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Dag Slettemeås, Ardis Storm-Mathisen and Jo Helle-Valle

RFID in Society

- Preparing for the Internet of Things

Handbook of Methods

(deliverable 3 of 4)

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PO BOX 4, St. Olavs plass, NO-0130 Oslo, NORWAY

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<p>Summary</p> <p>This report is the third of four reports stemming from the RCN-financed project <i>RFID in Society – Preparing for the Internet of Things</i> (2010-2017). In addition to articles, conference papers, an exhibition, presentations, media contributions and a project website, the project has published the following reports:</p> <ul style="list-style-type: none"> Del. 1 of 4: “Case Criteria & Selection” Del. 2 of 4: “Case Analyses & Evaluation” Del. 3 of 4: “Handbook of Methods” Del. 4 of 4: “Final Report & Summary” <p>The report provide an overview of the main epistemologies and methodologies that researchers face in practical research and innovation projects. Eight academic writings are described, based on theoretical-methodological inquiries of a range of RFID-related (or similar) applications stemming from the <i>RFID in Society</i> project.</p> <p>As present and future technology projects (in particular those that engage with IoT or pervasive systems) are often comprehensive – involving a range of different research disciplines, and combining technological development with social science research – it is crucial that all parties involved understand how knowledge is generated in/through these projects. In addition, innovators (designers, technologists) and researchers (academics) need to understand the premises on which the research is conducted, while policy needs to understand how to interpret the societal consequences identified and described in research outcomes. This latter aspect is particularly relevant to many recent projects that aspire to grasp and find solutions to large societal challenges.</p> <p>The main approaches specified here (positivism/interpretivism) are often considered incompatible (when it comes to being integrated in the same research design). We claim that this not necessarily the case. Combinations are possible, even though “full integration” needs substantial work. Both positivist and interpretivist epistemologies can inform each other, as can deductive and inductive methodologies/reasoning, and quantitative and qualitative methods. Even with substantial ground to cover in terms of achieving integration – it is still an asset for projects to be clear on what epistemological ground is being covered, and how the various research design elements involved are positioned against each other. This is the case of the <i>RFID in Society</i> project. We have made no attempt at integration, but the different perspectives have informed each other, they are applied where relevant to the study object, and they are exposed and critically discussed – being relevant parts of the total research design.</p>		
<p>Keywords</p> <p>Internet of things, IoT, RFID, methodology, epistemology, interpretivism, positivism</p>		

RFID in Society – Preparing for the Internet of Things.
Handbook of methods (Del. 3 of 4)

by

Dag Slette-meås, Ardis Storm-Mathisen & Jo Helle-Valle

2017

Forbruksforskningsinstituttet SIFO, Høgskolen i Oslo og Akershus
Postboks 4 St. Olavs plass, 0130 Oslo

Acknowledgements

This report is the third in a series of four project reports. It describes and evaluates the methodological anchors and achievements of the RCN-financed project «RFID in Society – Preparing for the Internet of things». The project was initiated in 2010, with a project period of three years. Due to unforeseen circumstances at two of the research facilities partaking in the project, the finalisation of the project has been delayed several times, with final completion in September 2017.

The project group decided that even though much of the work has been carried out in different time periods, the project reports (deliverable 1 to 4) should be published at the same time. In this way minor and major alterations could be implemented along the way in order to make the reports as connected and up-to-date as possible. This is particularly important when exploring new and evolving technologies and paradigms such as RFID and the Internet of Things.

The author of this report is Dag Slette-meås (SIFO/HiOA), with contributions from Ardis Storm-Mathisen and Jo Helle-Valle SIFO/HiOA. In addition, several authors have contributed through the papers described in this report; Stefanie Jenssen (post doc, TIK/UiO), Herbjørn Nysveen (SNF/NHH), Per E. Pedersen (BVUC)¹, Astri I. Fotland (master, NHH), and Anina Sætre Bjørnhaug (master, TIK/UiO). In addition, as part of the cross-project cooperation between the *RFID in Society* and the *NFC City* projects, Bente Evjemo (Telenor R&I) and Sigmund Akselsen (Telenor R&I) have co-authored papers.

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Forbruksforskningsinstituttet SIFO
Høgskolen i Oslo og Akershus

¹ Buskerud and Vestfold University College

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Summary

This report is the third of four reports stemming from the RCN-financed project *RFID in Society – Preparing for the Internet of Things* (2010-2017). In addition to articles, conference papers, an exhibition, presentations, media contributions and a project website, the project has published the following reports:

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As present and future technology projects (in particular those that engage with IoT or pervasive systems) are often comprehensive – involving a range of different research disciplines, and combining technological development with social science research – it is crucial that all parties involved understand how knowledge is generated in/through these projects. In addition, innovators (designers, technologists) and researchers (academics) need to understand the premises on which the research is conducted, while policy needs to understand how to interpret the societal consequences identified and described in research outcomes. This latter aspect is particularly relevant to many recent projects that aspire to grasp and find solutions to large societal challenges.

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1 Introduction

This report is the third of four reports stemming from the RCN-financed project *RFID in Society – Preparing for the Internet of Things* (2010-2017). In addition to articles, conference papers, an exhibition, presentations, media contributions and a project website², the project has published the following reports:

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Before presenting the content of this third report, we will first provide a brief background of the main project itself.

1.1 Short introduction to the *RFID in Society* project

The project *RFID in Society – Preparing for the Internet of Things. Researching Opportunities and Obstacles in RFID innovation (or short: RFID in Society)* is funded by the Research Council of Norway (RCN) under the VERDIKT programme. VERDIKT (*Kjernekompetanse og verdiskaping i IKT*) has had a total budget of 1.2 billion NOK in the period 2005-2014. In mid-2010, 204 million NOK was awarded to 21 projects within the areas of social networks, Internet of Things (IoT) and mobile internet. The *RFID in Society* project received funding as a “researcher project” (*forskerprosjekt*) under this call. SIFO³ has been leading the project, and TIK (UiO)⁴ and IMK (UiO)⁵ and SNF (NHH)⁶ has been project partners. The project commenced in 2010, involved a two master projects (TIK, NHH) and a post-doc position (TIK), and was completed in September 2017 (delayed due to unforeseen circumstances).

The backdrop for this project is the rapid growth in applications for RFID⁷ and sensor technology, and the emerging vision/paradigm of a future *Internet of things* (IoT). IoT has recently become a central theme in European and Norwegian ICT research politics, while RFID and other enabling technologies (sensors, actuators, etc.) are considered to be key components in a global IoT system. Advocates project vast economic opportunities and societal gain from IoT-development, while critics see enormous challenges (privacy, security, disruption, social effects, etc.) inherent in this technological move.

The aim of the project was to address this situation. It set out to study how novel technologies (such as RFID) and emerging paradigms (such as IoT) can affect individuals/consumers and

² Cf.: <https://rfidociety.wordpress.com/>

³ SIFO – Forbruksforskningsinstituttet, Høgskolen i Oslo og Akershus: <http://www.hioa.no/Om-HiOA/Senter-for-velferds-og-arbeidslivsforskning/SIFO>

⁴ TIK – Senter for teknologi, innovasjon og kultur, Universitetet i Oslo: <http://www.sv.uio.no/tik/>

⁵ IMK – Institutt for medier og kommunikasjon, Universitetet i Oslo: <https://www.hf.uio.no/imk/>

⁶ SNF – Samfunns- og næringslivsforskning, Handelshøyskolen i Bergen: <http://www.snf.no/>

⁷ RFID – Radio-frequency identification

community/society. This implied a focus on “people-centric” applications of relevant technology and policy, while addressing both opportunities and challenges when such technology enter everyday life. SIFO had already, in late 2000, addressed the emerging consumer aspects or RFID/IoT in conferences (Slette-meås 2007a), to policy/government (2007b) and journal articles (Slette-meås 2009). At the time of project initiation, research (in particular in the Norwegian context) on individual/societal consequences of RFID/IoT was scarce, and had so far not properly addressed the socially complex and many-faceted nature of this type of technology and its relationship to social environments.

The project proposed that new approaches were needed in order to understand the role and function of RFID/IoT in society, and how this technology in the future may radically affect economic and social life. The aim was to develop several methods for studying such innovations from different practical and theoretical perspectives, primarily by identifying relevant cases to be studied (pilots, actual applications, future visions). The outcome of this research aspire to support future Norwegian research/innovation as well as policy/organised interests when manoeuvring in the RFID/IoT field.

1.2 Background for this report (Del. 3 of 4)

Regarding the fragmentation in RFID- and IoT-related research, on aspects such as individual use and/or societal implications, knowledge generation does not easily translate from one study to the next. Frequently, a whole range of issues need to be addressed when studying various RFID/IoT innovations and their implications for individuals and society. The *RFID in Society* project has delved into this complexity by generating knowledge from a range of different case studies. In the next phase, of writing academic papers, the project researchers have employed different perspectives, hence being theoretically multi-disciplinary and methodologically multi-pronged. The project research questions and its main theoretical perspectives have worked as guides for the dedicated papers, as well as the more specific research questions posed.

This project does not relate to one type of technology or innovation, with only one goal or research interest. It has been consciously designed to avoid being framed – and hence constrained – by one specific theoretical/methodological paradigm. The researchers in the project comes from different academic disciplines, and are representatives of these various disciplines and related theoretical-methodological perspectives. In this way, the project has aspired to capture, not only different RFID/IoT applications, but also how these can be studied differently – and what implications this approach can have for knowledge production. In order to succeed with this, it is critical to be aware of one’s own epistemological or meta-theoretical anchoring.

As SIFO has been part of two IoT-projects under this research call, we have also co-authored several papers where insights from the various cases across the projects are drawn on in a comparative fashion. We will come back to this in the descriptions of the case studies in the practical methods section, which describes the papers written and the various methods used.

1.3 Guiding research questions

Now we return to *RFID in Society* project and its overarching theoretical-methodological design. At the outset of the project, the researchers used three main themes – and related research questions (RQs) – as a central guide for all the studies conducted, in order to position theoretical and methodological choices.

Hence, the first – and overarching – research theme/question (accounting for, and incorporating the three themes below) was:

- RQ1): How can the findings from the three RQ-themes below be analysed in an integrated manner, and be developed into a methodological design/framework for studying future innovations and potential consequences (opportunities and obstacles), both on a micro (individual) and macro (societal) level?

Furthermore, the first RQ-theme (incl. RQ2 and RQ3) related to macro structures and the role of technology in society (associated with Science and technology studies [STS] and Actor-Network Theory [ANT]). The research questions posed were:

- RQ2): Regarding RFID and IoT innovation; how can the social and the technical be studied together, and can we view the social as assembled by way of these technologies (objects and artefacts)?
- RQ3): How can actors (human/non-human) be identified and viewed in this field, and how to can we study the movements and transformations, and the ways in which actors take part in changing society through making technology ‘their own’?

The second RQ-theme (incl. RQ4 and RQ5) related to macro and micro orientations, as individuals engage with RFID technology/IoT environments on a variety of conceptual and practical levels, and in shifting contexts (associated primarily with risk/trust theories and domestication/appropriation theory). Hence, the guiding research questions were:

- RQ4): How can we study RFID in practical use in order to get a deeper understanding of RFID/IoT applications, and the potential opportunities and challenges they pose for individuals?
- RQ5): What method can best reveal the processes in which people tame, appropriate and domesticate these technologies into their everyday life?

The third RQ-theme (RQ6 and RQ7) related to the micro-level; how individuals adopt RFID (or similar) technology and what factors explain these adoption processes (associated with acceptance/adoption models). Hence, these research questions were posed:

- RQ6): What are the antecedents of consumers’ adoption of products and services incorporating RFID technology, and how do product/service category and consumer typologies moderate the effects of the antecedents of consumers’ adoption?
- RQ7): What are the antecedents of consumers’ adoption of products with RFID technology that are integrated with other technologies, and do product typologies and/or consumer characteristics potentially moderate these effects?

As stated in RQ1 above, a key part of the project is to develop a practical research-based *methodological framework* (based on actual studies and applications used on the project) that can be applied and guide future research on RFID and IoT innovations. The main argument for this is that RFID and IoT (and related technologies) cannot easily be studied using the same method across cases. RFID/IoT should rather be addressed as components that are pending in/between various social/technological situations, in the form of services that people interact with at different practical and conceptual different levels. This involves includes everything from small RFID chips to grand IoT visions. Furthermore, RFIDs (or related technologies) are rarely just RFIDs – they are often part of “products” that bear different names, and that may have RFID as a *central feature* of their functioning, or they may have RFID attached as a *secondary feature*. Such technology may function in the “background”, either being invisible to the user or

being out of reach (i.e. as part of a supply chain system), or they may be highly visible, operating in the “front end” where users can actively engage with the specific technology/product/service. The *RFID in Society* aspires to grasp the diversity of these various RFID-related technologies/products and their applications through a multi-pronged methodological design.

1.4 Guiding theoretical perspectives

The theoretical perspectives presented below have guided the academic debates and investigations in the project. However, the frameworks of ANT, domestication and adoption models have mostly been applied in the academic papers and presentations published (or in the process of being published), and less so risk/trust theories.

Actor-Network theory (ANT)

This theory was developed in the mid-1980s in order to explore tools and ways of doing research that took seriously the ways in which technology forms an integral part of society, enabling individual as well as collective agency (Callon 1986, Law 1986, Latour 1987). Within ANT, the social and the technical can be studied together. Rather than being understood as a theory in its own right, ANT can be seen as a tool for exploring and describing how the social is assembled by way of technologies; objects and artefacts (Latour 2005). This is one reason why this approach is considered particularly fruitful in the *RFID in Society* project. Another reason is the concern with ‘translations’ (a translation sociology) and ‘users’. This is due to a thorough concern with the study of movements and transformations (Latour 1987) and the ways in which actors take part in changing society through making technology ‘their own’. This concern with users, and how usage matters to technology acceptance and development, adds to the “fertility” of the approach. Thirdly, ANT is relevant because of its interest in the *role of knowledge* in what is often the ‘second modernity’.

Domestication theory

Domestication studies reveal relevant issues to be explored when people attempt to *adopt*, *appropriate*, or *domesticate* technological artefacts. Traditionally anchored in Media and Cultural Studies, the domestication perspective implies a perspective on how people ‘tame’, or make technologies ‘their own’ in a domestic/private setting. This means that such technologies should not only be viewed in a mere functional way, but that technologies (objects and mediated content) have to be meaningfully integrated by their users into everyday practices, and must be studied accordingly (Silverstone et al. 1992, Lie & Sørensen 1996). This perspective has been subject to various attempts of revision (i.e. Helle-Valle & Slettebakk 2008), in order to turn the notion of domestication away from the private and the domestic, to more general processes of ‘taming’ and ‘familiarising’, which is highly to innovation studies. In this way, it can be applied more widely, to areas where individuals engage with technologies in a variety of shifting contexts.

Technology adoption models

In the adoption literature, only a few studies have been conducted on understanding the antecedents of consumers’ adoption of products and services incorporating RFID technology (i.e. Müller-Seitz et al. 2009, Cazier et al 2008). The existing studies on RFID adoption among consumers are based on traditional adoption models used to predict adoption criteria for visual and often interactive products and services. An RFID tag is often just a minor (and not very salient) part of a product or service. Hence, the antecedents of adoption of products and services incorporating RFID tags may differ compared to traditional technological products and services. Therefore, new drivers of adoption for RFID-incorporating products and services must be explored. Cazier et al (2008) and Sill et al. (2008) focus on adoption of products with RFID technology in general, while Müller-Seitz et al (2009) focus on consumers’ adoption of RFID technology used at an electronic retail corporation. In general, RFID technology can be used in a wide variety of consumer products and environments. Hence, the significance of various

antecedents of consumers' adoption of RFID products will vary across products involving RFID technology. Furthermore, individual differences, i.e. gender (Nysveen et al. 2007) cause differences concerning antecedents of product and service adoption. Although somewhat discussed in the literature on companies' adoption of RFID (e.g. Roh et al. 2009, Vijayaraman et al. 2008), the integration of RFID technology with other technologies is not highlighted in the studies on adoption of RFID products among consumers. The potential increase in complexity, but also the potential increase of benefits, by integrating RFID products with other systems, may change the significance of adoption antecedents among consumers.

Risk and trust theories

Beck's seminal work *Risk Society* (1992) introduces the risks and hazards that are produced in the modern world of industrial and scientific development. These are considered *manufactured risks*, associated with uncertainty and unpredictability. In terms of theories on trust, this aspect emerges as a central, multi-level theme in several existing RFID-studies, both in terms of technological security/safety of pervasive systems, and in terms of ethical/privacy concerns. Luhmann's (1973; 1979; 1988) perspectives on trust is also highly relevant in this context. Luhmann addresses trust as a mechanism for *reducing social complexity* in modern societies. Trust becomes the answer to specific risk problems, or a way to handle uncertainty, whether real or anticipated. When new technological systems pervade society and reduce the possibilities of creating relationships based on *personal trust*, individuals resort to *system trust*. Hence, system trust is activated when the complexity of a system increases and the trust relationship must be expanded. Luhmann points out that trust is an implicit part of a larger system of technology, regulations, institutions and people, and must be studied accordingly.

Furthermore, distinctions are often made between *tacit* and *reflexive trust* (Lagerspetz 1996). Tacit trust is implicit and unspoken (unbroken trust), while reflexive trust refers to situations where trust is made explicit (reasons for 'activating' trust). This trust dichotomy is a relevant perspective on trust in RFID-IoT environments, as RFID often appears concealed or invisible. Reflexive trust does not necessarily stem from a self-experienced distrust in something/someone. In modern media-saturated societies, the probability that consumers have been notified of actual or possible trust breaches, or risks (Nilsson et al. 2000), through mass-media or interest organisations (privacy/consumer groups), is high. Public perception of large-scale innovations have proved to be swayed by media discourse (Anderson et al. 2009, Slettebakk 2009), affecting the innovation climate, and the pace and direction of development and implementation.

2 Theory and method intertwined

Before we address and describe the various methodological approaches used in this research project, through the papers published (or in the process of being published), it is crucial to repeat the *close relationship between theory and method*. In many instances, researchers may have a “favourite” theory or perspective that they want to test on a social reality. In many instances, the methodical approach is not always well anchored in the theoretical perspective, due to constraints such as lack of resources or lack of relevant knowledge. Hence, as the method is the “channel” or medium between the social reality and the theory, theory and method must work together to best describe, capture or co-construct reality (depending on epistemological foundation).

Nevertheless, this does not mean that theory and method are part of a given or predetermined relationship. Many new discoveries are done by breaking away from such fixity, testing new combinations of methods and theories. However, it is pertinent that researchers clarify why they choose a given theory – and method – when studying a phenomena (cf. Slettemeås et al. forthcoming). Often, this part is left out in research papers, either because of lack of space, or because this aspect is not properly reflected on. And, as part of this reflection – which ideally should be open to the critical gaze of other researchers through clear descriptions – lies the epistemological foundation. This guides which perspective and framework that are compatible with which method – and what aspect of social reality that can be studied when applying the given theory/method combination.

In this project we work within a social science paradigm. Even though most innovation projects entail a great deal of technological design and development, in the end it is made for (and by) people/users. Hence, the ultimate goal is to make people use technology/innovations, or to understand why they don't, or what effect the technology has on society and culture – which again implies the effect it has on society *through people's uses of it*. Hence – unless one believes that innovations are made in a social vacuum – identifying, understanding, interpreting or predicting use and social effects are central to all technological innovations.

2.1 A note on research paradigms

A *research paradigm* is the overarching set of common beliefs and agreements that should exist between scientists about how a problem is to be addressed and understood (Kuhn 1962) – or how researchers should agree on the ways in which a phenomenon should be studied, and what knowledge can be generated in the project by which means. There are many ways to describe the elements of a research paradigm, but there is generally some consensus in social sciences that we are dealing with components such as ontology, epistemology, theoretical perspective, methodology, methods and sources (data). Below we present a figure that clearly illustrates the relationship between these components. We will take a closer look at these relationships in the next sub-chapter when discussing the epistemological foundations of research.

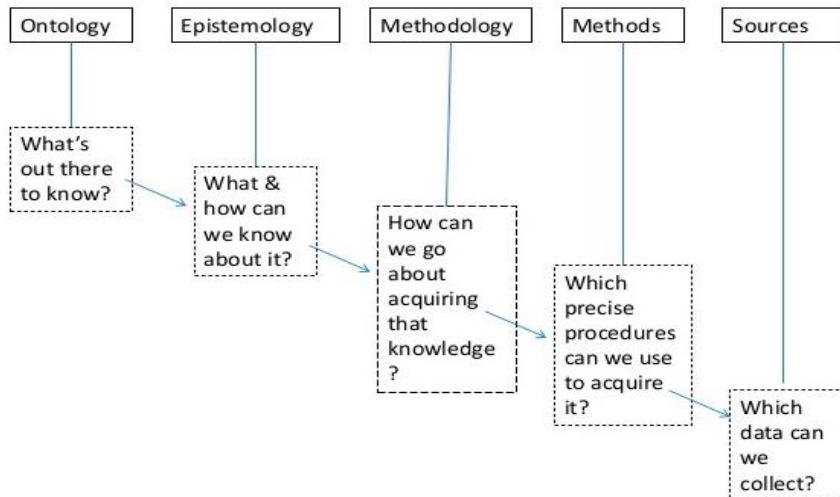


Figure 1: The relationship between ontology, epistemology, methodology, methods and sources – and what they contain. Source: <http://eissr.blogspot.no/2016/01/ontology-epistemology-and-methodology.html>

Often it is primarily *theory and method* that is addressed and described in projects and papers. Still, it is important to *be aware of all the components of the research paradigm* that the project is positioned within. Otherwise, project researchers may go in different directions, generating contradictory knowledge claims, while not being aware of the other researchers' positions. As Patel describes in a net-based resource⁸; “your ontology and epistemology create a holistic view of how knowledge is viewed and how we can see ourselves in relation to this knowledge, and the methodological strategies we use to un-/discover it”. Furthermore, Patel states that these more philosophical assumptions will increase the quality of research and also spur the researchers' creative sides. Additionally, we will claim that when it comes to large innovations projects, that it will increase the *coherence* of the various research tasks undertaken in the innovation project, and support a shared holistic view of the phenomena studied by the researchers involved (which may come from various research/academic disciplines)

2.2 A note on epistemology

In this report we aim to be fairly brief and descriptive when it comes to laying out the methodological approaches in the project. The point is to address why we have used these various perspectives and methods, and how this can inspire other research projects that have an innovation agenda or that fall under the “applied” research umbrella. Still, it can be relevant to repeat some basic theoretical guidelines, which all social science/humanistic research should adhere to.

Epistemology is the meta-theoretical foundation on which theories (and methods) are based – also called the *theory of knowledge*. It is crucial and relevant for researchers to know their epistemological foundation, or how they shift between different foundations, or try to bridge them in an eclectic manner (cf. pragmatism). This is because the epistemological stance indicates how the researcher identifies *what he/she consider as valid knowledge*, and how one come about to obtain it.

It is crucial (but often omitted in research projects and related publications) to state which position one holds, as this give an indication of the academic lens that is applied when approaching the research object. Often it is confusing for other researchers (not invested in the

⁸ Cf: <http://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language>

project) to read analyses that do not clearly state which position is taken when doing the analysis (conducted with a certain set of theories, methods and sources of data). Patel⁹ notes that many research practitioners, in particular those involved in applied research projects, are not sure which research paradigm they belong to. He sketches three main paradigms; *positivism*, *constructivism* and *pragmatism*. *Positivism* claims there is a single reality that can be measured and known, and hence practitioners tend to apply quantitative methods to measure this reality. *Constructivism* does not accept such a single reality or truth, and hence believe reality must be interpreted. Hence, the notion of *interpretivism* is used as the epistemological concept for the constructivist ontology¹⁰.

Below we see that *two main paradigms* have been split into an objectivism/constructivism dualism (ontology) and a positivism/interpretivism dualism (epistemology). We find this figure highly useful in terms of keeping track of *where to position a research paradigm*, and how to label and explain the various levels involved in each of them.

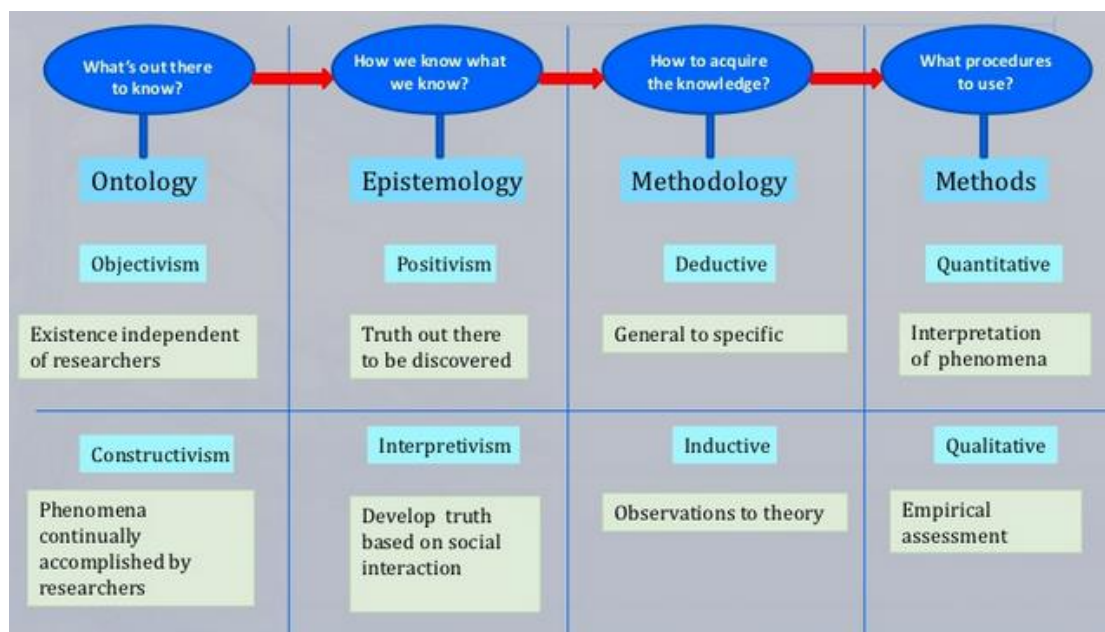


Figure 2: The relationship between ontology, epistemology, methodology and methods – and the dualism of objectivism/positivism and constructivism/interpretivism. Source: <http://eissr.blogspot.no/2016/01/ontology-epistemology-and-methodology.html>

The epistemological stance of any research endeavour furthermore guides the methodological approach chosen. We see that a positivist epistemology naturally invites a deductive-type methodology or reasoning (and quantitative methods). This type of reasoning works from the general to the more specific, hence it is often referred to as a "top-down" approach. Theories are identified in the literature, and relevant hypotheses tied to the research project are formulated and tested empirically, confirming or disconfirming the theory/model chosen. On the other hand, we see that interpretivist epistemology invites inductive methodology or reasoning (and qualitative methods), which on the contrary often starts with specific observations, detecting certain patterns and regularities, that inform broader generalizations, conceptual development or theories – thus often referred to as a "bottom up" approach.

⁹ Cf: <http://salmapatel.co.uk/academia/the-research-paradigm-methodology-epistemology-and-ontology-explained-in-simple-language>

¹⁰ The focus here is limited to positivism and interpretivism as the two main paradigms. Therefore, a discussion on pragmatism is left out.

Below we have used two figures from a net-based resource that illustrate this relationship well¹¹:



Figure 3: deductive methodology/reasoning or top-down approach vs. inductive reasoning or bottom-up approach. Source: <https://www.socialresearchmethods.net/kb/dedind.php>

In the next sub-chapter we try to elaborate on the epistemological substance of these two primary paradigms, namely the positivist approach and the interpretivist approach.

2.2.1 The positivist approach

There are different explanations to what a positivist inclination in research entails. Below we have gathered, from various sources, some basic assumptions that tend to be associated with the positivist approach:

- Reality is single, tangible and fragmentable¹².
- There is an objective reality that can be studied, and that independent of people and of the human mind (epistemology)
- In research, this implies that the researcher is separate from the reality and the research object(s) studied (ontology).
- This reality can be known objectively through empirical study.
- Macro-oriented (top-down) – look at society as a whole (sociology).
- Society has objective social facts that can be measured as natural science facts.
- Society exerts influence on people and shape their actions.
- Hence, people's actions are explained by social norms/background (sociology) or inherent psychological characteristics (psychology)
- Research should remain detached and value-free
- Aim of research is to unveil the laws governing human action, and to explain how and why things happen.
- Time and context-free generalisations (nomothetic statements) are possible¹³
- Methods strive for objectivity, reliability (replicability), validity (data truly measures reality), representativeness, generalisation (from sample to universe)
- Typical methods are quantitative; surveys, questionnaires, official statistics, structured interviews, experiments, content analysis
- Oriented towards hypothesis testing
- Prefer large samples and/or artificial locations (for control purposes)

¹¹ Cf: <https://www.socialresearchmethods.net/kb/dedind.php>

¹² Cf. Lincoln and Guba 1985

¹³ Ibid.

2.2.2 Interpretivist approach

As for the positivist approach, there are also many ideas of what signifies the interpretivist or constructivist approach. One general notion is that it is often seen as the “opposite” of, or a contrast to, positivism (and often results in a critique of the latter). Below we have gathered some basic assumptions, from various sources, that tend to be associated with the interpretivist approach:

- Realities are multiple, constructed and holistic¹⁴.
- Knowledge about the world and reality is constituted through a persons lived experience (epistemology)
- There is no reality that can be considered independent of people. Reality is socially constructed.
- Hence, the researcher and the reality studied cannot be separated (ontology), and the research object is interpreted through the researchers lived experience.
- Micro-oriented (bottom-up) – analyse society by studying individuals (sociology).
- Reality is constructed by meanings created by people, i.e. it is socially constructed.
- Behaviour and action results from peoples own meanings, not external forces or society.
- Hence, people’s actions are results of their own consciousness and meaning-construction. Hence, people understand/experience the same “objective reality” in different ways. Understandings depends on peoples perspective (relative).
- Researchers should develop Verstehen (understanding).
- Aim of research is to gain in-depth insights into individuals and their meanings, to understand why they act as they do – and in general how and why things happen.
- Only time and context-bound working hypothesis (ideographic statements) are possible¹⁵.
- Mutual shaping of all entities, hence it not possible to distinguish causes from effects.
- Methods search for subjective meaning, seek to establish defensible knowledge claims (validity), interpretive awareness, where researchers address the effects of their subjectivity (reliability), generalisation (from one sample/setting to a similar sample/setting).
- Typical methods are qualitative; hermeneutics, phenomenology, unstructured interviews, ethnography, participant observation, personal documents.
- Oriented towards generating theories.
- Prefer small samples and natural locations (for context)

Both positivism and interpretivism are as meta-theoretical perspectives subject to a great deal of critique. Positivism tends not to acknowledge that social life is more complex than “natural” life, and that experiences and actions stem from situated contexts that are not easy to separate or quantify. Hence, methods tend to be too reductive, while there are always some value judgements, personal ideas and so on brought into a study by researchers. As for interpretivism, the opposite can be claimed, that everything becomes socially constructed, and hence nothing is real, true or objective to all – every “fact” is relative, depending on situated views, perspectives and opinions¹⁶.

As well as being a “social science” project, the *RFID in Society* project applies a user or consumer perspective, as we seek to address (among other things) how users/consumers interact with RFID/IoT-related technologies/services. An interesting, although several decades old, article (Lutz 1989) addresses the need, also in consumer research, to elevate individual studies

¹⁴ Cf: Lincoln and Guba 1985

¹⁵ Ibid.

¹⁶ Cf. For example <https://www.slideshare.net/menmaatre.kiya/sshm-exam-revision>

in terms of their “paradigmatic” anchoring. Not only those philosophically inclined, but also practicing consumer researchers (as the author himself), need to revisit epistemological paradigms, due to the plethora of research work that have different ideas of how knowledge is generated. As a way to label the overarching or meta-theoretical positions, he refers to positivism and the research tradition we call interpretivist, but which he refers to as postpositivism, interpretivism, postmodernism or naturalism – and which he ends up referring to as *naturalism*. He also advocates the more eclectic view, drawing on both epistemologies – which is referred to as *pluralism*.

Lutz’ paper points to the paradigm shift (Kuhn 1970) experienced at that time (end of the 1980s), where many consumer researchers started rejecting the positivist approach, and turning to naturalism as the new “guiding paradigm for knowledge generation” (Lutz 1989:1). Lutz furthermore directs attention to Validity Networks Schema (VNS), which shows how research contains three interconnected domains – the *conceptual*, the *substantive* and the *methodological*. The ordering of these domains indicates the fundamental difference between positivism (conceptual-methodological-substantive) and naturalism (substantive-methodological-conceptual), in Lutz’ view.

Considering the *methodological domain*; this is where questions of epistemology arise, according to Lutz; or how the research conducted is evaluated in terms of what type of knowledge it generates. And positivism and naturalism (interpretivism) are very different in this sense. Qualitative procedures (naturalism) stands somewhat methodologically opposed to the quantitative and experimental procedures (positivism), and even more opposed in terms of how reality is to be understood or explained. Positivism seeks causal explanation while naturalism does not believe in “linear causality”, but rather seeks *Verstehen* – a rich understanding of the phenomena studied. Lutz concludes thus that “the roots of scientific inquiry [between the two positions] are axiomatically different and affect epistemological judgements about the merits of various methods and strategies” (Lutz 1989) – and that it is *in the methodological domain that the differences between the positivist and the naturalist paradigms are most striking*.

When positivism is challenged by the wide naturalist paradigm, where does this leave the field (of consumer research) Lutz asks. Two suggestions are 1) a complete schism, or 2) some integration of the two paradigms in a more pluralistic paradigm. Lutz claims that the latter is difficult, but that the former is not a viable option at all – some rapport must be sought¹⁷.

Weber, in a 2004 article, agrees with this position, that a clear separation between the two paradigms is futile:

"As researchers, our goal is to improve our knowledge of some phenomena. Different research methods and different data-analysis methods have different strengths and weaknesses. They provide us with different types of knowledge about the phenomena that are our focus. Moreover, different research methods have different strengths and weaknesses depending on our existing knowledge about the phenomena. If we are to be consummate researchers, we need to have a deep understanding of the strengths and weaknesses of different research methods and data-analysis techniques. We also need to have a deep understanding of the different sorts of knowledge we obtain using different research methods. In my view, obtaining this understanding is inhibited rather than facilitated by the current but longstanding positivist versus interpretive rhetoric" (Weber, 2004).

¹⁷ Lutz suggests Paul Anderson’s critical relativism as something to build on, where a central point is that there is no single scientific method, all disciplinary knowledge claims are based on the position of the researchers (beliefs, values, standards, methods, etc).

Thus we can conclude that *knowledge of both positions* is crucial for understanding the type of knowledge one's own project, and other less familiar projects, aspire to generate. This includes the ways and the sources that can be applied and used to generate knowledge, and finally, to understand that there are possibilities for some kind of pragmatic integration or eclectic use of each or the paradigms. However, this requires a prior familiarity – and understanding – of both positions.

This is the main methodological goal of the *RFID in Society* project – to use both these epistemological-methodological perspectives in the analyses, reflected in the papers published (or in the process of being published). In the final paper presented here, we have sought to use this knowledge (of positivism/interpretivism) to develop an interpretivist framework, by way of a proper critique of the positivist position.

3 Methodological description of studies conducted in the *RFID in Society* project

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. In a way, it encompasses concepts such as paradigm, theoretical model and research techniques. Hence, although they are often used interchangeably, methodology and method must be distinguished. Otherwise, methodology will be shifted away from its true epistemological meaning, being reduced to the procedure itself, or the set of tools or instruments used to gather data¹⁸. The methodology applied provides a more theoretical understanding of which method(s) that fit best to a certain case. It is therefore the *research strategy* that describes the best way to acquire knowledge – often specified by *research problems* – while the actual methods are identified in the methodological description (or are somewhat implied). The techniques for analysing the data gathered can also be specified in the methodology.

Here is a brief explanation of the two different approaches discussed so far, at the methodological/method level¹⁹:

- 1) The *empirical-analytical group* of methods (the positivist epistemology) focuses on objective knowledge, research questions that can be answered clearly, with operational definitions of variables that are measurable. The empirical-analytical group employs deductive reasoning, using existing theory as a foundation for formulating hypotheses that need to be tested. This approach focuses on explanation.
- 2) The *interpretative group* of methods (the interpretivist epistemology) seeks to understand a phenomenon in a comprehensive, holistic way. Interpretive methods focus on analytically disclosing the meaning-making practices of human subjects (why, how, or by what means people do what they do), while showing how those practices arrange so it can be used to generate observable outcomes. The interpretative group focuses more on subjective knowledge, hence its methods allow researchers to recognize their own connection to the phenomena. It also requires careful interpretation of variables.

Hence, it is crucial for any project – not only theoretical ones, but also more applied research and innovation projects – to specify not only which methods or procedures are applied, but also to the extent possible, why they are applied, how the resulting data should be analysed, and what knowledge comes out of this work. Then others will be able to critically evaluate the validity and reliability of the study. This is crucial in a world where disciplinary borders dissolve, and where developers and academics conjointly take part in the same knowledge creation, but with widely different backgrounds in terms of how to generate and interpret knowledge.

¹⁸ Cf: Wikipedia – «methodology»

¹⁹ This grouping is adapted from the University of Southern California – research guides. Cf: <http://lib-guides.usc.edu/writingguide/methodology>

In this sub-chapters below, we report on the various methodological approaches used in the different studies conducted in *RFID in Society* project (and some cross-project efforts that attempt to compare/contrast applications).

The examples provided here are based on the case studies presented in report 1 and 2, and on papers/manuscripts that have been published, or that are in the process of being published (submitted, resubmitted). The chapters will *not focus on the finding or outcomes* of the studies, but *describe and discuss the methodological approaches* used. The relevant references to each study/paper will be provided in dedicated appendices at the end of the report. In order to make the sub-chapters more readable there will be no direct referencing.

3.1 Study 1 – Exploratory multiple-case design

References:

- Slettemeås, D., A. Storm-Mathisen & J. Helle-Valle (2017). *RFID in Society. Preparing for the Internet of Things. Case Criteria & Selection (Del. 1 of 4)*. SIFO professional report nr. 2-2017. Oslo: SIFO
- Slettemeås, D., A. Storm-Mathisen & J. Helle-Valle (2017). *RFID in Society. Preparing for the Internet of Things. Case Analyses & Evaluation (Del. 2 of 4)*. SIFO professional report nr. 3-2017. Oslo: SIFO

3.1.1 Introduction to the study

In the first report (deliverable 1 of 4) of the *RFID in Society* project, we identified and mapped what types of technology/systems/applications (and related products/services) the project should focus on. As part of the mapping process, the research team identified criteria for both selecting cases and for organising them. Both criteria, and relevant cases, were deliberated on in a multi-step iterative process of inclusion and exclusion.

All cases were first arranged in a simplified template, where only a few key criteria were used in order to provide an accessible introduction to the cases. By following the simplified template, and adding insights from the previous iterative tree-structuring process, we developed an extended template for case description. In this process, the criteria were also modified to fit the cases, and the number of cases were gradually reduced to fit the criteria.

The second report (deliverable 2 of 4), describes the actual cases explored in more encompassing studies. We followed the explorative/descriptive multiple-case design. The cases were organised to provide the following information; case-specific information, relevant technologies and functions, user aspects, and societal issues and controversies. However, the cases (and researchers) varied, and so did the case descriptions and their layout.

3.1.2 Description of methodological approach

As a methodological framework, we followed a *case study approach* (Flyvbjerg 2006, Yin 2006, 2009). Case studies are common in the interpretivist tradition, and focus on interpretation and meaning rather than “facts”. Although our case study approach does not aspire to be theory-building, we still consider its descriptions to fall under the interpretivist paradigm. Yin (2006) states that compared to other methods, the strength of the case study method is its ability for in-depth examination of a case within its real-life context. Case study research enables investigation into novel topics and cases. In our project, the aim was to illuminate particular RFID-enabled applications (the units of analysis) to get a better understanding of these. Yin (2009) claims that case study design should not be considered merely a data collection tactic or design feature, but as a research strategy.

The case study method can refer to either single- or multiple-case studies. One may have chosen to study a unique or revelatory case. In our case, we focussed on specific services with a particular technology, or set of technologies, either embedded or attached. It is suggested that a formal case study screening procedure should be conducted, which was done in our case; starting from a simple set of criteria for choosing cases, then expanding the criteria through an iterative process, while at the same time reducing the potential cases to study. Hence, it can be specified as a *multiple-case study*, as all cases are described separately, but within the same research design goal.

Furthermore, our case study research strategy can be labelled “exploratory” or “descriptive”, rather than “explanatory” (Yin 2009). The goal is not to test or derive theory, but rather to acquire systematized insight for later selection and analyses. But even exploratory case studies, leaning on modest existing knowledge, should still be guided by; what is to be explored, the purpose of exploration, and the criteria for judging the success of the exploration. Selecting the proper cases (if many are available) is a critical issue. The *case selection or screening* goal is thus, according to Yin (2006), implemented to avoid the scenario whereby, after having started the actual case study, the selected cases turn out to not be viable or to represent an instance of something other than what you had intended to study. Hence, this initial phase of the research process is important, both to get *valid cases* as well as to secure *efficient use of project resources*.

The first task (described in deliverable 1) was to explore a variety primarily RFID-based cases, with some connection to citizens/consumers in the Norwegian context. The proximity of RFID systems to users reveals a range of opportunities and obstacles for product/service development that are not as prevalent in many other traditional industry/business applications. The idea was to identify cases at different *levels of maturity*, both due to practicalities (available cases) and to include the aspect of different ‘*life phases*’ of systems. Hence, early in the project the research group found it necessary to identify and map what types of applications the project should focus on. As part of the *mapping process*, the research team needed to identify *criteria* for both *selecting* cases and for *organising* them. Hence, it was decided to hold several *workshops* at an early stage where cases and criteria could be deliberated.

The inspiration for how to conduct case selections, and the subsequent case evaluation, stems partly from the work commissioned by the *European Technology Assessment Group (ETAG)*²⁰, in particular the report “RFID and Identity Management in Everyday Life” (ETAG 2006). The case study approach used in our project worked in a similar fashion, although the cases and the indicators/criteria for assessing the cases, were different. The study also used a similar method to the ETAG study (a funnel approach); first exploring a wide range of cases, then reducing these in terms of how relevant and typical they are for the constructed categories.

Then the process of *selecting relevant criteria* followed, through an *iterative process* of adding/excluding criteria, and specifying these in a *tree-shaped structure*. The next step in search for relevant cases for more extensive studies, was to use the structure and ideas generated from these iterations, and further narrow the focus to *specific cases in the Norwegian context*. Hence, information about relevant cases was gathered and the researchers initially explored 20-30 different cases. These were tested against the various specifications in the structuring approach. Potential cases were gradually eliminated, one by one, as they were found to be incompatible with the design, or for practical reasons, e.g. if too little information was available.

This iterative process of investigation and exclusion, resulted in 13 cases to be explored further. All cases were first arranged in a *simplified template*, where only a few key criteria were used in order to provide an accessible introduction to the cases. By following the simplified template and adding insights from the previous iterative tree-structuring process, an *extended template*

²⁰ Report prepared by the Rathenau Institute, The Netherlands.

for case description was developed. The extended template was adjusted in the process of fitting the various cases into the template. As the final template was ready, 13 cases were entered into the table system, and it was decided that more encompassing case studies should be conducted for 9 of these 13 potential cases. These are described in report deliverable 2. In terms of methods used in the 9 case studies, these were qualitatively oriented. First, desk research and literature review were conducted in most cases. Furthermore, some level of fieldwork was employed in nearly all cases. Researchers were observing applications-in-use, as well as taking part in personal testing of applications, and conducted interviews and informal talks with relevant actors, stakeholders or end-users/consumers. Field notes were taken, interviews recorded, and in most cases photo documentation was part of the “observation” process.

3.1.3 Brief evaluation

In terms of methodological anchoring, the *case study design* is positioned within the interpretive epistemology. However, in this case, the design does not seek theory-generation, but rather description and exploration. The use of a *multiple-case study approach* was an important first step of the research process, and central to the general methodological strategy of the *RFID in Society* project. It allowed the researchers to map the situation and get a picture of the relevant landscape of novel RFID-technology implementation in Norway. As the project was *not* an innovation project *per se*, but rather a research project, the research group had to rely on identifying *existing and piloted* use cases, and get access to information about these, and the possibility for conducting field-work, observations, testing, interviews, and so on.

The advantage of this *iterative mapping process*, with inclusion and exclusion of both criteria and cases, was the *overview* it gave of the “RFID-scenery” in the Norwegian context at the time. It provided the researchers with the ability to start with a wide fan, and then narrow down the cases to a manageable number to focus on. The multiple-case study approach allowed for three main benefits; in the preliminary stages, we could identify and describe single cases, focusing on the specifics and uniqueness of each case. Later, as the set of criteria used for evaluating cases was in place, giving the cases a comparative component, we could also see the cases together through the multiple-case design. Finally, the case descriptions allowed for further inquiry, such as more extensive methodological study and academic writing.

3.2 Study 2 – Intention to use RFID-enabled services

Reference:

- Fotland, A. I. (2012). *Intention to use RFID-enabled service. Theoretical review and case study*. Master thesis, Norges Handelshøyskole, spring 2012.

3.2.1 Introduction to the study

The ambition of this thesis is to shed light on the antecedents of consumer intention to use RFID-enabled services. The basis for the study is that RFID-technology is increasingly being introduced in the market for consumers. It is claimed that RFID-based technology has mostly been confined to B2B-services/logistics, but also banking an in-store services for retail companies. Much of the research is also focussed on technical aspects, and on increasing efficiency and reducing costs for companies. However, due to the increase in consumer-related applications of RFID, attention has turned to how consumer values and perceptions can be enhanced. The thesis states that the true value of new RFID-services can only be realized when consumers embrace these. The study thus claims that it is important to conduct research that can provide a better understanding of the intention to use and actual adoption processes of RFID-products among consumers, by looking at both what encourages (drivers) and discourages (barriers) intention to use, and actual adoption. Hence, the study is affiliated with the positivistic epistemology.

In this study, a *model is developed* and a range of *hypotheses tested*. A survey is conducted, representative for the Norwegian population, on hypothetical RFID-services for a cross-country skiing manufacturer. The service experiment is founded on the idea of an identification technology that makes every ski from the manufacturer traceable, from the factory, via the store, and through consumer usage. The service optimizes the skiing elements, material as well as for use, making the skiing experience unique and tailored to each user. The idea is for the skis to be implemented in a database, where data can be accessed through personal apps. Personal suggestions will be formed on how to prepare the skis and which tasks to choose, as well as distance covered.

3.2.2 Description of methodological approach

The study is positioned in the positivistic paradigm, within the *information systems (IS)* research tradition. The thesis refers to how a main issue within IS is to identify factors that can cause people to accept and makes use of technological systems. Thus, a key ingredient for those developing and introducing new systems/services, is to predict (future) behaviour, and/or to influence behavioural actions. RFID is a new type of innovation, that few consumers have previous experience with, hence it may be considered novel, unfamiliar or deterring. Therefore, this study finds it important to identify the relevant drivers that *influence intention to use RFID-services*, as well as identifying the drivers that *facilitate actual adoption*. In the thesis there is also a highly valid point, that much research on users beliefs/attitudes are conducted *after adoption*, and it is stated that beliefs and external stimuli thus is more relevant for studying continued-use behaviour. Factors affecting usage, i.e. *decision-making*, may be different compared to the *initial adoption* stages. It is therefore claimed that identifying pre-adoption criteria remains a critical issue for IS research, in particular for technologies in their early stage of implementation.

In the thesis, the author describes how RFID products lately have come “closer to the consumer”, and that some studies show that positive emotions towards RFID correlates positively with positive attitude towards products with RFID tags, and that particularly negative aspects such as privacy risk likelihood/harm also should be included in analysis. Findings indicate that one should not only focus on improving the perceived value of RFID, but also on reducing perceived risk (comment; and *actual risk*. This is relevant to many new technology systems that are highly connected and pervasive). It is getting increasingly more difficult for users to determine the extent of, and in what ways, information about them and their usage/habits are communicated to other parties. As products increasingly get unique identifiers, and communicate this identity (and that of their users), privacy is challenged. At the same time the privacy paradox is signalled; that users display high concern about digital privacy, but rarely engage in precautionary behaviour themselves.

For identifying recurrent predictors of intention and acceptance/actual use, there is a need to *develop a model* that reduces the complexity of reality, sorting out the main predictors (antecedents) of intention/use. The study applies the Unified Theory of Acceptance and Use of Technology (UTAUT), and, based on empirical studies and additional cognitive/affective theories, the model is extended with three additional determinants and moderators. Theoretically, the study has considered several “adoption/acceptance” models and their abilities to successfully predict technology adoption, and the UTAUT model has been exemplary, accounting for 70% of the usage intention in several studies. Furthermore, the UTAUT model originates from three other theoretical models; the theory of reasoned action (TRA), the theory of planned behaviour (TPB), and the technology acceptance model (TAM).

The main attribute of these models is that they are focussed on *cognitive structures* affecting the consumer decision process (of acceptance/non-acceptance), either directly or indirectly through intervening or moderating variables, that can explain and predict choice and behaviour.

The *TRA model*, finding its origins in the field of social psychology, aims to explain the relationship between *attitude and behaviour*, and it seeks to predict how individuals will behave based on their pre-existing attitudes and behavioural intentions. The key belief is that an individual's decision to behave in a certain way is based on what the person expects will be the outcome of performing that behaviour. The theory states that if people evaluate a behaviour as positive (attitude), and think other relevant people want them to perform the behaviour (subjective norm), this leads to higher intention (motivations) to act.

The *TPB model* is also a psychological theory linking beliefs and behaviour, but it seeks to improve on the predictive power of the TRA by including perceived behavioural control. The model suggests that behavioural intention not always leads to actual behaviour (behavioural intention cannot be the exclusive determinant of behaviour). An individual cannot always control own behaviour due to various constraints.

Finally, the *TAM-model* is a more specific *information systems theory* modelling *how* users come to accept and use a technology. It is one of the most influential extensions of TRA so far. It states that the main factors influencing people's decisions to accept a technology are *perceived usefulness (PU)* and *perceived ease of use (PEOU)*. These two measures replace many of the attitude measures of TRA. TAM (as TRA) assumes that when someone forms an intention to act, they will be free to act without constraints (as opposed to TPB). The thesis explains that TAM is more specific to technology system characteristics, and the model centres on user acceptance/rejection of new technology by explaining the relationship between psychological variables (beliefs, attitudes, behavioural intention) and technology use. This is where the theoretical contribution lies. TAM aims to provide a general explanation of determinants of technology acceptance, being valid across a broad range of technologies.

TAM has been continuously expanded, with two major upgrades being the TAM 2 (including the construct "subjective norm") and the UTAUT. The UTAUT was developed as a framework to deliver a higher prediction of success in terms of technology adoption. It was based on a review of eight validated models and their extensions. The intention behind it was to assess the likelihood of success for new technologies, and to understand the drivers of acceptance in order to design interventions for those less inclined to use the technology.

Hence, the theoretical outline is presented, and the model proposed (based on UTAUT) seeks to *explain intention to use products/services facilitated through RFID technology*. It is stated that the antecedents and moderators will build on general perspectives of RFID adoption theory and specific models attempting to explain intention to use RFID products. The author claims that although UTAUT is of a more general character, it is presumed that it will be applicable to the RFID context. However, certain elements are added to provide more accuracy to the model. The model is built and tested through a set of hypotheses, that have been formulated based on theory and earlier empirical studies. This includes system-related factors (of technology) and personality traits (of users), as well as privacy concerns, emotional system responses, and experiences. Furthermore, moderators are added in building the model, such as situational context, and perception of control.

For the purpose of testing the model, and exploring the hypotheses, a pilot cases study was devised. This was the first step in an innovation effort to develop RFID-services for a Norwegian ski manufacturer. This signalled a move from a conventional product innovation process – where the customer is just a receiver of value creation – to a service-dominated logic where the customer takes part in the co-creation of value. At the same time, by adding such services to products the manufacturers themselves are able to capture more of the value-creation throughout the product life-cycle, the thesis states. The pilot sets out to design and test 8 potential scenarios exemplifying real service scenarios, based on purchase of new skis and the future use of these. The basic scheme is that users have a long experience in purchasing and

“adopting” skis, while the new service-offerings are the new unfamiliar adoption scenarios that consumers must relate to.

The method used to gather data for exploring the hypotheses and testing the model, was an online survey of a representative sample of the Norwegian population (N=560). These were recruited by a professional company, respondents were e-mailed, and could answer the questionnaire by clicking on a link to the survey. All respondents were exposed to one of the eight service descriptions, and each description was manipulated with one of two moderators (consumer perception of control with personal information used in the services, or if RFID was used as a social or individual service), while each manipulation was developed for both an *affective* and *cognitive* usage context. Then analyses were performed. The results showed that only “performance expectancy” and “anxiety” were the predominant antecedents of intention to use the RFID-enabled services, while “experience” showed moderate influence, indicating that extending the UTAUT did not add to the predictive efficiency of the model (rather making it more complicated and less sophisticated).

3.2.3 Brief evaluation

In terms of methodological approach, this study is based on the positivist epistemology, being highly theoretical in the sense that it seeks to build and test a general model (based on an RFID-specific technology scenario). The focus is on explanation rather than interpretation. As the “technology” (the enhanced ski-service) being tested was not yet developed, researchers (and developers) were interested in *consumer intention to purchase and use such services* – in the future. To do this they had to rely on a hypothetical service, described in the survey material presented. This guides the methodological design by way of finding factors that can explain or predict future adoption. For this purpose, the researchers considered the UTAUT model fruitful. The advantage of such modelling is that one can use existing research, and theoretical contributions, to develop hypotheses that can be tested. Various antecedents and moderators can be explored, and either be discarded or validated as relevant for explaining future behaviour.

As the material object (cross-country skis) in this case was a traditional product with a long history of adoption, while the RFID-enhanced “ski-service” tied to the physical product was a novel service with no adoption history, it was crucial to separate exactly “what” was the relevant object of future adoption. Predicting such future adoption is highly difficult. Interpretive research paradigms yield more context and relational understanding, but have a hard time explaining future adoption opportunities more generally. At the same time, positivistic paradigms and predictive modelling attempts, are better at theorising and testing the causal relationship between relevant variables, but are often limited in terms of “oversimplifying reality”. Hence, all paradigms have limitations that need to be accepted and explained. This gives the best ground for understanding their contribution to the relevant research task.

3.3 Study 3 – Consumer adoption of RFID-enabled services.

Reference:

- Nysveen, H. and P. E. Pedersen (2012). “Consumer adoption of RFID-enabled services. Applying an extended UTAUT model”. *Information Systems Frontier*, 18, 293-314.

3.3.1 Introduction to the study

The study outlined in this article is based on the same experimental design as the master thesis described in the previous chapter. An extended version of the UTAUT model is applied to

explore the applicability of several antecedents of acceptance of (eight versions) of an conceptual RFID-enabled ski-service (description). UTAUT was originally developed for an organizational setting, but has later been validated for consumer contexts. It is the testing of the model that is the key focus of the study, and the results indicate significant influences from performance expectancy, effort expectancy and technology anxiety on the attitude to use the described RFID-enabled ski service. The authors refer to the lack of studies of RFID adoption, and that the few existing ones are mainly of RFID technology itself, focusing on antecedents such as system perceptions and personality traits in explaining RFID acceptance.

3.3.2 Description of methodological approach

In a similar way as the master thesis, the study falls within the positivist epistemology. The article applies an extended version of the UTAUT model, and includes technology anxiety and privacy risk harm as influencing people's acceptance of new technology-based services. The authors build the model by referring to a range of previous studies, and include antecedents related to system perception, personality traits and social influence. The advantage of the UTAUT, as stated earlier, is that it has shown superior predictive validity compared to other adoption models, and it is a highly comprehensive model (compared to i.e. TAM). In addition to this, the study adds moderating variables to the UTAUT model, such as gender, age and experience. Also, it is claimed that moderating variables are largely neglected in existing research on adoption of RFID-enabled services (such as situational and personal characteristics). By including such moderators, a more nuanced understanding of which factors affect technology adoption can be generated.

An important aim of testing these moderating variables is of course to *develop and strengthen the model* applied, but it also gives *information about certain segments of consumers*, and how to approach these with marketing mix measures. Hence, there is an academic as well as practical/commercial contribution in this study. In addition, the actual testing of the UTAUT model on eight different versions of the RFID-enabled ski service means that the study provides a foundation for generalizing the results to a variety of contexts for RFID-enabled services.

The study reviews previous empirical (and non-empirical) studies on acceptance of RFID-technology, and summarizes these. The authors find that most of the studies seek to explain *intention to use*, rather than *actual usage* of RFID, which is probably due to the lack of RFID services available in the consumer market. Hence, several studies use service descriptions/scenarios as stimuli. Applying *actual usage* as a dependent variable (as in the original UTAUT) becomes difficult, and the studies mainly use intention or attitude. As the study referred to here is also based on service descriptions, the *intention/usage* variables are switched to *attitude/intention*. However, it is emphasized that the focus is still on "usage constructs" (attitude to use) and not "object constructs" (attitude to technology). The research model is built by applying the antecedents of performance expectancy, effort expectancy, social influence, facilitating conditions, privacy risk harm and technology anxiety as background variables, gender, age and experience as moderating variables, and attitude to use and intention to use as dependent variables. Then hypotheses are generated about the degree of influence of the variables on each other.

The method used in the empirical study (in order to test the hypotheses, and investigate the influences of the proposed antecedents on intention to use RFID-enabled services) is based on a quantitative approach, using an online survey (N=560). Respondents were provided with an introductory text and eight variations of the service concept description. Each respondent was only exposed to one version of the description. Both those with and without skiing experience could answer the questionnaire. To measure the variables, various items were used (between two and six for the variables used).

The study claims to contribute to research in several ways; the study takes a comprehensive perspective on explaining acceptance of RFID-enabled services by applying a “contextualised version” of UTAUT (in itself comprehensive being a synthesis of eight different models), while other studies typically have a more narrow approach. Hence, the model can capture more nuance when addressing RFID-enabled service adoption, which is needed, as RFID-services appear to have other characteristics than “simpler” technology products.

The study also claims to have managerial implications, where designers of RFID-enabled services can use the results. For example, performance expectancy points to a strong focus on making services that are perceived as useful to targeted consumers (by e.g. engaging in co-creation activities with users), and effort expectancy, addressing the importance of developing user-friendly services (by e.g. consumer involvement in service innovation).

For future research, the study suggests that qualitative research should be performed, where RFID-enabled services, and issues affecting adoption, are discussed in more depth with potential customers, identifying other criteria for adoption than the antecedents applied in this study – antecedents that later can be tested quantitatively. This, again, may provide for models explaining a higher level of variance in intention to use RFID-enabled services in future studies of technology adoption. The authors claim that the results are not specific to “ski-services” with RFID, but can be generalized to other sports, such as running or biking.

3.3.3 Brief evaluation

When it comes to methodological approach, this study (as the previous one) is based on the positivist epistemology. This deductive approach is concerned with developing hypotheses based on existing theory, and then devising a research strategy to test the hypothesis. The point of such deductive reasoning is to study “the particular” – or the case – and seeking general validity (that what is found may be true for many cases). Hence, the focus is on *explaining* general relationships rather than interpreting the complexity of the particular.

To sum up, the research design and methodology applied here is both theoretically and practically oriented; first building and testing a model where the findings can be generalised to other similar technologies and use-contexts. This knowledge serves the academic community. In addition, there is a practical/managerial outcome, with some substantial advice to managers/designer on how to develop products for future adoption. Finally, what is lacking in this kind of studies is more in-depth knowledge on the situational aspects affecting user adoption, or intention to adopt. Models aiming for general validity tend to lose sight of the particular. This is where more inductive methodologies could complement such deductive methodologies. This particular study proposes to bridge this gap in future studies by suggesting that qualitative research should be performed, to help identify other criteria for adoption than the antecedents applied in the study. This is in line with the main aim of the *RFID in Society* project, of providing synergies and linkages between disparate research disciplines (with apparently incongruent epistemological stances) through a common practical research project.

3.4 Study 4 – RFID in toll/ticketing: a user-centric approach

Reference:

- Storm-Mathisen, A. (2014). “RFID in toll/ticketing – a user-centric approach”. *Info*, 16, (6), 60-73.

3.4.1 Introduction to the study

This study discusses two RFID-based services from the transportation sector; a) public transportation ticketing and b) toll collection on public roads. The study applies a *user-centric approach*, drawing on perspectives from sociology, anthropology and STS (science and technology studies). A premise for the study is that the notion of “RFID” for a long time has been used as a collective concept covering a range of technologies that resemble each other. Several studies addressing adoption of RFID tends to see technology (here; RFID-products) as a fairly homogenous technology product group (for example positivistic information systems (IS) studies, such as the two previous ones), with specific variables affecting user adoption of technology in a linear cause-effect relationship. This study, on the contrary, is based on an interpretive epistemology, applying inductive methodology and reasoning. With this approach, RFID-technology, the user, and the immediate user-technology relationship (among other contextual factors) are considered relevant for identifying and analysing why and how a technological solution is perceived, adopted and used.

In the transportation solutions presented here, *RFID is central to the functioning of the applications*, and should represent a core value to the consumer. However, the degree of consumer value *is not given* (although articulated by providers); it depends on a range of contextual and situational factors – and this is what the study attempts to address (theoretically) and to identify (empirically). The applied methodology also addresses any discrepancies between supplier-proclaimed and user-experienced benefits (or hassle/risk) associated with the RFID-applications. It is critical to identify and understand such discrepancies when new technology solutions and systems are being developed and marketed. The findings from the study reveal that RFID applications are heterogeneous products signified by different levels of maturity, complexity, and are being adopted by diverse user groups. This implies variations in expectations, functional requirements and privacy concerns. As a consequence, the theoretical and methodological perspectives must be broadened to encapsulate the actual heterogeneity of RFID-applications as well as the relevant nuances of users – and user adoption/appropriation criteria.

3.4.2 Description of methodological approach

This study, is as already stated based on an interpretive epistemology. Inductive methodology and reasoning is applied with the aim of exploring and detecting patterns and regularities that can inform theory, based on situated specific observations, being more open-ended and exploratory. Regarding the two different RFID-applications in the study, these are examined from a *social science perspective*, based on *radical practice theory*, where a combination of *domestication theory* and *actor-network theory (ANT)* is applied. Within domestication and ANT, there is an inclination towards using *ethnographically inspired* methods. The reason for this is that both perspectives seek to come close to the user, observing and interpreting their actions and discursive utterances – as they happen. It is the *situated experiences* of the users that can provide the most relevant knowledge for understanding the actual “success” of RFID-applications. Hence, it is a *reflexive case-based approach* where experiences with RFID technology are contextualised in the relevant settings of usage, identifying and describing the social mechanisms that link the actual user experiences with the wider socialities of which they are part.

The ideal of the radical practice perspective applied is the insistence that *practice should “speak for itself”*, opposite to the positivist notion of structurally formed models determining or explaining behaviour. It also implies a *non-representational theory of meaning*, which insists that *meaning is always anchored in the practical settings where the expressions of meanings are found*. Furthermore, discourse and practice are not opposites. Rather, the discursive is an element in a wider practical enactment of doing. With such an approach, the materiality of things is important to capture, as well as the capacity of things to act on their surroundings.

This is where ANT becomes relevant to the methodological approach, where researchers “follow the actor” (here; the RFID-applications). ANT involves detailed empirical studies of the interplay between technology and users, and the social is seen as a product of such engagement

In the study the *comparative technique* implies studying a) the specific RFID technologies/products (ticketing and toll collection), b) their history and related public discourses, and c) seeing how the “social is assembled” through RFID-applications in use. To support this methodological approach, the paper applies some conceptual tools from domestication theory, which allows the researcher to grasp and describe how “RFID” moves from the public sphere of production/market into the more private meaning domain of individual/household consumption – in a process of taming and domestication. The four concepts of appropriation, objectification, incorporation and conversion are used to structure the data and analysis.

In addition to comparing/contrasting the two applications, the perceptions of suppliers and actual users are also compared in the study, by gathering data on the discursive presentation of RFID by suppliers, as well as data on RFID experiences and interpretations by users. This implied *desk research* (reports, documents, newspapers, online debates, blogs) and *interviews*, covering the time interval from implementation till present-day. A small *in-situ fieldwork* was also conducted to gather data on *actual user practices* (using photo-/video-assisted observations and interviews), following users of the two applications in their daily engagement with the technology. The fieldwork generated data where the discursive could be analysed as elements in the wider practical enactments of “doing travel with RFID” (through ticketing and toll-collection). It also provided data on user experiences with the *prior “travel systems”* that existed before RFID implementation. Such insights are highly relevant to the analysis, as no new technological system is implemented into an ahistorical social vacuum. Users draw on experiences with previous systems, and negotiate previous practices and interpretations, when they consider or engage with new systems. Hence, the methodological design (using various perspectives and data gathering techniques) is capable of capturing the nuances of what plays into and generate the different user perceptions of the two RFID applications.

3.4.3 Brief evaluation

Contrary to the two positivistic approaches in chapter 3.2. and 3.3, this interpretive approach is tailored to the research task at hand. The aim is not to predict future behaviour of some experimental RFID-service. Hence, rather than devising a more or less decontextualized model, stripped of rich situational substance, this study applies a more inductive methodology, using various methods to achieve in data and analysis. It is, however not entirely explorative, but guided in theoretical-methodological terms by radical practice theory, domestication theory and actor-network theory. Hence, the approach applies a rich contextual fan, seeing the RFID-enabled services, the users, and the immediate user-technology relationship relevant to understand how the services are perceived, adopted and used. In addition, this approach allows for comparative techniques to study the two services (ticketing and toll collection), and to study the diversity supplier-consumer perceptions/interpretation of the same RFID-enabled services. This is done in a *real life* context, and not in an experimental, de-contextualised setting. Therefore, stringent modelling is not a viable option in terms of research strategy. Rather, the strategy chosen is that of using various theoretical perspectives [domestication, ANT], methods [desk research, interviews, in-situ fieldwork]), based on an overarching interpretive epistemology.

3.5 Study 5 – A user perspective on transport ticketing

Reference:

- Storm-Mathisen, A., Evjemo, B. & Helle-Valle, J. (n.d.). “From smartcard to smartphone: A user perspective on transport ticketing.” Manuscript ready to be submitted to peer-reviewed journal.

3.5.1 Introduction to the study

The analysis in this manuscript is based on two different studies, originating from two different research endeavours; one «researcher project» (RFID in Society) and one «innovation project» (NFC City), both under the same RCN call on IoT. The study contrasts and compares two ticketing solutions in two different Norwegian cities. Hence, it differs from the study above that contrasts and compares user interpretations/experiences with *two different transportation sector solutions* (ticketing vs toll collection).

The study addresses the rapid technological development over the last ten years within ticketing technology, driven by providers striving for increased efficiency and reduced costs. The study also acknowledges that the transportation sector is one of many consumer-related fields that look into *Internet of Things (IoT)* technologies. The IoT-vision of an ecosystem of smart applications and services to improve and simplify citizens' lives is central to the EU Digital Agenda. These transitions are costly to implement and their *success rely on consumer acceptance*. It is therefore critical to *understand the complexity of user experience* and the significance of *contextual use of RFID-enabled services*. The article thus takes a user/consumer perspective on recent developments in public transport ticketing – from cash/paper, via smartcards to NFC and app based ticketing on smartphones. The central aim is to address *user experiences* of this transition, by comparing developments in two Norwegian cities. The empirical data is analyzed within a *practice theoretical framework* based on *domestication* and *actor-network theories* (partly similar to the previous approach). The findings show that consumer *appropriation* of new ticketing technologies is different from that envisaged by providers, and linked to user's experiences with preceding ticketing tokens and solutions. This underlines the importance of *contextualizing* and attending to the *practicalities of interactions between technologies and users* when new ticketing solutions are designed and launched.

3.5.2 Description of methodological approach

The methodological approach is based on an interpretive epistemology, and the theoretical framework (building on perspectives from sociology and anthropology) recognizes *the complexity* of contactless technologies and simultaneously enables a *contextualization of user-experiences*. In order to examine how various types of contactless applications are experienced and used by consumers, the study privileges *practice* – what people actually do – applying tools and perspectives from *domestication* research and actor-network theory (ANT). This approach is similar to the one described in the previous chapter, with the aim to analyze transitions from paper to card ticketing.

The two theories share an *insistence on practice* and hold a *critical approach* to the application of *models* (either rules constructed by the actors themselves or by researchers in order to make sense of a complex reality), as models cannot capture and explain the whole of social reality, the article claims. Hence, to understand the uses of contactless technologies one must study both what people *say and do*; the interplay of bodily movements, the materiality of the contactless technologies, and the practical situation that this interplay takes place in. Domestication and ANT are fruitful analytical perspectives in combination as they illuminate different aspects of user practices. Domestication theory directs attention to different 'stages' where the technology/service moves from 'alien' technology to a fully 'familiarized' artefact, while ANT enables the researcher to describe and analyze the dynamics, progressions, routines and the complexity of actual usage and how *things* make things happen.

The theoretical angle, and the insistence on a practice perspective in data gathering and analysis, naturally invites *qualitative methods* to investigate consumer experiences with ticketing solutions and the social mechanisms involved. Hence, a reflexive multi-methodological research strategy is applied. This method is designed to *compare* consumer experiences with the two ticketing systems in two Norwegian cities (the Ruter smartcard plus mobile app in Oslo

and the Troms-kortet on smartcard plus NFC-trial for smartphones in Tromsø). This strategic choice of cases provides a good foundation for comparisons and for generalizations. The multi-method approach draws on various sources of data; media coverage, public reports, surveys, interviews and field observations of people travelling.

The exploration of the *practicalities involved for users* of the various ticketing solutions is here guided by the *domestication perspective*. This approach emphasizes how technologies move from production to consumption (via the market; from object, to product, to artefact), being tamed by users through the processes: *appropriation* (practical usage of the service), *objectification* (placement and display in an environment), *incorporation* (temporal integration into everyday practices) and *conversion* (when technologies are communicated to the public world, indicating a person's status and social belonging). The use of these “conceptual” phases makes it easier both to focus on the temporal as well as spatial aspects of technology appropriation, in addition to simplifying the organisation of empirical data in analyses. Through this analytical tool, the study reveals that transition from tickets on a plastic card to the mobile phone has required *fewer new practices* to be acquired by the consumer than did the change from paper-based tickets to plastic cards, since these users were already familiar with the mobile technology.

However, there are other elements to consider in understanding consumer appropriation of new technology. Central to the *actor-network perspective* is to ‘follow the actor’ (here the RFID-applications) and look at “how things make things happen”. Hence, the *mapping of public controversies* around new technologies was used as an analytical tool. This helped identifying the various actors involved in the process, the constellations of human and non-human actors, and how these contribute to re-assembling the social. Comparing the two cases, which are at different levels of maturity (also internally) illustrates the different ‘life phases’ and complexity of the systems., and why appropriation/domestication of RFID applications is challenging. The use of ANT allow for more detailed empirical studies of the interplay between the material and functional aspects of technology and subjects, regarding the *social as a product of such action, not as a precondition*.

The study shows that small changes from a provider perspective can engender considerable impact on consumer practices. This underlines the importance of contextualizing and paying attention to the practicalities of interactions between technologies and users. The use of contrasting and comparison is useful, both to identify differences/similarities in different technological solutions, in user practices, as well as a way to detect the often contrasting ideas and experiences of the same technology seen from the developer vs the user perspective.

3.5.3 Brief evaluation

Based on research emanating from two different research projects, this study enables the researchers to contrast and compare two ticketing solutions, from two different cities. Such studies require an interpretive approach, drawing on a wide fan of theoretical and methodical tools, in order to capture the complexity of user experience and the significance of contextual use of these ticketing services. The advantage of such an approach is that it is not constrained by the presumptions about one-way causal relationships between variables affiliated with simplified explanation models. Rather, the conceptual tools of domestication theory, i.e. the domestication phases, enable researchers to focus on the temporal as well as the spatial aspects of technology appropriation, while actor-network theory provide tools for “following” the relevant actors, be it technologies, users or relationships. As such, the theoretical-analytical combination of tools in this study has made it possible to analyse changing ticketing solutions - from paper or coupons, via plastic cards or smartcards, to smartphones – as well as how previous experiences and practices (with other already domesticated technologies) factor into adoption/appropriation decisions and user habits.

3.6 Study 6 – creating a potential caring technology

Reference:

- Bjørnhaug, A. S. (2012). *Å skape en mulig omsorgsteknologi. En studie av et møte mellom sporingsteknologi og et nytt bruksområde*. Master thesis, TIK, University of Oslo, May 2012.

3.6.1 Introduction to the study

This master thesis seeks to explore how a *tracking technology* can be shaped into a potential *caring technology*. Hence, it builds on a tradition that sees the technical and social aspects of reality as intertwined phenomena. The study uses the coming demographic changes as a backdrop, with an increasing number of elderly and a potential scarcity of health and care workers. This should inspire new ideas of how “to do care”. In this scenario, there is a political push towards innovation in health and caring technology (welfare technology). The study departs from the idea that *existing technology* can be used in new ways, but that this is not necessarily a simple and straightforward process; it involves a constant shaping process, with various actors and arenas involved. There is a co-construction of both users and technology.

This follows a development in the relationship between “welfare/care” and “technology”, from the idea of technology (cold) seen as a contrast to human care (warm), to an understanding of technology and care being mutually constituted. Hence, both technology, and the context it is part of, must “adjust” as they meet and interact. In terms of technology, “tracking technology” is perceived as technology that makes possible tracking and recovery of artefacts or people, with GPS, ultrasound and RFID being relevant to this case study (GPS was chosen for practical reasons). The GPS device functions as an alarm/tracker attached to the person, while the software is embedded in the terminal used by the supervisors.

The framework used in the study employs resources from science and technology studies (STS) and anthropology. These resources provides the author with the capability to describe the work that is put into the “shaping” of the technology, through three different arenas of translation (here; the public arena, a technology supplier, and a caring facility). An ethnographic approach is used to address the shaping and negotiation processes in/on these arenas. The study analyse how tracking technology and care work interact, and “what they become” when they meet each other (their mutual shaping), with many actors affecting/being affected in these translation processes. Both the technology and the care sector are *shaped to something specific* in different arenas (hence reality is not seen a singular and given).

3.6.2 Description of methodological approach

The main research aim, which clearly guides methodological approach of the thesis, is “how a tracking technology is sought to be translated, in different arenas, into a caring technology”. This means that the focus lies on “*what*” is being translated (what is being changed), and furthermore “*how*” this translation work happens (what translation processes are the actors part of). Then, consequentially, rather than addressing welfare and caring technology as something given, the study seeks to explore how the technology is made and shaped when meeting a new context of use.

The theoretical-methodological approach in this study, emanates from constructivist/interpretivist social theory that perceives the social and natural worlds to exist in shifting networks of relationship, hence avoiding any essentialist explanations or assumptions. The study is embedded in STS, which views science and technology as socially embedded. STS involves studies of how social, political and cultural values affect scientific research and technological innova-

tion, and how these latter then affect society, politics and culture. Over time STS has also considered the relationship between technology and user more *mutually constructed*, while ANT seeks to avoid the dichotomy of the social and technical altogether. In addition to STS, the study is inspired by anthropology. Both research disciplines pay attention to and explore the relationship between the material and the social aspects of society (between technology/people, designer/consumer, and expectations/practice). This means that the theoretical perspectives guide the methodical focus towards specific domains of data gathering; i.e. by pointing out the importance of paying attention to what happens at the *boundaries* of the different contexts studied.

To enable this approach, the study methodologically anchors in the theoretical framework “Teknografi”, which draws on analytical resources both from STS and anthropology. It is the interdisciplinarity of the framework that enables the researcher to grasp and explain the ongoing complex techno-social processes from a holistic viewpoint. This is critical as the approach seeks to analyse technology, users, and “care” as intertwined phenomena. It is a highly *heuristic approach*, useful when studying *technology in the making*, following relevant actors and controversies. The concepts used to describe and explore the meeting between a technology and new use contexts are; *script* (the inscription of the innovator’s own visions in the technology), *appropriation* (the taming and meaning ascribed to the technology by the user), *translation* (the process that technology goes through in-between ascription and appropriation), and *modes of ordering* (the steering principles embodied in networks of social relations – how reality is categorized and “done”).

In terms of methods, an *ethnographic approach* is followed, inspired by *multi-sited ethnography* and the methodical principle of “*following the actor*”. Ethnography allows the researcher to participate in the reality studied, to study a phenomenon as it happens and in context, and it allows direct access to the everyday work that is performed. As the creation of a tracking technology as a caring technology happens in many arenas, involving several constellations of actors, a *multi-sitedness* is pertinent. The empirical material is gathered through participant observation, participant listening, and “close-reading” of texts. The data is applied in three separate analyses, as part of the three arenas for translation (the public arena, the technology supplier, and the caring facility). These are then analysed together to get a broader picture of how the tracking technology, and the contexts it is part of, are shaped and changed. There is a constant roundel between theory, concepts and data, and the analysis is an integral part of the fieldwork (not performed separately after data collection). Principles of quality evaluation for qualitative research is followed; such as *credibility*, *transferability*, *dependability* and *confirmability*²¹.

3.6.3 Brief evaluation

The methodological approach described above supports the idea that rather than being singular and given, technology and reality are multiple and context-specific. Hence, the theoretical stance, the concepts applied for making sense of reality/data, and the specific methods and tools used for data gathering and analysis, are connected. The approach is explorative and indicative, abiding by the interpretive/constructivist epistemology. By using such a comprehensive approach, the study is able to capture a range of shaping processes, such as “health-Norway”, laws and regulations, patients, care workers, institutions, “good welfare”, and the physical technology itself. By investigating negotiations between actors with both coinciding and contradictory interests, the outcomes prove to be effects of specific practices and contexts. Hence, nothing is predetermined, leaving predictions of effects nearly impossible prior to investigation. It is therefore argued that it is critical to take into account the *unpredictability of the technology*, both when designing it, when making political guidelines, and when establishing new routines for technology use at institutions. The non-positivistic approach and methodology applied here is essential both for exploring and understanding this aspect. This approach is fruitful when

²¹ Cf: (Lincoln & Guba 1985).

studying other application areas, where existing technology is applied or embedded into new use cultures. In these instances it is the “meaning conversion” related to this process that needs to be studied (and which is the “novelty”), rather than the technology itself.

3.7 Study 7 – Counting with RFID in Norwegian apparel

Reference:

- Jenssen, S. R. (n.d.). "Bodies matter: Counting with RFID in Norwegian apparel". Manuscript ready to be submitted to the peer-reviewed journal.

3.7.1 Introduction to the study

The study positions itself in the ongoing debate, on a European (and global) level, of how the human condition will be affected in an increasingly online and interconnected world. This supports the notion that there is a need for a more comprehensive and interdisciplinary perspective on this development. The increasing pervasiveness of ICT blurs the distinction between reality and virtuality, and between human, machine and nature, moving us from information scarcity to information abundance. This move contributes to a shift from the primacy of entities to that of interactions.

The aim of the paper is to explore how “bodies matter” when environments around them become “smart” and populated by “thinking things”. The study asks what happens to human bodies in such smart environments and proposes a dual conceptualization of the notion of *embodiment* and a *feminist focus*, without giving analytical preference to either of them. Embodiment is often seen as a learning process of bodily engagement with its surroundings, but where the social and biological features are left behind in the analysis, giving the impression that embodiment is something generic (and not situated, appearing in specific settings). Feminist accounts point out the demands and premises of multiple bodies, emphasizing that bodies are not only socially constructed representations, but also “real”. However, the paper underscores that also this is problematic when bodily interactions with environments are downplayed in order to study *bodies as specific entities*. With this theoretical background, the study describes a fieldwork in the Norwegian clothing industry, where RFID technology is tested to count clothes more efficiently, and to explore how bodies matter in this context. The study questions, on the basis of the explorative study, the notion that “thinking things” (or in this context, smart RFID-enabled clothes) now begin to anticipate the choices of people, and render bodies increasingly inert.

3.7.2 Description of methodological approach

The methodological basis of the study is mainly constructivist/interpretivist, where meaning is interpreted as not residing in people, nor in “texts” (or surrounding), but meaning is rather constructed in their situated relationship. On this background, the author argues that the concept of embodiment is crucial, albeit not sufficient to discuss human conditions in an interconnected era. In juridical and ethical frameworks, human bodies are defined with physical borders that can be violated, thus seen as a demarcated entity. In the socio-cultural literature, since the 1980s onwards, bodies as demarcated entities, independent from technologies, have been questioned, while in the 1990s the body became more politicized (i.e. through the concept of cyborg) as a battlefield of technology and biology. Later, the body has been discussed in socio-cultural studies of everyday life in techno-scientific networks. This study addresses *bodies in a specific workplace*, where RFID connects everyday objects (clothing) to the internet. The notion “information-rich-environments” is employed as a way to emphasize that we always interact in particular spaces that comprise all types of materials, and where information is produced, received and employed heterogeneously.

In theoretical terms, the question becomes how to address bodies in information-rich environments; hence the dual conceptualization of embodiment and feminism on the multiple materialities of bodies. *Embodiment* is often seen as a *learning process*, varying between more or less conscious and intentional processes. It is stated that such learning processes are not possible without real and living bodies, but equally impossible without an environment where the body is in constant interaction with all kinds of physical arrangements and sources of information. Simultaneously, the *materiality of bodily matter* must be addressed, where bodies/body parts interact with things, environments, circumstances and expectations. It is claimed that the social construction of bodily identities cannot explain the existence of some bodily feature alone – and that social scientists must *bring the material* back into their work (“the social world is very real, there are bodies and matter and real consequences of this materiality”). *Feminist accounts* of bodies emphasize the demands and premises of *multiple bodies*; bodies are real and not only socially constructed representations. However, this study claims that an exclusive focus on bodies themselves can be problematic when their interaction with environments are downplayed at the cost of approaching bodies as specific entities. Hence, the dual conceptualisation approach of the study, analysing social reality through the multiple materialities of bodies and their embodied learning, is seen as a useful analytical gaze in an era of pervasive, connected technologies.

Based on the premises and conceptualisations above, the study applies a *fieldwork* as a methodical technique to get to grips with these multiple materialities of bodies facing RFID-services. The fieldwork was conducted in several clothing shops, where installations were observed and their use discussed with technology providers and shop managers. This supplemented earlier work, where the implementation of tracking technology was studied in the clothing industry, through literature studies and conference attendance. Fieldwork was chosen as a method to gain insight into the *working of a clothing store as an information-rich environment* (this information-richness would be hard to capture without being “in the field”). The focus is here on the employees, and their handling of textiles, in particular the practical routine work of doing inventory (repetitive) – counting items in storage rooms and selling/display areas (for managers to know what needs to be ordered/replaced). This work is traditionally done by scanning barcodes, identifying (individual) items that belong to certain product groups (group belonging). The RFID-tagging of items turns this around, enabling “group scanning”, but identifying items on an “individual level” (unique IDs, contained in a chip, with information transmitted to readers by an antenna). Readers can be fixed (at entrance, or in storage rooms) or mobile. In this way, *RFID transforms the information-rich environment of the apparel store*. This creates potential for new routines and more efficient use of personnel.

The study conducted of this novel RFID-solution (on the pilot level) acknowledges the usefulness of personal experiences, notes and images that materialize in writing. This includes the *embodied and situated participation* of the researcher in the field (ethnographic moments). Hence, the analyses based on fieldwork material and case study work is defined by what the researcher extracts from his/her experience (subjective and embedded). It follows the analytical notion that “the erasure of researchers’ bodies from research obscures the complexities of knowledge production and yields deceptively tidy accounts of research”. Hence, qualitative research based on case studies should, according to the author, be discussed from a *situated and embodied perspective*. Thus, the ethnographic moment presented in the study is not based on the observing researcher, nor the extract of empirical material from interviewees, but on a participating researcher taking active part in the counting of RFID-enabled items with a mobile reader – making her part of her own ethnographic material²². A “hybrid” approach (neither participant observation, nor action research) is used in the analysis, following the notion of embodied and situated participation, enabling rich and embedded descriptions that advances knowledge on how bodies, and smart objects and environments, interact and affect each other.

²² Rather unwittingly, the researcher was asked by the store manager to act as a test person for the RFID solution.

3.7.3 Brief evaluation

The aim of this test (the practical part) of RFID was for the manager to investigate the potential for new routines and more efficient use of personnel. This change was not considered to be just a simple technology implementation, swapping one “device” with another. The manager had to integrate the unfamiliar (RFID) into familiar environments, potentially altering existing (employee) perceptions and work culture. This meant that existing routine practices and the tacit knowledge of employees regarding their relationship with non-RFID-clothing were being challenged. Successful adoption of such new technology is thus not easy to predict beforehand, and should always be considered as an interplay between the technology and its socio-cultural environment. Thus, to get a wider understanding of this aspect, and the bodily interactions with smart environments, the suggested approach is fruitful (rather than merely concentrating on a one-to-one relationship between user and technology).

The case study conducted around this practical test (the academic part) had a wider scope, exploring embodied and situated practices around the RFID-technology in information-rich environments. Hence, the counting of clothes with RFID technology could be seen as a specific embodied and bodily experience, and the combination of embodiment and feminist theory captured this complexity conceptually, while the ethnographic fieldwork was useful in terms of identifying the relevant empirical material for analysing these relationships.

3.8 Study 8 – Appropriation framework for IoT ecosystem research and innovation

Reference:

- Sletteå, D., Evjemo, B. & Akselsen, S. (n.d.). "Developing an appropriation framework for Internet of Things (IoT) ecosystem research and innovation". Manuscript ready to be submitted to peer-reviewed journal.

3.8.1 Introduction to the study

While the other seven studies referred to previously in chapter 3 are mainly empirical in nature, this final study has a more conceptual/theoretical orientation. The main ambition of the study is to draw on experiences and analyses from the two research/innovation projects mentioned so far (*RFID in Society* and *NFC City*), and their main methodological orientations, and on this basis develop a framework for analysing adoption/appropriation and use within complex technological ecosystems. Hence, it covers a main ambition of both projects, which is to explore and develop a conceptual framework that can properly address comprehensive adoption/appropriation scenarios of novel technological implementations. This is considered highly relevant and necessary in a world where the vision of the “internet of things” reigns, and where people, objects and environments become “smarter” and ever more “connected”.

The paper first assesses the limitations of positivistic technology adoption models when it comes to analysing complex IoT multi-service systems. Then it argues for an interpretive epistemology and reviews four central (cross-disciplinary) appropriation approaches. The main concepts of these approaches are critically assessed and refined – and used for developing a more comprehensive appropriation framework for IoT ecosystem research.

3.8.2 Description of methodological approach

The study begins with a brief review of the more traditional positivistic acceptance/adoption models that are prevalent in RFID/IoT research studies. These models are critically evaluated

in order to bring forth their shortcomings when it comes to more contextualised adoption/appropriation scenarios in comprehensive IoT ecosystem innovation and research. The study claims that acceptance/adoption models have been popular when studying new technological innovations, in particular within information systems (IS) research, much due to the clarity and predictive potential of the models. The models simplify reality in terms of variables, relations and effects, enticing developers and managers in terms of feedback on design and implementation. This is often needed in a highly competitive and time-constrained market, where lack of accurate pre-launch insights may lead to failure rather than success.

Positivistic models, such as the Technology Acceptance Model (TAM) have over the years proved highly influential in accommodating the need for prediction, positing that technology use can be explained or predicted by user motivation, which is influenced directly by external stimulus of system features and capabilities. Hence, the main strength of acceptance models is their core focus on how *future acceptance can be conceptualised* through analytical modelling. In order to adapt to new technologies and innovations the models have also been continuously extended and modified (cf. the more comprehensive UTAUT model discussed in previous sub-chapters). In addition to their predictive qualities, such models are considered simple and cost-effective because as they are less context dependent, generating high validity across a range of innovations. Still, this means that there is less potential for examining specific qualities of technologies, and their situated meaning and relevance.

The theoretical ambition of these models are not on a societal or relational level, and the theories and hypothesis generated to test the theoretical assumptions mainly centre on psychological variables, such as the relationship between attitude, intention and actual use. For example, TAM states that when beliefs are formed about ease of use and usefulness, and the consequent intention to use is posited, action (actual use) will be performed in a frictionless and unconstrained manner, disregarding structural and situational elements affecting use. This assumption is however less prevalent in many other adoption models. A main critique against TAM and similar models is that they divert attention away from other relevant research issues, e.g. what actually makes a system useful and meaningful to its users.

Consequently, the study proposes that an interpretive approach is better at capturing the cultural context of acceptance experiences, and the nuances of meaningful technology use, related practices and shifting use contexts. The study identifies several alternative approaches to the dominating positivistic position (which is still prevalent in much IS research). Such interpretivist/constructivist approaches do not pride their validity on statistical generalisation, but on a deeper understanding and coherent analytical accounts, by using a diversity of perspectives and methods to study the same research phenomenon. Validity is seen through results being transferable and adaptable to other research settings. This implies a shift towards qualitative research designs (ethnographic techniques and thick descriptions), as well as mixed methods enabling data triangulation.

The concept of *appropriation* is found to be a promising alternative to *adoption* models. The study then identifies and describes four different approaches to appropriation. These stem from research disciplines such as Computer-Supported Cooperative Work (CSCW), a neighbouring field to IS, as well as sociological and cultural disciplines, including consumer and media research. These approaches apply different concepts and place emphasis on different aspects related to users, interactions/processes and technology, but still display epistemological consistency. Then, a negotiation of concepts from these four perspectives provides the conceptual substance for developing a more encompassing appropriation framework. The appropriation approaches discussed and applied are;

- 1) *appropriation within CSCW*, with a key focus on understanding why and how users go beyond the scripts of designers in adopting new technologies, applying notions of active and

creative appropriation work by users; 2) *the model of technology appropriation*, which emphasizes the blurring of work/everyday contexts, and that analytical frameworks need to be adjusted to encapsulate the multiplicity of potential use contexts. In addition there is a need to move beyond the initial decision to adopt (pre-adoption) to the longer-term appropriation of technology (post-adoption); 3) *segmentation of appropriation* is an approach within consumer research that is critical to the simplicity of technology acceptance models, which does not recognize that technology use may change over time. It states that analytical frameworks must capture the various contexts of technology use and the users' active sense-making processes, seeing users as active, creative and interpretive agents; and 4) *the domestication perspective*, which pays particular attention to how technology is brought in from the market/public sphere (as a commodity) and made familiar and acceptable within the private/domestic domain (as an artefact). This is done through a process of taming, meaning-ascription and adjustment to everyday practices. Four key dimensions or phases in the consumption cycle is suggested – appropriation, objectification, incorporation, and conversion. Appropriation and conversion primarily emphasize the symbolic meanings of artefacts, while objectification and incorporation signal their material expression. The symbolic and moral dimensions of technologies are more specified in the domestication perspective than in other accounts of appropriation.

The study argues that positivistic approaches (technology acceptance/adoption models) show limitations when analysing complex and dynamic service systems, and that frameworks with conceptual nuance and richness to capture the multiple, situated and shifting interactions between users and technologies/services are needed. Thus, based on the analytical insights from the four approaches the new appropriation framework is developed in the paper, with concepts and relationships specified through a figure.

3.8.3 Brief evaluation

As opposed to the other empirically oriented articles, this paper sought to develop an analytical framework to guide future research and innovation work. The work put into it was highly useful for both the project with a societal/consumer focus (*RFID in Society*) and the innovation project (*NFC City*). It gave researchers in both projects the opportunity to discuss and negotiate the primary perspectives applied (seen in the previous chapters), with a critical eye to what e.g. traditional acceptance/adoption models (positivistic epistemology) as compared to appropriation approaches (interpretive epistemology) can accomplish in analyses of IoT (and similar) innovations.

The paper turned out to be useful in terms of guiding the continuous (re-)design of the projects. In particular, the acknowledgement that users now are *highly active and integrated parts* of responsive technology-service ecosystems, not only passive end-users. This insight affects research/innovation designs, requiring that epistemological and analytical conceptions are revisited in order to conceptualise and position users and usage (adoption/appropriation) within relevant and fruitful analytical frameworks.

4 Methodological research design – summed up

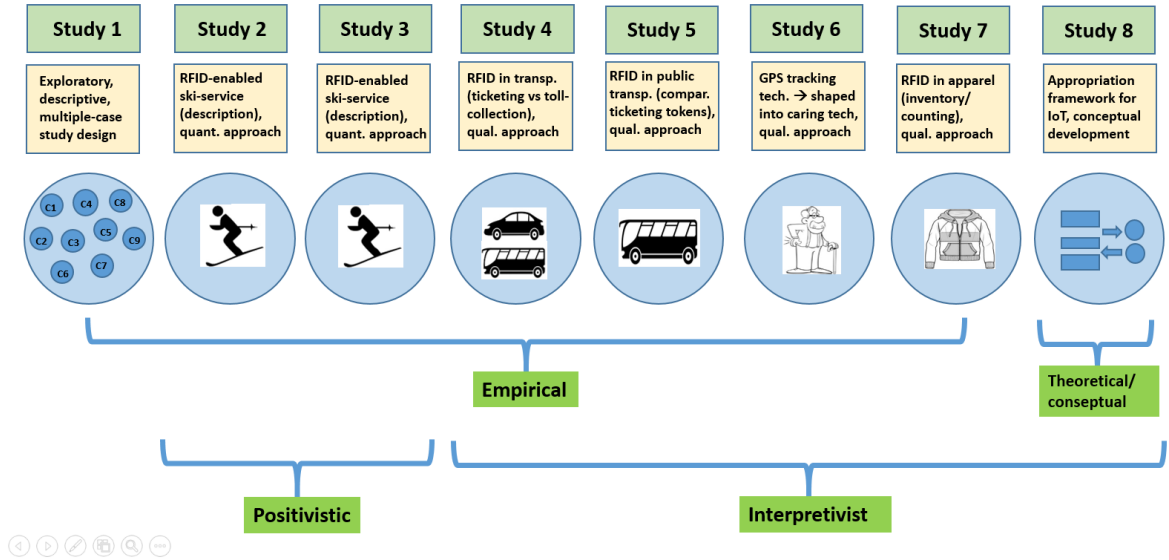
This report has guided us through the main epistemologies and methodologies that researchers face in practical research and innovation projects. To exemplify, we have presented eight academic writings that are based on theoretical-methodological inquiries of a range of RFID-related (or similar) applications, stemming from the *RFID in Society* project (with some comparative work conducted with experiences/applications from the *NFC City* project).

As present and future technology projects (in particular those that engage with IoT or pervasive systems) are often comprehensive – involving a range of different research disciplines, and combining technological development with social science research – it is crucial that all parties involved understand how knowledge is generated in/through these projects. In addition, innovators (designers, technologists) and researchers (academics) need to understand the premises on which the research is conducted, while policy needs to understand how to interpret the societal consequences identified and described in research outcomes. This latter aspect is particularly relevant to many recent projects that aspire to grasp and find solutions to large societal challenges.

The main approaches specified here (positivism/interpretivism) are often considered incompatible (when it comes to being integrated in the same research design). We claim that this not necessarily the case. Combinations are possible, even though “full integration” needs substantial work. Both positivist and interpretivist epistemologies can inform each other, as can deductive and inductive methodologies/reasoning, and quantitative and qualitative methods. Even with substantial ground to cover in terms of achieving integration – it is still an asset for projects to be clear on what epistemological ground is being covered, and how the various research design elements involved are positioned against each other.

This is the case of the *RFID in Society* project. We have made little attempt at integration, but the different perspectives have informed each other, they are applied where relevant to the study object, and they are exposed and critically discussed – being relevant parts of the total research design. Hence, below, we sketch the overall methodological research design of the *RFID in Society* project:

RFID in Society – methodological research design



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Consumption Research Norway SIFO at Oslo and Akershus University College of Applied Sciences (HiOA) has a special responsibility to contribute to the knowledge base for consumer policy in Norway and will develop new knowledge about consumption, consumer policy and consumer position and role in society.

Key research topics are:

- consumers in the market and consumer choice
- household resource allocations
- consumer economy - debt development and poverty
- technological development and consumers' every day life
- digital daily life and coping
- environmental effects of different types of consumption
- food and eating habits
- textiles - value chains - consequences for everyday life and environment
- consumption significance for social inclusion
- consumer policy

The logo for SIFO (Consumption Research Norway) features the word "SIFO" in a bold, blue, sans-serif font. The letter "O" is stylized with a white diagonal slash through it.

Consumption Research Norway

OSLO AND AKERSHUS
UNIVERSITY COLLEGE
OF APPLIED SCIENCES

Oslo and Akershus University college
of Applied Sciences
Consumption Research Norway
PO box 4 - St. Olavs plass - NO-0130 Oslo.

Visiting address: Stensberggt. 26, Oslo.

Phone: +47 67 23 50 00

E-mail: post@hioa.no **Internet:** www.hioa.no/sifo

