and while not usually as dramatic, I believe it is important to also consider them in real life. As Aggeri & Segrestin (2007) note, “the introduction of innovations produces unexpected effects and destabilizes existing practices”. While that is to a large degree precisely what they are meant to do, the unexpected effects can be negative as well as positive.

In times when both companies and countries are in the midst of changes, it may seem that innovation offers a solution to difficult problems. It is then important to take into account the undesirable consequences that innovations may lead to, consequences that oftentimes are completely unanticipated. A deeper understanding of these consequences for example in
terms of how they arise, whom they affect and what they are, may help in lessening and counteracting them.

1.1 Research problem
In research about innovation, the focus tends to be on how innovation influences economic growth, the different contexts in which innovation happens and on national systems of innovation (Fagerberg & Verspagen 2009; Sveiby, Gripenberg & Segercranz 2012, p. 1). On top of the fact that there is a tendency in innovation research to mainly consider other things than the consequences of innovation, there is also a pro-innovation bias, an assumption that “the innovations studied are ‘good’ and should be adopted by everyone” (Rogers, 1976). There is thus a research gap in regards to the unanticipated and undesirable consequences of innovation. While Sveiby et al. (2012) have undertaken research on the undesirable consequences of innovation, their literature search was done in 2009, and so it becomes important to study the issue again to see whether or not a larger amount of research now considers undesirable consequences of innovation. Furthermore, there is no study done on what the undesirable consequences that innovation leads to are. This thesis aims to change that and to create a descriptive model to show these consequences.

As is clear from above, this thesis will study innovation in a different light, concentrating on unanticipated and undesirable consequences of innovation. It is a part of a larger research project at Hanken School of Economics named “The Future of Innovation” and led by professor emeritus Karl-Erik Sveiby. The research project, and this thesis as a part of it, tries to gain a deeper understanding of what kind of undesired consequences innovations lead to. In this thesis, the research questions are as follows:

1. What unanticipated and undesirable consequences does innovation lead to?
2. Who is affected by the consequences?

1.2 Purpose of the thesis
The purpose of the thesis is to do a literature search on the unanticipated and undesirable consequences of innovation, and based on the findings, to develop a descriptive model for categorizing the identified effects and consequences.

1.3 Definitions
In this part, I will introduce the most central concepts that are relevant for my thesis.
1.3.1 Innovation

Innovation is commonly defined as a new idea, for example “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers 2003, p. 12) or as a commercialized invention (U.S. Department of Commerce 1967, p. 2; MacLaurin 1953). The implications of different definitions will be discussed below in chapter 2.4. In my thesis I will search for articles containing the word innovation. Thus, it is in effect the authors of the studied articles that influence what innovation means in this thesis. I will use the articles that the authors themselves have decided to be about innovation, and this thesis will for that reason not define innovation.

1.3.2 Consequence

Merton (1936) defines consequences as “those elements in the resulting situation which are exclusively the outcome of the action”. In this thesis elements that are outcomes of the interplay between the action and other actions are also studied as deciding whether or not some elements are exclusively the outcome of one action is in practice difficult.

1.3.2.1 Unanticipated consequences

In this thesis unanticipated consequences will be defined as changes due to an innovation that are unanticipated by the innovator(s) and the agents(s) working toward the diffusion of the innovation. Whilst other stakeholders may have anticipated the consequences, the key question is whether or not those who are responsible for the diffusion of the innovation have anticipated them.

1.3.2.2 Undesirable consequences

The definition of undesirable consequences that will be used is “the effects of an innovation on an adopter, rejecter, third party, social system or the environment that can reasonably be regarded as negative to the affected entity”. Thus, adverse effects that affect the adopters negatively are naturally included, as well as the negative effects that affect the rejecters. Likewise, not only individual people but also larger social systems may be studied, as well as the negative effects on individual people in social systems that enjoy overall positive consequences. Negative environmental effects are also studied. Naturally, undesirable consequences can also befall the innovator or innovating company, but in this thesis only consequences on stakeholders and the environment are studied.
What is regarded as negative or undesirable is inevitably subjective to some degree. Merton (1968, p. 105) notes that consequences can be functional or dysfunctional for a system (or nonfunctional, essentially irrelevant for what is studied), in other words increasing or decreasing “the adaptation or adjustment of a given system”. Giddens, who in general rejects the functionalist view, also sees that latent functional social needs may motivate actions with functional consequences for groups when actors act with the purpose of fulfilling social needs (Giddens 1984, p. 12-13). What in my definition is labelled as negative can therefore also be understood as dysfunctional, since it is through their consequences that innovations influence systems, i.e. reproduced relations between actors or collectivities (Giddens 1984, p. 25).

1.4 Structure of the thesis

The next chapter presents the theoretical framework of the thesis. Three concepts will be discussed in the chapter. The first of these concepts is that of externalities, after that the structuration theory will be presented. Lastly, I write about the unanticipated consequences and the difficulties in anticipating consequences. The theoretical chapter is concluded with a discussion between the difference between unanticipated and unintended consequences, and finally a summary of the chapter and the research question. The third chapter is about the methods that are used in this work, from the research approach and design to different ways of assessing this research and qualitative research in general. The fourth chapter presents the results of the literature search that was conducted. The results of the literature search will then be analysed in terms of the consequences that are found and the stakeholders that are affected by the undesirable consequences, as well as in terms of different variables that are relevant in the articles. The descriptive model is also created and presented in the end of the fourth chapter. The fifth chapter discusses the results of the thesis vis-à-vis the research questions and past research and theory. The sixth and last chapter is the summary of the thesis in Swedish.

1.5 Limitations

This thesis was originally supposed to study articles published before the year 2016 and after the year 2008 available on the database Web of Science. In order to increase the number of articles, the search later broadened to the earliest year available on the database Web of Science, 1986. For the years 1986 to 2015, academic articles that mentioned the word “innovat” or a derivative of it were considered. To further increase the number of relevant
articles, articles including the derivatives of the word “technolog” from the years 2002 to 2008 were also studied. In the end, 10 articles were found with the search word “innovat*” and 8 with the search word “technolog*”.

In line with the research questions defined above, this thesis will study articles that have found unanticipated and undesirable consequences of innovation that have affected internal and external stakeholders. In this way, only empirical studies will be considered, and consequences on change agents or innovating companies are not considered in this thesis. For a closer description of which articles are included, please see chapter 3.
2 THEORETICAL FRAMEWORK

The theoretical framework that is used in this thesis is presented in this chapter. The framework will be used for analysing unanticipated and undesirable consequences in the studied journal articles. I will first present the concept of externalities, then move on to Giddens’ (1984) structuration theory and Merton’s (1936) treatment on the unanticipated consequences of purposive action. The reason for choosing these theoretical concepts or theories is that they give a broad view of the issue at hand. The concept of externalities is vital to understanding how the undesirable consequences to stakeholders are treated in economics. Structuration theory is important when considering actions of individuals especially under the influence of social structures. It is included in the theoretical chapter to give a broader view of the issue even though it will not be used in the analysis. Merton’s (1936) article on the factors that limit the ability to anticipate consequences is included because it gives a deeper understanding on how unanticipated consequences happen, and it is used in the analysis.

2.1 Externalities

In a landmark article on negative externalities, Ronald Coase (1960) defines the problem as “those actions of business firms which have harmful effects on others”. These harmful effects are what Pigou (1952) calls social costs, i.e. costs that “are thrown upon people not directly concerned” (Pigou 1952, p. 134). Dahlman explains the situation in the following way: “when all voluntary contractual arrangements have been entered into by market transactors, there still remain some interactions that ought to be internalized but which the market forces left to themselves cannot cope with” (Dahlman, 1979). In other words, externalities are effects, which may in themselves be either positive or negative, that are imposed on third parties by the actions of an actor. A classic example is that of “uncompensated damage done to surrounding woods by sparks from railway engines” (Pigou 1952, p.134), another negative example could be pollution from factories. An example of a positive externality is schooling (Weir & Knight, 2004). Externalities can also be classified according to how they are created, into consumption and production externalities (Liu & Turnovsky, 2005). Furthermore, there are so-called network externalities, meaning externalities where the participation of some actors affects others (Liebowitz & Margolis, 1994). An example where there are positive network externalities noted by Liebowitz & Margolis (1994) are video games, whereas highways that can get crowded are affected by negative network externalities.
Externalities have been written about to a great extent in economic literature due to the inefficiency and problems relating to optimization of resource allocation that they generate (Callon, 1998). As Callon (1998) notes, it is then not on moral grounds that economists try to eliminate externalities. Both Pigou and Coase concentrate on effects that are priced, Pigou (1952, p. 134) writing that while indirect effects may exist, they are excluded from the analysis, and “the marginal social net product (...) is taken (...) to consist of physical elements and objective services only”. Coase (1960) likewise only treats monetized costs and benefits. What this means for the analysis of externalities then, is that effects that are difficult or impossible to monetize run a risk of not being included in the analysis. Unanticipated and undesirable consequences on stakeholders are oftentimes difficult to measure in monetary terms, but will be considered as externalities in this thesis, as they are harmful effects brought on by the actions of others. The definition of externalities used here does therefore not differ in meaning from those used by others (e.g. Pigou, 1952, p. 134; Coase, 1960 & Callon, 1998), but is nevertheless used in a wider sense as effects are considered without regard to the possibility of monetizing them. In the next section, I will present how externalities lead to inefficiency from the perspective of society.

2.1.1 Inefficiency caused by externalities
I will begin by showing how a negative externality leads to an inefficient solution from the perspective of the society, followed by the way in which a positive one also leads to a solution that is not optimal.
Where there is a negative externality, the marginal social cost is larger than the marginal private cost by the amount of the externality (the marginal external cost). Thus, without a solution to the inefficiency, such as a government intervention or negotiation between the parties, the market solution will be production of the quantity $Q_1$ for the price of $p_1$. This is the intersection between demand and the marginal private cost. This however leads to a negative externality the size of the area $M$. If the producing firm internalizes the externality, i.e., is forced to consider the negative effects, the new equilibrium will be at $Q^*$ with the price $p^*$. This is where the marginal social cost, which is the sum of the private and external marginal costs, meets demand. The new equilibrium thus leads to a smaller amount of production, the difference being $Q_1 - Q^*$. (Besanko & Braeutigam 2010, p. 703)

In the case of a positive externality, the problem is not overproduction from the society’s perspective as is the case with a negative externality, rather it is a problem of underproduction.
Without intervention and negotiation, the market equilibrium will again be at \( Q_1 \) and \( p_1 \), that is, where supply meets the marginal private benefit. However, as the marginal social benefit is the sum of the marginal private benefit and the marginal external benefit (the externality), this equilibrium is not optimal from a societal perspective. The optimal solution from the society’s perspective is the intersection between supply and the marginal social benefit. This happens at \( Q^* \) and \( p^* \). At this point however, the marginal private benefit is lower, at \( p^* \). In order to make the supply meet the demand, society can subsidise the good or service being produced, which will lower its price. The optimal amount is equal to the difference between the marginal social benefit and the marginal private benefit at \( Q^* \), as shown in the graph. With this subsidy, the equilibrium is at \( Q^* \) and \( p^* \). (Besanko & Braeutigam 2010, p. 714)

### 2.1.2 Pigouvian & Coasean traditions

From the central texts on externalities of Pigou (1952) and Coase (1960), two main traditions have emerged, the Pigouvian and the Coasean (Aslanbeigui & Medema, 1998; Vatn & Bromley, 1996). I will concentrate on the original texts in my presentation of the theoretical framework on externalities, as it has been noted that the original articles are different from...
the traditions that they inspired while at the same time not being as far from each other as one might think (Aslanbeigui & Medema, 1998).

Pigou discusses externalities in his work The Economics of Welfare (Pigou, 1952). He sees the goal of his treatment on externalities as improving welfare, mainly through increasing the national dividend, the “part of the objective income of the community [...] which can be measured in money” (Pigou 1952, p. 31), though not improving the national dividend at the expense of human welfare in a larger context. On the externalities where the number of actors is large, and the probability of high transaction costs is high, Pigou sees that the state may have an important part to play, for example in introducing taxes or subsidies. These taxes or subsidies are meant to correct the externalities and are called Pigouvian taxes and subsidies (Sandmo, 2008). Though the Pigouvian tradition is better known for advocating government intervention in the form of taxes, subsidies or regulation, Pigou acknowledges its potential problems, such as the solution being in fact worse than the original problem, and the fact that the intervention will lead to reallocation of different resources, which can lead to other problems. (Aslanbeigui & Medema, 1998)

Coase’s article aims to show that the proposed solutions to externality problems, put forward by Pigou among others, were “inappropriate, in that they lead to results which are not necessarily, or even usually, desirable” (Coase, 1960). Instead of seeing the problem of externalities as one where one actor (A), who’s activities lead to negative externalities on other actors (B), should necessarily be liable for those effects, Coase sees the problem as one in which it is to be decided how to minimize the harm. This is not necessarily done by restraining the actor producing the externalities, as it would be harmful to them. It is instead to be decided which one of the two or more actors is allowed to harm which: A (the one producing the externalities in continuing the actions), or B (the one hoping to restrain A, in succeeding in it).

Coase (1960) first shows that when A is liable for the damage of the externalities and there are no transaction costs to hinder transactions between the two parties, market transactions will lead to a solution which is the most efficient from the society’s perspective. Secondly, in a situation where there is no liability for damage, market transactions will lead to an identical outcome from the point of view of market efficiency, the only difference being in the distribution of money between the two parties (Coase, 1960). These situations require that there are clear rules on whether or not the producer of the externalities is in fact liable
for the damage, without them “there can be no market transactions to transfer and recombine” the rights (Coase, 1960). However, “the ultimate result (which maximizes the value of production) is independent of the legal position if the pricing system is assumed to work without cost” (Coase, 1960). This is called the Coase Theorem (Hoffman & Spitzer, 1982). For the case where transaction costs exist (which is the most common occurrence), Coase sees that it is possible for the government intervention in some situations to give better results than the leaving of the situation to market forces, but likewise to sometimes be costlier (Coase, 1960). Finally, there is the possibility of not doing anything about the externality, which might be cheaper than any kind of solution (Coase, 1960).

Aslanbeigui & Medema (1998) argue that the difference in the objectives between Coase and Pigou is essentially that while Coase is mostly seeking to maximize efficiency, Pigou has other objectives, such as “protecting and elevating the lower classes” - in the end a difference in ethical values. Of course, it is worth remembering that Coase’s aim was to criticize the prevalent view of government interventions increasing efficiency, and as such, it is natural that he concentrated on showing that it is not necessarily so (Aslanbeigui & Medema, 1998). Finally, Aslanbeigui & Medema (1998) present four categories of difficulties with government interventions that Pigou and Coase identified. First, both saw governments as imperfect and at times incompetent. Secondly, the costs of intervention could be costly. Thirdly, determining the right amount of regulation or taxation could be “difficult, if not impossible” (Aslanbeigui & Medema, 1998). Lastly, the intervention causes distortions in markets.

As was mentioned above, both Pigou and Coase consider externalities that are priced. Callon (1998) argues that before externalities can be priced, a number of requirements need to be met. Firstly, the effects have to be identified and proved. The source or sources of the effects as well as those that are impacted by the effects then need to be identified. Thirdly, the impacts need to be evaluated and measured. Only when these requirements are met is it possible to negotiate how to deal with the externalities and to possibly internalise them. Callon (1998) notes that while the requirements may be met easily enough in some situations, in others they become significant problems. According to Callon modern problems are largely situations in which “everything becomes controversial”, from the existence of the effects, to the identification of the actors, the evaluation of possible effects, and so on. Callon (1998) describes such contexts as “hot”, and in those situations, the value
of Coase’s theorem is limited. The main problems are instead in establishing a common knowledge about the effects.

2.2 Structuration theory

Structuration theory was established by Anthony Giddens in his work The Constitution of Society. The theory advances the idea that it is insufficient to view the actions of agents as completely free without taking into account the social situations that they are in, but likewise insufficient to consider only social structures without taking into regard the actions of individual actors (Jones & Karsten, 2008). Therefore, “structuration theory seeks to provide a synthesis of agency and structure which explains social behaviour through recursive interactions between these dialectical forces” (McAulay, 2007).

Giddens (1984, p. 25) defines structure, system and structuration in the following way:

<table>
<thead>
<tr>
<th>Structure</th>
<th>Rules and resources, or sets of transformation relations, organized as properties of social systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>Reproduced relations between actors or collectivities, organized as regular social practices</td>
</tr>
<tr>
<td>Structuration</td>
<td>Conditions governing the continuity or transmutation of structures, and therefore the reproduction of social systems</td>
</tr>
</tbody>
</table>

Figure 4 Definitions on structure, system & structuration (adapted from Giddens 1984, p. 25)

Structures are thus, as rules and resources, “both constraining and enabling” (Giddens 1984, p. 25) and parts of systems. Systems in turns are the actions that individuals routinely do, and structuration means the conditions in which structures are “produced and reproduced” (Giddens 1984, p. 25).
The duality of structure, which is central in Giddens’ theory, means that structure and the actions of individuals form a duality, a system in which they interact and form each other. Giddens notes that “according to the notion of the duality of structure, the structural properties of social systems are both medium and outcome of the practices they recursively organize” (Giddens 1984, p. 25), and likewise the actors “draw upon the modalities of structuration in the reproduction of systems of interaction, by the same token reconstituting their structural properties” (Giddens 1984, p. 28). Due to this connection and interplay, the “constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality” (Giddens 1984, p. 25). This interaction is seen in the figure below.

![Figure 5](image)

**Figure 5** The dimensions of the duality of structure (adapted from Giddens 1984, p. 29)

The structures above, signification, domination and legitimation are different sets of rules and resources. Giddens mentions some examples, such as legal institutions of the legitimation structure and political institutions (authorization) and economic institutions (allocation) of the domination structure (Giddens 1984, p. 31). Signification structures are for example different modes of discourse (Giddens 1984, p. 31).

### 2.3 Consequences of action

The main source for my theoretical discussion on unanticipated consequences of innovation will be the article The Unanticipated Consequences of Purposive Social Action by Robert Merton (1936). Merton defines consequences (of purposive action) as “those elements in the resulting situation which are exclusively the outcome of the action, i.e. those elements which would not have occurred had the action not taken place” (Merton, 1936). Rogers (2003, p. 30-31) on the other hand uses an alternate definition; “consequences are the changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation”. One can be tempted to see a difference in the definitions, namely that while
Merton sees only consequences of action as consequences, Rogers sees also consequences resulting from the rejection of an innovation, i.e. oftentimes the absence of action as falling into the definition of consequences. It could however be argued that there are situations during which the rejection of an innovation is an action in itself. This could for example be the case if there exists social pressure to conform by adopting an innovation. In such a situation perhaps the rejection of the innovation is best looked at as an action, in which case Merton’s definition includes consequences of rejection.

2.3.1 Undesirable consequences
Undesirable consequences from innovations can be defined as “the dysfunctional effects of an innovation to an individual or to a social system” (Rogers 2003, p. 442). This definition of course is somewhat incomplete without an understanding of the nature of the dysfunctional effects. Rogers offers the following explanation: “The determination of whether consequences are functional or dysfunctional depends on how the innovation affects the adopters” (Rogers 2003, p. 442). This explanation still leaves a certain vagueness on the functional effects, such as whose perspective one should concentrate on, whose opinion on whether an effect is functional or not in complex situations matters, and whether or not functional or dysfunctional effects on others apart from adopters should be considered.

Giddens rejects the functionalist view of considering actions as filling a functional need and leading to consequences classified as either functional or dysfunctional (Giddens 1984, p. 294). Instead, he underlines the thought that purposive actions are taken by individuals, and that these actions can result in consequences that were not intended. The difference is clarified in the figure below, with a) being the view favoured by Giddens, and b) being the functionalist view that he rejects:
What can be seen as functional consequences for the social system from the functionalist perspective is in Giddens' view in fact consequences of purposive action by individuals, and can as such be unintended (Giddens 1984, 294). The question whether the unintended consequences are functional or not, and by extension undesirable or not, is thus not a matter that is possible to answer easily or objectively, and is defined by perspective and opinion.

### 2.3.2 Unanticipated consequences

Rogers (2003, p. 448) defines anticipated consequences as “changes due to an innovation that are recognized and intended by the members of a social system”, and unanticipated ones as those that are neither “intended nor recognized” by the same actors. This definition concentrates on the members of a social system, rather than exclusively on the change agent(s) whose actions brought the consequences about. While Merton (1936) does not define unanticipated consequences, calling them “in a measure self-explanatory”, in underlining the importance of distinguishing between the meaning of unanticipated (undesired) and undesirable consequences, he demonstrates a focus on the viewpoint of the actor rather than various stakeholders: “the intended and anticipated outcomes of purposive action, however, are always, in the very nature of the case, relatively desirable to the actor” (emphasis mine).
2.3.3 Limitations to correctly anticipating consequences

Merton lists five distinct factors that hinder the correct anticipation of consequences of action (Merton, 1936).

The first reason is that there is limited information on the possible consequences of an action, what Merton (1936) calls “the existing state of knowledge” and “ignorance”. This may be a case of either not having enough information to reliably predict the consequences, or the situation being too complex to predict. Both of these cases are made more important by the fact that people oftentimes feel that the environment “compel(s) us to act with some confidence even though it is manifest that the information on which we base our action is not complete” (Merton, 1936). In addition to this is the fact that predicting consequences in essence is an economic problem of allocation time and energy to those activities. The second reason is error, for example misunderstandings in judging the current or future situation, or making a wrong choice in deciding how to act, or making a mistake in the action itself. Thirdly, there are cases where “the actor’s paramount concern with the foreseen immediate consequences excludes the consideration of further or other consequences of the same act” (Merton 1936), a factor Merton (1936) calls the “imperious immediacy of interest”, but has also been called “myopia” (McAulay, 2007; Sveiby & al. 2012, p. 64). Fourthly, there are basic values (also called values (McAulay, 2007) or ideology (Sveiby et al., 2012, p. 64), i.e. situations where some values are so important to the actor that no thought is given to consequences since the action is so strongly aligned with those values. Lastly, as Merton (1936) explains: “public predictions of future social developments are frequently not sustained precisely because the prediction has become a new element in the concrete situation, thus tending to change the initial course of developments” (Merton, 1936). McAulay (2007) calls this last factor self-defeating predictions, and Merton notes that it was “picturesquely termed the ‘suicidal prophecy’ by the nineteenth century logician John Venn” (Merton 1968, p. 182). I will for the three last factors use the terms proposed by McAulay (2007) as the original ones were “sometimes outmoded” (McAulay, 2007). Thus, the terms I use are ignorance, error, myopia, values and self-defeating predictions.
Sveiby et al. (2012) have by adapting theory from Rogers (1983), Merton (1936) and Freeman (1984) created a model that goes to summarize the theoretical view of the consequences of innovation. It is shown below.

Apart from anticipated and unanticipated, and desirable and undesirable, the consequences in the model are divided into direct and indirect consequences. The model also shows that consequences lead to new consequences. It seems probable that as one moves towards later generations of consequences, the original change agent’s possibilities of foreseeing those consequences decreases substantially.
2.3.4 Unanticipated or unintended consequences?

Both the terms unanticipated and unintended have been used in research about consequences. Sveiby et al. (2012, p. 63) note that the terms have sometimes been used interchangeably. It is however true, as Baert (1991) points out, that they are not strictly speaking synonyms. It is entirely possible for an actor to anticipate a consequence that was not intended, though unanticipated consequences are necessarily unintended. To illuminate this difference, I have provided a few examples from my data in the table below.

<table>
<thead>
<tr>
<th>Undesirable consequences for others than change agents caused by an innovation</th>
<th>Example from data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipated and intended</td>
<td>Work extending technology leading to a greater workload and less time with family (Towers et al., 2006)</td>
</tr>
<tr>
<td>Anticipated but unintended</td>
<td>Rebound effect of energy efficiency measures (Herring &amp; Roy, 2007)</td>
</tr>
<tr>
<td>Unanticipated and unintended</td>
<td>Aggression as a consequence of using psychotropic drugs (Geels et al., 2007)</td>
</tr>
<tr>
<td>Unanticipated and intended</td>
<td>Logical impossibility, as mentioned in the text above</td>
</tr>
</tbody>
</table>

**Table 1** Examples of consequences

Figure 9 The relationship between unintended and unanticipated, and anticipated and intended consequences (adapted from Baert 1991 and Giddens 1984, p. 38)
Giddens’ (1984) discussion on unintended consequences is more concerned with the contrasting of his view with the functionalist view of consequences, and does not discuss the difference between unintended and unanticipated consequences. The example he uses might almost as well have been discussed as unanticipated consequences, even though it is difficult to determine to what extent an unintended consequence might have been anticipated. In a similar way, Merton’s (1936) discussion on unanticipated consequences does not go into detail on the differences between unanticipated and unintended (and for example unforeseen and unexpected consequences as mentioned by Baert (1991)).

While the above account might lead one to think that Giddens’ and Merton’s views are in essence fairly similar, this is not the case. The differences between Giddens and Merton are seen in their views on the functions of the unanticipated (or unintended) consequences. Giddens is clear in his rejection of Merton’s view: “Merton then goes on to couple unintended consequences with functional analysis, a conceptual move which [...] I wish to reject” (Giddens 1984, p. 12). According to Giddens, Merton sees unanticipated consequences as potentially fulfilling latent needs of a group or society, and if that is the case, then they might not be “so irrational after all” (Giddens 1984, p. 12). This view is shown in the figure below.

![Diagram showing the relationship between social activities, purposive action, functional latent need, and unanticipated consequences](image)

**Figure 10** Merton’s view on social activities and their consequences when filling a latent need according to Giddens (adapted from Giddens 1984, p. 12-13 & 294)

What is missing, in Giddens’ view, is an explanation of how latent functions motivate an individual actor to act in a certain way. An action filling a latent need does not in itself explain the action, as there needs to be a causal link between the reason and the action, and a society’s need does not automatically qualify. Giddens explains it in the following way: “to say that the existence of a social state A needs a social practice B to help it survive in recognizably similar form is to pose a question that then has to be answered; it does not itself answer it. The relation between A and B is not analogous to the relation that obtains between wants or needs and intentions in the individual actor” (Giddens 1984, p. 12-13). An exception to this is when actors purposely act in what they take society’s needs to be (Giddens 1984, p. 13).
Giddens is demonstrably quite critical of Merton’s functional view on the unanticipated consequences. Yet Merton’s work on the factors limiting an actor’s ability to foresee consequences is very valuable and useful in my analysis. Furthermore, in the case of innovations, the change agents and actors working toward the diffusion of the innovation are oftentimes companies and employees in companies. These companies do in fact have, if not other, at least monetary incentives to increase the functionality of the innovation’s consequences. Thus, they are actors acting in “cognizance of what they take to be social needs” (Giddens 1984, p. 13) of the system.

As there is a difference between the terms “unanticipated” and “unintended”, it is necessary to make a deliberate choice as to which term to employ. As such, this thesis is primarily concerned with unanticipated consequences. The consequences may thus be either intended or unintended.

2.4 Discussion on innovation and the relevance of the research question
Rogers (2003, p. 12) defines innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption”. He sees it as irrelevant whether or not another actor might have invented or adopted the same idea earlier, noting that “if an idea seems new to the individual, it is an innovation” (Rogers 2003, p. 12). Some on the other hand highlight the commercial or processual aspects of innovation, defining innovation for example as “the process by which an invention or idea is translated into the economy” (U.S. Department of Commerce 1967, p.2) or by claiming that “when an invention is introduced commercially as a new or improved product or process, it becomes an innovation” (MacLaurin 1953). Schumpeter (1939, p. 84-86) also sees innovation as something clearly different from invention, and as something with a distinct commercial value, noting that “innovation is possible without anything we should identify as invention and invention does not necessarily induce innovation, but produces of itself, [...] no economically relevant effect at all” and that it is the “businessman who turns the invention into an innovation”.

As the importance of Rogers’ works is decreasing (Fougère & Harding, 2012, p. 33; Sveiby et al., 2012, p. 63), it has become common to see other similar definitions that highlight the commercial aspects of an innovation, in line with MacLaurin’s (1953) thinking. This can lead to research and the general interest being directed towards aspects of commercial interest. In addition to the three major research interests of innovation studies that Fagerberg & Verspagen (2009) acknowledged, i.e. the influence of innovation on economic growth, the
different contexts in which innovation happens and national systems of innovation, the view of innovation as tightly linked to commercialisation could lead to the focus of innovation research being directed towards the interests of companies, such as how to increase the amount of innovations, the speed of innovation, the profitability of innovations, and so on. The consequences of innovation are pushed out of focus, it has been noted by Rogers (1983, p. 377) and Sveiby et al. (2012, p. 61), that only a very small fraction of innovation research studies the undesirable consequences of innovation, and those that do, consider mostly consequences for companies or change agents (Sveiby et al. 2012, p. 78-79) or the effect on employment (Sveiby et al. 2012, p. 79). This is why more research on the negative effects is needed.

As has already been stated, this thesis will not explicitly define innovation. Instead, articles that according to the authors of the articles consider innovation are potentially relevant. This means that the definitions that authors use is of great interest and importance for this thesis, since there is a possibility of excluding potentially relevant articles if the authors do not explicitly define the issue as being about innovation.

2.5 Summary of the theoretical framework
The theoretical framework of the thesis will be used to analyse the data that is found through the literature search. The theoretical framework consists of the theory of externalities and the five factors of Merton (1936) that limit the ability to anticipate consequences. Though the structuration theory of Giddens has been presented in this chapter to some detail, it will not be used in the theoretical framework to analyse the articles. Instead, Merton’s factors will be used, the benefits being that the factors are practical to use in analysis, the functionalist view of Merton is not a problem as was explained above in chapter 2.3.4 in relation to the diffusors incentives to act to increase the functionality of the innovations, and the list of five factors is very easy to understand.

Whereas the literature on externalities in many cases does not consider externalities that are difficult to monetize, the literature on innovation, purposive action and structuration theory at times misses the potential for discussion on externalities and stakeholders. I present the table below to clarify how some of the authors presented above have discussed the issue. Innovation has been central only for Rogers, but the discussion on action and consequences of Giddens and Merton can be used for discussing innovation and unanticipated and undesirable consequences.
The three authors all see an actor as the main change agent, as one who (under the influence of structures and systems) acts in a certain way, as one who purposively acts, and as one who diffuses the innovation. The stakeholders are, to the extent that they are considered, those that are affected by the original innovation or action. In considering for whom the innovation is new, Rogers focuses on the adopters and Giddens and Merton have their focus mainly on the actor. Consequences are judged to be unanticipated and unintended if they are unanticipated and unintended to the original actor in the texts of Giddens and Merton. It is only in the case of undesirable consequences that the views of others are more clearly formulated. Rogers has a somewhat similar focus, though considering unintended

<table>
<thead>
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<th></th>
<th>Giddens</th>
<th>Merton</th>
<th>Rogers</th>
</tr>
</thead>
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<td><strong>Who is seen as the change agent?</strong></td>
<td>An actor</td>
<td>An actor</td>
<td>An actor</td>
</tr>
<tr>
<td><strong>Who are the stakeholders?</strong></td>
<td>Other actors through structures and systems</td>
<td>Those affected by the consequences of the action</td>
<td>Those affected by the consequences of the innovation</td>
</tr>
<tr>
<td><strong>For whom is the innovation new?</strong></td>
<td>The actor foremost</td>
<td>The actor</td>
<td>The adopter(s)</td>
</tr>
<tr>
<td><strong>For whom are the consequences...</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unanticipated?</td>
<td>The actor</td>
<td>The actor</td>
<td>Change agents</td>
</tr>
<tr>
<td>Unintended?</td>
<td>The actor</td>
<td>The actor</td>
<td>Adopters and change agents</td>
</tr>
<tr>
<td>Undesirable?</td>
<td>The actor and/or others</td>
<td>The actor and/or others</td>
<td>Adopters, rejecters and social systems</td>
</tr>
</tbody>
</table>

**Table 2  Summary of theoretical framework**
consequences also from the view of the adopters of an innovation and undesirable consequences for the rejecters and social systems.

In much of past research on the undesirable consequences of innovation, the concept of externalities has not been explicitly used in the analysis. The stakeholders have at times been given only a little attention when the focus has been on the change agents. As the purpose of this thesis is to study the negative consequences to actors other than the company that has adopted an innovation, or a related change agent, it is essentially externalities that are studied. Vatn & Bromley (1997) note that externalities are “basically novelties”, underlining the fact that they usually are “recognized after they have been produced”, perhaps unintentionally underlying the suitability of integrating the theories of externalities with those of unanticipated consequences. By explicitly using the concept of externalities and drawing insights from past research on externalities, it should be possible to acquire a broader understanding of the consequences. The past discussions on possible solutions, from taxes, subsidies and regulation, to market solutions or no action at all, might also offer insights into the externalities that will be found in this thesis.

The work done by Sveiby et al. (2012) in studying the research on the unintended and undesirable consequences of innovation is in many ways similar to the research I will be conducting. However as no similar research has been done that would consider articles published after 2009, it is interesting to see whether or not the negative consequences have been studied more recently. Furthermore, it is important to see what kind of consequences that are found and studied, and to develop a descriptive model of them with the help of the theoretical framework presented above.
3 METHODOLOGY

In this chapter I will present my methodology. I will begin by briefly discussing the research approach, after which I will present my research design. In this part I will explain in some detail the process through which I gathered my data material and how it was analysed. The third subchapter deals with the data that I use in the thesis, showing both how many articles were chosen and eventually dropped, and explaining the choice of eliminating some particular articles. The last part of this chapter assesses the research in this thesis, considering reliability, replication and validity, and lastly discussing the inevitable limitations.

3.1 Research approach

Creswell sees research approaches as taking place in a continuum from qualitative, through mixed methods, to quantitative (Creswell 2014, p. 3). Hammersley (1992) also notes that there are not only two opposing standpoints, but “a range of positions” (Hammersley 1992, p. 172). A common, though in many ways limited, way to differentiate between these is that qualitative methods use words, are more interpretive, inductive, and keen on considering the complexity of a situation (Bryman & Bell 2015, 35-37; Hammersley 1992, p. 161). Quantitative methods on the other hand focus on numbers, on testing hypotheses and finding generalisable results (Bryman & Bell 2015, 35-37; Hammersley 1992, p. 161). Clearly, they are suitable for different kinds of aims (Silverman 2011, p. 7).

This study will be qualitative, as the aim is to study articles published in academic journals and the unanticipated and undesirable consequences found in them. The benefit of using a qualitative method here is that it permits a deeper understanding and analysis of the cases where consequences have been found (Patton 2015, p. 12-13). It also enables for a descriptive model to be created.

3.2 Research design

A research design can be defined as different “types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research design” (Creswell 2014, p. 12). The designs of this thesis are presented below.

The first method was searching for articles on the database Web of Science by Thomson Reuters. I will explain in detail how the search was conducted in order to increase the replicability of the study. First, the search word, either “innovat*” or “technolog*” was
searched for in the topic of articles for a specific timespan. In Web of Science, it is possible to search according to title, author, topic, and so on, and in this case, the search was done for topics. The asterisk at the end of the search word includes all derivatives of the search word in the results, for example innovation, innovative, and innovating. Upon obtaining the results, they were refined first by choosing only results from the category “MANAGEMENT”, then by considering only documents of the “ARTICLE” type. After this, the Boolean search string found in appendix A was copied into “Search within results for...” and the search was conducted. The resulting articles were then refined according to publication year and the relevance of the resulting articles was considered. The search was, as mentioned in the introduction, originally conducted for the years 2009 to 2015 with the search word “innovat*”, but as only six relevant articles were found, the search was expanded to the beginning of the Web of Science timespan, to 1986. At this time 10 articles had been found, and the search was expanded with the use of the search word “technolog*” to replace “innovat*” for the years 2002 to 2008 and eight more articles were found. The reason for expanding the search was to increase the generalisability of the study by using more cases.

The criteria for judging the relevance of the articles followed from the research questions presented in the introduction. First of all, for an article to be chosen it had to be an empirical study as I was looking for concrete examples of the consequences of innovation, therefore a theoretical study would not suffice. Secondly, the articles had to be about innovation. In the first study with the search word “innovat*”, this came naturally, but with the second search term the word innovation or a derivative of it was not in all cases used. In these instances, I included all otherwise relevant articles that included a new idea, product, practice, object or process. Finally, the consequences of the innovation had to be undesirable to people or the environment according to the definition presented in subchapter 1.2.2.2. In this sense the criterion that the consequences be undesirable was prioritized above the need for them to be unanticipated. The articles that seemed promising after reading the abstracts were saved for reading by the supervisor as the leader of the research project.

As has already been stated, this thesis is part of the research project “The Future of Innovation” at Hanken School of Economics led by professor emeritus Karl-Erik Sveiby. There are therefore other similar projects that to some degree influenced some of the choices made in this one. Ian Niilola will search for articles with derivatives of the word “technolog*” for the years 2009 to 2015. Camilla Cedercreutz on the other hand used the same search
string as I in her bachelor’s thesis, but searched articles from 2002 to 2008. There was therefore some amount of overlap between the searches, however this was judged by the leader of the research project to be of no great importance. The search conducted in this thesis is different from the one conducted by Sveiby et al. (Sveiby et al. 2012), which searched for articles up until 2009 in the EBSCO database.

Using the findings from the articles, I created a descriptive model to categorize the unanticipated and undesirable consequences that have come from innovations. Creating theory by studying cases is “a research strategy that involves using one or more cases to create theoretical constructs, propositions and/or midrange theory from case-based, empirical evidence” (Eisenhardt & Graebner 2007; Eisenhardt 1989). Data analysis can be seen as an interplay between data reduction, data display, and conclusion drawing/verification before, during and after data collection (Miles & Huberman 1994, p. 11).

The sampling strategy of cases in this thesis is the complete target population (Patton 2015, p. 285). While the data collection methods are not those that Eisenhardt (1989) advocates, for example having multiple data collection methods, the last four steps of Eisenhardt’s process are followed. Those steps consist of analysing data, shaping hypotheses, enfolding literature and finally reaching closure (Eisenhardt 1989).

3.2.1 Data analysis

Miles & Hubermann (1994, p. 173-177) make a distinction between variable-oriented and case-oriented strategies for cross-case analysis. Variable oriented strategies focus on common variables in different cases in order to see relationships between variables and outcomes whereas a case-oriented strategy concentrates on relationships within one case and “only then turns to comparative analysis of a (usually limited) number of cases” (Miles & Hubernann 1994, p. 174). What I have done in this thesis is a mixed strategy, as I created two partially ordered meta-matrices following Miles & Hubermann (1994, p. 177-182). These were matrices that included all the articles in my data and different variables that were meant to provide an understanding of both each case as well as the cases as a whole or smaller groups. With these matrices, created in Microsoft Excel, it was possible to group articles based on different variables, for example which perspective the article had, how many consequences were found, what kind of innovation was studied, and so on. They were central in both gaining an understanding of the data and finding relevant patterns. The
reason for creating two matrices rather than one was practical, the first matrix was simply too wide for reading.

Based on these meta-matrices the descriptive causal model was created. It is presented below in chapter 4. It was created on the basis of Miles & Hubermann (1994, p. 222-228), most notably perhaps making several versions of the model. It is meant to be a model that “explains what is happening”, but “that does not forcibly smooth the diversity” (Miles & Huberman 1994, p. 207).

3.3 Data

The articles that were found comprise my data in this thesis. I have in the tables below shown the results from my search. In the top left corner is the search word that was used, “innovat*” for the first one and “technolog*” for the second. The first column shows the year for which the search was done and the second all the articles that were found. The third column (in grey) shows the amount of relevant articles for that year following both my initial judgement and reading of them in their entirety, as well as the reading by professor emeritus Sveiby. The last column shows the percentage of relevant articles for that year out of all the articles that were found during the search process.
Table 3  Result of literature search per year

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In total 1467 7 0,48 %

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In total 331 8 2,42 %

The amount of articles that were considered and finally found to be relevant can be summarised in the table below. The all results-column is the sum of the results from the two tables above, the number of relevant articles the sum of the relevant articles from both the tables above, and the percentage of relevant articles is equal to the number of relevant articles divided by all articles.

<table>
<thead>
<tr>
<th>All results</th>
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</tr>
</thead>
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<tr>
<td>All articles</td>
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</tbody>
</table>

Table 4  Final result of literature search
I will analyse the contents of the articles later in the analysis chapter, as the purpose of this subchapter is only to give an overview of the data collection and its results from a numerical perspective. An exception to this are the three articles that were deemed relevant after a reading of their abstracts, but after having been read in entirety were no longer considered to be relevant. These articles were all found with the “innovat*” search word. The first of these articles was written by Švarc, Perković & Lažnjak (2011) with the title “Unintended consequences of innovation policy programmes: Social evaluation of technological projects programme in Croatia”. The reason for not including this article in the data material was that the article discusses an innovation policy programme, not innovation per se. Thus, the article does not actually study an innovation that might have consequences. The second article is of by Vo & Bartram (2012). The title of this article is “The adoption, character and impact of strategic human resource management: a case study of two large metropolitan Vietnamese public hospitals”. The reason for omitting this article was that it found that the human resource functions were “heavily controlled” by the state, which “stifled local autonomy and management innovation to effectively managing human resources” (Vo & Bartram, 2012). Negative consequences were thus not a result of an innovation, and therefore the article was not relevant for this study. The last article is named “The diffusion of mobile social networking: Exploring adoption externalities in four G7 countries” and written by Scaglione, Giovannetti & Hamoudia (2015). This article studied adoption externalities, rather than negative externalities or consequences, but found positive network externalities. Whilst there certainly may be some negative indirect consequences that arise from positive network externalities, due to the fact that these were not directly discussed the article does not belong to the data material.

A central part of the theoretical framework of this thesis is the concept of externalities. Even though many consequences on stakeholders arising from innovation do technically fall under the definition of externalities and can therefore be treated as externalities, this has not occurred in the articles of my data material. One speculative reason for this is that externalities are more often considered in texts concerning economics (see e.g. Pigou, 1952 and Dahlman, 1979), which management-articles oftentimes are not. In order to be able to study articles that discuss externalities I have a separate group of five articles that study externalities. One of the articles is that of Scaglione et al. (2015) mentioned above, another is that of Hall & Martin (2005) which also belongs to my original data, and the three remaining are by Bhattacharya & Packalén (2012), Heller (2001) and Katz & Shapiro (1985).
They will be presented below, in chapter 4. This group of five articles was given to me by my supervisor professor emeritus Karl-Erik Sveiby. Therefore, they are not a part of any larger population from which one could draw conclusions. They are included and studied only in the role of gaining an understanding of the interplay between externalities and unanticipated and undesirable consequences.

3.4 Assessment of the research
Bryman & Bell see reliability, replication and validity as “three of the most prominent criteria for the evaluation of business and management research” (Bryman & Bell 2015, p. 49). In this chapter, I will discuss these criteria, their general meaning and what they mean for this thesis.

3.4.1 Reliability, replication & validity
Hammersley defines reliability as “the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions” (Hammersley 1992, p. 67). Robson (2011) identifies four elements which may cause problems with reliability: participant error, participant bias, observer error and observer bias (Robson 2011, p. 86-87). Participant error means short-term fluctuations in the data from a participant “on a more or less random basis”, whereas participant bias means a less random error that could lead to a bias (Robson 2011, p. 86). Observer error refers to errors the observer could make, also more or less randomly or without causing bias, which is the function of observer bias (Robson 2011, p. 86-87). Of these, observer error might be relevant for this thesis if it were the case that I as a researcher read the articles and abstracts in a state of mind when I might miss relevant or include irrelevant articles. As such, the data material has been collected in advance, so as to avoid deadline-induced stress and late evenings. Additionally, Karl-Erik Sveiby as the leader of the research project read through all the articles chosen, hence improving reliability and providing a form of triangulation. Observer bias could occur in case I would systematically include irrelevant or exclude relevant articles. For this reason, I increase transparency by noting also the articles that at first seemed relevant but in the end were not chosen. On this note, there have also been discussions with other members from the research team aimed at eliminating bias.

In regards to replication, my study should be very unproblematic and to ensure this, I have provided information and details on what I have done at every step. The fact that the search
string is included in appendix A, and thus can be used by others, is also a factor that enhances replicability. As a whole, replicating this study should be easy as long as the database Web of Science is in operation.

Bryman & Bell (2015) state that validity is “concerned with the integrity of the conclusions that are generated from a piece of research”, and is “in many ways the most important criterion of research” (Bryman & Bell 2015, p. 50). There are four main types of validity: measurement validity, whether or not the measure of a concept reflects that concept; internal validity, whether or not a causal relationship in a conclusion holds; external validity, whether or not the results can be generalised beyond the specific context; ecological validity, whether or not the research is applicable for “people’s everyday, natural social settings” (Bryman & Bell 2015, p. 50-51).

The question of measurement validity, i.e. if one can find the unanticipated and undesirable consequences of innovation by studying what consequences past research has found, is very relevant for this thesis. To some degree the response is certainly yes, but there is a risk that some are not found as they are not considered in the innovation research, as Sveiby et al. (2012, p. 79) have noted. This factor might decrease the measurement validity. Internal validity refers in this thesis to whether or not one might expect the causal relationships in the model to hold, i.e. the consequences actually being a result mainly of innovation and no other factors. The model is created on the peer-reviewed articles that have previously established the causal relationships. Therefore, the internal validity is dependent on the internal validity of the articles that were studied. As the articles are published in peer-reviewed journals, it is reasonable to assume that the internal validity of this thesis will be high. External validity will most likely be high in this study in comparison with many qualitative studies, and there is no reason to assume that different search engines should give significantly different results to this study performed by using Web of Science. This can be considered by comparing the results here with those of Sveiby et al. (2012, p. 68-78). Another point to consider in regards to external validity is whether my results can be generalised to other innovations, not just to other research. In this regard, the external validity might be a problem in the sense that it is possible not all kinds of innovation have been found in my data search. Innovations that have not been studied or published, for example, will not be included in my data and it is difficult to know whether my findings can be generalised to those situations. As for ecological validity, it could be argued that in order
to decrease the occurrence and severity of unanticipated and undesirable consequences, further research on them might be needed, and underlining the lack of such research is a first step. As such, there exists a certain level of ecological validity.

Concerning validity, Silverman (2011, p. 369) identifies five criteria for assessment:

- The impact of the researcher on the setting
- The values of the researcher
- The truth status of a respondent’s account
- Triangulation, comparing different kinds of data and methods
- Respondent validation

Figure 11   Criteria for assessing validity (adapted from Silverman 2011, p. 369)

In many of these I am rather fortunate as they should not be problems in my research, for example the researcher’s impact as well as respondent validation are not relevant in this case.

The values of the researcher are something that must be taken into account. Some of the undesirable consequences may be such that some people see them as negative whereas other people see them as neutral or even positive. Widening income gaps could be an example of such an outcome. To address this, I have created a table with examples from my cases to show transparently what in this thesis is included as an undesirable consequence.

The “truth status” is not a large problem in this thesis. The articles that I study are published in peer-reviewed journals and so one could safely assume that the consequences mentioned in them are valid. Triangulation, or studying the same phenomena using different methods or different sources or forms of data, is something that I have not done. What could have been done is for example using additional databases in order to find articles that are not found through Web of Science. Another way of obtaining additional data could have been to conduct interviews with different actors affected by an innovation, such as employees, change agents, environmental activists, residents close to an affected area, and so on. Unfortunately, this could not be done due to time constraints.

3.4.2 Limitations

As with all research, the limitations in this thesis are important to note. A major limitation that was already mentioned when discussing the measurement validity above is that of finding only cases that come up with the search words and that are available in the search
engine. Another limitation is the number of articles, which in this study is fifteen. There are
some drawbacks with a number that low, lacking generalisability being the most obvious
one. There is also a risk that some kind of consequences and some stakeholders are not found
in my data material at all. As there are some consequences that are present in only one article
in my data, there does not seem to be saturation in terms of samples. There are drawbacks
with a larger number of cases as well, for example difficulties finding them and a much more
difficult analysis, which is why fifteen articles was deemed sufficient.

Having a causal model means that there are claims of causality, that not only are A and B
correlated but A in fact causes B. This is of course precisely what my model claims in regards
to innovation. One might regard such a statement as bold and it is possible that my data
includes cases where the causality could be questioned or seen as simplified. The causality
is however not mainly a result of this study, but a result of the study that is included in my
data, it is therefore not simply a result of my analysis but also a starting point.

A limitation of the model is that not all cases are included. By including more variables,
perhaps different kinds of consequences that were present in the data material no more than
once, the model would have been more complete in a sense. Now it is certainly lacking some
real-life cases. The reason for not including everything that came up in the analysis in the
model is that what it now lacks in scope it makes up for in readability and usefulness.
4 RESULTS

The final sample consisting of fifteen articles will be presented in this chapter in some detail. As follows from my research questions, the main questions of interest are the consequences of innovations and whom they affect. To give an overview, the table below shows the studied articles, the research methods and data, the type of innovation that was studied, the search word that was used for finding the article, one or two examples of the consequences, the change agent and the affected stakeholder.
<table>
<thead>
<tr>
<th>Authors &amp; year</th>
<th>Title</th>
<th>Research method and Data</th>
<th>Type of innovation (&amp; search word)</th>
<th>Example of consequence</th>
<th>Example of consequence</th>
<th>Change agent(s)</th>
<th>Type of affected stakeholder(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggeri &amp; Segrestin (2007)</td>
<td>Innovation and project development: an impossible equation? Lessons from an innovative automobile project development</td>
<td>Case-study methodology, 80 semi-directive interviews, taking part in projects, archival sources</td>
<td>Process &amp; administrative (innovat*)</td>
<td>Functional expertise learning possibilities decreased</td>
<td>Delay and increased costs</td>
<td>Managers</td>
<td>Internal experts</td>
</tr>
<tr>
<td>Bayer, Barlow &amp; Curry (2007)</td>
<td>Assessing the impact of a care innovation: telecare</td>
<td>Workshops and interviews, scenario building and simulation modelling</td>
<td>Service &amp; technological (technolog*)</td>
<td>Difficulty adapting to telecare</td>
<td></td>
<td>Government</td>
<td>Patients</td>
</tr>
<tr>
<td>Cañibano (2013)</td>
<td>Implementing innovative HRM: trade-off effects of employee well-being</td>
<td>Case study on three HRM practices and tools, 50 interviews and document analysis</td>
<td>Administrative (innovat*)</td>
<td>Distortion of work boundaries, invasion of private life</td>
<td>Stress and backache</td>
<td>HR</td>
<td>Employees, employees' families</td>
</tr>
<tr>
<td>Authors &amp; year</td>
<td>Title</td>
<td>Research method and Data</td>
<td>Type of innovation (&amp; search word)</td>
<td>Example of consequence</td>
<td>Change agent(s)</td>
<td>Type of affected stakeholder(s)</td>
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<tr>
<td>Giuri, Torrisi &amp; Zinovyeva (2008)</td>
<td>ICT, skills, and organizational change: evidence from Italian manufacturing firms</td>
<td>Correlation analysis and production function approach, three surveys of Italian manufacturing firms.</td>
<td>Technological and organisational (technolog*)</td>
<td>Increased stress</td>
<td>Companies</td>
<td>Workers</td>
<td></td>
</tr>
<tr>
<td>Authors &amp; year</td>
<td>Title</td>
<td>Research method and Data</td>
<td>Type of innovation (&amp; search word)</td>
<td>Example of consequence</td>
<td>Example of consequence</td>
<td>Change agent(s)</td>
<td>Type of affected stakeholder(s)</td>
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</tr>
<tr>
<td>Hall &amp; Martin (2005)</td>
<td>Disruptive technologies, stakeholders and the innovation value-added chain: a framework for evaluating radical technology development</td>
<td>Case study</td>
<td>Radical, technological (technolog*)</td>
<td>Gene transfer to wild plants</td>
<td>Increased dependence on seed companies</td>
<td>Companies</td>
<td>Adopters, environment &amp; end-customers</td>
</tr>
<tr>
<td>Herring &amp; Roy (2007)</td>
<td>Technological innovation, energy efficient design and the rebound effect</td>
<td>Telephone interviews, survey, newsletter</td>
<td>Green (innovat*)</td>
<td>Increased use of energy-using products as they get more efficient.</td>
<td></td>
<td>Companies &amp; government</td>
<td>Environment</td>
</tr>
<tr>
<td>Rangarajan, Jones &amp; Chin (2005)</td>
<td>Impact of sales force automation on technology-related stress, effort, and technology usage among salespeople</td>
<td>Hypothesis testing, survey in a company</td>
<td>Technological (technolog*)</td>
<td>Role conflict</td>
<td></td>
<td>Company</td>
<td>Employees</td>
</tr>
<tr>
<td>Thatcher et al. (2006)</td>
<td>Internet anxiety: An empirical study of the effects of personality, beliefs, and social support</td>
<td>Questionnaire sent to students</td>
<td>Technological (innovat*)</td>
<td>Internet anxiety</td>
<td></td>
<td>Companies &amp; government</td>
<td>Users</td>
</tr>
<tr>
<td>Towers, Duxbury, Higgins &amp; Thomas (2006)</td>
<td>Time thieves and space invaders: technology, work and the organization</td>
<td>Survey, interviews and focus groups, all from a government department in Canada</td>
<td>Technological, administrative (technolog*)</td>
<td>Greater workload</td>
<td>Decreased time with family</td>
<td>Company &amp; employees</td>
<td>Employees, employees’ families</td>
</tr>
</tbody>
</table>

Table 5  An overview of the data
I have also five articles that study externalities, as mentioned in the methods chapter. They are presented below.

<table>
<thead>
<tr>
<th>Authors &amp; year</th>
<th>Title</th>
<th>Research method and data</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhattacharya &amp; Packalén (2012)</td>
<td>The other ex ante moral hazard in health</td>
<td>Theoretical model</td>
<td>There is a positive externality to diseases that benefit innovators and other patients.</td>
</tr>
<tr>
<td>Hall &amp; Martin (2005)</td>
<td>Disruptive technologies, stakeholders and the innovation value-added chain: a framework for evaluating radical technology development</td>
<td>Case study</td>
<td>For radical technologies, the needs and wants of many different stakeholders need to be considered.</td>
</tr>
<tr>
<td>Katz &amp; Shapiro (1985)</td>
<td>Network Externalities, Competition, and Compatibility</td>
<td>Theoretical model</td>
<td>Compatibility is an important factor of network externalities, and it is affected by consumers' expectations of future market share.</td>
</tr>
<tr>
<td>Scaglione, Giovannetti &amp; Hamoudia (2015)</td>
<td>The diffusion of mobile social networking: Exploring adoption externalities in four G7 countries</td>
<td>Comparing two diffusion models with data of actual diffusion in four countries</td>
<td>All diffusion curves were left skewed, which is evidence of network externalities.</td>
</tr>
</tbody>
</table>

Table 6 An overview of the articles discussing externalities

4.1 Analysis
In the next sections the data is studied in light of the different consequences that were found, the stakeholders that were affected by the innovations as well as the change agents that were working for the diffusion of the innovations. Following this, I will analyse the data more thoroughly and look through more variables. The overarching goal is of course still to, based on the findings, develop a descriptive model in order to categorize the consequences that are found in the data.

I will begin the process of creating the model by studying the data in regards to different variables, and look for what is common, what seems to be normal or occurring. This was
initially done with the help of two meta-matrices as explained above in chapter 3.2.1. The two meta-matrices were combined and reduced in scope to the table presented in the result-section.

4.1.1 The types of consequences
I have categorised the consequences into five different groups. The largest group by far is labelled Negative feelings because of changes in the workplace. These consequences were found in nine out of the fifteen articles. These consequences are for example increased stress or competitiveness, feelings of intrusion of work into time spent with family, and frustration with new programs (Cañibano, 2013; Towers et al., 2006 and Cucciniello & Nasi, 2014). The next groups are Physical problems on people and Consequences for the environment, each with three instances found in the data. Examples include increased stress and backache and decreased biodiversity (Cañibano, 2013 and Arora, Romijn & Caniëls, 2014). The last two groups are Financial consequences and Difficulties for patients, each with one case in the literature. For the former the case is about negative consequences of file sharing on musical artists, and for the latter the difficulties of elderly patients to adapt to telecare (Bhattacharjee et al., 2007 and Bayer, Barlow & Curry, 2007).

In considering the consequences outlined in the articles, Merton’s (1936) limiting factors provide a framework. The consequences found in the articles seem to fall into two main categories. First, there are the consequences that have come into being mainly through actions taken because of some values that have prompted an actor to act in some way without considering possible undesirable consequences of the action. This is what Merton (1936) calls “fundamental values” and was named “values” above. Examples of these are found in Arora et al. (2014) as a significant “developmentalist” ideology, and in Towers et al. (2006) as a strong work ethic. Secondly, there are consequences that are mostly the result of either ignorance or error, usually a misjudgement about the consequences. An example with both ignorance and error playing an important role is in the article of Aggeri & Segrestin (2007), where there was a lack of information about the situation, in large part because of errors in how to follow up on the few instances of critical communication about the risks in the project. There was one case of myopia, that of Cañibano (2013), and no cases of self-defeating predictions in the data. It is of course important to note that the articles do not discuss the consequence in these terms, and so these judgements are based on my reading of the articles. It is not unreasonable to think that other readings would yield differing results.
to some degree. In the case of Geels, Pieters & Snelders (2007), for example, I interpreted the deaths that the drugs led to as errors, whereas a more cynical reading might see them as a case of values leading to neglecting the risks of negative consequences.

Despite the factors complicating the anticipation of the consequences, in many cases the consequences have not been very difficult to anticipate. Neither the employees reacting negatively to top-down changes in the workplace (Cucciniello & Nasi, 2014), nor new technology leading to employees extending their work to the home (leading to negative consequences) (Towers et al., 2006) seem counter-intuitive.

4.1.2 The affected stakeholders and the change agents

The most common stakeholders who are affected seem to be the adopters (see e.g. Cañibano, 2013; Do Cho & Chang, 2008; Rangarajan et al., 2005 and Towers et al., 2006). Consequences most often befall these adopters themselves, but in some cases may also indirectly affect their social circles. It is however important to note that the adopter oftentimes is a different actor than the change agent (see e.g. Do Cho & Chang, 2008; Rangarajan et al., 2005 and Towers et al., 2006). This means that while the adopter is adopting the use of the innovation, the decision to do so may have been made elsewhere. Thus, it would be incorrect to assume that an adopter is necessarily acting completely through his or her own will. Employees adapting a new technology or patients adapting a new medicine based on their doctor’s recommendations are not completely free agents as they lack necessary bureaucratic power or information to act as they please.

Another, partially overlapping group of stakeholders is employees. As most of the articles considered undesirable consequences of changes in the workplace, it is not surprising that employees would be a large stakeholder. In many cases where the employees were negatively affected the consequences would indirectly affect their families too. That is the case for example when an employee has a decreased amount of time to spend with family or is feeling increased stress (Towers et al., 2006; Giuri et al., 2008).

The environment is also at risk for being negatively affected by different innovations. This is the case for decreased biodiversity as mentioned above, but also for gene transfer to wild plants, a reduced gene pool and from an increased use of energy-using products as they become more energy-efficient (Hall & Martin, 2005; Herring & Roy, 2007).
The innovation or innovations from each article was identified as a specific kind of innovation as seen in the fourth column in table 5. As the second part of the article search was for articles containing a derivative of the word “technolog”, it is not surprising to note that the largest group of innovations were technological. Ten articles studied technological innovations, but they found on average 1.6 undesirable consequences. Administrative innovations on the other hand were found in four cases, but here 3.25 undesirable consequences were found on average. As no more than four consequences per article were included in the analysis, 3.25 can be regarded as quite high. Many kinds of innovations had on average either one or four consequences, but as there were only one or two cases of these innovations, one cannot draw any conclusions about them. Furthermore, it is a given that the mere number of consequences found in the data says nothing about their seriousness.

In different cases there are various change agents leading to the adoption of innovations. In the case of digital sharing technologies studied by Bhattacharjee et al. (2007) the adoption happens as a basically independent decision made by the users themselves, whereas in the case of sales force automation technologies studied by Do Cho & Chang (2008) the change agents are managers of the sales force. The change agent is not always only one actor but there may be significant cooperation, for example between the company and the employees as in the case of work extending technology studied by Towers et al. (2006), or between companies and the government as in the case of the biofuel innovation system studied by Arora et al. (2014). By far the most common change agent in the data was still one or more companies (or specific parts of companies like HR or management). Companies were significant change agents in all but two articles. Of the two articles where companies did not play a significant role, one of the change agents identified was the government (Bayer et al. 2007). Governments were also change agents in three of the articles where companies were present as change agents. In the Bhattacharjee et al. (2007) article, the change agents were the users themselves, as mentioned above.

4.1.3 Direct and indirect consequences

While most of the consequences that were found in the data were direct, there were examples of indirect consequences also. In these cases, the direct consequence, which did not in itself need to be undesirable, led to indirect undesirable consequences. An example of this is found in Herring & Roy (2007) where innovation led to different products being more energy efficient. The direct consequence, quite desirable in this instance, was that the products used
less energy. Because of this, however, the energy using products were used differently, e.g. loft insulation leading to higher room temperatures. Another example is found in Bhattacharjee et al. (2007) where digital sharing technologies were studied. The technology that was studied, WinMx, a file-sharing network, made it possible for users to upload and download music. The direct consequence of the innovation was thus the increased access to music for the adopters. It was however found by the researchers that the innovation had indirect consequences on the time the albums stayed on the charts. Those artists with albums whose time on the charts suffered from the technology were in turn affected by the change in survival time on the charts. This is an example of an indirect consequence.

4.1.4 Methods & data
There were many different types of methods in the data, and consequently many different forms of data as well. Surveys and case studies were the most common methods. In some cases, for example in the article by Geels et al. (2007) which studied the psychotropic drugs in the 20th century by investigating “primary and secondary sources”, the method had a potentially significant impact. It seems plausible that other methods, and indeed other sources, could have given a different reading and understanding of the history. Likewise in the case of the article by Arora et al. (2014), considering the biofuel innovation system in Tanzania, the data that was sampled through a snowballing method played a large role.

The articles discussing externalities differ from the main data sample in that they have more often used economic theory, with Katz & Shapiro (1985) and Bhattacharya & Packalén (2012) being clear examples of these. This finding is not too surprising considering that externality is a term most often used in economics.

4.1.5 Level of analysis
In studying the articles, I have looked for which level has been studied, the macro, meso or micro level. Interestingly, there is an almost even distribution between these, with four articles concentrating on the macro level, five on the meso level, and five on the micro level, and one that is a mix of micro and meso level analyses. There does not seem to be a clear connection between the level of analysis and any other factors of the analysis, for example affected stakeholders, but finding that there is literature on all different levels is interesting in itself.
4.1.6 Research paradigm

In order to consider whether the research paradigm to which the researcher or researchers were adhering to might have an effect on the other variables, I studied which research paradigm each article belonged to. The framework I used was introduced by Burrell and Morgan (1979). The framework is a matrix consisting of two dimensions and four squares, each square representing one paradigm. One dimension is the “subjective-objective dimension”, with different assumptions related to ontology, epistemology, human nature and methodology. In this dimension, the objectivist side prefers realism, positivism, determinism and therefore favours nomothetic methodologies, i.e. methodologies aiming at understanding concepts, “their measurement and the identification of underlying themes” (Burrell & Morgan 1979, p. 1-3). The subjectivist side on the other hand has different assumptions on all points. The other dimension is that of “regulation-radical change”, with the regulation side being concerned with “the need for regulation in human affairs” and with why “society tends to hold together rather than fall apart”, the radical change side instead with “man’s emancipation from the structures which limit and stunt his potential for development” (Burrell & Morgan 1979, p. 17). These two dimension lead to the matrix with four paradigms. On the subjectivist side there is the radical humanist paradigm at the radical change end, and the interpretive paradigm at the regulation end (Burrell & Morgan 1979, p. 22). On the objectivist side there is the radical structuralist paradigm at the radical change end and the functionalist paradigm at the regulation end (Burrell & Morgan 1979, p. 22). The matrix is presented below.
Most of the articles in the data are from the functionalist paradigm, and I identified only two articles as belonging to another paradigm, those of Arora et al. (2014) and Geels et al. (2007), which are radical structuralist. These two articles studied how larger social and structural changes affected people or groups of people, whereas most other articles concentrated on smaller changes, changes resulting from one or a few innovations in a more static setting.

4.1.7 Perspective

I studied whether the authors of the articles concentrated on the change agents or on the stakeholders in their analysis. The reason for doing this was the thought that in concentrating on one part, the authors might miss the viewpoint of the other part, as well as perhaps unknowingly adopt the view of the focal actor. Adopting the view of one part carries the risk of making normative judgements in line with that part and introducing bias to the research. In management literature, from which the articles were found, one could hypothesize that the view of the change agents may be common. My data on the other hand
is comprised of articles studying consequences for stakeholders, so it was unclear whether this would be the case for my data.

The perspective was not strictly either of the change agent or of the stakeholder in most of the articles. It was also evenly distributed, as I found seven articles with the change agent as the key focus, seven with the stakeholder as the focus, and one that was a clear mix of the two. Examples of articles with the change agent perspective are Aggeri & Segrestin’s (2007) article which notes that process innovations can lead to negative effects “on collective learning processes and that these effects have managerial implications for innovative developments” and Bayer et al. (2007) where the authors note that “policy makers should place greater emphasis on understanding the dynamic effects of telecare implementation on care systems”. It is rather clear in these examples that the perspective is one of a change agent’s, managers and policy makers, and that the findings in the articles are aimed at them. For the stakeholder perspective, examples include Cañibano (2013) where the aim is to see effects on stakeholders, i.e. employees: “The purpose of this paper is to explore whether the implementation of these innovative practices has an impact on the three dimensions of well-being (physical, psychological and social)” and Herring & Roy (2007) where the rebound effect of energy efficiency improvements lead to “greater consumption” and consumers buying “more products” and/or choosing “larger, more powerful, more feature laden models”, which of course has effects on the environment. Considering possible normative judgments and bias in the research was difficult and there were no clear-cut instances of this. In the article of Do Cho & Chang (2008), the authors discuss “resistance” of the salesforce against the diffusion of the innovations, which can be seen as a normative judgment of the case. Another example is that of Arora et al. (2014) who note that the IMF and the Tanzanian government were neoliberal, a term that is critical rather than neutral. In the remaining articles, I did not find normative judgments and it does not seem that the choice of perspective would clearly steer the findings of the studies.

4.1.8 Articles considering externalities

Due to the fact that only one of the articles in the data used the term externality, I have studied four additional articles, all of which use the term. These articles are not part of any larger population from which one could draw conclusions. Nevertheless, I discuss these five articles here.
Four of the five articles have a theoretical model in the centre of the study. The study by Bhattacharya & Packalén (2012) develops a theoretical model which shows that there is a positive externality linked with diseases, with obesity used as an example. The reason for this is that the potential remuneration linked with finding a treatment or cure of a disease is much greater, and it indirectly “induces additional innovation” which benefits others (Bhattacharya & Packalén, 2012). Heller’s (2001) article seeks to better the socio-technical model by underlining joint-optimization (instead of simply maximisation). Joint-optimisation of the different systems, i.e. the social, technical and ecological, reduces the potential negative externalities of the technological system by also taking into account the other systems and optimising them jointly. Katz and Shapiro’s (1985) article studies the network externalities present in situations where compatibility between different products. As compatibility is a main concern for consumers it is important for companies too, and it greatly influences network externalities that are linked to the product. The fourth article is that of Scaglione et al. (2015), which studies the diffusion of mobile social networking from the perspective of adoption externalities. Adoption externalities lead to unequal benefits of adoption between early and late adopters (Scaglione et al., 2015). As is usually the case with positive network externalities, the benefits were larger for later adopters (Scaglione et al., 2015). The article of Hall & Martin (2005) discusses how “undesirable environmental, health, and social side affects” that radical innovations may lead to are not limited to the actors considered in the innovation value-added chain, i.e. the suppliers, the innovator, customer and complementary innovator, but can also lead to other uncertainties and externalities (Hall & Martin, 2005 & Afuah & Bahram, 1995).

The main differences between these articles and the data material is that the articles considering externalities are mainly theoretical and considering models rather than empirical cases. This naturally leads to differences in methods as well.

4.1.9 The model
On the basis of the results and the analysis above it is reasonable to begin sketching out the model that is the purpose of this thesis. The figure below is created to incorporate most of what has been discussed in this fourth chapter, from the research paradigm, the methods,
level of analysis, focal agent, to the change agents, limiting factors to foreseeing consequences, the consequences, the stakeholders and finally the indirect consequences.

The model seeks to show the findings of my data material. From the top, most articles operated from a functionalist paradigm, that is, from a more objectivist rather than subjectivist point of departure, and a more “regulation” point of view on Burrel & Morgan’s (1979) regulation-radical change dimension. Most articles used surveys and/or case studies with interviews as their methods, and the micro, meso and macro levels of analysis were as common. The perspective on change agents or stakeholders was also equally common. The most interesting part of the model begins with innovation, of which there are different kinds as noted in the model. With values and error & ignorance being factors that hinder the
change agents’ ability to foresee consequences, innovation leads to three main groups of consequences, negative feelings from changes at work, physical consequences on people and environmental consequences. These consequences affect three main groups of stakeholders. The first group of consequences happen to employees at the workplaces where the innovation has been adopted. Physical consequences on people concern mostly adopters, but also employees in some cases, and environmental consequences of course happen to the environment. Finally, there is the possibility of the direct consequences or stakeholders on whom these direct consequences have befallen, to trigger indirect consequences.

The bigger weight given to the arrow from innovation to the first group of consequences, the negative feelings from changes at the workplace, does not refer to the severity of the consequences but rather to the prevalence of the consequences in the data. Likewise for the box of companies as change agents compared to that of the government, the companies were the most common change agents in the data. The clouds “Values” and “Error & ignorance” refer to the factors that hinder the agents’ possibilities to correctly anticipate the consequences of innovations. From the triangles labeled “Employees”, “Adopters” and “Environment” there are arrows going down to the box labeled “2nd generation consequences”. This refers to cases where the direct unanticipated and undesirable consequences give rise to indirect consequences which might in turn give rise to new indirect consequences, and so on. While the arrows are a light grey colour to indicate the somewhat speculative and uncertain nature of these consequences, in most articles only direct consequences are considered, indirect consequences have been found in for example the article by Bhattacharjee et al. (2007) where the decreased time the albums stay on the charts is an indirect consequence of the file sharing technology. The cloud “Merton’s factors” in the bottom right again refers to the different factors that make it difficult for agents to foresee consequences.

The problem with the model is that it is rather complicated and lacking in readability. While it performs the intended function as sought to in chapter 1, namely a model for categorizing the effects and consequences, it includes other information as well. It is not clear that all the information in the model adds value however, hence I followed the advice of Miles & Huberman (1994, p. 226) at this point and created a new, more refined, model.
The advantage of the new version of the model is that it is much simpler. It is indeed easy to
with little more than a glance see what is occurring and why. A detail that also changed is
that the arrows are dashed from the clouds representing Merton’s factors onwards, this
represents the lessened degree of purposefulness at this point in the process. Of course, this
version of the model contains much less information, a factor which is unavoidable when
details are left out. The first model includes more information on what the literature on the
undesirable consequences of innovation looks like, for example in terms of research
paradigm or level of analysis. These factors are not included in this second model. This
second version is more practical in nature and is perhaps better suited for seeing simply
what kind of consequences have been found to happen and to whom, and what kind of
factors most often limit the ability of change agents to anticipate the consequences. From
these different uses follows that those who might show interest in these models, the target
groups in a sense, differ. The first model is likely to be more interesting to researchers and
others whose interest lies primarily in the academic literature. This second model could be more interesting to change agents and stakeholders in real-life situations.
5 DISCUSSION AND CONCLUSIONS
As Foucault’s quote in the beginning of the thesis and the results indicate, unanticipated consequences are present in human action, and diffusion of innovations is no exception. In this final chapter, I will discuss the results, the model, and the thesis as a whole. First, I summarise the findings and then move on to discuss the model that I created based on them. I will try to find the most important practical and theoretical consequences of my model, and discuss how it fits in with previous research. In the third subchapter, I will discuss the contributions of this thesis to research, and give some suggestions for future research that could circumvent the limitations of this thesis. I will move on to consider the research questions that were stated in the beginning of the thesis, whether they were answered and what the answer was. In the end of this chapter, there are some final conclusions.

5.1 Summary of findings
The literature search that I conducted in this thesis found that the majority of the undesirable consequences of innovation, as detailed in academic literature, happen in a work setting. This means that the employer, the organisation, or the employees adopt an innovation that then, apart from possible positive consequences also has negative consequences on the employees. These consequences are either negative psychological or social issues, such as stress, role conflict or less time with family, or physical problems such as backache. Innovations also lead to physical problems for adopters of innovations outside of companies, as well as environmental consequences. These externalities are difficult to monetise, a matter that was mentioned in the beginning of the discussion on externalities.

The most common change agents apart from companies are governments and governmental agencies. Using Merton’s (1936) reasons for the limited ability of change agents to foresee consequences, the most common reasons were values, error and ignorance.

I will next move on to the discussion on the model, the theory, and some interesting cases and implications.

5.2 Discussion on the model and theory
In the discussion below, I will begin by discussing some possible practical uses of the model as well as the influence of the theoretical framework on the model. Next, a short note on how the duality of structure can be seen in the indirect consequences is presented. I will move on to some interesting cases in the data, first Heller’s (2001) article on socio-oecotechnology
and the similarities between the points in it and my model and the theory of externalities, and secondly the article by Geels et al. (2007) and the question of internalising externalities and the moral implications of anticipating undesirable consequences. Lastly, I note that the differences in the prevalence of negative consequences in the literature between my two search words could possibly be traced to the pro-innovation bias mentioned in the introduction.

The model was created strictly based on the findings of this thesis, and only to show what my findings say about the unanticipated and undesirable consequences of innovation. It is therefore a theoretical model meant to visualize the results of my literature search. This is not to say that it could not be useful for change agents or stakeholders dealing with innovation. Considering the pro-innovation bias, simply recognising the fact that innovations can have undesirable consequences to different stakeholders is important. This model does so, but also underlines the main groups of consequences and affected stakeholders. Therefore, the model can be used as a reminder or a warning that innovations, as with all change projects, can lead to negative consequences regardless of whether or not they also lead to positive ones. This is important for companies in that corporate social responsibility and public relations are large issues for many corporations, and so negatively affecting internal and external stakeholders is an enormous risk. Naturally, other change agents are similarly at risk for the negative consequences that might befall them should they cause negative consequences to stakeholders, so the model is not tied to companies only.

The model supports three of Merton’s (1936) factors that hinder agents in foreseeing the consequences of their actions. The benefit of this is that change agents might be reminded to consider uncertainty and reflect the fact that there might be unanticipated direct and indirect consequences to different stakeholders. Merton’s discussion on the factors improved my model and was very useful for the analysis, and while not all of the factors that he proposes were found in the data, there is no contradiction between my findings and Merton’s treatment on the factors. As I have written before in the analysis, the decision on what to judge the reason for the unanticipated consequences to be was to some degree subjective.

In terms of externalities, it might have been made clearer in the model that the consequences can be seen as externalities on the stakeholders. This was not completely supported by my data however, as the consequences were not defined as externalities, so it was not justified.
Having a clear sign that the consequences are externalities might have made the discussion on how to internalise some of the effects clearer. In the case of Katz & Shapiro (1985) (one of the articles considering externalities) the compatibility affected both consumers’ choices as well as firms’ decisions. Compatibility is thus a network externality. Consumers’ preferences for compatibility are not enough to motivate firms to adapt compatible technology, but other factors have importance too, such as a firm’s reputation, technological issues such as whether an adapter between standards can be created, and public policy (Katz & Shapiro, 1985). This again points to the difficulties of internalising externalities and deciding whether it is a reasonable goal (Coase, 1960), where especially in the case of network externalities it may not be. It would have been interesting to add to the model some interaction between the change agents and different actors that try to minimize externalities or make the producers of the externalities internalise them. As was seen in Katz & Shapiro (1985), consumer choices and preferences are not necessarily enough to eliminate the externalities. There is a whole range of actors that might be relevant in expanding the model. In the case of the health problems from psychotropic drugs (Geels et al., 2007) the actor would likely be the state actors (judicial and legislative system), in the case of the greater workload from work-extending technology (Towers et al., 2006) the actors might be trade unions, and so on.

The first version of the model included the indirect consequences of innovation. The indirect consequences come into being through an interplay between the direct consequences and other aspects of the situation. Actors change their behaviours because of these indirect consequences, which in turn affects the different structures in society that Giddens (1984, p. 25) introduced. The duality of structure further states that the new structures and systems in turn affect the behaviour of the actors, which affects the structures and systems, and so on, which is the “recursive interaction” that McAulay (2007) writes about. This is in part a theoretical discussion as no case in the data studied this question. A speculative and potential example could still be given with the help of a case from the data. Towers et al. (2006) found that work extending technology led to less time with family for the employees. An indirect consequence of this could be negative feelings for the family members, leading to a change in action on their part. Were this to happen routinely, a new system and structure would effectively have been come into being, which in turn would affect the employees and their family members. This is one way in which Giddens’ structuration theory and the duality
of structure can be used to think about the n\textsuperscript{th} generation consequences that the original innovation may lead to. This example was as mentioned speculative.

Heller (2001) argues that maximising the utility of technology without taking into account the effect on people leads to problems and cites Trist & Murray as noting that “where the achievement of an objective is dependent upon independent but correlative systems, then it is impossible to optimise for overall performance without seeking to jointly optimise these correlative systems” (Trist & Murray, 1993, p. 587-588). Heller (2001) argues that joint optimisation of many systems is the solution, and adds an oecological system to the socio-technical model. This is similar to my model in the sense that consequences on the environment are included in my model, though not only when they directly affect humans, as was the meaning in Heller’s article. It is also interesting in connection to the theoretical discussion on externalities outlined in chapter 2. The problem with externalities from an efficiency point of view was that they lead to either over- or underproduction. Over- or underproduction was seen from the point of view of society, or a utilitarian view, i.e. a view on how to maximize the utility of all actors in society. This is in essence very similar to Heller’s (2001) underlining of the importance of joint optimisation in order to get the best possible result for the three systems, the social, the technological and the oecological.

Perhaps the most interesting case in the data comes from Geels et al. (2007). In the article, the authors present the case of psychotropic drugs in the 20\textsuperscript{th} century. The drugs, being innovations by both Rogers’ (2003, p.12) definition in the sense that they were new objects as well as for example MacLaurin’s (1953) definition in the sense that they were commercialised inventions, led to unanticipated and undesirable consequences on the adopters. The most grave of these consequences was “accidental death” (Geels et al., 2007). In regards to my model, the case presents a perfect fit, being an innovation that leads to physical consequences to people, i.e. the adopters. My model does not however have a way of classifying the gravity of the consequences, and the gravity is a factor that would be on one hand interesting, and on another difficult to measure and potentially influenced by subjectivity. The case is also interesting to consider with the externality-concept in mind. As a large part of the costs befalls the adopters, the social cost is larger than the private cost (to the pharmaceutical companies). This, according to the theory on externalities presented in the second chapter, leads to overproduction from society’s point of view. What could be done to curb this is take action to make the producer of the externalities internalise the external
costs. Whilst it is impossible to completely shift the costs from the adopters to the producer of the externality in the case of death, internalising could still mean actions such as fines for the company, lawsuits against the individuals in the company responsible for the effects, and so on. I mentioned in the beginning of the analysis that I had interpreted the inability of the company to foresee the consequences as errors in Merton’s (1936) classification, though another reading would have been possible. The decision on how to view the mistakes, whether to see them as “errors” or “values”, has moral implications. Perhaps the more unanticipated some undesirable consequences are, the less morally objectionable they are, though desirable consequences have to also be taken into account. There are other cases in the data that give rise to questions on morality, the one on psychotropic drugs having been an extreme example. In many cases innovations led to negative consequences on employees. Employees are different from medical patients in that they have, at least in theory, the opportunity to leave and end the relationship with their employer. The consequences that they are subjected to have on the other hand been easier to anticipate. Cañibano (2013) for example finds that some innovative HRM practices have negative consequences on employees, for example invasion of work into private life, and stress. These are externalities that befall stakeholders, namely employees and their families. While they are not as grave as the consequences of the psychotropic drugs, it could be argued that they were easier to anticipate. While the moral implications are to some degree outside of the scope of this thesis, it does seem that they might be problematic to an extent.

In my data, more relevant articles were found with the search word “technolog*” than with the search word “innovat*”. The articles that were found with the “innovat*” search word were all explicitly discussing innovation whereas many of the other articles were only implicitly studying innovation. Oftentimes the innovation was framed in a different way, for example as a “technology”, as “automation” or “ICT” (Bhattacharjee et al., 2007; Geels et al., 2007; Rangarajan et al., 2005 & Giuri et al., 2008). It was in the case of articles found with the “technolog*” search word in which I made the decision on whether or not something would be regarded as an innovation in this thesis, whether it was relevant enough to be included. By contrast it was the original researcher(s) who made the decision to define something as innovation in the articles found with the search word “innovat*”. It is therefore possible that the reason for the difficulty in finding articles considering negative consequences of innovation with the original search word comes from the pro-innovation bias discussed in the introduction.
5.3 Contributions and suggestions for future research

The most important contribution of this thesis is the model that categorises the undesirable consequences of innovation and shows the affected stakeholders that have been found in the search of academic literature. To my knowledge, no such model has been done before. This model is important because it shows what the actual undesirable consequences of innovation can be and whom they affect. It thus helps concretise the theoretical discussion of undesirable consequences of innovation and is a counterweight to the prevailing pro-innovation bias.

The literature search with the original search word found that less than half a percent of the articles found studied undesirable consequences of innovation to stakeholders. This search was done with “innovat*” as the search word and with a search string specifically created to find undesirable consequences. This finding shows that the consequences of innovation, especially the negative consequences, are still not being studied in literature about innovation in management, and corroborates the findings of Sveiby et al. who found that only 0.10% of innovation articles consider negative consequences of innovation (Sveiby et al. 2012, p. 66) and Rogers who found that less than 3% of diffusion publications consider consequences of innovation (Rogers 1983, p. 375-377). My findings show that this has not changed in recent years and is therefore an interesting contribution to the literature. This is also interesting in the sense that Callon (1998) saw the identification of externalities as the first step towards pricing them, which is oftentimes what is needed for them to be internalised. With such a small proportion of the literature studying negative externalities of innovation, simply identifying the consequences can be seen as a contribution.

Before discussing the suggestions for future research, I will briefly discuss the limitations of this thesis again. In regards to reliability, the more problematic issues in the method chapter were observer error and observer bias. To minimise observer error I maximised my concentration while searching for articles. I read through and worked with the articles to such a degree that I find it unlikely that irrelevant articles would be included, but it is not impossible that relevant ones can have been missed. Observer bias is unlikely to be a problem because in uncertain situations I erred on the side of including articles whose relevance was uncertain and omitted them later. As noted, the omitted articles have been described in order to increase transparency. In regards to validity, external and ecological validity provide the most interesting questions. External validity, which refers to the
generalisability of the results beyond a specific situation (Bryman & Bell 2015, p. 50-51), is likely high if one compares to articles found in other databases. Generalisability to innovations beyond those that have been studied in this thesis is on the other hand uncertain. It seems likely that there are many innovations that lead to unanticipated and undesirable consequences that are not included in the analysis or the model. This is a problem for the external validity of this thesis. Ecological validity refers to the applicability of the research to people’s normal lives (Bryman & Bell 2015, p. 50-51). The ecological validity could be very high in this thesis. The model refers to precisely those kinds of situations and can be used to lessen the undesirable consequences to external stakeholders that often are employees, adopters, employees’ family members, patients, and so on.

As has been mentioned above in chapters 3.4.2 and 5.1, only cases, consequences and stakeholders that have been found in the data have been included in the analysis and the model. Therefore, the answers given to the research questions given above should not be considered exhaustive, but rather as answers that are contextually defined by this research. Future research could indeed find new consequences and new stakeholders by not using the word “innovation” as the search word for finding relevant articles. Potential alternatives could include “technology”, “change” and “novelty”, for example. This would have the benefit of sidestepping the pro-innovation bias and finding undesirable consequences of innovation through other research. This approach might also give a broader and more balanced view of the negative consequences of innovation. In this thesis, most of the consequences were on employees, and while they undoubtedly are an important stakeholder in many different kinds of innovations, it is likely that a part of the reason for this strong representation comes from the fact that the data was gathered from management literature. If an interdisciplinary understanding of different consequences of innovation is the goal, then a broader spectrum of search words and sources could be considered.

The undesirable and unanticipated consequences that have been studied have, by definition, to a considerable degree already taken place. Future research could study how to best minimise these effects. In some situations removing the innovation is impossible, finding best practices on how to make the best of the situation for different stakeholders would be important.
5.4 Research questions

In the first chapter I laid out two research questions that I sought to answer; “What unanticipated and undesirable consequences does innovation lead to?” and “Who is affected by the consequences?”. Based on the findings of the literature search I created a model that answered both of these questions. The unanticipated and undesirable consequences that innovations leads to are grouped into three groups: negative feelings from changes at work, physical consequences to people and environmental consequences. The stakeholders that are affected are mainly employees, adopters and the environment. This is the way my model, shown in figure 14, appropriately answers the questions.

It is important to note that the model only considers the main groups of consequences that were found in the literature. Two groups were omitted because they only appeared once in the literature and thus were significantly rarer than the other groups. The consequences that do not appear in the model are financial consequences to musical artists, found in Bhattacharjee et al. (2007), and difficulties for patients, which appeared in Bayer et al. (2007). These can be added to the answers to my research questions, though adding them to the model would severely decrease the generalisability. Furthermore, it is important to note that there are certainly more consequences of innovation and more affected stakeholders, which did not appear in the results of this thesis as no article on them was found. Likewise, the indirect consequences are not included in the model, though they were in the first version. The indirect consequences were also clearly found in only two articles, but this may partly be because many of the articles concentrated on direct consequences. Indirect consequences are more complex in that they often are formed through an interaction with other components of the situation to a greater degree than the direct consequences, often become apparent only after some time, and may befall unanticipated parties. The indirect consequences were omitted from the model because they only appeared in a small amount of the articles and were more speculative than the rest, and to increase the readability of the model.

5.5 Conclusions

This thesis counteracts the prevailing pro-innovation bias. It is clear from the research conducted here, and other research before this, that innovations in fact do lead to consequences that are undesirable and objectionable. The pro-innovation bias and the lack of research on negative consequences of innovation comprise a self-inforcing spiral. The lack
of research on adverse consequences strengthens the pro-innovation bias, which in turn partly explains the lack of research. The research in this thesis offsets both parts of the circle.

The findings of this thesis have some practical consequences and implications. It is important for diffusers and other actors that work with or encounter innovations to take into account that there may be unanticipated consequences that may be undesirable. These consequences may of course lead to new indirect consequences. In order to combat this, one should avoid naïveté regarding innovations; avoid a too strong pro-innovation bias. It might be easier said than done, but being aware of the danger of undesirable consequences is a start. This is important in work-settings where innovations demonstrably may very well lead to negative externalities to stakeholders who did not make the decision about whether or not to adopt or diffuse the innovation. Being aware of the possible consequences might also lead to steps to decrease the probability of them taking place, such as involving different stakeholders in the process, launching pilot projects on a smaller scale, and so on.

Interesting are also the consequences that concern others than employees, who to some degree have a freedom to stay or leave. Change agents should assess the risks of consequences concerning patients and the environment carefully as they concern external stakeholders. Furthermore, these examples pose grave risks.
6 SVENSK SAMMANFATTNING

Introduktion
Innovation ses ofta som något centrale för både länder och företags utveckling (se t.ex. Ezell, Nager & Atkinson 2016, s. 4). Det är viktigt att notera att innovationer ändå kan ha såväl negativa som positiva följer. Innovationer leder till oväntade effekter och destabilisering av existerande sedvanor (Aggeri & Segrestin, 2007). Endast en bråkdel av innovationsforskningen undersöker konsekvenser med innovationer (Fagerberg & Verspagen 2009; Sveiby et al. 2012, s. 1) och dessutom präglas innovationsforskningen av en pro-innovationspartiskhet (pro-innovation bias), ett antagande att innovationer är positiva och borde godkännas (Rogers, 1976).

Denna avhandling undersöker de negativa följerna av innovationer. Avhandlingen är delaktig i forskningsprojektet ”The Future of Innovation” vid Svenska Handelshögskolan som leds av professor emeritus Karl-Erik Sveiby. Forskningsfrågorna för avhandlingen är följande:

1. Vilka oväntade och oönskade (unanticipated and undesirable) konsekvenser leder innovationer till?
2. Vem påverkas av konsekvenserna?

Avhandlingens syfte
Avhandlingens syfte är att göra en litteratsökning på oväntade och oönskade konsekvenser med innovationer. På basis av resultatet skall en deskriptiv modell skapas med syftet att kategorisera de effekter och konsekvenser som litteratsökningen funnit.

Definitioner
Innovation definieras ofta som en ny idé (Rogers 2003, s. 12) eller som en kommersialisera rad upfinning (U.S. Department of Commerce 1967, s. 2; MacLaurin 1953). I den här avhandlingen görs en litteratsökning på artiklar som innehåller ordet innovation. Således är det skribenterna till artiklarna som påverkar vad som räknas som innovation i avhandlingen, jag kommer att använda artiklar som skribenterna har menat att handlar om innovation, och jag definierar därför inte innovation här.
Vad gäller konsekvenser, utökas Mertons (1936) definition på konsekvenser till att syfta på de elementen i en resulterande situation som är en följd av en handling, samt de elementen som är en följd av en interaktion mellan den handlingen och andra handlingar.

Oväntade konsekvenser definieras som konsekvenser som orsakas av en innovation och som är oväntade av uppfinnaren och dem som jobbar för spridningen av innovationen.

Med oönskade konsekvenser menas i avhandlingen effekter av en innovation för en som antar innovationen, till en som inte gör det, till tredje parter, sociala system eller till omgivningen, som rimligen kan ses som negativa för den påverkade parten.

Avgränsningar


Som en följd av forskningsfrågorna ovan skall avhandlingen studera artiklar som har hittat oväntade och oönskade konsekvenser av innovationer som påverkat interna och externa intressenter. Därför studeras uteslutande artiklar med empiriska fall, och följder som påverkar förändringsagenter eller företag tas inte i beaktande. En närmare beskrivning av vilka artiklar som inkluderas ges i metod-delen.

Teoretisk referensram


Externaliteter

Externaliteter är effekter som påtvingas tredje parter på grund någon annans handlingar. Externaliteter kan vara antingen positiva eller negativa. Negativa exempel på externaliteter

**Ineffektivitet orsakad av externaliteter**

En negativ externalitet betyder att den marginala sociala kostnaden är större än den marginala privata kostnaden. Skillnadens storlek är den marginala externa kostnaden, alltså externaliteten. Produceuten av externaliteten kommer inte att ta den i beaktande utan maximera privata nytan genom att producera till den grad att den marginala privata kostnaden är lika stor som den marginala privata nytan, vilket leder till överproduktion ur samhällets synvinkel. (Besanko & Braeutigam 2010, s. 703)

Vid fallet av positiva externaliteter kommer produceuten av externaliteten att producera åter till den grad att den marginala privata kostnaden är lika stor som den marginala privata nytan. Den marginala sociala nytan är dock större än den marginala privata nytan, så ur samhällets synvinkel maximeras inte nytan utan en positiv externalitet leder till underproduktion. (Besanko & Braeutigam 2010, s. 714)

**Pigous och Coases traditioner**

**Struktureringsteori**

Giddens’ struktureringsteori förespråkar behovet av att se handlande i kontext av olika sociala strukturer som påverkar handlandet, och likaså se att handlande påverkar strukturerna (Jones & Karsten, 2008). Termen strukturers dualitet (*duality of structure*) betyder just denna växelverkan.

**Konsekvenser av agerande och begränsningar till att förutse dem**


**Diskussion över innovation och forskningsfrågans relevans**


**Metoder**

I detta kapitel presenteras forskningsansatsen, forskningsdesignen, datamaterialet och olika faktorer som påverkar studiens kvalité.

**Forskningsansats**
Creswell (2014, s. 3) anser att forskningsansatser finns på ett kontinuum från kvalitativa metoder, genom blandade metoder (mixed methods) till kvantitativa metoder. Denna avhandling kommer att använda sig av kvalitativa metoder då de lämpar sig bättre i fallet eftersom målet är att få en djupare förståelse och det endast finns få fall, vilket är en nackdel med tanke på kvantitativa metoder.

**Forskningsdesign**


Då artiklarnas relevans bedömdes togs forskningsfrågorna i beaktande. Först och främst krävdes att artikeln handlar om ett riktigt fall, en teoretisk diskussion räckte inte. För det andra krävdes att artikeln handlar om innovation. För det tredje krävdes att konsekvenserna är oönskade.

**Dataanalys**

För att analysera data skapade jag två tabeller med Microsoft Excel. I tabellerna lade jag in olika variabler från data, till exempel vilken sorts innovation artikeln handlade om, vilka konsekvenser som hittades, vem som drabbades av konsekvenserna, och så vidare. Orsaken till att två tabeller gjordes var att den första blev för bred och det gjorde läsandet av tabellen svårt. Tabellen gjordes enligt Miles & Huberman (1994, s. 177-182).

**Data**

Tabellen nedan visar statistik över datainsamlingen.
Tabellen nedan summerar resultatet av litteratursökningen. Kolumnen med rubriken Alla resultat innehåller summan av alla artiklarna med olika sökorden, kolumnen med rubriken relevanta summan av de relevanta artiklarna med de båda sökorden, och kolumnen med rubriken % visar procentuella andelen relevanta artiklar.

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<td>0</td>
<td>0,00 %</td>
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<td>0</td>
<td>0,00 %</td>
</tr>
<tr>
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<td>0</td>
<td>0,00 %</td>
</tr>
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<td>30</td>
<td>0</td>
<td>0,00 %</td>
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<td>1</td>
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</tr>
<tr>
<td>2007</td>
<td>52</td>
<td>2</td>
<td>3,85 %</td>
</tr>
<tr>
<td>2008</td>
<td>65</td>
<td>1</td>
<td>1,54 %</td>
</tr>
<tr>
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<td><strong>1467</strong></td>
<td><strong>7</strong></td>
<td><strong>0,48 %</strong></td>
</tr>
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<th>%</th>
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<tr>
<td><strong>Technolog</strong></td>
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<td></td>
<td></td>
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<td>2002</td>
<td>29</td>
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<td>0</td>
<td>0,00 %</td>
</tr>
<tr>
<td>2004</td>
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<td>0</td>
<td>0,00 %</td>
</tr>
<tr>
<td>2005</td>
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<td>2</td>
<td>4,26 %</td>
</tr>
<tr>
<td>2006</td>
<td>46</td>
<td>1</td>
<td>2,17 %</td>
</tr>
<tr>
<td>2007</td>
<td>54</td>
<td>3</td>
<td>5,56 %</td>
</tr>
<tr>
<td>2008</td>
<td>71</td>
<td>2</td>
<td>2,82 %</td>
</tr>
<tr>
<td><strong>Totalt</strong></td>
<td><strong>331</strong></td>
<td><strong>8</strong></td>
<td><strong>2,42 %</strong></td>
</tr>
</tbody>
</table>

Tabell 7  Litteratursökningens resultat per år

Tabell 8  Litteratursökningens slutgiltiga resultat
Jag valde de relevanta artiklarna efter att ha läst igenom introduktionen, men i tre fall var jag tvungen att senare lämna bort artiklarna då det vid närmare läsning kom fram att de inte var relevanta.

Förutom artiklarna som presenterats ovan har fem artiklar som handlar om externaliteter studerats. Orsaken till detta är att det i litteratursökningen inte hittades fler än en artikel som handlar om externaliteter, och diskussionen om externaliteterna bedömdes bli bättre med artiklar som botten. Artiklarna fick jag av handledaren Karl-Erik Sveiby och de är inte representativa över någon population utan används endast som diskussion och som enstaka fall.

**Reliabilitet, replikation & validitet**

Reliabilitet, replikation och validitet ses av Bryman & Bell som de tre viktigaste kriterierna för att evaluerar affärs- och ledarskapsundersökning (Bryman & Bell 2015, s. 49). Reliabilitet betyder att fall bestäms höra till samma grupp av olika observatörer eller av samma observatör vid olika tidpunkter (Hammersley 1992, s. 67). För att öka på reliabiliteten och få in en form av trianguleringen har forskningsprojektets ledare läst igenom artiklarna jag hittade. Vidare har jag i avhandlingen skrivit ut vilka artiklar som lämnats bort då deras bristande relevans kommit fram.

Replikation är inte ett problem i min avhandling då det är lätt för andra forskare att gå in på Web of Science och göra likadan litteratursökning som jag gjort, och på så sätt replikera denna undersökning.

Validitet är enligt Bryman & Bell det viktigaste kriteriet av forskning (Bryman & Bell 2015, s. 50). Faktorer som kan minska validiteten i denna avhandling är att litteratursökningen är gjord med två sökord, vilket leder till att artiklar som handlar om innovationer men som inte kommer upp i sökningen inte hittas. Då endast innovationer som hittats i artiklarna kan generalisering till andra innovationer vara problematiskt ur validitetssynpunkt. Slutligen nämner Bryman & Bell ekologisk validitet (ecological validity), som handlar om tillämpningen av forskningen i människors vanliga liv. Ekologiska validiteten av avhandlingen är hög, modellen som lämpar sig utmärkt att tillämpas i vanligt liv. (Bryman & Bell 2015, s. 50-51)
Begränsningar

En viktig begränsning är att avhandlingen enbart studerat innovationer som undersöks i tidigare forskning och som dessutom hittats i litteratursökningen. En annan begränsning gäller modellen, nämligen att inte alla fall som hittats i litteraturen är inkluderade. Jag bedömde att det som modellen går miste om i generaliseringsmöjligheter vägs upp av bättre läsbarhet.

Resultat & analys

Artiklarna som hittats i litteratursökningen presenteras i tabellen nedan. Jag har klassificerat konsekvenserna som hittats i artiklarna till fem grupper.

De sista grupperna är Ekonomiska konsekvenser och Svårigheter för patienter, de båda består av ett fall. För den tidigare gruppen handlar det om konsekvenserna för musikartister av fildelning (Bhattacharjee et al., 2007) och för den senare om gamla patienters svårigheter med televård (Bayer et al., 2007).

<table>
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<tr>
<th>Författare &amp; år</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggeri &amp; Segrestin (2007)</td>
<td>Innovation and project development: an impossible equation? Lessons from an innovative automobile project development</td>
</tr>
<tr>
<td>Bayer, Barlow &amp; Curry (2007)</td>
<td>Assessing the impact of a care innovation: telecare</td>
</tr>
<tr>
<td>Cañibano (2013)</td>
<td>Implementing innovative HRM: trade-off effects of employee well-being</td>
</tr>
<tr>
<td>Cucciniello &amp; Nasi (2014)</td>
<td>Evaluation of the impacts of innovation in the health care sector - a comparative analysis</td>
</tr>
<tr>
<td>Giuri, Torrisi &amp; Zinovyeva (2008)</td>
<td>ICT, skills, and organizational change: evidence from Italian manufacturing firms</td>
</tr>
<tr>
<td>Hall &amp; Martin (2005)</td>
<td>Disruptive technologies, stakeholders and the innovation value-added chain: a framework for evaluating radical technology development</td>
</tr>
<tr>
<td>Herring &amp; Roy (2007)</td>
<td>Technological innovation, energy efficient design and the rebound effect</td>
</tr>
<tr>
<td>Rangarajan, Jones &amp; Chin (2005)</td>
<td>Impact of sales force automation on technology-related stress, effort, and technology usage among salespeople</td>
</tr>
<tr>
<td>Thatcher et al. (2006)</td>
<td>Internet anxiety: An empirical study of the effects of personality, beliefs, and social support</td>
</tr>
<tr>
<td>Towers, Duxbury, Higgins &amp; Thomas (2006)</td>
<td>Time thieves and space invaders: technology, work and the organization</td>
</tr>
</tbody>
</table>

Tabell 9 Slutliga datamaterialet
Den vanligaste gruppen av intressenter som blivit påverkade av innovationer är de som tar innovationen i bruk. Det är värt att notera att det inte nödvändigtvis har varit deras beslut att ta i bruk innovationen utan beslutet kan ha fattats på annat håll. En arbetstagare som följer arbetsgivarens order eller en patient som följer läkarens rekommendationer är inte fullt fria att välja hur de handlar. En annan viktig grupp av intressenter som blir påverkade av innovationer är arbetstagare. I flera fall påverkas dessutom arbetstagares familjer indirekt av konsekvenser som i första hand drabbar arbetstagare, detta är fallet till exempel i ökad stress.

Slutligen påverkas även naturen av innovationer, de fall som har hittats har handlat om till exempel minskad biodiversitet, genöverföring till vilda växter och en ökad användning av elektroniska apparater som en följd av att de blivit mera energisparande (Hall & Martin, 2005; Herring & Roy, 2007).

Pilarna i modellen går från innovation till olika konsekvenser som innovation enligt studien leder till. Molnen med "värderingar" och "misstag och okunskap" representerar faktorer som Merton (1936) beskrivit som försvårar aktörers möjligheter att förutse konsekvenser. Pilar går vidare från konsekvenserna till intressenterna för att visa vem som blir påverkad.

**Figur 15  Den slutgiltiga modellen**

**Diskussion, begränsningar och konklusion**


Resultaten av avhandlingen var att majoriteten av de oönskade konsekvenserna som akademiska litteraturen skildrat påverkar arbetstagare. Andra konsekvenser är hälsorelaterade problem och olika negativa konsekvenser till naturen. De vanligaste förändringsagenterna är företag.
Forskningsfrågorna var: "vilka oväntade och oönskade (unanticipated and undesirable) konsekvenser leder innovationer till?" och "vem påverkas av konsekvenserna?". På basis av modellen kan man svara att innovationer leder till negativa känslor på grund av förändringar på arbetsplatsen, fysiska problem och negativa konsekvenser till naturen. Intressenter som påverkas är arbetstagare, de som tar i bruk innovationerna och naturen.


Avhandlingens mest centrala bidrag är modellen som kategoriserar innovationers konsekvenser och de berörda intressenterna, ingen sådan modell har funnits sedan tidigare. Vidare är det viktigt att notera att endast en bråkdel av innovationsforskningen studerar innovationers konsekvenser, 0,83% av artiklarna som hittades var relevanta för avhandlingen. Detta är i stil med vad Rogers (1983, s. 375-377) och Sveiby et al. (2012, s. 66) har funnit.

För att undvika de viktigaste begränsningarna i min avhandling kunde framtida forskning undersöka innovationers negativa konsekvenser på ett sätt som inte kräver att forskaren definierar frågan som relaterat till innovation. Alternativ kunde vara till exempel teknologi, förändring, modernisering, etc.

De viktigaste begränsningarna i min avhandling är att endast fall som hittats i litteratursökningen kunde tas med i analysen, och då innovationer diskuterades utan att explicit använda ordet innovation så blir en betydande del av litteraturen utanför analysen. Vidare är inte allt som hittats inkluderade i min modell. Detta minskar på hur komplett modellen är, men var ett val som gjordes för att öka på läsbarheten av modellen.

Mina resultat på att det är viktigt för aktörer som jobbar med innovationer att ta i beaktande att de ofta leder till oväntade och oönskade konsekvenser. Det är speciellt viktigt på
arbetsplatser där det bevisligen händer att vissa innovationer leder till negativa konsekvenser för arbetstagare.
REFERENCES


The search string that was used is presented below:

(unanticipated NEAR/10 effect* OR unanticipated NEAR/10 "side effect" OR unanticipated NEAR/10 "side effects" OR unanticipated NEAR/10 result* OR unanticipated NEAR/10 impact* OR unanticipated NEAR/10 consequence* OR unanticipated NEAR/10 output* OR unanticipated NEAR/10 externalit* OR unanticipated NEAR/10 pollutant) OR (unexpected NEAR/10 effect* OR unexpected NEAR/10 "side effect" OR unexpected NEAR/10 "side effects" OR unexpected NEAR/10 result* OR unexpected NEAR/10 impact* OR unexpected NEAR/10 consequence* OR unexpected NEAR/10 output* OR unexpected NEAR/10 externalit* OR unexpected NEAR/10 pollutant) OR (unforeseen NEAR/10 effect* OR unforeseen NEAR/10 result* OR unforeseen NEAR/10 output* OR unforeseen NEAR/10 "side effect" OR unforeseen NEAR/10 "side effects" OR unforeseen NEAR/10 internalit* OR unforeseen NEAR/10 pollutant) OR (surprising NEAR/10 effect* OR surprising NEAR/10 "side effect" OR surprising NEAR/10 result* OR surprising NEAR/10 output* OR surprising NEAR/10 "side effects" OR surprising NEAR/10 internalit* OR surprising NEAR/10 pollutant) OR (unintended NEAR/10 effect* OR unintended NEAR/10 "side effect" OR unintended NEAR/10 result* OR unintended NEAR/10 "side effects" OR unintended NEAR/10 output* OR unintended NEAR/10 internalit* OR unintended NEAR/10 pollutant) OR (indirect NEAR/10 effect* OR indirect NEAR/10 "side effect" OR indirect NEAR/10 result* OR indirect NEAR/10 "side effects" OR indirect NEAR/10 internalit* OR indirect NEAR/10 pollutant) OR (negative NEAR/10 effect* OR negative NEAR/10 "side effect" OR negative NEAR/10 result* OR negative NEAR/10 "side effects" OR negative NEAR/10 output* OR negative NEAR/10 internalit* OR negative NEAR/10 pollutant) OR (undesirable NEAR/10 effect* OR undesirable NEAR/10 "side effect" OR undesirable NEAR/10 result* OR undesirable NEAR/10 "side effects" OR undesirable NEAR/10 output* OR undesirable NEAR/10 internalit* OR undesirable NEAR/10 pollutant) OR (environmental NEAR/10 effect* OR environmental NEAR/10 "side effect" OR environmental NEAR/10 result* OR environmental NEAR/10 "side effects" OR environmental NEAR/10 output* OR environmental NEAR/10 internalit* OR environmental NEAR/10 pollutant) OR (systemic NEAR/10 effect* OR systemic NEAR/10 "side effect" OR systemic NEAR/10 result* OR systemic NEAR/10 "side effects" OR systemic NEAR/10 output* OR systemic NEAR/10 internalit* OR systemic NEAR/10 pollutant)