Unpacking inscriptions

A sociomateriality perspective on the design process of a milk package

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To my parents

Doctoral dissertation in Business Administration

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Abstract

Today's trend of fast-paced innovation in the field of, for example, information technology results in an acclaim of quick changes. At the same time, product innovation is only one facet of market offerings as industry standard comprise multiple interests that stabilize object characteristics, something which complicates change. Such industry standards are not unique to advanced technological objects. This thesis illustrates how the design process of a milk package, an exemplary piece of a mundane engineered object, is dependent on inscriptions wherein various interests and expert knowledge shape how this milk package is engineered and used in a practical setting.

This thesis starts out from an object perspective to explore the milk package's design process, but also emphasizes the environment and the specific conditions through which it travels. Based on a sociomateriality perspective, the study emphasizes a relational ontology and identifies the social and material conditions that influence the design of an engineered object. Over its lifespan, the milk package is used in different contexts and for different purposes (e.g., as a container of food, an item in a logistic system, and waste product) which emphasize various actors' interests. On the basis of these mechanisms, the milk package is best described as an 'engineered object multiple' wherein what the thesis describes as *inscription domains* play a key role in determining the physical, aesthetic, and symbolic properties of the object.

The concept of inscription domains enable detailed exploration of how an object is stabilized (or modified) by multiple interests, as advanced by various actors. Seen this way, new design processes unfold on the basis of previous inscriptions and become the result of compromises between different, and sometimes conflicting, interests. Based on this specific case on the engineering of the milk package, a number of theoretical contributions as well as managerial and policy implications are formulated, but so too are calls for more studies of how mundane engineered objects are constitutive of everyday life.

Keywords: sociomateriality, inscriptions, inscription domains, negotiation process, mundane engineered objects, milk package, design process

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One of the first things I became acquainted with as a PhD student was a verse of William Blake's poem *Auguries of Innocence,* communicated to me to illustrate what research is all about.

To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour.

These words have stayed with me and now that this thesis has been written, it is also a good time to be grateful to the research process and the ways in which it has enriched my life, to go beyond learning to become a researcher. In the same way the poem encourages one to appreciate the small details in order to explore the greater setting, my years as a PhD student have provoked my curiosity, not only as regards research, but also everyday life, making it increasingly fascinating.

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Chapter 1: Introduction

The world's waste production is constantly increasing and every 2 hours we throw out enough stuff to fill the world's largest container ship with trash (a capacity of 19,224 standard containers (Lloyd's List, 2014)). This means 12 container ships every single day, and 4,380 container ships in one year (The World Counts, 2015). Waste can be seen in cities, oceans, and the countryside and is having a growing environmental impact, due to both the pollution factor and how it influences the ecosystem and the lives of animals. The material aspect of waste makes it different from other sources of pollution since it is visible to the eye, compared to, for example, pollution from CO_2, freons and asbestos.

Internationally renowned organizations, such as the IPCC, the World Bank, and the UN, refer to the increasing amounts of waste as a genuine problem regarding a sustainable future, illustrated in published reports describing and reporting on the challenges posed by increasing waste volumes (IPCC, 2014; The World Bank, 2012; FAO, 2013). The urgent results being reported on, have become a general concern via published articles by mainstream media focusing on the different challenges caused by over-production and waste. Waste issues are visible in different ways, e.g. the growing volumes of urban waste which, according to the World Bank, will double over the next 15 years, highlighting the critical need for improved urban waste management as well as to reduce CO_2 pollution (RT, 2012). Another pressing issue is the increasing volume of plastics in our oceans, whereby an astonishing amount, eight million tons of plastic waste, annually enters our oceans; eight million tons which, spread out, would cover an area 34 times the size of New York's Manhattan

Island to ankle depth (BBC, 2015). Additionally, waste has also resulted in human health issues, highlighting the risk of toxic waste leaking into our water and soil and causing major health problems in areas close to waste disposal sites (BBC, 2013).

A large source of waste is household in origin, primarily consisting of consumer goods packaging and food waste (William, 2011). Food packages have become a symbol of waste due to the large volumes and their polluting effect when not dealt with by proper waste management disposal systems, such as recycling or incineration plants (Corvellec & Hultman, 2012). However, waste can consist of different things and does not have to be a source of pollution if dealt with correctly by a waste management system. Countries have invested in different waste management systems and, even though some countries still see landfill as a convenient solution, many countries have invested in recycling systems in order to change the linear structure and bring discarded materials back into the production structure (Corvellec & Hultman, 2012). In Sweden, food packages are subject to rigid legislation in order to ensure good protection of their food content (SCS, 2006:1273), legislation which also prohibits packages from consisting of toxic materials and ensures commitment to waste management requirements. The discussion about waste not only centers on the debate about how to best deal with waste, but also on its 'to be or not to be' (Corvellec & Hultman, 2012), resulting in regulations stipulating that packages should only be made from enough material to keep a product safe, but no more than that (SCS, 2006:1273).

The existing recycling system copes with metal, glass, paper, and plastics, but within each material there are restrictions as regards how these must be managed in order to be recyclable (FTI, 2019). The choice of materials has consequences for the producer since these materials have different qualities, weights and material costs; however, these materials also have different qualities in terms of their recyclability. Glass and metal are recyclable over time, but paper fibers and plastics decrease in terms of their material quality each time they are recycled, managing to be recycled seven times before being sent for incineration. Moreover, there are some plastics that are not suitable for recycling plants, or exist in quantities so small that they make investment in recycling too expensive (Harvey, 2014). These materials are instead sent for incineration to produce energy (FTI, 2015). Plastics have become increasingly popular since they create strong materials that ensure protection and are cheap to produce and light in weight, thus being convenient in logistical flows. However, plastics are more difficult to recycle since they come in many varieties, which makes the current system capable of recycling 30%, with the aim of increasing recycling to 50% (FTI, 2019). Moreover, plastic is also the material most frequently being encountered in the environment as 'trash'; if

there is a failure to align with existing waste management systems, it can take hundreds and even thousands of years for it to degrade, depending on the environmental condition it ends up in (Barnes et al., 2009; Andrady, 2015).

Therefore, different types of packaging materials have either positive or negative consequences during the different stages of the value chain, resulting in the applicable packaging material having to be decided on in accordance with the food product and the conditions existing in the contextual environment. However, a food package is not created with the sole purpose of becoming waste, its primary purpose is to protect the food content making it a requested product to start with. Thus, an object's tasks and purpose are determining parameters when it comes to exploring its ability to respond to different waste management aspects (Cheyne, 2002) and thus it is important to start with an object's tasks instead of objectively viewing that object from a waste perspective if there is any interest in exploring the object's environmental impact.

Food has not always been packaged. Rather, this was a major innovation which made it possible to store and transport food in ways previously impossible. Throughout the nineteenth century, developments in canning and bottling developed rapidly in the major industrial nations of Europe, in response to demands resulting from population growth, urbanization and the expansion of sea travel (Hawkins, 2013). Packaging has been identified as a key part of the development of markets and the reordering of producer-consumer relations (Cochoy & Grandclément-Chaffy 2005). Hawkins (2011) argues that packaging is an integral part of market assemblages without which consumption would be difficult or even impossible.

The attitude towards food packages is two-sided. The environmental impact from production and material resources, and the waste management activities imposed on consumers and society, are identified as reasons for a negative attitude. Recycling does not happen automatically, but when consumers buy packaged food they are forced to engage with the 'end of life' activities of packages. Once the food has been consumed, the package shifts in nature from initially having a food protecting function to becoming a piece of waste. Consumers and consumer groups have introduced initiatives to further encourage companies to reduce the amount of food packaging and to "name and shame" brands who use packages that do not meet consumer expectations (sajavlapackat.se). Also, making comments on a company's own social media pages has increased the consumer's ability to be heard. Consumers' opinion have gained power in shaping public opinion since they are perceived to have potential to construct company legitimacy crisis (Grafström et al., 2015). To respond to consumers' complaints about minimizing packaging, there are at

least 70 retailers around Europe who are challenging industry standards and selling food in bulk using the so called anti-packaging store concept (Bepakt, 2016).

The other side argues for the need for food packages to protect the food and to ensure that it can be transported around the world to end starvation. Food content often has a higher environmental impact, with the packaging reducing the total environmental impact by making sure that the food is not damaged. The industry sees the package as an essential function of serving consumers with safe and qualitative products, arguing that unpacked food results in higher volumes of food waste, by extension resulting in a higher environmental impact (e.g. Williams, 2011). From an industry perspective, the package's responsibilities are in relation to the other aspects that make up the consumption product and thus not identified separately to this context.

Milk is a food product that results in large amounts of packaging waste. For Swedish households milk is an important food product, with Swedes annually drinking 74 liters of milk per person (Karlsson, 2019), resulting in a large number of milk packages to deal with in the waste management system. The dairy company Dairy Corp (pseudonym), one of the largest dairies in Sweden, receives and handles 5 million liters of milk on a daily basis all year around and the refined products are packaged into more than one billion packages. For the last 60 years, the traditional Swedish milk package has been a rectangular package made from paper-based packaging materials with plastic layers on the inside of the container that prevent the milk from leaking (Brunnström & Wagner, 2014). The display areas of the packages are covered in information of different sorts, e.g. manufacture-specific information, nutritional information, branding and advertisements. However, looking at milk containers from different parts of the world tells us that a variety of models are used in different countries. To mention just a few: the polybottle (the HDPE bottle) is popular in the UK (Wrap, 2019); bagged milk is a common option in Canada (Upadhyaya, 2018); and chalk-based containers are gaining market share in Eur-Asian countries (Ecolean, 2017). This shows us that there are different ways of making a milk container, but it does not tell us why a specific model becomes the standard container in a certain setting. Thus the components that result in specific design model is interesting to investigate further.

Organizing objects

A milk package is mundane in its appearance, and is only one of many mundane technologies holding a purpose in order to facilitate or stabilize society (Latour, 2005). Michael (2003) defines mundane technologies as

"[t]echnologies whose novelty has worn off; these are technologies which are now fully integrated into, and are an unremarkable part of, everyday life" (2003:131). Mundane objects have been a field of interest within the discipline of science and technology research; they have been studied in order to illustrate how objects are important components of the way society is built up. Bruno Latour (1992) argues that "technology is society made durable", which he illustrates by exemplifying the role of: seat belts for ensuring compliance with rules regarding passenger safety; grooms (automated door-closers) for minimizing drafts; speed bumps, also referred to as sleeping policemen, for ensuring compliance with speed restrictions; and the hotel key's metal weight in order to inscribe aimed-for guest behaviors. By the use of objects, it is possible to structure society and to create behavioral patterns without constant supervision, e.g. allowing speedbumps to act as policemen in order to ensure slow speeds in populated areas (Latour, 1992).

Moreover, mundane technologies not only support order in society, they also meet comfort requirements in our day-to-day lives. These objects can be of a simple design, but they play an important role in managing modern life. Latour (2005:71) develops this:

> After all, there is hardly any doubt that kettles 'boil' water, knifes 'cut' meat, baskets 'hold' provisions, hammers 'hit' nails on the head, rails 'keep' kids from falling, locks 'close' rooms against uninvited visitors, soap 'takes' the dirt away, schedules 'list' class sessions, prize tags 'help' people calculating, and so on.

Likewise, a milk package 'contains' milk, an important task in today's urbanized countries. However, a milk package also has other responsibilities to meet in order to fulfill its expectations. Therefore, in contrast to the mundane technologies presented above, which were given a specific responsibility when introduced, milk packages have become industrialized in order to meet multiple demands when brought to market. Technology is created via negotiation, based on human and technological demands (Bijker & Law, 1992). Thus it is further argued that "[t]he idea of a 'pure' technology is nonsense. Technologies always embody compromise" (1992:2). Also a mundane object consists of a set of diverse forces, resulting in the building of a heterogeneous network that brings together all types of actants (Akrich, 1992). Many interests are displayed in the lifecycle of the package, through interests engaged in producing, distributing, consuming and recycling the material. Moreover, societal interests, in terms of legislation and norms, are actively engaged in the food packaging process. Thus, a milk package will be defined as a mundane engineered object. While mundane engineered objects are commonplace technologies, widely ignored by their users in terms of their

everyday qualities, this does not suggest that mundane engineered object are uncomplicated either to produce or to modify. An engineered object is a device or machine that is primarily seen through its technical qualities and mechanical performance, although it is argued to additionally have a cultural heritage, which provides a setting controlled by standards, regulations and cultural demands (Trammel et al, 2008; Styhre et al., 2018). An engineered object holds multiple interests, which are to be negotiated within the boundaries of the physical object. "Engineering is the art of compromise", argues Petroski (1996:3), "and there is always role for improvement in the real world. But engineers is also the art of the practical; engineers realize that they must at some point curtail design and begin to manufacture or build".

Engineered objects range from more complicated objects, such as the MP3 format (Sterne, 2012), airplanes (Bijker & Law, 1992), buildings and water supply systems (Petroski, 1996) to more mundane engineered objects such as grooms (Latour, 1992), pencil points, zippers, and aluminum cans that are all engineered and holds compromise. For example, a paper clip can appear as the simplest design, but also this design holds qualities and compromises. It has been designed for purposes of material springiness (to be elastic enough to be opened easily and to go back to its original shape), cost efficiency and demands on the manufacturing process, which has resulted in compromises in terms of a design with limitations regarding holding on to many paper sheets, risk of tearing the paper, and more (Petroski, 1996). This thesis has the aim of exploring how interests are negotiated in order to be inscribed into the object, which will be studied during a design process.

Object design processes

The above discussion starts out from a focus in waste issues bringing attention to the constructed object that eventually needs to be managed by the waste system. Using an object focus, gives insight to the many aspects contributing toward deciding how an object is designed and that, in different contexts, the same product category is developed in different ways. Coming back to the milk package's waste impact, it is relevant to learn more about why it is designed in a given way, in terms of material choice, physical shape and displayed information. There is knowledge of the different expectations on a food package and the challenges of mastering all expectations within the same physical object, but not of how the different interests are negotiated in order to result in a final design. In order to learn about what makes up an object design, it is important to explore the object's contextual environment, from which the actor interests originate.

Building on the work of Edward Soja (1989), Gieryn (2002) argues that a completed artifact hides the options discussed along the design process: "[o]nce completed, buildings hide the many possibilities that did not get built, as they bury the interests, politics, and power that shaped the one design that did." (2002:38-39). However, the hidden interests are also part of creating the setting, which emphasizes the importance of learning about the activities of a design process in order to identify both the various interests and how these interests can oppose each other. Gieryn (2002:42) continues by arguing that a: "[d]esign process is simultaneously the representation of an artifact in graphic, verbal, or numerical form, and the enrollment or enlistment of those allies necessary to move the artifact toward a material form".

In this thesis a design process concerns the period during which an established project group is officially given the task of implementing a new object design, until it is established in production and gains the general acceptance of the users, stabilizing it as an object in use. Thus, the implementation phase and design adjustment are still part of the design process. The setting that an engineered object exists within is not stable and, eventually, design changes can be requested in order to respond to relevant object attributes. Therefore, in a competitive environment, the object that manages to respond to contextual changes is the market winner or preferred format (Sterne, 2012).

Comparing different types of engineered objects provides insight that a more stable object such as a bridge (Winner, 1980) or a building (Gieryn, 2002) can be challenging to implement, but it can also be dominant in relation to other components in its setting. In contrast, smaller and more mundane, or taken-for-granted, objects can experience major challenges in their design process whereby the existing contextual environment can be either a gate or a blockage (e.g. Ribes et al., 2013).

Once an object has successfully been implemented, the affected actors and artifacts need to attune to it since the object's design influences how they act and organize around it. The solidity of engineered objects has been identified as creating stability as regards how society is organized. Winner (1980:127) reasons that:

> The things we call 'technologies' are ways of building order in our world. Many technical devices and systems important in everyday life contain possibilities for many different ways of ordering human society. Consciously or not, deliberately or inadvertently, societies choose structures for technologies that influence how people are going to work, communicate, consume, and so forth over a very long time.

Although the settings that technologies are introduced into and exist within are not static, but develop over time, the changes are often small, keeping the general infrastructure in place. Hence, new interests need to be met in alignment with the existing structure, requiring negotiations and a design process based on the previous object model and additional actors' interests (Law & Callon, 1992:45). Additionally, the stable foundation of a building can seem to be a stable artifact; however, although the façade can look the same over centuries, it will most likely need to be maintained and modernized in order to adapt to, for example, lower energy budgets or knowledge of the hazardous impact of building materials (Brand, 1994).

Thus, learning how interests are responded to in a milk package requires a theoretical perspective that provides a lens for learning about the organizing being performed when designing that milk package.

Previous studies

Objects are designed and produced by organizations and are thus an important component of enabling organizational scholars to understand organizing. Joerges & Czarniawska (1998) phrase this as follows: "The study of organization is incomplete as long as tangible technology remains in its blind spot" (1998:363). The social world is constituted on the basis of a variety of mundane engineered objects that assist individual and social activities, yet operate without much thought or gratitude. In order to make interests visible, the milk package is studied through a design process during which interests are negotiated.

During technological development, theoretical perspectives have also developed in order to properly study complex technologies that have become increasingly important parts of organizing work. The concept of technology is based on the Greek concept of *techne* (the arts and skills of the artisan) and *logos* (a branch of learning) (le Goff, 1993), communicating a pursuit of development inherent in the definition of technology. A major research stream in management research into technology originates from science and technology studies, while one branch has resulted in the sociomateriality perspective (e.g. Orlikowski, 2007; Suchman, 2007). It offers a lens for showing that "there is no social that is not also material, and no material that is not also social" (Orlikowski, 2007:1437), thus building on a relational ontology of the relationship between social and material conditions (Orlikowski, 2010). When discussing the 'social' in the context of science and technology research, it refers to the 'sociological' but also the political, economic, psychological and historical (Bijker & Law, 1992). Moreover, from a sociomateriality perspective, which is additionally based on a practice lens,

it represents the doing and thus the "enactment of a particular set of activities that meld materiality with institutions, norms, discourses, and all other phenomena we typically define as 'social'" (Leonardi, 2012:34).

The sociomaterial perspective is created as a reaction to the limited understanding of technology's role in organizing (Orlikowski & Scott, 2008), with empirical phenomena primarily studying the organizing role of software technology and other high-technology objects. Examples of software technology studies are performed on the Google search engine (Orlikowski, 2007), email programs (Barley, et al., 2010), online social media website (Scott & Orlikowski, 2014), and general discussions about digital artifacts (Kallinikos et al, 2013). Moreover, examples of studies of high-technology objects include robotics (Barrett et al, 2012), a power amplifier for a radio (Rennstam, 2012), and reproductive medicine (Styhre & Arman, 2013). The empirical studies have constituting the sociomateriality perspective to become an important lens for exploring how social and material conditions jointly develop a technology into its given design.

Object inscriptions are material translations of a setting (Latour, 1991) and thus traces of what an object is composed of (Akrich, 1992). The existing literature on the notion of inscription provides insights into the social traces of a material object and how these traces influence the way the object is constructed and enacted. This is communicated through: the inscription device's role in ensuring the transformation of matter into a figure or diagram (Latour & Woolgar, 1979/1986), how objects are inscriptions of institutions (Joerges & Czarniawska, 1998; Czarniawska, 2008), how tools' inscriptions have organizing power (Gärtner & Huber, 2018) and hold organization knowledge (Rennstam, 2012), how values can be inscribed in order to have a performative role (Fuentes, 2014) and redefine an object (Corvellec, 2016), and added interests that result in the inclusion of product parameters (Reijonen & Tryggestad, 2012). Joerges & Czarniawska (1998) argue that "technical inscriptions are taken for granted more easily than other organizational texts" (1998:382) and call for research to closely examine the relationship between technical and other organizational texts as a way to connect the divergent research traditions in technology and organization.

The previous section communicates studies that use the notion of inscription to explore *what* interests are inscribed into an object. However, this thesis is interested in learning *how* interests become inscribed, which results in an additional focus on learning how engaged actors enact the object and how this influences their interests in object attributes. Studies of the enactment of an object have identified the 'object multiple' (Mol, 2002) on the basis of actors

from different fields of expertise meeting objects with different meanings. David Pye (1968) express it as:

> The properties of materials are objective and measurable. They are *out there*. The qualities on the other hand are subjective: they are *in here*: in our heads [bodies]. They are [embodied] ideas of ours. They are part of that private view of the world which artists each have within them. We each have our own view of what stoniness is.
>
> (Pye, 1968:45-47; original emphasis, cited in Ingold, 2007:13)

Since actors have divergent views on an object's qualities it also result in different interests in relation to what should be inscribed into an object. Rijonen and Tryggestad (2012) state that the divergent interests can be difficult to respond to in the same object, due to the physical boundaries that need to be negotiated, making it challenging to respond to added object attributes. Hence, it is possible to see that the relevant actors cannot inscribe their interests in just any given way; instead, this needs to be negotiated between the relevant actors (Law & Callon, 1992). Thus, there is a lack of knowledge of *how* these competing interests are negotiated, and result in the given object design. Moreover, this research gap is talked about by Leonardi and Barley (2008), who claim that students of technology and organizing generally "pay little analytic attention to a technology's material constraints and affordances and focus" (2008:163); however, these studies primarily show how people "organize around the technologies they employ" (2008:163). Additionally, Holmström and Robey (2005) call for research to further study the inscription process, and what determining factors to which interests become inscribed.

From a practical perspective, learning more about engineered objects' design processes provides the knowledge to explore these objects' ability to meet the societal challenges increasingly being faced by producing organizations (KPMG, 2017). Over the last two decades, research has increasingly dealt with learning about sustainability challenges and the role of business in society. In line with general organization studies, there has been a growing interest in accounting for the role of materiality in sustainability research. Studies that have started out from a materiality perspective can be divided up into the following three foci[1]: Firstly, studies that emphasize the natural environment, which is the victim of activities, as an influential interest holder (George & Fussel, 2000; Bergström & Dobers, 2000; Redclift, 2005; Hermansen, 2010;

[1] Review of the following journals: Business Ethics Quarterly, Journal of Business Ethics, Business & Society, Business Ethics: A European Review, Organization & Environment, Business Strategy & the Environment, Corporate Social Responsibility & Environmental Management, Sustainable Development, Business & Society Review

Boons, 2013; Bansal & Know-Hayes, 2013; Grushina, 2016), and ANT studies that unbox the network of human and non-human actants involved in a project or process, which should all be considered from an ethical or sustainability perspective (Ählström & Egels-Zandén, 2008; Egels-Zandén & Wahlqvist, 2007; Bled, 2010), secondly, practice-studies based on social and material influences and how these impact sustainability efforts (Martin, 2008; Fuentes, 2014; Nilstad Pettersen, 2016; Goggins, 2018), and thirdly, studies recognizing object agency and its impact on organizing (Larssaether et al, 2009; Sutheerawatthana & Minato, 2009; Benn et al, 2013; Martin, 2018; Reuber & Morgan-Thomas, 2017).

However, there is little research conducted that starts from sociomateriality perspective and explores the technology's ability to answer to sustainability efforts. Which, building on Reijonen and Tryggestad's (2012) findings of a technology's resistance to inscribe additional product attributes, is a relevant area to study in relation to the general organizing of an object, since all qualities and tasks must be responded to in the same physical entity.

Research focus

The different views and expectations regarding an object's qualities makes it interesting to learn about the negotiation between the different, and sometimes conflicting, interests which aims to be responded to within the same object design. Thus, it is during the design process that an object's ability to respond to different interests is determined. Building on this, the purpose of this study is to explore the organizing and handling of a milk package to see how this influences the engineering of a new object design. This results in the following research question:

> How are interests, originating from different competencies, perceived needs and beliefs, inscribed into an engineered object during a design process?

The aim of responding to the presented research question is performed using a qualitative study primarily building on interviews with actors that directly and indirectly engage with the milk package and who therefore are interested in its product qualities. The milk package is a good representative of the engineered object due to the aim of discussing an object that is of a mundane appearance and often taken for granted, but still an omnipresent object in most homes and thus relatable. People of all ages consume milk, from small children to the elderly; it also has a cultural heritage in the Swedish food tradition. Moreover, food production organizations are also regulated to ensure compliance with waste management, making packages a relevant representative for discussing

societal challenges, since they exist in a context to which the topic is directly applicable. Additionally, demands are also being placed on food packages to ensure the protection of their food content, illustrating the fact that an object must be negotiated between different interests. Since a new object design is developed and launched in an established setting, it requires knowledge of the general manufacturing, distribution and usage of the package in order to explore the interests engaging in the design process.

Outline of the thesis

Chapter 2: A sociomateriality perspective is the theoretical lens used in this thesis. Sociomateriality builds on a relational ontology, making it an applicable lens for understanding what constructs an engineered object, communicated through studies of object agency and factors that shape the industry through, for example, regulatory and infrastructural requirements. The last section of this theoretical chapter discusses the notion of inscription as a relevant perspective for analyzing the empirical material, and discussing its strengths and shortcomings.

Chapter 3: Methodology presents the methodological approach used for studying how the organizing of a milk package influences the outcome of that milk package's design process. It presents the studied setting and the procedures performed during the data collection process involving interviews, observations and legislative texts, as well as other documents. Moreover, it also presents the analyzing of the material, including the coding procedure. Finally, it presents information aimed at validating the collected data.

Chapter 4: To contain milk provides a general overview of milk as a food source, presenting its treatment before consumption in order to ensure a safe product and the cultural preferences concerning milk's taste and treatment. The milk content is highly influential in designing a milk package and there are different aspects that it has to meet in order to provide a safe and attractive product on the market.

Chapter 5: Manufacturing a milk product reflects the context that a milk package exists within, traveling through the manufacturing process, along the logistical and distribution stages, to consumption and, eventually, waste management. The different stages of a milk package's life illustrate the different rules and standards that it should comply with, or the operative requirements which it should meet.

Chapter 6: Negotiating a new packaging design presents the implementation of the milk design process and how different interests are mutually negotiated

in order to find a suitable packaging solution that can be agreed upon. It communicates compromises and negotiations between different interests.

Chapter 7: Package design adjustments communicates the need to update the Gabletop package in order to meet consumer demands since the design process is not finished until all the product interests have been responded to in the package design. Moreover, it also illustrates that a topic, e.g. meeting 'green' expectations, can be seen from different angles, depending on the actors' expertise.

Chapter 8: Unpacking inscriptions presents the concept of inscription domains in order to explore the interests engaged in an engineered object. The milk package is enacted in different ways over its lifespan, which can be illustrated as 'engineered object multiple'. The interests that originates from these enactments are categorized into different inscription domains, role in determining the physical, aesthetic, and symbolic properties of the object. Additionally, the inscription domains serve as a foundation for learning about stabilizing factors in an object's context, and the negotiation processes that result in a given object design.

Chapter 9: Concluding discussion and contributions answers the research question and presents the theoretical contributions, as well as managerial and policy implications. Lastly, it provides recommendations for future research.

Chapter 2: A sociomateriality perspective

How are interests, originating from different competencies, perceived needs and beliefs, inscribed into an engineered object in a design process? In order to expand the vocabulary needed to answer this research question, the theoretical chapter explores the theoretical framework of sociomateriality in order to study the organizing performed in a design process. The theoretical chapter is divided up according to the following structure. In the first section the founding ideas about the sociomateriality perspective are discussed. Sociomateriality builds on the understanding of a social and material entanglement where neither is dominant vis-à-vis the other, instead building on a relational ontology (Orlikowski, 2010), which makes it an applicable lens for understanding what constructs an engineered object, an object that exists in a social and material context. The following sections provide empirical studies that explore object agency and factors that shape the terms an object should respond to, such as regulatory and infrastructural factors. The last section of this theoretical chapter discusses the notion of inscription as a relevant perspective for analyzing the empirical material and discussing its strengths and shortcomings, in order to successfully analyze the empirical case.

To see the world in a sociomateriality perspective is to learn how organizing builds on social and material entanglements, and how these two aspects are important to take into consideration when studying organizing and the development of engineered objects. The sociomaterial perspective has been developed with the aim of serving as an organizational research lens for improving our understanding of technology's role in organizing. It builds upon studies in sociology and upon science and technology studies that have

incorporated interesting ideas, building on discussions referring to the social and the material in the same register, paving the way for the recognition of the notion of sociomateriality (Orlikowski, 2007). The influential studies originate from areas of, for example, actor-networks, which provide agency to all actants – human as well as non-human (Callon, 1986; Latour, 1992: 2005); sociotechnical ensemble suggesting that, not only engineers, but also all relevant social groups contribute to the social construction of technology, leading to objects being as much an economic and political result as a technical one (Bijker, 1995); the 'mangle of practices' which discuss the emerging performance in the intersection between human and non-human agency (Pickering, 1995); object-centered sociality in which a shift in forms of relatedness is advocated that is based on social and normative integration, but includes objects as an embedded environment or relationship partner (Knorr-Cetina, 1997); relational materiality where materials are treated as relational products and do not exist in and of themselves, but encourage researchers to see the messy world where objectivity does not exist and hence to understand the multiplicity and fluidity of the things in the world (Law, 2004); and material sociology that pays attention to artifacts and other physical objects' role in social relations (Beunza et al., 2006).

From a sociomateriality perspective a constitutive entanglement of the material and social is advocated and springs from a limited understanding of how the humans' actions and interactions in organizing are bound up with the material forms and spaces (Orlikowski 2007). Sociomateriality builds on a practice-based theory with a relational ontology primarily interested in the relationship between entities, in this case the relationship between the social and material (Orlikowski, 2010). Styhre and Arman (2013) argue that sociomateriality originates from the sociological term practice "starting with social practices and arriv[ing] at materiality as a theoretical necessity" (2013:56), differently from material sociology which has the material as its starting point.

Materials have historically had a limited role in the studying of organizing, but as materials in forms of, for example, technology have gained an increasingly important position in the organizational setting it has been recognized that materiality is an important area to study in order to better understand the organizational field. Barad (2003) has shown concern about the lack of interest in materials in social studies and argues that: "Language matters. Discourse matters. Culture matters. But there is an important sense in which the only thing that does not seem to matter anymore is matter" (2003:801).

Barad (2003) further argues that materiality research has been neglected in favor of the notion of linguistics, which has been provided with too much power and views entities rather as 'independent objects with inherent

boundaries and properties'. Despite the call for materiality-focused research in the field of organizational studies it has been recognized that organization scholars have historically found it challenging to link human and object entanglement in practice. Orlikowski and Scott (2008) identify three reasons why materiality has been a neglected topic in organization studies. First, the complexity and specialization of organizational life requires the investigation of multiple issues - economic, political, strategic, psychological, and sociological - not just technological issues, resulting in it being a secondary task in relation to the more primary organizational issues. Second, many organizational scholars have traditionally been uninterested in technological topics, instead being educated to attend to the human, cultural, and economic elements of institutions, not the material ones. Finally, there has been a general belief that technology is simply part of the institutional infrastructure; hence, it has faded into the background and remains largely taken for granted.

Material and social components are not categorized in terms of their importance based on the refinement of technology or skill, all aspects are important to include in order to understand how the sociomaterial setting is shaped. Styhre and Arman (2013) argue that the materials and social components involved in practices that concern reproductive medicine are presented to highlight how mundane and highly complex technologies, together with human skills and engagement, are all needed to perform successful practices. Reproductive capabilities build on the material resources such as advanced technologies – freezers and microscopes, and mundane objects such as plastic containers and pipettes. However, the social is also active throughout the practice through social interaction, communication, regulation, ethical guidelines and professional judgement. It structures and shapes the day-to-day work (Styhre & Arman, 2013:186).

Constitutive entanglement is a fundamental notion in the sociomaterial perspective and builds on the understanding that the social and material are inseparably related. Orlikowski (2007) argues that viewing practices as 'sociomaterial' is a way to see these two parameters, the social and the material, as constitutively entangled in everyday life. A position of constitutive entanglement does not favor either humans or technology (in one-way interactions), nor does it link them together through a form of mutual reciprocation (in two-way interactions); instead, the social and the material are considered to be inseparably related. Orlikowski (2007:1437) famously argues that "there is no social that is not also material, and no material that is not also social". As an illustration, Winance (2006) uses the unity of a disabled human body and a wheelchair, an entanglement that builds on both the social and the material in order to result in a design that would otherwise be impossible. The body is not only placed in a wheelchair, the wheelchair is also continuously

adjusted in order to adapt to, and go beyond, the demands made by the human body. The community that is created is referred to as a "body-in-the-wheelchair-of-the-person" since the two components result in an outcome that cannot be achieved by the individual components when separated.

> [M]ateriality denotes the force of the ties that shape and hold the 'body-in-the-wheelchair-of-the-person'. Materiality refers neither to the body of the person nor to the wheelchair but to the force or the resistance of their conjunction. /…/ Through adjustment, a community is shaped.
>
> (Winance, 2006:58)

Winance (2006) illustrates that both the human and the wheelchair have individual limitations that need to be considered, but when these are accounted for then the combined product has greater qualities than the individual pieces have independently. Other examples display dependence on the social and material dimensions in operations that have historically only built on material knowledge. Beunza and Stark (2004) and Beunza et al. (2006) give examples of social and material entanglements through an ethnographic study performed on arbitrage in a Wall Street trading room, where Beunza and Stark (2004) illustrate how social understandings are also part of creating value in a trading room, which is recognized for its objective understanding of operations. Beunza et al. (2006) build on the same empirical case and focus on the importance of the theory of arbitrage and how its enforcement is dependent on social conviction since, in the initial phase, an arbitrage often results in losses before it becomes profitable. Beunza et al. (2006) argue that "[a] price is a thing, but it is also social" (2006:733) due to the shared conviction of the theory and that the material measure of the price is dominated by the understanding of pending profits.

The notion of constitutive entanglement is useful in order to see how both the material and the social aspects need to be taken into consideration in order to understand organizing. Therefore, in order to learn about how an object results in its given qualities, it is important to explore the contextual changes and agency concerns resulting in changed demands or expectations, and how these are dealt with. Perspectives within materiality incorporate aspects of technologies' ability to change over time. Within a process of materialization, a technology stabilizes over time to produce the effect of boundary, fixity, and surface that we call "matter", thus being appreciated as passive, but which can be changed or developed (Orlikowski, 2007). Despite the social interests in technology, Barad (2007) argues that materiality is not a separate or static entity, but dynamically produced-in-practice: "Matter is not immutable or passive. Nor is it a fixed support, location, referent, or source of sustainability for discourse" (2007:151).

Technological change can have a direct impact on an actor's relationship with it. Koivunen (2009) presents a continuing dialogue between the technology and the actor since technology can develop due to changes in regulation or normative demands that include new actors and interests in the technology. Thus, a technology can change for one actor due to the modifications created by another actor. Despite the arguments of technology to never be fully stabile, design changes cannot be performed in just any given way, instead being bound to the setting that the technology is established in, as discussed further in the coming section.

Shaping the technology

Engineered objects belong to a contextual setting and are shaped by the demands of, for example, infrastructure, regulations and politics, resulting in compromises in the final product. Bijker and Law (1992) discuss how a technology is the consequence of the environment it is created in:

> The idea of a 'pure' technology is nonsense. Technologies always embody compromise. Politics, economics, theories of the strength of materials, notions about what is beautiful or worthwhile, professional preferences, prejudices and skills, design tools, available raw materials, theories about the behavior of the natural environment – all of these are thrown into the melting pot whenever an artifact is designed or built.
>
> (Bijker & Law, 1992:2)

A highly regulated system is built on standards that a technology has to be aligned with (Timmermans & Epstein 2010), hence leaving little room for varying demands and enactments. A design process builds on intentions, which serve as structures for the project. These structures put boundaries on how actors engage with the object, and not all actors are in a position to execute changes by the existing standards (Timmermans & Epstein, 2010). Thus, the intentions of a design process are bound to be managed within the framework that is set by standards. However, standards not only influence possible intentions, they are also argued to have an important role in achieving a targeted outcome (Allen and Sriram, 2000). They can be a determinant of how an entity should respond in order to meet the defining criteria, or be a fixed or official measure, e.g. a price, quality or quantity. Allen and Sriram (2000) define standards as "documented agreements containing technical guidelines to ensure that materials, products, processes, representations, and services are fit for their purpose" (2000:172). Industry standards become a complex infrastructure of standards that guide actions and practices and result in a basis

for shared understandings between actors from different fields of expertise. Standardized activities, within a specialized profession, often originate from experts documenting their behavior, becoming, through feedback from other specialists, a standardized behavior throughout the field of expertise. Inspired by Bowker and Star's (1999) discussions on classifications and categorizations, Timmermans and Epstein (2010) define standardization as:

> [A] process of constructing uniformities across time and space, through the generation of agreed-upon rules. The standards thereby created tend to span more than one community of practice or activity site; they make things work together over distance or heterogeneous metrics; and they are usually backed up by external bodies of some sort, such as professional organizations, manufacturers' associations, or the state.
>
> (Timmermans & Epstein, 2010:71)

Standardizations build on rigid knowledge, shared across larger distances, and are difficult to change since they belong to the language used by the relevant actors. Standards become strong sources of alignment within a supply chain since many different engineered objects must respond to some shared rules in order to handle the objects safely. From afar, standards can be perceived as objective rules aimed at managing the specific setting, but these standards have been applied through rigid negotiations.

> Standards promise to provide the optimal technical solution for particular problems, and scientists and engineers are often called upon to provide expertise for standard-setting. This does not mean, however, that standards are intrinsically neutral. Standards' objectivity, universality, and optimality are hard won victories that can be heavily contested by third parties lobbing accusations of bias and politicization.
>
> (Timmermans & Epstein, 2010:73-74)

In project settings, standards and actors more actively advocate their interests being heard in the project design, with Law (1987/1994) introducing the concept of 'heterogeneous engineering' to explain the arrangement of human and nonhuman elements engaged in the creation of stable artifacts. Lucy Suchman (2000a) performed an empirical study on a bridge-building project in order to learn about the engagement between heterogeneous, but interdependent, interests. Her findings present bridge-building as a persuasive performance that relies upon and reflectively constitutes the elements to be aligned, illustrating that the actual construction work on the bridge is only one piece of the work of building a bridge.

> [I]t also turns out that the bridge itself represents a small fraction of the entire project relative to the highway approaches and interchanges that tie the bridge into the landmasses that it connects. And, while the design of the bridge structure is contracted out, Department engineers maintain responsibilities for the bridge alignments (that is, for deciding just where the bridge will be located and anchored) and for the design of all connected roadways. Moreover, it is here that many of the complexities of civil engineering work actually lie.
>
> (Suchman, 2000a:315)

A bridge project is part of the category of 'highway projects', resulting in the engagement of many actors – counties, cities, rights-of-way, and environmentally protected areas are represented by politicians, citizens' groups, private property owners and public interest agencies. All areas and actors communicate demands and opinions that need to be involved and listened to. Moreover, initiatives, e.g. clean air Acts or environmental protection Acts, can be initiated anytime during the process, resulting forcing the bridge-building team back to the drawing board for redesign and renegotiations (Suchman, 2000a). In conclusion, Suchman (2000a) remarks that: "The results are arrangements of social and material elements that, aligned well, can be effectively performed as stable artifacts that support the movement of people and goods through time and space" (2000a:325). Thus, when all the aspects and interests have been communicated, there is a chance of finding a stable artifact that is accepted by all the elements involved.

However, it is not only during the creation phase that projects demand engagement. The maintenance of an infrastructure, including highway products, but also other underlying structures that enable a modern society to function, i.e. electricity, water, the Internet etc., is similar to a creation project in the sense that the output quality depends on the ability to manage the demands (Star, 2002). Star (1999) explains infrastructure as big, layered and complex; thus, changes in infrastructure take time and must be managed through negotiation. Star states that "[n]obody is really in charge over infrastructure" (1999:382) since infrastructural change is not an internal project, with such effort requiring adjustment to other aspects of the involved systems. Thus, the final outcome is difficult to foresee.

A finalized bridge-building project, or any other type of infrastructure or technology, is not its final design; rather, its applicability to its contextual environment can change over time and it can thus be challenged in terms of its existing characteristics. Star (2002) argues that 'good' infrastructure is invisible in the sense that it ensures that activities are performed in the way they are designed to be used, by silently ensuring a satisfying outcome. 'Poor'

infrastructure, on the other hand, becomes highly visible in its inability to ensure smooth activity. In this case, all the building blocks become highlighted, showing how the infrastructure's skeleton consists of a complex matrix of boundary objects and standards. Infrastructures can be varyingly strong and also change over time, with some infrastructures improving while others are modified or exchanged. Star (2002) illustrates the infrastructure as a brick wall in which all components are the building blocks of that wall: "Each stands on top of the other, supporting, but not in a smooth or seamless fashion. Some stone walls fall down; some survive for thousands of years. Some are added to and maintained, some neglected" (Star, 2002:10-11).

Modifications or replacements of infrastructure take time, and can even be refused, since many activities have followed the rules of the existing structure and might thus need to be adjusted in order to align with any changes. However, not only infrastructural projects are challenged in this way, engineered objects can also inhibit changes since they co-exist with other actors and standards along their supply chain.

Leonardi (2010) highlights the contextual factors in order to understand the progress of technological development. Leonardi (2010) challenges the general story that the industry communicates car safety testing and the journey 'from road to lab to math' in terms of being driven by technological development. Instead, Leonardi (2010) argues that the story is only partly about technological development, but that it has, importantly, "co-evolved with legal action and a shifting US regulatory environment" (2010:267). Moreover, in order to transfer regulatory demands onto technology, there had to be organizational changes. "[T]he changes, over time, in strategies toward crash testing were made possible by technological, regulatory, and organizational innovations, which all evolve in response to each other" (Leonardi, 2010:268).

This resulted in the technological development being a shared outcome of the development within these three elements, instead of a development whereby only one element could be singled out for acknowledgement. Thus, the contextual environment is crucial to consider when to improving an understanding of technological changes and improvements.

Greener (2002), too, considers contextual factors to be seldom accounted for. Greener (2002) argues that management studies have historically failed to take up the role of tangible materials in organizations when it comes to understanding the logic of path dependency. The consequences of standards are recognized in many technologies, where the initial logic of a design can later become outdated, but stays in place due to the surrounding organizing that is based on this standard. Generations of typists have learned the QWERTY keyboard, a keyboard that was invented in order to keep the typist typing at a

pace that would prevent the tendency for the type bars to "clash and jam if struck in rapid succession" (David, 1985:333), a problem that occurred in keyboards that allowed faster typing. This keyboard layout was also designed to accommodate the sales trick of easily being able to type the brand name "TYPE WRITER", with the QWERTY layout being the final result. Over time more people learned this keyboard, which made it competitive vis-à-vis other keyboards, even though typewriter quality improved and could, if desirable, handle other keyboards that allowed faster typing. Thus, the initial logic of using the QWERTY keyboard is long gone; however, since people invested time in learning to master it, it became an international standard. Star and Ruhleder (1996, building on Becker (1982) write that "[g]enerations of typists have learned the QWERTY keyboard; its limitations are inherited by the computer keyboard and thence by the design of today's computer furniture" (1996: 113). The structures that uphold a technology can be invisible until challenged, at times of, for example, undergoing a design process when the structure or logic of the established technology is challenged.

Thus, in-between the times when a technology is challenged, it can be recognized as a function rather than a material object since its existence is taken for granted. Suchman (2000b) studies artifacts in everyday working practice, presenting how the everyday use of artifacts functioning to mediate activity also results in giving the artifact in question significance and functionality. Building on a text by Bødker (1996), Suchman (2000b) describes how artifacts move from being the symbol of the activity to becoming a transparent medium that smoothly coordinates that activity: "At the same time that tools and symbol systems mediate between individual and purpose, or subject and object, artifacts are continually shaped in and through their use". And she continues: "artifacts shift from being themselves the objects of our activity to working as transparent media through which we act with and on other objects" (Suchman, 2000b:6). There is not, thus, a constant focus on improving or adjusting an engineered object; this happens at specific times of change and is then taken out of context to be reviewed.

To summarize, an engineered object exists within a setting and thus cannot act, or be modified, in any given way, instead needing to align with industry standards as well as other actors' interests. This is important when studying a milk package that belongs to the food industry with its rigid regulations.

Object agency

As explored in the previous section, an engineered object builds on interests shown by the context that it is established in. Thus, these interests bring qualities into the object that result in preferences and potential treatment. Barad

(2013) argues that objects are not inert matter available for any inscription of culture and meaning; instead, they are shaped through practice between the social and material whereby the object has agency and is continuously a part of shaping its own materializing of its attributes and design. The initial properties are continuously being developed through practices.

> It is not an inert canvas for the inscription of culture and meanings, a static thing without memory, history, or an inheritance to call its own. It is not simply some thereness available for the taking. A mere backdrop to what really matters.
>
> (Barad, 2013:2)

Thus, objects hold knowledge and agency. Harré (2002) gives voice to the relationship between an object and humans "[t]he common material object, a non-living individual that occupies space and time, and is capable of interacting with human beings. Some material things are passive in relation to people, other things are active" (2002:23). This definition describes that not all objects are the same, and neither are all relationships between actors and objects the same. This relationship can depend on from what cultural understanding an object is enacted, which can give a seemingly neutral object a symbolic meaning, called a social substance (Harré, 2002). Harré (2002) argues that artifacts are as much a social act as cultural greetings are recognized to be: "The point of this article is to try to show that the same is true of how a piece of coloured cloth can serve as a national flag, a small metal disc as a coin, and so on" (2002:25). Brei & Böhm (2014) recognize how an ordinary commodity is transformed into a consumer activist brand as a consequence of a marketing campaign. Due to the altruistic message of the campaign, the commodity, bottled water, became a statement product and a symbol for caring, in contrast to the general understanding that drinking bottled water is wasteful consumption (Hawkins, 2011).

Rennstam (2012) argues that although objects are created by humans, they can be resistant to human attempts to make sense of them. Traditionally, agency has been deemed to belong to either humans or objects, meaning that it has been looked at from the perspective that one of the actants is in position of agency (Introna, 2007:32). However, the sociomaterial perspective builds on the belief that both social and material agency should be heard and taken into consideration (Orlikowski, 2010), with the possibilities of what can be achieved constantly being renegotiated, described thus by Ashcraft, Kuhn and Cooren (2009):

> Agency is not about determining the attributes of actors, but is instead about the constant (re)negotiation of possibilities, such that material

> and human agencies keep shaping one another in evolving time and space.
>
> (Ashcraft, et al., 2009: 31)

Rennstam (2012) builds on the work of Orlikowski (2007) when discussing the roles of social and material agency in organizing. Rennstam (2012) argues that an object is an equal actor to the humans who are involved, but its agency can be reduced if the actors do not engage with the object. However, the object must be included in decisions that are directly related to it in order to achieve a successful outcome. Rennstam (2012) introduces the concept of organizational objects, with the characteristics of objects being stabilizing reminders of organizational relationships, whereby these objects participate in organizational practices of knowing as perpetually unfinished and resistant objects of knowledge that 'act back' when acted upon. Additionally, Lindberg and Walter (2013) presents 'objects-in-use', where something is not an object until it is acted upon. The relationship between humans and objects is thus interactive and the agency of objects emerges once they have been interacted with. Starting from the creation of an object, as it travels along a chain of actors, it gathers more knowledge, generating object agency. Rennstam (2012) argues that organizational objects and actors interact to creatively develop knowledge in order to solve organizational problems by exchanging knowledge with each other. However, the way in which an object portraits agency is based on the inscriptions developed through practices.

Agency is not free, it has to be maintained through control parameters, which come at a price, in addition to consequences regarding lost value in terms of prohibiting desired aims. Fama and Jensen (1983) present this thus:

> Agency problems arise because contracts are not costlessly written and enforced. Agency costs include the costs of structuring, monitoring, and bonding a set of contracts among agents with conflicting interests. Agency costs also include the value of output lost because the costs of full enforcement of contracts exceed the benefits.
>
> (Fama and Jensen, 1983:304)

The bonding of contracts, in order to control conflicts between interests, results in the shaping of technology so as to ensure stability within the context it exists in. Agency costs can be visible when exploring the interests that are inscribed into an object.

Object inscriptions

The notion of inscription provides a useful lens for learning how both the social and material components construct an object. Inscriptions are traces of what a technology is constructed of (Akrich & Latour, 1992), visible as material translations of any setting like written texts, tables, numbers, and lists that can be engaged with and acted upon (Latour, 1986:14). Object inscriptions hold different actors' interests and, through the processes of translation and inscription, these dissimilar interests are aligned with each other and stabilized within the object (Callon, 1991). Latour and Woolgar (1979/1986) studied "the transformation of rats and chemicals into paper" (Latour, 1986:3) and elaborated on 'inscription device', which refers to an item that transforms something into a figure or diagram and ensures that its value is communicated:

> An inscription device is any item of apparatus or particular configuration of such items which can transform a material substance into a figure or diagram which is directly usable by one of the members of the office space.
>
> (Latour and Woolgar, 1979/1986:44)

The physical space, showing figures, diagrams or labels, leave no room for further explanation, but the communicated message is understood as facts or truths. Latour and Woolgar (1979/1986) study a laboratory environment, identifying that the outcomes communicated through reports are not challenged, but that the inscriptions are regarded as having a direct relationship with "the original substance" (Latour and Woolgar, 1979/1986:45) and communicating the original substance's focus of discussion. Latour (1986) expresses the experience of viewing the transformation of original substance into text thus: "All these inscriptions, as I called them, were combinable. Superimposable and could, with only a minimum of cleaning up, be integrated as figures in the text of the articles people were writing" (Latour, 1986:3-4). However, inscriptions are often misread as absolute truths and the output of diagrams or curves is not recognized as trends or averages, leaving them unchallenged and not revisited (Latour and Woolgar, 1979/1986). Thus, when something is inscribed it is also complied with.

Akrich and Latour (1992) provide a summary of a convenient vocabulary for human and non-human assembling, explaining how interests are de-scribed by an analyst to communicate what the various actors in the setting do to each other, while engineers, inventors and manufacturers in-scribe interests into the object.

> [F]or instance, the heavy keys are de-scribed by the following text DO NOT FORGET TO BRING THE KEYS BACK TO THE FRONT

> DESK, the in-scription being: TRANSLATE the message above by HEAVY WEIGHTS ATTACHED TO KEYS FORCE CLIENTS TO BE REMINDED TO BRING BACK THE KEYS TO THE FRONT DESK.
>
> (Akrich & Latour, 1992:259-260)

When an interest is inscribed it can be difficult to trace movements "from words to things" (1992:260), but this only occurs in 'a crisis' where the object is challenged and the constructing components become visible.

Inscriptions can be found everywhere. Joerges and Czarniawska (1998) argue that the world is inscribed and that the majority of these inscriptions are created by organizations. Using the example of a bottle of mineral water, Joerges and Czarniawska (1998) illustrate the organizing dimensions of its material technology, arguing that "[a]ll organizing, in its symbolical, political and practical aspects, needs to be inscribed into the matter in order to make organizations durable (indeed, possible)" (1998:371). Thus, it is further argued, technology makes organizing durable. Consumer goods are identified as highly semioticized objects and are full of signs of the greater system they need to align with: "Within a symbolist perspective in organization studies, researchers began to demonstrate that artifacts tell us something, that they are more than 'mere physical matter'" (Joerges and Czarniawska, 1998:370). Latour and Woolgar (1979/1986) discuss inscriptions as "numerical or lexical codes", but in inscription devices, e.g. consumer goods, "[s]hapes, sizes, colors, textures are also inscriptions" (Joerges & Czarniawska, 1998:375). Thus, the combination of inscriptions leads to a symbolic value that builds the attitude or way of handling the technology, but which can also be changed through the inclusion or exclusion of one or more inscriptions.

In another object genre, management tools are understood to play an important role in organizing work and, depending on a tool's inscriptions, this work is managed differently since it allows for certain behaviors and usage (Gärtner & Huber, 2018). The inscriptions in such tool hold inscriptions with "variable capacities to enable, translate, and regulate behavior" (2018:270). Actors have different interests in objects depending on their field of expertise, which is emphasized by Akrich (1992), who argues that the actors involved in the technology also encourage their own interests to be inscribed in the technology. Akrich (1992) describes how designers work with the challenges of innovating a product by involving different actors and learning about their interests:

> Designers thus define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume

> that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of 'inscribing' this vision of (or predictions about) the world in the technical content of the new object.
>
> (Akrich, 1992:208)

Actors make different demands of a technology depending on their expertise, giving it multiple roles or purposes (Mol, 2002; Leonardi, 2007: 2011). Robey and Sahay (1996) empirically show that an information technology's consequences are socially constructed, meaning that the social consequences of the technology depend more upon its social meanings than its material properties (Robey & Sahay, 1996:106). Thus, the way of interpreting the technology and its inscriptions is what determines how it develops and changes. This is further emphasized in Ingold's (2000) argument that artifacts are never a free-standing entity but embedded in a system of relations. Different understandings of an object can also result in an object being able to gain more than one technical identity (Faulkner & Runde, 2009), and thus actors can have different expectations regarding the object.

> Note that it is quite possible for the same physical object to possess more than one technical identity. There are two main possibilities here. The first arises where different social groups, possibly intersecting, assign different functions to the same object, such as the group that uses nail files for manicures and the group that uses them to pick locks.
>
> (Faulkner & Runde, 2009:444)

Thus, in a design process, there are many different interests to meet the varying actors' demands. Leonardi and Barley (2008) discuss how changes in technology result in new ways of enacting technology, which has an impact on the social networks that define the organizational structure:

> When technologies are used in ways that allow people to do new things that would have been impossible before, tasks and roles frequently change. When work roles change, role relationships usually change: workers interact with colleagues in new ways and may even find themselves interacting with members of occupations with whom they formerly had no contact. When role relationships change, it is likely that the social network that defines the structure of an organization will also shift.
>
> (Leonardi & Barley, 2008:165)

At one point projects must be tested on external actors and exposed to the usage, or failed usage, of the users. This stage is often full of surprises in terms

of how the actors enact the project, and how the project team responds to the received feedback. Leonardi and Barley (2008) argue that human behavior when consuming, handling, using or ignoring a product can vary from what its designers envisaged as being a logical behavior when interacting with it: "[b]ecause technologies are designed and because designs can be altered, humans can both intend and change the social effects of a technology by redesigning it or, failing that, by refusing to use it" (2008:160). Thus, it is from the interaction that it is possible to learn how well the object meets the actors' demands.

Thus inscriptions result in ways of influencing enactment since they allow and neglect some usage or treatment. However, the work of inscribing interests into an object can be challenging. Reijonen and Tryggestad (2012) claim that artifacts can be understood differently over time and illustrate how new product properties can be requested, in this case the attribute of being environmentally-friendly, but how such requests can be difficult to inscribe and instead are gradually acquired over time. The acquiring of new product properties shapes the relationship with the market: "product properties eventually (de)stabilize in constant alignment with market actors' interests while simultaneously shaping these" (2012:216), resulting in a challenging of the specific product definition. The interconnectedness between the object and the market shows that the greening of the industry cannot happen solely from an artifact perspective, it must also occur through symbiosis between the two.

The above discussion builds on literature that has developed the notion of inscriptions, a useful lens when exploring what an object is constructed by (e.g. Latour & Woolgar, 1986/1994; Joerges & Czarniawska, 1998). Additionally, the notion of inscriptions is a lens that allows the exploring of the organizing performed when designing an object (e.g. Gärtner & Huber, 2018; Reijonen & Tryggestad, 2012). Therefore, it provides a possibility of opening up an established object and seeing the different regulations and standards it answers to, and which serve to standardize qualities and ensure safe products.

Inscriptions belong to a specific expertise in a setting, e.g. researchers in a laboratory lab inscribe codes and texts into their laboratory reports (Latour & Woolgar, 1986/1994), or authorities write regulatory and health focused inscriptions into a bottle (Joerges & Czarniawska, 1998). These are expected to happen at a certain occasion and to then be managed by the engaged actors. However, inspired by research on the notion of enactment that communicate that many actors engage with having their interests inscribed (e.g. Leonardi, 2011) because objects can have multiple meanings depending on the actors' different fields of expertise (Mol, 2002), which result in different interests in object qualities. This results in challenges in defining a disease such as

atherosclerosis since there are “different atherosclerosis enacted over moments in a patient's itinerary: diagnosis and treatment” (2002:115). Object design studies, too, communicate that objects have different parameters to respond to, illustrating that various actors are engaged in inscribing interests (e.g. Leonardi, 2011; Reijonen & Tryggestad, 2012).

Thus, this supports a need to account for the different mechanisms, within the same physical format, that actors engage with when learning about an inscription process which illustrates the demand to account for interests originating from different kinds of expertise, perceived needs and beliefs. Based on this argumentation, the analytical lens of inscription should be developed in order to improve the capacity to study how engineered objects are constructed, something which can be done by dividing interests into domains based on their perception of the engineered object’s roles and tasks. The concept of the domain is useful when categorizing interests. Styhre (2001) reflects that Foucault (1980) analyzed genealogy through the lens of domains in order to capture the different axis it consists of, where the domains allow categorization, but without making the axes mutually exclusive. Additionally, Bruns (2013) make similar use of domains to communicate different expertise in the field of systems biology cancer research, which start from the same phenomena, but approach it from separate fields of expertise. Thus, domains are useful for unboxing a larger community, for example a space, a concept, or a technology, where the domains can make sense of, for example, a space holding separate or opposing understandings.

In this way, the concept of domains provide the possibility of seeing different object mechanisms that result in the many, and sometimes conflicting, interests inscribed into an engineered object. Thus, it allows to account for the interests shaping the object, e.g. regulations, standards and economic interests, but also in relation to the object’s agency to ‘act back’ when acted upon (Rennstam, 2012), as a way to learn about the interests that construct an engineered object.

Chapter 3: Methodology

Methodological choices build on ontological and epistemological assumptions and this study adopts a relativism ontology by using the theoretical framework of sociomateriality which advocates social and material entanglement in practice (e.g. Orlikowski, 2007: 2010). This ontological understanding has direct consequences for data collection since it implies a need to learn about objects as equally important to learning about people and, additionally, exploring how they interact with each other. Flyvbjerg (2006) emphasizes that good social science is problem-driven and not methodologically-driven in the sense that the employed method should be the one with the greatest potential to answer the research question. Hence, this study builds on a qualitative empirical method that allows the researcher to be close to the phenomenon and to gain a rigid understanding of the organizing work. Silverman (1993/2006) emphasizes that the main benefit of qualitative studies is the possibility to view a phenomenon that would not be visible in a quantitative setting. For theory-building research that answers "how" and "why" questions, Eisenhart & Graebner (2007) argue that the qualitative method, called case studies, is the best way to seek answers, with Lee (1999:38) adding that qualitative research is well suited to "describing, interpreting, and explaining" a phenomenon.

This study could be argued to be a "revelatory case" in terms of observing a process and its related mechanisms, which have not previously been observed or adequately described (Yin, 2003). The "revelatory" part of the case lies in the opportunity to study the process of applying a new milk package on the national market level, which, at the studied dairy production site, had used a previous packaging solution for the last 30 years. This resulted in a design process for an object with an increasing amount of engaged actors, as compared to when it was previously established. Additionally, although

famous researchers such as Bruno Latour, John Law and Michel Callon have performed studies on mundane objects, objects in these genres are often neglected in organizational studies in favor of hi-tech and modern technology (e.g. Vaughan, 1990; Orlikowski, 2007; Leonardi, 2011), something which results in revelatory aspects.

As a case study might mean different things to different people, it is important to answer the question "What is this case a case of?" (Flyvbjerg, 2006:238). Czarniawska (2014) claims that many researchers confuse the studied site with a case study, but emphasizes that a case study is a study of a phenomenon. This thesis studies how the organizing and handling of a milk package influences the outcome of that milk package's design process. Moreover, it also builds on the aim of learning about how different interests become inscribed into an engineered object, making the object a key component of data collection. Thus, this study employs an ANT-inspired methodology by exploring the social and material aspects of data collection (e.g. Latour, 2005).

The setting

Data collection is managed within the Swedish milk industry, with the aim of studying the organizing and handling of a milk package, which requires knowledge of the direct practices of both a milk package and the underlying structures that the industry relies upon, e.g. knowledge of legislation, cultural preferences and competition. The milk package's design process resulted in a new packaging solution called 'Gabletop with screw-cap', which was launched in mid-2012. My empirical data collection was initiated in early 2015; at this point, the milk package design process was still a relevant topic since reactions to the launched Gabletop package had not indicated complete success, but had required adjustments, which were undertaken at this stage. It was during the stage of implementing new packaging attributes in 2015 when this study was started, entailing that the initial design process had been studied retrospectively and interviewees had been affected by the feedback received during the implementation phase. However, among the divergent interests, it was possible to identify different actors that had been active during design process decision-making, as well as actors directly affected by the decisions made. During the data collection period, two design changes were made to the package.

A milk package contains milk that belongs to the 'fresh food' category, entailing quick production flows and local distribution. Additionally both the package producing company and waste management treatment have been located in Sweden. This results in the ability to trace the full production life of a milk package within Sweden, which, from a research perspective, has made it easier to get in contact with the identified actors along the supply chain and

the relevant industry associations. It has ensured face-to-face interviews, and made visits to key locations for observations achievable. Furthermore, it also means that the actors are well acquainted with Swedish rules and regulations, and current discussions in the packaging field.

A package travels through many organizations throughout its life. In this story the milk package's material is produced by X-Pak (package producing company), filled with milk and made into a consumer good at Dairy Corp (product-owning company), and logistically distributed and sold by retailers such as Foodtail (retailing organization). Although all three organizations are highly involved in the production stages of a milk package, it is Dairy Corp that makes the final decisions about which packages to use in its consumer goods and bring to market. Moreover, it is also the responsible organization as regards ensuring product safety on the market, resulting in Dairy Corp being the organization that I have primarily engaged with for data collection.

These organizations execute and organize the milk package during the different production stages, but there are also influential interests that go beyond the organizations engaged in the production of the milk package. These interests concern the governmental agencies, industry associations and consumer groups that need to be considered when learning about the organizing of a milk package. Milk is consumed by most people, from small children to the elderly, having a cultural heritage in the Swedish food tradition. Hence, the case is useful from a pedagogical point of view in illustrating that also a mundane object such as the milk package is organized within a sophisticated setting based on rules and standards, making design changes difficult.

This study builds both on an underlying interest in sustainability-related issues in production industries and on what this interest means to the organizations engaged in milk package production. This is studied by learning about how interests are inscribed into an engineered object's design process. From this perspective the empirical setting is suitable since the production companies engaged in the package have formulated great ambitions via their sustainability agenda and should hence encompass the growing sustainability demands. At X-Pak there is a long-term goal of offering all of that company's products using 100% renewable materials; at Dairy Corp there is a communicated aim of decreasing emissions of greenhouse gases by 25% in production, transportation and packaging by 2020, compared to 2005 levels. An overarching goal of Foodtail is to decrease that company's climate impact by 30% by 2020, compared with 2006 levels, foremost related to the areas of logistical and distribution.

Data Collection methods

The purpose of data collection has been to learn how different interests engage with the milk package and how their interests are negotiated for inscription into the object. In order to learn about the different interests that engage with the milk package, the initial focus was on mapping the food packaging industry in order to trace the engaged interests. Second, when knowledge of the general engagement of the industry had been established, data collection was performed in organizations directly involved in the production of the milk package and the consumer good it eventually became a part of. This made it possible to gain insight into how the organizing of the milk package was performed and which actors engage with the package, and how, during its different life stages. Moreover, in order to identify interests and learn how these become inscribed into a milk package, data collection focused on the milk package's design process, which teaches us about the courses of action required to achieve a new package design, which was eventually implemented and accepted on the market.

This resulted in the use of three different field-note techniques. First, I conducted interviews with people who in some way engaged with the package, starting out from a general industry perspective and narrowing down to a specific milk package. Second, I conducted observations in order to learn how the package is managed in different settings. In this way, I was able to follow the package along the supply chain to see how it is managed during production, and to observe how it was displayed in the store. Lastly, I read and analyzed documents about the packaging industry, which originated both from the companies involved in producing the package and from the legislators and regulators. Additionally, I analyzed the information written on the package in order to trace the origin of the package inscriptions (Joerges & Czarniawska, 1998).

Data collection was performed over a period of two years, from 2015 to 2017, with a more intense data collection period occurring in 2015. The collection of new material was stopped when the interviewees were adding little new information and when people were starting to refer back to people already interviewed. At that time I came to the conclusion that data collection had reached a satisfactory level (Kvale, 1996).

Mapping interests

Milk package goes through many different stages throughout its life. In order to answer my research question I began my study by mapping the life stages of the milk package, which allowed me to identify the actors that engage with the package at different stages along the supply chain, both practically and as

industry associations engaging with industry interests. During this phase, I made two decisions that had a direct impact on data collection. First, in order to focus on the milk package I decided to start the supply chain with the production of packaging material, although another option would have been to go all the way to the organizing of material resources, e.g. organizations engaging with oil and wood resources that eventually become packaging materials. Second, the study has its origins in an organizational perspective, which results in a focus on the work performed by the organizations engaged in the production phases of the package, in order to learn about organizing matters.

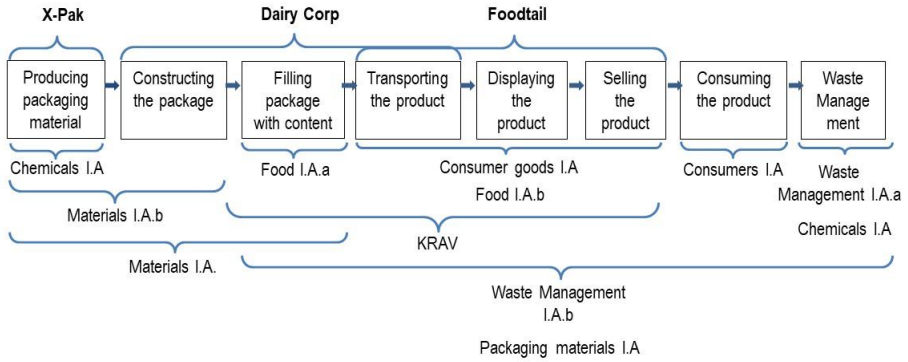

Figure 1: Organizations in relation to their engagement

The overarching focus of the interviews has been learning about the interviewees' engagement and enactment with the milk package. Since the interviewees were geographically separated and active during different life stages of the milk package, data collection was primarily based on interviews. Another common technique used in data collection in organization research is performing observations since this provides a firsthand understanding of the organizing work (Czarniawska, 2014). However, since the aim of this study was to explore a larger context of interests engaged with an engineered object, and it was not a solution fully applicable to this study, interviewing was instead a rewarding technique for learning about a topic of concern. Charmaz (2006:25) develops this as follows: "[A]n interview is a directed conversation (Lofland & Lofland, 1984,1995); intensive interviewing permits an in-depth exploration of a particular topic or experience and, thus, is a useful method for interpretive inquiry.

In organization studies, the topic of interest is often the practical performance of the interviewees' work. In this study, the topic of interest is the aim of exploring how different actors engage with a milk package. Therefore, the

interviewees in this study were identified because they had roles engaging with the milk package, either directly or indirectly.

The initial interviews served to provide information about the food packaging industry: i.e. which actors are involved, and how they influence the industry. The focus was on food packages in general as these interviewees were part of the food packaging industry and not milk and dairy packages specifically. The interviews were structured as 'intense interviews' (Charmas, 2006; Czarniawska, 2014), conducted in order to comply with an open-ended format which allowed the improvising of questions in order to follow up interesting leads and new themes arising during them. Kvale's (1996) framework of conversational, qualitative interviewing was useful as regards ensuring that the interviews produced data that was relevant to the research area under study.

The interviewees were traced using the so called snowballing technique (Czarniawska, 2007) whereby interviews were ended by asking about other relevant people to interview, making the process reliant on interviewees who were experts in the industry and the organizations as regards guiding me toward other relevant people. The first interviewees were initially suggested by the trade association, referred to as Consumer goods I.A.; from there, the list of interesting people and organizations expanded on the basis of the interviewed actors' suggestions. These recommendations contained actors involved in recycling, opinion-holders, e.g. consumer organizations and environmentally-focused NGOs, trade associations, quality certification organizations and academia. These were telephone interviews, with the exception of the interviews conducted at KRAV, where I met the interviewees face-to-face. The key themes in these interviews and information about the positions and organizations of the interviewees, are presented in Table 1.

Table 1: Interviews performed at trade associations

Industry associations	Role	Date	Duration	Themes
Packaging materials I.A.	Researcher	2015-01-13	1.5 h	- Challenges pack. industry - Trends
Consumers I.A.	CEO	2015-01-23	50 min	- Opinion-molders food industry - Social sustainability food industry - Modern packaging solutions
Materials I.A.	CEO	2015-02-04	1h 10min	- Pack. material challenges - Price pressures - Increasing collaborations

Waste management I.A.a	CEO	2015-02-04	57 min	- Recycling statistics - Pack. material challenges - Consumer communications
Materials I.A.b	Project leader	2015-02-05	50 min	- Certifications - R&D in packaging - Polluting materials - Material qualities
Food I.A.a	Project leader	2015-02-13	45 min	- Innovation food & packaging - Background food industry
Chemicals I.A	Communication manager Plastics	2015-02-17	55 min	- The qualities of plastic - Plastic and recycling
Waste management I.A.b	CEO	2015-03-20	50 min	- Material pollution - Attitudes & behaviors over time
Food I.A.b	Researcher	2015-03-30	1 h	- Food waste - Packages seen as 'service' - Packaging research
KRAV Quality Certification org	Legal advisor	2015-10-08	1h 15min	- Demands re. packages - Polluting materials - Packaging development - Industry collaborations
KRAV Quality Certification org	Consumer contact	2015-10-08	1h 15min	- Consumer interests - Consumer attitudes - Communications

Since I ended the interviews by asking for recommendations about who else to speak with, this assisted me in identifying the actors engaged in the manufacturing and distribution phases of the package. At the companies (X-Pak, Dairy Corp and Foodtail), I interviewed people who were directly involved in production, distribution and product sales. The main focus was on Dairy Corp as this company is legally responsible for products entering the market and in a position to make final decisions as regards which types of dairy package to bring onto the market. I performed 10 interviews with industry actors, as well as 35 interviews and 10 additional follow-up interviews, with actors at the production companies. In total, there were 55 interviews.

Table 2 communicates the interviews performed at Dairy Corp for data collection. The initial interest was learning about the direct organizing of milk packages performed during the manufacturing phase, and to gain insight into the work performed during a design process. The interviews were conducted with actors working either directly or indirectly with dairy packages and in order to learn how these actors work with the package, or how their work impacts it, resulting in a wide range of actors. The milk package's design

process was an important interview subject as regards making the interviewees concretize their work and aims, and as regards learning how different interests were either conflictive or supportive.

Table 2: Interviews conducted at Dairy Corp

Name	Department	Date	Time	Themes
Erik	Supply Chain	2015-04-23	1h 40min	- Packaging alternatives - Projects - Internal interests
	Follow-up interview	2015-10-23	30 min	- Project management - Packaging materials
Magnus	Asst. Site Production Manager	2015-04-23	40 min	- Milk history - Dairy Corp history - Production possibilities
	Follow-up interview	2016-12-06	30 min	- Manufacturing routines
Hans	Site Production Manager	2015-04-23	30 min	- Machines - Packaging materials - Local production site
Eva	Marketing department	2015-05-10	1h	- Product marketing - Private label assortments
	Follow-up interview	2016-04-22	1h 30min	- Packaging projects - Project groups - Project management
Marie	Marketing department	2015-05-10	1h	- Packaging projects - Renewal - Food waste
	Follow-up interview	2015-10-23	30 min	- Project management - milk packages
Sofia	Marketing department	2015-05-10	1h 15min	- Milk - Packaging challenges - Packaging projects - Packaging producers
Adam	R&D	2015-06-02	1 h	- Aligning food and package - Package to protect food
Jonas	R&D	2015-06-10	1h 30min	- Supply chain challenges - Lean production
Emil	Sustainability department	2015-09-04	40 min	- Internal sustainability work - Packaging projects - Role of guiding
Gunilla	Consumer Care	2015-09-04	50 min	- Consumer contacts - Media - Milk farmers' vulnerability

Katarina	Procurement	2015-09-04	55 min	- Procurement aims - Small financial resources - Procurement process
Alf	Marketing department	2015-10-09	50 min	- Brands and value - Quality certifications - Local production - Challenged by private label assortment
Jenny	Sustainability department	2015-10-23	1h 40min	- Company governance - Marketing dept. dominance - Bio-based materials
Margareta	Management team, Admin	2016-01-19	1h 30min	- Dairy Corp's history - Ownership and governance - Package's tasks
Elin	Marketing department	2016-04-20	1h 20min	- Advertising - Packages as face of product - Challenges
Tobias	Procurement	2016-04-22	1h 15min	- Private labels - Company structures and improvements - Internal communications
Niklas	Sales department	2016-04-22	1h 10min	- Slow internal system - Common understanding: 'one size fits all' - Retailer relations
Sara	Production	2016-10-18	1h	- Milking procedure - Farmer-Dairy Corp relations - Farmer challenges - Safety
Maria	Production	2016-12-06	1h	- Project management - Production efficiency - Projects are time consuming
Lars	Production	2016-12-06	1h	- Production safety - Traceability - Hygiene - Certificates & documentation

Given the interest in the actors' engagement with a milk package, the organization where the object is produced has been given little attention. Although the interviews were largely conducted at Dairy Corp I have not visited the company without having booked any meetings. Moreover, there was never a time when I was given free access to the company, since neither a desk nor an access card were given to me. Instead, my initial contact with a person in a high position within the organizational structure resulted in 'word of mouth' among the employees, leading to people knowing about my presence and study.

Table 3 lists the interviews conducted at X-Pak. In an interview at Dairy Corp, Erik from Supply Chain put me in contact with Göran from Sales at X-Pak, which has Dairy Corp as one of its customers. X-Pak sells packaging solutions to Dairy Corp; staff in mechanical engineering at X-Pak are active at the milk production factories since they perform servicing and install new machines. In a similar manner as with previous interviews, the interviewees shared valuable information and guided me toward other relevant people to interview. After the first interview at X-Pak my aim was to learn more about X-Pak's role in designing innovative packages and about the work performed in order to ensure that these packages align with supply chain demands.

Table 3: Interviews conducted at X-Pak

Name	Department	Date	Time	Themes
Göran	Sales department	2015-10-23	50 min	- Industry relationships - Packaging projects - New packaging materials
	Follow-up interview	2016-11-30	30 min	- X-Pak's role in industry - History and development
Nils	Innovation	2015-12-09	1h	- Org. chart - Environmental focus - Customer demands
Anna	Innovation	2015-12-16	1h	- Green products - How projects are initiated - Influencers: suppliers, customers, Consumers
Tage	Sales department	2016-10-12	2h	- Established industry standards - Recycling of materials - Communications

Table 4 lists the interviews conducted at Foodtail. When following the manufacturing of dairy products, and learning about a milk package's design process, the retailers have an important role since they are the ones managing parts of the distribution process, in addition to putting the products on the display shelves in order to be sold. Thus, the organizing of the dairy products, as well as the organizing of all different food products, was an important theme during the interviews with the employees at Foodtail.

Table 4: Interviews conducted at Foodtail

Name	Department	Date	Time	Themes
Mikaela	Packaging development	2015-10-19	40 min	- Packg. innov. dependent on product - Packaging innovations expensive

Maria	Packaging development	2015-11-05	1h	- Product specifications from producer - Wasted products and action - 'Green' innovations
Frida	Design	2015-11-05	1h	- Supply chain management - KPI packaging design - Trends
Daniel	Logistics	2015-11-05	1h	- Waste and incentives for change - Supply chain management - KPIs
	Follow-up interview	2015-11-20	50 min	- Industry standards - size and volume - Waste is expensive - Sluggish industry systems
Karin	Logistics	2015-11-04	50 min	- Wrapping - Industry standards - Waste
Claes	Sales department	2015-12-07	1h	- Profitability work - Tools for improved sales - Internal feedback loops
	Follow-up interview	2016-01-07	50 min	- In-store sales techniques - Supply chain management
Erik	Store management	2016-01-07	50 min	- Communications with supply chain - Safe treatment and production - Store focus
Joakim	Dairy assortment	2016-01-07	50 min	- Dairy range changes - Store management - Revision windows

Most of the interviews were conducted at the respective interviewee's workplace. Exceptions to this involved one interview being performed at a café, one in the interviewee's home, one via Skype while the interviewee was driving his car, and three regular Skype interviews. The interviews lasted between 30 minutes and 1 hour 40 minutes, the average being one hour. All the interviews were recorded and then transcribed.

Following the object

Porsander (2005:14) provides an inspirational study whose empirical focus was on giving a computerized administrative system its own voice. Similarly, this study is interested in coming close to the object in order to learn about the interests organizing it and in having interest in a new packaging design. Therefore, collecting the empirical data was designed in order to track the package using a helicopter perspective (illustrated in Figure 1) and in order to identify the actors along its supply chain and to use this to identify actors for interviews. Coming close to the milk package in the places where it is managed provides insights into how it engages with other objects, e.g. the milk content,

related machinery, truck loading area, display areas in grocery stores, etc. This is a helpful technique when it comes to making a usually invisible network visible (Czarniawska, 2014).

Moreover, in order to gain more thorough insight into the production of a milk package, from being manufactured, distributed and put on display for sale, and thus to be able to apply the information given to me during interviews using my own experiences, I visited three venues. These venues were: a dairy production facility, where the package is assembled, filled with content and sealed, a logistic storehouse, where products are quality-checked and stored until delivered to the store, and a grocery store, where products are received, displayed and sold. These visits were hosted by interviewees, who guided me through these venues. These visits started with an interview of the person in question who then guided me through the venue, which helped me to understand the organizing and practical work carried out at the venue, before starting the tour. Throughout the visits I had the opportunity to ask questions and, since my guides already knew my research interests, they also emphasized things that were assumed to be of interest to me, but had only been briefly mentioned or forgotten about during the interview.

This data collection technique is influenced by something called "object shadowing" (Czarniawska, 2007). Shadowing the object encourages the researcher to learn about the different stages of its life, as well as who and what it interacts with along the way. There are at least three advantages of shadowing an object. Firstly, it helps to avoid some of the ethical problems related to shadowing people. Secondly, it is a way to learn about power. If everything was clear right from the beginning, and all the actors were already known, there would be no story to tell. Lastly, following an object diminishes the risk of focusing merely on people and neglecting many other actants forming a network (Czarniawska, 2007). Leonardi and Barley (2008) encourage studies interested in studying the interplay between materiality and agency during times of development and use in order to increasingly follow the technology:

> To date, most students of technology and organizing follow the social: that is, even though they may select research sites based on their interest in a particular technology, data collection typically involves charting patterns of use, interaction and organizing (2008:167).

Observing the technology as it moved from one group to another made it possible to identify how the engaged actors see the technology's material properties against the backdrop of their own work agenda and perspective (Leonardi, 2007).

Using methodological terminology, these visits are referred to as guided tours (Adolfsson et al, 2009). Adolfsson et al. (2009) argue that a guided tour is recognized as an effective way of passing on knowledge, presenting stories, and displaying ongoing processes. Yet, it is possible for tours to be organized in such a way as to show visitors only what their guide wants them to see. My guided tours were different from routine guided tours (e.g. Adolfsson et al., 2009), in that they were created as they were performed. My guides were not professional guides but practitioners at the respective site; although they may have guided other visitors previously, my tour was unique as I was allowed to choose what was presented, visualized, or interacted with. Nonetheless, my personal guides told me their stories, and presented what they perceived to be relevant areas to display on the basis of my research interest.

These visits were valuable for data collection as regards visualizing what comments such as "efficiency" and "high volume product" actually mean in the manufacture of dairy products; as regards what "26,000 pallets a day" and "needs to fit on a pallet" mean in a distribution hub context; and as regards experiencing statements such as "too large a range" and "need to fit in the display area" when communicated in respect of the dairy range of the grocery store.

Encouraged by Martin and Turner's (1986) suggestions, I sat down as soon as possible after the visits had ended, and always within two hours, to write down my experiences. I first made a list of the keywords used. Then I worked with one keyword at a time, turning them into lengthy and detailed descriptions. Finally, I attached photos to my observation notes, which had been documented while doing the tours, in order to improve my understanding and to remind me of the setting when coming back to these extracts in the future.

Documents and inscriptions

A milk package belongs to an industry setting where there are rigid industry standards and legislation; in order to learn about these different rules and regulations, documents have been important sources of data (Atkinson & Coffey, 1997). These documents belong to the following genre: legislative texts, reports on industry standards, annual reports and website information for the organizations involved.

Moreover, the package itself has also been a great source of information. Inspired by Joerges and Czarniawska (1998) I have analyzed the visual information printed on the package in order to analyze both what is inscribed and where these inscriptions originate from.

Analyzing the data

As suggested by many field researchers, fieldwork is usually organized according to an abductive logic (Czarniawska 2014:43). In abductive logic the researcher goes back and forth between data collection and analysis (Charmas, 2006). When collecting data, I formulated summaries of the key information (e.g. Miles & Huberman, 1994) in order to make the main area of interest in the interviews available. The analysis of already-collected material leads to further data collection, since this process visualizes important information and what direction the coming interviews should take. Data collection was performed during three phases, with the analysis of the collected material being performed in-between each collection phase. The interview data from the industry actors guided the following stage so as to focus directly on the production companies and primarily Dairy Corp, since they are the ones making final decisions about what to launch on the market. This second phase of the data collection process revealed an interconnectedness between the actors along the supply chain, where decisions were based on internal and external demands in order to have dairy products that were attractive throughout the supply chain. Analysis of this stage resulted in knowledge of the milk package's design process which was a project that engaged many actors as a consequence of the big changes and compromises it resulted in. This led to the third phase, where I was more selective and formulated more specific questions in order to learn about the design process, leading to 10 follow-up interviews with some actors as well as interviews with other actors who were directly involved in the project, but who did not work with the general production of the milk package.

The interviews were recorded and later transcribed to facilitate coding of the material. The transcripts were then closely analyzed on different topics relating to the interviewee's everyday work, his/her interaction with the packages, etc. Reading and re-reading the transcribed material eventually allowed some themes to emerge from the body of material and these served as the basis for coding the data. Coding is an important link when going from data collection to developing an emergent theory, since it is through coding that the researcher defines what is in the data (Charmas, 2006). Thus, the coding process is an important step in deconstructing the collected material from the voices of the interviewees and allowing the re-building of the material into the story told in the empirical Chapters 4 to 7, and the analyzing of the material theoretically, which is done in Chapter 8.

Van Maanen (1979) introduces two types of concepts needed when coding the material: "Put simply, first-order concepts are the 'facts' of an ethnographic investigation and the second-order concepts are the 'theories' an analyst uses

to organize and explain these facts" (1979:540). What Van Maanen refers to as "first order concepts" relates to the empirically-grounded data directly visible in my material. Categorization of these concepts started out from broad themes related to the package; I identified 25 different concepts that labeled things like: "package as a piece of puzzle", in order to group the distribution process which results in managing large volumes of products and has strict size requirements; "food safety concerns", including the legislation and certification that a package engages with; "package as protection", as a concept for grouping the industry focus that thought packages should primarily protect the milk and that everything else was secondary; "package as waste", for grouping statements on how packages become visible when their job of protecting the milk is performed, but with the package still being around; "manufacturing efficiency", which describes statements that focus on the package as a high volume product requiring a high level of manufacturing efficiency. These concepts were closely connected with the text and were analyzed in relation to each other to establish first-order concepts that grouped more inclusive themes.

When this initial coding had been performed I went through the identified concepts to find common areas and to group them into broader concepts or, in Van Maanen's (1979) words, to place them in "second order concepts". The second-order concepts were created to abstract from the empirical data in order to enable theorizing. This process was driven by the question: 'What's going on here?' (Gioia, Corley & Hamilton, 2013:20); that is, the first-order concepts describe different expectations of what the milk package should respond to. However, during the first attempt at coding the second-order concepts, the focus had a descriptive tone that gave a good industry overview, but failed to produce depth in order to ensure an analytical contribution that would add theoretical knowledge. In the first-order concepts, I was able to identify many different interests wishing to be represented in the milk package, which allowed me to see conflicts between different interests whose aim was to be inscribed into it. The actor interests can be divided up into the different categories, whereby each category shares an understanding of the milk package's role and responsibilities. A milk package must respond to different aspects, e.g. legislation, milk qualities, related machinery, standards introduced into the contextual environment, and user perceptions. These aspects become inscribed into the object through the work of different actors who communicate knowledge using their competence, perceived need and belief. It is possible to identify interests seeking object inscriptions within three distinct, but related, categories. The identified categories are defined as follows:

Material quality concerns - interests that serve to ensure packaging materials that comply with the regulations and safety requirements placed on the package, as well as ensuring that packaging material aligns with waste management regulations.

Operative functionality - interests that work toward ensuring the functions of a milk package during the different stages along its supply chain. These interests relate to a product's alignment with the standardized requirements of the general food industry. Moreover, operative functionality refers to interests that work toward ensuring a well-functioning package that meets functional expectations on requirements to, for example, open easily, pour milk from, attract, and be recyclable.

Economic incentives - interests within the economic aspects of a milk package with the aim of ensuring product profitability by means of using resources efficiently. The milk package is considered one piece of the consumer good to be sold on the market, with the interests relating to the cost savings and competitive advantages which, in different ways, influence the milk product's economic results.

As will be argued, these categorizations help us to see how objects have different meanings to actors who have diverging expertise. In the analytical chapter, these categories are theorized and communicated as inscription domains. This lens demonstrates the different mechanisms of the milk package that the different actor interests build upon, and how a milk package is designed with the mission of compromising interests rather than optimizing them. The categories are all needed in order to ensure a milk package is accepted and the inscription domains are interrelated, resulting in the need to negotiate the interests between the domains, but additionally negotiated within a domain.

Quality of the study

This method chapter aims to answer requirements regarding dependability through providing a detailed description of the research design, including data collection and the analytical process (e.g. Krefting, 1991), as a way to ensure that readers can follow the development of insight and the analytical process (Guba, 1981). Moreover, complete records of the data collected during the research process, including interview transcriptions and the coding of the material during the different stages, will be kept safe to enable examination at the point of completing the study (e.g. Bryman & Bell, 2015).

The nature of the topic of this thesis does not belong to what can be considered to be a sensitive research field. Nevertheless, ethical concerns have been taken into consideration during the collection, analysis and presentation of the

empirical data. The interviewees have been recruited on a voluntary basis and have been informed about the research purpose prior to their interviews. This study is based on a milk package and the interviewees have been traced on the basis of their engagement with that package. Therefore, the empirical material involves actors from many different positions, and within a wide range of trade associations, who were identified as influential as regards the way the milk package industry is structured. In order to keep attention focused on the milk package, the organizations and interviewees have been given pseudonyms. There is one exception regarding interviews with people working at KRAV, which is a well-known brand, and this was decided in consultation with the interviewees.

The empirical material is based on a design process that has primarily been studied in a retrospective manner, which can be argued to have advantages and weaknesses. On the one hand, retrospectively collected material makes the data reliant on the interviewees' recollections of past events (e.g. Tsoukas & Chia, 2002), and can be argued to lack nuance since all the engaged actors know the result. However, one advantage of a retrospective study is that it allows you to gain an overview of the design process and be guided toward the key events that were relevant to the final design result. Moreover, it also provides the possibility of tracing the relevant actants, potentially going unnoticed during the ongoing process (Czarniawska, 2014).

In the empirical story presented in the coming chapters, the interests that compose these categories are presented on the basis of their view of and interaction with the milk package, and how it is related to during a design process.

Chapter 4: To contain milk

From an observer's perspective, little has happened in the Swedish milk packaging industry since the introduction of cardboard-based packages almost 70 years ago. Over the same period of time the dairy industry has evolved greatly from building on local and regional production scales, to become an internationally traded good with more intense competition. In order to stay competitive the dairy companies have been confronted with a growing amount of interests to be considered.

The empirical study builds on the initiation and implementation of a new milk package within a product-owner organization called Dairy Corp. After more than 30 years of using Tetra Brik machines to manufacture milk packages, the machines have become increasingly dependent on service and maintenance and thus Dairy Corp had to consider a new machine park. Dairy Corp could choose from investing in new Tetra Brik packaging machines or machines providing other types of packaging solutions. In order to implement a modern packaging solution the choice was to invest in a new packaging machine park.

The empirical story explores how different interests are considered and negotiated when managed in a design process in order to see what construct the new packaging design. Since the last decade, a package's environmental impact have become increasingly important to take into consideration, but the way to include these interests are highly argued between different actors engaged with the package. Thus, it is interesting to see how this is negotiated in the design process and how different interests relate to each other.

In order to study how a milk package is constructed it requires to open up the fixed object and see all aspect that eventually result in the final design. It requires to learn about the setting that the package will be implemented in and

to learn about the demands it must answer to. This was managed through studying discussions and negotiations performed in a design process. In order to present the empirical findings in a pedagogical way, the empirical story is divided into four chapters as follow. The first chapter gives a general overview about milk as a food source, presenting the legislative demands on packaging material qualities to produce ensure a safe product that also answers to the cultural preferences on milk's taste and treatment. The milk content is highly influential in designing a milk package and there are different aspects it must answer to in order to provide a safe and attractive product on the market. The second chapter presents the context that a milk package exists in, travelling from manufacturing process, along the logistical and distribution stages, for consumption and eventually waste management. The different stages of a milk packages life illustrates different rules and standards that it should align with or operative demands to which it should respond. The third chapter presents the implementation of the milk design process and presents how different interests are negotiated between each other in order to find a suitable packaging solution that can be agreed upon. It communicates compromises and negotiations between different interests. The last chapter communicates the need to answer to new product demands, showing that a design process is not finished until all product interests are responded to in the milk package design. Moreover, it illustrates that a topic, such as to answer to 'green' expectations, can be seen from different angles depending on the actors' expertise.

Milk characteristics

In order to discuss milk packages, it is important to start by presenting cow's milk. Cow's milk, from now on referred to as milk, has been an important food product in Swedish households for generations. By including 18 out of the 22 most important nutrients for humans, milk is sometimes referred to as 'the original drink of humans' (Brunnström & Wagner, 2015:49). Its main components are water, proteins, and lactose, consisting of two types of sugars and minerals. The component that is most spoken of is protein, which is good for bone structure and teeth and commonly marketed to children, women and mothers, who are recognized as being in some need of the extra protein (Brunnström & Wagner, 2015).

Milk is a sensitive product that has a limited shelf life. This is because the fat and protein in the milk are sensitive and can decompose and degrade the milk quality. Decomposition happens faster if the milk is exposed to oxygen and light, and the warmer the milk is when stored. However, shelf life can be extended if the product is treated carefully and kept under certain temperatures. Moreover, specific packaging solutions can protect the milk from its

surroundings and thus minimize and slow down the degrading process (Brunnström & Wagner, 2015).

To improve the product's shelf life, milk is heat-treated to kill the microorganisms in it. Heat-treatment that reaches 140 degrees Celsius belongs to the category of UHT (Ultra High Temperature) milk and results in a longer shelf life in the product, but with the result that it gives the milk a different taste. This technique is common in many countries, but is rejected by Swedish consumers in favor of pasteurized milk. Pasteurized milk is heated up to 72 degrees Celsius for 16 seconds before being cooled down and packaged. It is stored in a refrigerator to prolong the milk's shelf life since heat-treatment up to 72 degrees is not high enough to allow the milk to be stored at room temperature and to stay fresh for long (Olsson, 2008).

The point at which the milk is ready for consumption is where containers become relevant, in order to protect the milk content all the way from production to consumption. A package is defined as a product that is created to include, protect and represent goods, or to be used to deliver, or in other ways handle, goods – from raw material to final product and from producer to user (SCS 2006:1273). A well-designed packaging solution prevents the exchange and transportation of gas, light and microorganisms between the package's inside and outside, prolonging the product's shelf life (Brunnström & Wagner, 2015).

However, the first milk container did not have the above mentioned qualities. Instead, the traditional way of selling milk in Sweden was to sell it in bulk whereby people used their own containers in order to bring their milk back home. During the 1870–80s, glass bottles filled with milk were introduced in the cities of London and New York, and in 1884, Sweden also started using this system; however, it was not until the 1920s that the system really had its breakthrough here. The milk was distributed using horse-drawn wagons and the glass bottles used were collected as new orders were delivered. However, the glass bottles were easily destroyed if handled carelessly and new bottles constantly needed to be produced and introduced into the system. The glass bottles improved over the years, both the type of cap used for sealing them and also the colors of the glass as transparent bottles turned out to quicken the aging of the milk. The different local milk producers introduced their own glass bottles, which formed part of the recycling system and which kept consumers loyal to brands. Therefore, the dairies were big promoters of the circular recycling system. However, when the smaller dairies were merged into larger dairy cooperatives, their dependence on consumer loyalty decreased (Brunnström & Wagner, 2015).

Cardboard packages were developed and in 1911, John R Van Wormer was awarded a patent for a packaging solution that eventually turned into Pure-Pak's ridge model. At the same time, the Philadelphia Bureau of Health published findings that recycled glass bottles had four times the bacterial content of disposable cardboard packaging (Brunnström & Wagner, 2015). However, the cardboard packages were a lot more expensive than the glass bottle system, which made it difficult to implement on the Swedish market. A reason for this was that in 1939, the Swedish government had decided to place a limit on the price of milk packaging; at the time, it was SEK 0.02. Europe was at war and this was a way for the government to ensure that the price of milk did not rise too much, and was kept affordable for most households. The price was based on the popular packaging solution of renewable glass bottles, which was much more cost-effective than the current production price of the cardboard packages existing in other countries (Andersson & Larsson, 1998).

However, consumers were tired of the recycled glass bottles due to the varying quality of the bottles, the hard work of carrying them back and forth to the store, and because the milk quality varied. This demanded the creation of a new type of packaging solution, that could compete with the glass bottles, and thus the tetrahedron-shaped cardboard cartons were launched. Thus, since the initiated efforts to contain milk in disposable packages, it has required lean solutions, which have additionally resulted in systems that support good milk quality.

> What was so great about it [the tetrahedron] was that the milk wasn't poured into the package, it was produced like a tube and then the milk was poured inside as the packaging material was glued together.
>
> (Margareta, Management team admin; Dairy Corp, 2016)

When the new cardboard companies started promoting disposable packaging, this attracted a lot of consumers – the package was yours and yours alone, no one had used it before and would not do so afterwards. For Sweden, it took until the 1960s before the milk filled cardboard packaging became visible in the store. This was the result of a collaboration between the newly opened X-Pak and Dairy Corp. Most Swedish citizens consume dairy products, leading to many liters of milk being produced on a yearly basis. The dairy company Dairy Corp, one of the largest dairies in Sweden, receives and handles 5 million liters of milk on a daily basis all year around, with the refined products being packaged into more than one billion packages.

Keeping milk safe

Along with milk becoming a traded consumer good, the market has become increasingly regulated. These regulations are created based on experience and the need to ensure safe food products. Food production and distribution is based on a rigid legal framework in terms of quality, health and safety, which also puts demands on the packaging solution. National and international regulations have to be taken into account before launching a food package on the market. Food safety is not only ensured through the quality of the packaging solution, but also the through the treatment of the product. Dairy products belong to the fresh food range that needs to be kept cold and there is legislation demanding a secure "cold chain", from when the milk is extracted until it is consumed.

The regulatory precautions originate from the many chemicals involved in products created by society, and the need to protect food against such chemicals. Food safety not only applies in order to protect against unsafe packaging materials, the package should also shield the food content from external substances. There can be health and safety consequences if the wrong material is used, but due to challenges to see the exact molecules building a package material that makes it important with validity from external organizations. Launching a food package on the market requires undergoing migration tests to ensure that it complies with all regulations and demands. The migration tests and certificates are performed by third parties who check that materials and additives in direct contact with food content fulfill the requirements in the following legislation:

Table 5: Legislation governing food packages.

§ 1 Material and articles in contact with food must meet the stipulations in:
Swedish legislation *The Swedish Ordinances SCS 2006:804, 2006:813 Regulation from Swedish National Food Agency*: - LIVSFS 2011:7 on Contact with Foods - LIVSFS 2003:9 on Nutritional Supplements - LIVSFS 2004:30 on food additives - SLV FS 1993:36 on Certain Foreign Substances in Food **EU rules** - EU regulation 1935/2004/EC (Framework reg) - EU regulation 178/2002/EC (General Food Law) - EU regulation 2232/96/EC (Food reg) - EU regulation 2023/2006 GMP

Material-specific EU rules
- 1183/2012, 93/11 Nitrosamine
- 1985/2005 Epoxy
- 2005/31 Ceramics
- 2007/42 Cellophane
- 282/2008 Recycled plastic
- 450/2009 A&I packaging
- 10/2011 Plastic w amendments

Source: Normpack (2017)

Since these regulations need to be aligned with the producing of dairy products, they are influential in creating a structured way of how to manage the production processes throughout the supply chain. The National Food Agency (Livsmedelsverket), the County Administrative Boards (Länsstyrelserna), and other government agencies act in accordance with the governmental instructions and are the representatives visiting the sites where food is handled, such as at production sites, logistical storehouses and grocery stores, in order to secure correct treatment.

Over the years, milk has become an internationally traded good. Within the EU, many of the member countries have a national milk industry. Since the internationalization of milk as a traded good, it has been regulated in order to ensure that supply and demand are met. Reasons for implementing regulation of the milk supply include the EU market having promised to buy all produced milk, but without such regulation, demand would not meet the volumes of the milk supply. Thus, milk quotas were introduced and these quotas were in place until 2015. Along with many other industries, milk has become an internationally traded good as a result of EU membership. Milk is traded at a world market price (Global dairy trade, 2015) and the industry has suffered from an over-supply since 2015 when EU milk quotas (milk production limits in the EU countries) were. This over-supply is also a consequence of the Russian embargo that was initiated in 2014, preventing European provisions from entering that market.

> Today milk is something that is traded at world market prices, which means that our market is affected by the milk supply in any other country that is recognized as a 'dairy nation'. So now, with the boycott of Russia, this has resulted in a rather big impact [of over-supply], like a domino effect.
>
> (Eva, Marketing department, Dairy Corp, 2015)

This has led to a lower-performing price of milk per kilo; in 2016, it was at €0.309 compared to €0.337 (2015) and €0.417 (2014) (Karlsson, 2016).

Additionally, Swedish consumers are also showing a negative consumption trend, which has resulted in a 23% lower consumption since 1995. The production of milk powder has increased most in comparison with other dairy products since milk powder can be stored and has been a solution ensuring that the milk does not go to waste. Since 2014, the low milk price has reached a critical level for many farmers, who risk being forced to shut down their dairy farms and this has started a major discussion in both the media and in politics. Swedish consumers have reacted to the dairy farmers' worsening work situation and are thus advancing the national and local consumption of milk products. However, fresh milk consumption is only one part of the overall milk consumption, and thus the impact is limited.

> There is a surplus on the world market, even though there is a growing demand for Swedish milk and this is because the price is connected with a sort of world market price. And you can't store milk in just any condition [but it must be kept cold].
>
> (Sofia, Marketing department, Dairy Corp, 2015)

The internationalization of the milk industry not only impacts the milk price's volatility, it also impacts international competition over packaging solutions.

Packaging materials

Food safety has become increasingly important over the years as more packaging materials have entered the market and some materials have resulted in food scandals where chemicals have left the packaging material and migrated into the food content. The interest in a food package starts with the molecules that the material is composed of. A package's material is in direct contact with the food content and previous experience has shown that migration from the packaging material into the food content has resulted in unforeseen effects. Such experience has led to care on the part of the industry and suspicion on the part of consumers.

> There's a lot of discussion about chemicals in food, and whether the packaging poses a health risk and there's also more of a focus on the environment. /…/ So, many of these issues are in focus, much more so today than 10 years ago.
>
> (CEO, Consumers I.A., 2015)

There are some ill-reputed substances such as BPA (Bisphenol A) the lacquer used in metal cans, which has a negative impact on the human immune system and which migrated into the food content (DN, 2014). The realization that the package is not just a product in itself, but that, through invisible substances, it migrates into the food and can be dangerous to the consumer, has started a

major debate on what a package material should be and how to prevent dangerous substances.

> Bisphenol A and then there is bisphenol C and bisphenol E. These are additives to various plastics that are considered to be dangerous. But there are also other additives. Generally on the subject of additives... all plastics are, in addition to the basic molecule or the base polymer, made of plasticizers and fillers and God knows what else!
>
> (CEO, Consumers I.A., 2015)

Another infamous substance is PVC (Polyvinyl chloride) which can be found in some plastics. A debate has been ongoing from the early 1990s and regulations have been created to protect consumers from it as it can contaminate the food content (DN, 2014).

> I have probably been poorly informed if you go back a few years. I have not realized that there are so many additives in all kinds of plastic. That it exists in PVC has been known for a very long time because the additives are so very dangerous. But there are additives in all plastics, and the discussions then focus on how it migrates into the product. That kind of question I come across from time to time.
>
> (Jenny, Sustainability department, Dairy Corp, 2015)

However, with the improved knowledge of different types of materials and their impacts, as well as regulations to prevent the usage of some materials, there are still occasions when it can be found in a package.

> We both thought that PVC had been removed from food packages 25 years ago. But it turns out that, of the food chain's range of packaging foil, around 70 to 100% today is made of PVC. And their environmental managers thought it had been phased out, but it sneaks in through the back door again. So there's a lot to dig around in.
>
> (Legal advisor, KRAV Quality Certification org, 2015)

Although there is some knowledge of the dangers of the material, there are still actors who include it in their packaging solutions. The packaging industry has become a global industry and the standards differ between countries. There are stories in the industry of an international packaging producer sending a specific type of package to the supervisory agencies to perform migration tests, but then selling a different package consisting of other materials to the customer. One reason why this can happen is the challenge of tracing the material all the way back to where it was created as it travels through a complex supply chain where the actors have limited insight into the material's origin.

> It is very difficult to find [all different types of substances within a material] because they are composed in complex ways. Even the orderer of the package usually does not know exactly what it contains, but they still buy the materials. And those who extract polyethylene for different packages, they purchase a polyethylene raw material. Although it is not polyethylene, it has gone through 3-4 steps where additives have been added. And to go back and find out exactly what it is, that's really difficult.
>
> (Legal advisor, KRAV Quality Certification org, 2015)

Since one cannot always determine what a material consists of just by looking at it, this makes the actors doubt the quality in a way different from before the scandals. The uncertainty is primarily related to plastic materials since plastics can consist of many different types of material structures. These material structures require knowledge from suppliers so they can tell what qualities a specific plastic has as they provide different characteristics and advantages. Anna in Innovation (X-Pak, (2015) see how the material complexity creates mistrust and uncertainty: ”I blame no one. I work with this every day, but how are people supposed to know the different plastics with PE, PT, and the PEA and the PA and PPET... they don’t have a chance.” A packaging material that is legal can still have different qualities that the customer should be aware of to make sure it tallies with the needs of the food content.

Except for regulatory demands regarding how to handle the milk content safely, it has become more popular to differentiate between competitors by applying external validity using labels and certifications. Certifications can tell you about the quality of the content (KRAV) and package material (FSC). Labels and certifications can visually distinguish one product from another since they symbolize an added value to the product. To be certified and thus to be allowed to use the label, the company must follow the requirements and routines that the specific certifying organization demands. The label is communicated on the package and serves as a quality stamp and information about the food content or packaging material, which cannot be seen by the eye.

Package as a piece of waste

Food packaging related food scandals are one reason for consumers’ skepticism toward food packages, but the waste parameter is also known to be a result of consumers’ sharing a negative view of packages. However, the negative view is not shared by actors in the industry and the CEO of an trade association argues that consumers must recognize the value of the package before it becomes a piece of waste.

> Three of four Europeans view packages as waste. Sometimes it can feel a bit hopeless when hearing that packages are viewed as waste since we have come so far in their development that they [the consumers] should understand that the package primarily does a job and that someone pays to make the consumer product go all the way to the consumer.
>
> (CEO, Materials I.A., 2015)

The negative attitude towards packages is argued to be based on a historical lack of waste treatment. Historically, products were launched onto the market without an established waste management system, something that is still the case in some parts of the world. Since the introduction of packages, the market for goods has developed and more quantities of products have continuously been sold and consumed. Growing populations and growing market economies have led to environmental challenges, where packages have been subject to become the face of illustrating waste.

> There are many other stakeholders who push this view [of the package as waste] and packages have been seen over the last 60 years or so as a component creating litter in society. In the 1960's, it was very much about "keeping Sweden tidy" and packages were often found in nature.
>
> (CEO, Materials I.A., 2015)

Awareness has spread, with packaging industries, along with all other producing industries, being encouraged by societal actors, NGOs and citizens to reduce their environmental impact. These encouragements can, for example, come in the form of regulations, consumer demands or publicly naming and shaming.

In order to learn how waste management became a part of the dairy industry, it started when cardboard packages were introduced onto the market. At this time, they were not connected with any recycling system. However, as the volume of cardboard packages increased, and they found their way to landfill, groups in society started questioning this waste and whether tax money should pay for the cost of disposing of it. In 1990, Dairy Corp started an incentive to reintroduce glass bottles in order to keep milk in a circular system. These initiatives were planned to serve as substitute systems in parallel to the cardboard package and the retailers who were involved in these initiatives were provided with dishwashers to ensure hygienic management of the bottles. After the trial period at two different locations in Sweden, where initially 10-13% of consumers used the circular glass system, the projects ended due to consumers' initial commitment fading and the circular system being rejected for single-use packages (Brunnström & Wagner, 2015). Also, the expected environmental

benefits of not using disposal packaging were minimal as bottle cleaning and increased milk waste were environmentally costly. After this initiative, Dairy Corp initiated two more projects using circular processes, the last of which included plastic bottles instead of glass bottles. The plastic bottle had many benefits as it was a light but very strong material, it was possible to clean and was not too expensive to produce. However, after some time, problems occurred, e.g. odors and molecular mergers between milk and plastic, in addition to the plastic, in new research, including Bisphenol A (BPA). Both projects eventually failed (Brunnström & Wagner, 2015) and it seemed as if the consumers, the retailers and the external system had lost their way when it came to this system.

Although the dairy producers failed to find suitable circular systems, their initiatives put pressure on the cardboard producers to find recyclable solutions for their cardboard containers. Moreover, at those times there was an ongoing societal discussion about introducing regulations regarding the recycling of produced packages, which was realized in 1993 (FTI, 2018b). As a response to this, Tetra Pak developed a centrifugation procedure that made it possible to separate cardboard from plastic and aluminum and to recycle the material (Brunnström & Wagner, 2015). This legislative demand resulted in a new approach to waste management, forcing producers to be responsible for the proper waste management of the package. The purpose of the "legislation regarding producer responsibility for packaging" is that packages should be produced in such a way that their volume and weight are confined to the level needed in order to ensure safety and good hygiene. The producers are responsible for arranging a system for collection of the packaging waste produced, and for ensuring that it can be traced back to the producer. The waste should be handled in an environmentally acceptable way and achieve the official recycling target for the specific material (SCS, 2006:1273). The producer is identified as the one who professionally produces, who is responsible for importing into Sweden, or who sells a product/good that is put into a package (SCS 2006:1273). Swedish producers have come together and collaboratively own a collecting/packaging system called FTI. This organization was given the task of offering sites where consumers can leave their used packages which are then sent off to recycling and incineration plants.

The government guidelines on recycling influence the types of packaging materials the dairy companies feel comfortable working with. A material that cannot be recycled in the current Swedish recycling system is thus not of interest as it would result in high penalties. Making use of FTI, although it is producer-owned, comes with a cost. The large numbers of packages needing to be handled, and the need to ensure proper waste management, cost Dairy Corp, one of the largest producers of packages, SEK 30 million a year.

Although performed improvements to manage the packaging material, there is generally a negative association with waste, and circular systems have again gained interest. Low milk prices in the mid-2010s have resulted in milk farmers suffering from low incomes and in some smaller dairies and retailers using circular system solutions as ways of attracting consumers into paying extra for their milk and additionally helping local farmers. The solution to fill milk in glass bottles portraits an old fashion tradition and consumers are willing to pay extra for this solution. In Borås, a local grocery store does not buy its milk from dairies but directly from farmers. Consumers can buy containers in the store and get them refilled whenever they buy new milk (Martinsson, 2015). Also, dairies try to find efficient ways to increase the income of the farmers and *Gäsene mejeri*, which is primarily a cheese producer, has begun selling traditional milk – milk from which the cream has not been removed. Consumers pour their milk from a milk machine into a container, which they can decide the volume of (Nilsson, 2015). In both these examples, the price is SEK 15-20 per liter, which is considerably more than the milk sold in supermarkets. The new way of having a circular packaging system can thus be managed by smaller dairies, but results from trials by larger dairies have failed since these are dependent on sales beyond fresh milk and are thus more sensitive to the international milk index and international competition.

This chapter has been written in order to communicate the relationship between milk and package. Historically, containers were limited to the role of containing milk, but over time, they have become better at responding to more interests. Milk qualities have been highly influential in the design of milk packages in terms of ensuring that these match requirements regarding food safety during production, but also as regards ensuring that they are not in themselves sources of pollution, neither as regards toxic molecules nor as regards material waste.

The different regulations act as stabilizers of the industry since a lack of alignment results in different sorts of penalties, such as a rejection to access the market, financial fees, or societal naming and shaming. Moreover, these regulations have resulted in limiting a package's flexibility in different attributes and resulted in rigid demands on the production setting.

Chapter 5: Manufacturing a milk product

To understand the practical demands made on a dairy package, one needs to follow the manufacturing and logistical process whereby this must match physical demands and demands regarding efficiency and output. The manufacturing stage is built up in order to meet milk quality demands and regulations about food safety must be managed all the way from milking the cow until the milk reaches the consumer. These regulations have been incorporated into standards in order to practically perform the correct and safe treatment of the milk product. The manufacturing process starts as early on as the cow milking process.

At a Swedish dairy farm, cows are usually milked twice a day. They are led in to the milking area and positioned where the milking hose can reach their teats. Since cows are living animals, the milk quality depends on the cow's wellbeing, hence the farmer excludes milk from cows that are either sick or have just given birth since the milk has a different nutrition content at this point. When initiating the milking process, the first thing is to clean the teats with a wet cloth in order to remove any form of dirt. At this stage, each teat is checked to stimulate it for the upcoming milking procedure, but also to see the milk's quality. If the cow has an infection its milk will consist of a different texture, which a skilled farmer can visually recognize. A milk farmer at Dairy Corp (2016) says that "it is something that you learn over time and there are quite a few teats every day. And eventually, you will recognize if there is something odd about the milk".

When a defect is spotted in the milk, it is put in a small container and then a liquid is added that will determine the bacteria ratio. Milk can be contaminated

if a cow carries bacteria or is ill, but also due to chemical contaminants such as: antibiotics; hormones; disinfectants; nitrites, nitrates and nitrosamines; pesticides; PCBs; mycotoxins; toxic metals and dioxins (Harding, 1999). To protect the consumer and ensure safe products, there are regulations in place to make sure that the milk is kept as natural as possible. However, this can be challenging since some of the above listed chemicals serve as medicines for sick cows (Harding, 1999).

When a cow's milk is cleared for usage, the milking equipment is placed on the teats and milk is extracted. In the hose, before reaching the tank, the milk is filtered to ensure that external bodies such as flies are hindered from entering the tank. In between every milking procedure, the hose is cleaned with hot water and disinfectant to prevent bacteria from spreading. Eventually the milk enters the cooling tank, where it is stored until the trucks arrive to collect it. The milk must cool fairly quickly to prevent it becoming sour and to avoid bacteria thriving.

Milk attracts many different types of bacteria and there are three broad temperature ranges in which to classify their optimal growth rate – the psychrophiles bacteria (low temperatures between 0-15˚C), the mesophiles bacteria (medium temperatures between 20-40˚C), and the thermophiles bacteria (high temperatures between 45-55˚C) (Harding, 1999:44-45). The numbers of bacteria are tracked since this is relevant knowledge in learning how hygienic the production is, and also since the bacteria level is directly correlated with milk spoilage. Thus the level of bacteria is always attempted to be minimized and to grow at the slowest rate and this is managed through heat treatment and storing the milk at low temperatures (Harding, 1999).

Trucks are scheduled to collect the milk and these trucks' schedules are planned in order to optimize the trip by loading milk from all the farmers in the area.

> Dairy Corp must reach even the smallest farm somewhere far away close to nowhere which only has 10 cows. In such cases they lose money. But they have a collection guarantee which leads to a higher cost level compared to other dairies.
>
> (Sara, Production, Dairy Corp, 2015)

Trucks from Dairy Corp travel all through Sweden to collect milk, and some of these trips are not profitable if not enough milk is collected. Thus, the farmer's price per liter for milk is lower than at other dairies.

Production and manufacturing of dairy products

There are strict rules governing the manufacturing of dairy products since the milk needs to be handled safely, and due to the high milk volumes which must be managed efficiently. Since milk became a traded good, there have been continuous initiatives to improve the production stages, and to make better use of the milk. The main business purpose of Dairy Corp is to provide the farmers (owners) with a good return on their milk and the key performance indicators are referred to as profitability and volume. These are the most important parameters in projects, but projects are also prioritized based on the investment required for marketing and the workforce.

> We say that the cow is milked around the clock regardless of whether we want it or not, but we want to make it as profitable as possible for the farmer. It is our goal for the farmer to get as much money as possible and then the products must be profitable and drive volume so we shift them.
>
> (Marie, Marketing department, Dairy Corp, 2015)

Trucks transport the milk in tanks and deliver it straight from the dairy farmer to the dairy production site. Milk is stored in large cylinders until it is transferred through thick pipelines to the production area. On the way from the cylinder, to being poured into a package, it is adjusted to the product specifics – type of dairy product (such as milk, yoghurt and crème fraîche to give a few examples), fat percentage, any added flavors, lactose free or other added/removed attributes. The whole procedure is managed in bacteria free areas and staff hygiene is of the utmost importance, and they are refused entry into the production area if not wearing disposable protective clothing of plastic, including a hairnet and safety shoes. The hands must be sterilized before entering the factory and one is not allowed to enter the area if suffering from a virus or bacteria. Also, the use of patches, if wounded, is highly restricted and requires the person to sign a document when collecting a patch after an injury. The patches are blue and have metal built into them to be traceable by metal detectors to minimize the risk of patches ending up in the products.

The machines are cleaned on a daily basis and in-between shifts in production, between one type of product and another. The high hygiene and protection requirements have led to a closed system where the milk is not exposed to light until the consumer opens the package after purchasing it.

> The milk never sees the light of day. So you can never see the milk, from the stage when it leaves the teat of the cow until you pour it in a glass. You can never see it because it's in a closed system all the way.

> And, from a health perspective, this is optimal because nothing can ever be added to it.
>
> (Margareta, Management team admin; Dairy Corp, 2016)

The system is well-tuned in order to meet demands regarding both food safety and production efficiency. Milk production has historically been performed by local systems located close to the farmers, dairy production sites and consumers. As dairy organizations, such as Dairy Corp, have grown larger the production of milk has become intensified by means of more efficient solutions such as a few main dairy sites where the advantages of large scale production volumes can be utilized through full day production opportunities, fully loaded transportation vehicles and decreased use of process media such as electricity and water. This has provided environmental benefits as the system has become more efficient, but on a social level, there are many citizens who have questioned the solution of departing from the local system (Brunnström & Wagner, 2015:177).

To handle the challenge of milk's short product shelf life, Dairy Corp has located its dairy production sites close to the consumers. Dairy Corp has three large production sites that are geographically located in order to distribute milk to consumers all over Sweden. The dairy production sites are located in highly populated areas because when the milk is produced and packaged, it needs to be sent quickly to the retailers and from there on to the consumers. Other sites producing dairy products with a longer shelf life, such as cheese and butter, are instead placed close to the farmers so the milk can be transported a short distance before initiating the production of e.g. cheese, a product which needs 10 liters of milk to make 1 kilo of cheese. The cheese can later be shipped nationwide, or even internationally since once it has been produced, it has a much longer shelf life. Retaining longer transportation times, once the product is ready, is beneficial as it means lower transportation weights when sending pieces of cheese and it has a longer shelf life which can cope with the extra logistical times prior to reaching grocery stores. Hence, large volumes of dairy products result in logistics becoming an important component of resulting in an efficient flow, from both a cost and product quality perspective, but it needs to be implemented in a dialog concerning the type of product being produced since these have different qualities.

Production schedules are communicated on a daily basis. Staff working in production receive the requested numbers of product to be produced on a daily basis and the machines are set to deliver these numbers. The specific numbers are calculated at Dairy Corp's Headquarters, which send the daily orders to the different factories. The functionality of the machines is crucial due to the limited durability of the product. If machines break down this directly affects

the time schedule regarding production. For some products, there is a higher retailer and consumer demand than the volumes the machines are capable of producing. This occurs because there is limited capacity in the machines compared to the numbers of products needing to be produced; if a machine breaks down this puts even more pressure on the remaining machines. For other products, there is a high dependence on a specific machine, which produces the full range of a certain product. The machine is capable of handling the full range, but machine failure is extra sensitive.

> A machine that produces butter, let's say it produces 5 tons per hour, which is a lot, but it's a machine that supplies all of Sweden with butter. Then you have to be sure that this machine really functions the way it should. Because otherwise it's tough, right, then we can't deliver products. And the quality must be good too.
>
> (Katarina, Procurement, Dairy Corp, 2015)

If machine problems occur and this results in products not being delivered to grocery stores at the appointed time, then they will be wasted. In the product category of dairy products, fresh milk has the shortest shelf-life and it must be delivered to the grocery store 5 days before the printed expiration date. This is based on a rule saying that the grocery stores are not allowed to sell products with less than 2 days left before the expiration date.

Most of the packages are shaped by the packaging and filling machine. This can be flat fiber-based papers that are turned into milk or yoghurt packages in the machine before the dairy content is poured into the package and it is sealed. Alternatively, it could also be flat plastic blanks that are shaped into 4-packs of small yoghurt cups, filled with yoghurt and sealed with aluminum lids. The staff are responsible for filling the machine with packaging material to keep it going; to make sure that the machines are running; and that the final result is of the right quality.

The dairy production site is well planned and has been shaped to handle production and logistics. The package comes to life by being placed in machines where it is folded, filled with dairy content and sealed. As mentioned above, the machines are crucial to the production of dairy products; when problems occur it is of the highest priority to fix them. The high degree of automation in production keeps the workers busy ensuring that the outcome is of the right quality. Machine problems are many; Per in Production (Dairy Corp, 2016) argues that it is more spectacular when the full system functions, than when it breaks down: "There are so many things that can break down that it's more incredible that everything works fine than that it doesn't" (Per, Production, Dairy Corp (2016).

New machines or processes must be aligned with the existing system and this is experienced as a troublesome process. Therefore the production workers generally prefer the older machines which they know how to handle. Per in Production (Dairy Corp, 2016) continues:

> You have to get to know the machine. The machine works best after some time once it has softened up. It [the machine] needs to nudge the parts into place to function properly.

When a new product category is to be produced, the machines are stopped to be cleaned, configured for the new settings and then restarted. The first few products serve as test products to see that the flavoring is good, the date stamp is installed correctly and that the package is being correctly sealed. About 1% of all packages are wasted during production and this mainly occurs in the process of getting the machines fully installed after a product change.

Although most machines are supposed to be more or less self-sufficient, solving all the steps without human interference, there are packaging solutions that are more challenging for the machines, where the workers need to manually finalize the packaging process. One such packaging solution is the crème fraîche package where the machines have recurrently had problems placing the plastic lid on the cup. The cup is sealed with an aluminum lid and, on top of that, the plastic lid is placed in order to secure re-sealable packages and to also serve as an extra support during transportation. On occasions when the workers have been flooded with work and the plastic lid requires manual work to be added, the stamp showing the expiration date has been placed on top of the aluminum lid and products have left the production sites without the plastic lid. However, this resulted in negative feedback from the consumers, who missed having the re-sealable lid since they found it more hygienic. Further, the logistical actors presented feedback on higher portions of wasted products since without the plastic lid the aluminum lid did not managed the transportation without breaking. Production efficiency and volume are key performance indicators and the workers have to meet these demands, in this case resulting in consequences further down the supply chain.

When the products are produced they are transported on travellators, located above the machines, through the production area and into the storage area. The travellators are built using long rails and their length depends on the time the products must “rest” before being ready to be placed in secondary packaging and cooled down in the storage area. The production area is further illustrated from the field note extracts when observing the manufacturing of dairy products:

The production area is full of machines standing close together, making it difficult to understand how these heavy and large pieces of metal composing the machines were transported and implemented in this tight space. When following the production of milk products it is remarkable how quick the process is; a product is folded, filled with milk, sealed, disinfected and placed on a travellator in just a few seconds. The next one is produced before I even lose interest in the previous product which rolls away on travellators, and so is the next. The quick flows and large volumes become apparent as a travellator is stopped in order to wait for trucks to pick them up. About ten meters of a travellator rail is filled up with products ready to be shipped to the cooling area. The products that fill up the travellators make visible the network of rails transporting products all over the production room. They are positioned as long snakes that wind up to the ceiling and in caring connection with other machines, going in all directions, reminding you of the innovative queues in amusement parks where people line up in order to go on a roller coaster ride (Field note extracts, 2015-04-23).

Figure 2: Field note extract - production productivity

Once placed in the cooling area the products are stacked together on pallets in the most optimal way for their upcoming transportation to the logistic storehouse. The most optimal way of stacking the products relates to logistically efficient stacking and depends on how well the logistical stacking serves the treatment of the products. When packed on pallets there has traditionally been a focus on achieving the optimal way in terms of logistics, but for some products, this has caused problems during cooling.

> We calculate the best way to stack the products in the optimal way. Sometimes we have had improvements that resulted in us piling them too good, so the products in the middle were difficult to cool down.
>
> (Marie, Marketing department, Dairy Corp, 2015)

Dairy Corp strives to transport its products to the logistic storehouse as quickly as possible and arrangements have been made to improve this. However, this has led to less optimal logistic solutions. Marie in the Marketing department (Dairy Corp, 2015) continues:

> Nowadays they have been re-packed and thus the stacking is not optimal in terms of quantity, but optimal for cooling. This is because it is important that our products are cooled quickly so they can get out to the customer and the customer does not want warm yogurt at 12 degrees, but at 5 degrees so the cold chain is maintained.

When the products (products produced for households) have reached the right temperature, they are picked up by trucks and sent to a retail storehouse or delivered straight to the grocery store.

Regulations governing food safety have consequences for the logistic treatment. Although the dairy package helps to protect the milk content it still needs to be treated in the correct way to ensure high quality. Since milk is a fresh product it must be kept at the right temperature throughout its logistical chain. Information about product treatment and the expiration date is stated on the package. In Sweden, milk should be stored at a maximum of +8°C and there is a regulation demanding that the expiration date should be adjusted for this temperature (Löndahl & Strömblad, 2007). In our neighboring countries, Norway and Denmark, the same regulation is adjusted for a refrigeration temperature of +5°C. When a dairy product is kept in a colder place its durability is extended; in Norway and Denmark the expiration date is also prolonged by two days, compared to the Swedish dates. Although there are differing temperature regulations in the Nordic countries, the actual temperature of household refrigerators does not differ much between the countries. There are regulations forcing the dairy companies to set the expiration date at +8°C, but the Swedish National Food Agency encourages consumers to keep a temperature of around +4 to +5°C in their refrigerators to prolong the durability of the products. On their website it says:

> Store your food properly and it will last longer. It may seem obvious, but it's easier said than done, if you are unsure where different types of food is properly stored, a simple rule of thumb is that the colder the food is when stored, the longer its durability will be. Often, you also get guidance from the packaging. A good refrigerator temperature is +4-5°C (Modin & Lindblad, 2011).

Increasing amounts of food waste have been connected with consumers' respect for the expiration date and it is common that milk is poured away before reaching the date printed on the package, resulting in fresh food being discarded. However, the regulation governing the cold chain temperature puts pressure on production in two opposing ways. By being forced to put a shorter expiration date than in other countries and some products, such as fresh milk, having a short shelf life, puts pressure on production sites to have high efficiency throughout the production stages. On the other hand, when a

production site produces dairy products for Denmark or Norway, it needs to ensure a lower temperature in the product before it is transported away from the site. To get the product to drop from 22 degrees to 5 degrees takes time and this additional time requires more cold storage space for the products, which is expensive. The logistics, distribution centers and grocery stores are also affected by the cold chain. The involved actors are responsible by law to ensure that the cold chain is not broken. The store's cold chain responsibility ends when the consumer takes the product out of the store. The need to align with safety legislation along the supply chain illustrates how small nuances in e.g. decisions about the cold chain temperature have a direct impact on the product treatment.

Industry interconnectedness

Fresh dairy products' sensitivity to different sorts of treatment requires information to be communicated via the package. The package has a key role in communicating its demands to different actors in the supply chain and it holds information that is important for other actors in the production chain, information that enables legislative supervision as well as information to the end-consumer.

There are clear instructions about what must be presented and food packages should, with few exceptions, be labeled with the following information: title; nutrition declaration; list of ingredients; content of allergens; the expiration date; alcohol content (required in some cases); special storage conditions (mandatory in some cases); operating instructions (required in some cases); origin (required in some cases); identification mark (for animal products); company name and address; identification marking of the batch (expiration date is sufficient when the day and month are included). Moreover, the requirements go beyond guiding what information needs to be communicated by listing instructions for the legibility of the text (coloring and text size) to make sure that it is readable by the consumers and instructions regarding how information is presented on the package, where some information must be directly visible together with other information.

If an actor fails to provide the correct information on the package, this results in the exclusion of the product from the market until the errors are corrected. The National Food Agency governs the food products that enter the market and in addition to the information printed on the container, they also make regular visits to Dairy Corp to ensure that they have updated and valid documentation for the package material.

> The primary packaging is the most important [package] from a food safety perspective. /…/ it is important that we meet the National Food

> Agency's [Livsmedelsverket] requirements so we have comprehensive documentation for all packaging that is in contact with the food content.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

To ensure safety measures are upheld, production companies are required to have all the documentation available at the production sites and be ready to show it to representatives of the National Food Agency who make recurring inspections to check the quality of the production. This work requires both the right competence and the hours available to make sure the work is done. This additional workload has required Erik at Supply Chain, Dairy Corp to repeatedly employ a temporary worker in order to manage this job.

> I usually hire someone to help me with the documentation and make all the necessary certificates available to the dairies, because the National Food Agency performs inspections of the dairies all the time and they ask the quality department to prove that the packages have proper documentation and that migration tests have been done, and so on.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

This process goes beyond Dairy Corp, but the packaging producer selling the packaging material, such as X-Pak, is often in charge of the migration tests. However, Dairy Corp must be able to present the information from these tests, make sure that the correct information is placed on the packaging, and that the production is being performed in accordance with the set rules. Legislative demands regarding traceability of the products are visualized on the package by information about the factory producing the product and the specific time of production. If an error is spotted the information provided on the package should make it possible to trace the product back to the time and place of production and to thus secure the source of failed products.

> Let's say that at 10 o'clock something happens and if they [the products] do not get a stamp and you put them through [the stamp procedure] again, if it was a lid for example and you run it again, then it's illegal and you're breaking the law. Moreover, you have no traceability. Let's say that you produced it two hours earlier and you got some acid in the product, but then you have no traceability.
>
> (Lars, Production, Dairy Corp, 2016)

If products fail to communicate the correct information, or it is not visibly printed or there is incorrect information about the time or date, then the products are wasted.

Distribution and logistics

Dairy products are managed by retailers before reaching stores to be bought and consumed. The retailer Foodtail's distribution hubs receive and manage large amounts of pallets filled with products every day and are dependent on an efficient system to manage this.

> Roughly, we receive around 26.000 pallets a day at Foodtail. It's a lot. /…/ So just these 26,000 pallets, when placing them on top of each other in a pile, will result in 4 kilometers of empty pallets a day on which the goods have entered.
>
> (Karin, Logistics, Foodtail, 2015)

The system keeping track of all goods relies on bar-codes placed on the packaging that provide information about the product, such as content, expiration date and weight, and these pallets are then placed in pre-arranged and module built storage area in the distribution hub while waiting for the goods to be collected and sent to stores. The storage area is based on the volume of a standardized pallet. Pallets that are packed in a way that exceeds the requested volumes are troublesome and the storehouse's packaging manager contacts the product-owner to discuss possible changes to meet the measurements. The following notes were written during a visit to one of Foodtail's distribution hubs:

> It is only when walking around in the hub area that it's possible to grasp the large numbers of goods that land here every day before continuing to stores. The hub area is impressive in size and from a distance the pallets looks like smaller boxes, closely placed together as the pieces of a puzzle. The staff move around on small trucks, some are responsible for placing the pallets on their specific spot using lifters to reach all the way to the ceiling, and others move around to pick up different products in accordance with the specific store's 'shopping list'. All goods are packaged in both a primary and secondary package, which gives little knowledge that the hall is filled with different types of food delicacies, instead making it feel like a postal distribution hub. Everything is square, clean and efficient, very different from the parameters of smell, colorfulness and life that food represents when advertised to consumers (Field note extracts, 2015-11-05).

Figure 3: Field note excerpts - cube created food storage

The major retailers in Sweden have collectively produced an industry handbook called "The ECR Packaging guide", presenting information about how product owners, such as Dairy Corp, should produce the correct type of packages that comply with the module system and be durable enough to manage the distribution system. In the handbook, this is presented as follow:

> To protect and enclose the products; to be a bearer of the brand; to be an information carrier to the consumer; to streamline logistics management through barcode labeling according to GS1 standard; to facilitate physical handling and optimize transport by following the module system. It is important, both from an economic and a sustainability perspective, that the package is durable enough to be handled in traditional warehouses, but also that it fits into automated warehouses. To produce goods which, due to poor packaging, break during inventory and transportation management is both wasteful and results in unnecessary environmental impact (ECR Packaging guide, 2012:4).

A lot of work has been done to improve the storage and logistic challenges. A current aim is to automate as much as possible in the distribution hub's management system, so the staff encourage solutions that are stackable that allow the optimization of the transported volumes per truck. The way products are packaged also affects how well they survive transportation from one place to another. The storehouse manager constantly works toward reducing the numbers of products going to waste, as this has a negative effect on the efficiency level of the storehouse workers, the cost of lost products and the environmental impact. Previously the retailer had paid the cost of wasted products, but now they have moved away from this by making the product-owner company pay for badly produced products.

> Something that is good is that we have begun to charge suppliers for these shortcomings [products that have gone to waste] that have cost us a lot of money and somehow we have borne the cost in the past, but now we actively charge the suppliers that deliver poor quality to us.
>
> (Mikaela, Packaging development; Foodtail, 2015)

However, not all producers are interested in paying for products wasted beyond their own treatment. The new payment routines can be included in updated contracts, but the first time a product is destroyed the initial contact is handled in a less strict and friendlier way. In such cases, Foodtail prioritizes keeping a good relationship with the product-owners and a Foodtail representative firstly initiates contact to discuss bad quality products. This way the product-owner is handed the opportunity to improve the products before they are forced to pay

for the wasted products. If the same product continuously gets destroyed, the data is reported and the product-owner bears the cost.

Charging the product-owner for wasted products is a way to visualize poor packaging qualities and thus give them an insight to the continuous life of the products when they leave their internal systems. Moreover, the added cost has worked as an incentive making them improve their packaging and standards have now improved.

> Since we actively started working on these issues [minimizing product waste], and especially since starting to charge the suppliers for wasted products in the grocery store and at the distribution hubs, we have seen, of course, that things are going in the right direction
>
> (Mikaela, Packaging development, Foodtail, 2015)

Despite this effort, Daniel in Logistics (Foodtail, 2015) does not see the system as fully functioning and argues that it is still common that damaged products are not communicated to the product-owner.

> Well really, if a 6-pack of eggs is damaged, do you call [the product owner] and complain about it? Not the first time, and maybe not the third time either. No. /…/ so it's not always that the product-owner gets to bear the cost of the product even if the packaging solution is poor.
>
> (Daniel, Logistics, Foodtail, 2015)

Product-owners experience Foodtail as influential in product development since it is the gateway to reach consumers by, but Foodtail experiences sometimes being stuck in the position of demanding packaging improvement but still wanting to be flexible with contracts. According to Daniel in Logistics (Foodtail, 2015), Foodtail does not want to write too lengthy contracts, since it cannot know future consumer demand. This has a limiting effect on the improvement activities that Foodtail can put on the product-owners, since the packaging adjustments can be costly and the product-owner wants to secure payback for such investment. The contracts most often last for a year and depending on the size of the requested improvement, it can be difficult to see an adjustment to this if the product-owner is not sure that the investment will pay for itself.

A logistic puzzle

It is not only the storage area that is module built, the whole logistical logic is based on the same pallet volumes. This means that the truck´s storage area is maximized when it is able to store "whole" pallets, and an option with fewer products is placing two "half" pallets on top of each other. In addition, the

secondary packages that are placed on the pallet should further be adjusted to have the size that fits into the steel-cage, which is filled and sent off to the grocery stores. Furthermore, the primary packages inside the secondary package should fit the module sized display areas in the store. It is a complex puzzle that the product-owner must be aware of in order to ensure his products reach attractive display areas in the stores.

> The dimensions are incredibly important in the logistic chain. This affects everything. If you have good dimensions on your products, you have a better degree of filling – both during the transportation to the warehouse and also during the transportation to the grocery store.
>
> (Mikaela, Packaging development, Foodtail, 2015)

The shelves are positioned to generate a symmetric and tidy impression, a logic used to prevent the customer from feeling overwhelmed by all the options. This is done by placing the shelves on the same height inside all the refrigerators on the same wall. In the ECR packaging guide (2012:12) it is communicated that the interiors are standardized and hold the measurements 600x400 mm, which the packages should fit into. However, finding a suitable location for a product can be problematic if a product does not fit into the planned display area. The puzzle of getting everything into a good display position is an everyday challenge. The way the products are displayed in the refrigerator is based on their profitability; how popular they are; and in a location where they would not need to be refilled more than twice per day. The worst-case scenario, expressed by the store manager, is when the store runs out of products before a new delivery has arrived. According to Erik in Store Management this is undesirable because it can affect consumers' perceptions of the reliability of the store's supply.

The problem related to displaying products is rarely communicated externally, instead there are attempts to solve it internally. The final solution for troublesome packaging models, if they do not fit anywhere, is to place them in less attractive areas such as on the floor level or on the top shelves. The result of such a solution commonly leads to lower sale figures than another display would generate, and after a few months of poor sales, the outcome can lead to the product not being ordered anymore.

> Claes in Sales department: It can be the case that you place it [an misfitting package] where it fits, but you know that it won't sell so well.
>
> Erik in Store Management: So you give it a few months and then you stop ordering it because it is so far down on the sales list.

> Claes in Sales department: But it might have been able to sell better [in another location].

The store employees present challenges as regards providing all products with the same opportunity and Claes in the Sales department emphasizes the consequences of products being displayed in an unattractive location:

> It ends up in the recycling bin, or if we put it a bit crassly: where the birds shit or where the dogs pee. At the top or the bottom, where sales are the worst.

Thus, a small difference in packaging size can have major consequences due to not suiting the planned structure. If the product-owner does not ask for feedback or in some other way tries to understand the lack of sales, the product might be lost without further knowledge. However, it is more than just the size dimensions on a package that are important for sales, but it also includes being attractive to the consumers. Over time, there have been market changes that have resulted in intensified market competition for dairy products.

Intensified market competition

Over the last few years there have been food market changes whereby the largest Swedish food retailers have shifted from primarily selling externally branded products to more directly focusing on own-brand products (from now on referred to as private label products). This is a development that can also be recognized in other countries, where for example the UK's market-leading retailers: Tesco, Aldi and Sainsbury have been influential actors regarding the Swedish retailers' development. The large retailers are growing their private label ranges, which results in sales accounting for about 25% of the total income. In these products, the retailers are personally responsible for the content and packaging quality, which has resulted in an increased interest in the matter (CEO, Consumers I.A., 2015).

Generally, retailers do not have their own food or packaging production, instead buying unlabeled products from processing organizations. The product orders are placed with specific requests and this is responded to by the processing company, saying what it can offer and at what price. As the retailers grow stronger they can place greater demands on the processing companies in terms of food quality content and packaging solutions. The Swedish dairy processing companies have their own branded range of dairy products, but they have also become suppliers of 'private label' dairy products to the major Swedish retailers. Fresh dairy products provide higher returns to farmers than turning milk into powder products, which is the final option when it comes to not wasting milk, thus being a more profitable solution for the dairy suppliers.

Therefore the growing volumes of private label products are perceived as positive for the dairy companies, but have also created intensified competition for the PBO companies since consumers have a larger range of products and brands to choose from.

> The customers [retailers] have all the power in deciding the pricing in the stores, of course, so they adjust the prices that they want. We suggest a price that we think the consumer could pay for the product, but of course they always decide [a price] just below that.
>
> (Eva, Marketing department, Dairy Corp, 2015)

In stores, the private label products are cheaper alternatives since the retailers have full control of the price setting, which results in a more difficult position for product owners to be in as regards staying competitive and producing profits.

Growing product ranges

Not only has the private label assortment increased competition, it has also been a trend as regards innovating new types of dairy products and new additions to the existing range. It is a challenge for the dairy manager, at the grocery store, to order the correct volumes of products. This is the case since the large range of products makes it more difficult to predict which specific product, within the same range, the consumer prefers and will purchase. Despite this challenge, the manager of the grocery store wants to offer as many options as possible to satisfy the majority of his/her customers.

Nowadays the dairy range is extensively larger than before, with the range of dairy products having increased quickly. Only last year the product range increased greatly just at one dairy production site at Dairy Corp. Hans, Site Production Manager (Dairy Corp, 2015) argues that:

> There's been quite a lot happening over the past year. After the latest launch, we're up to 285 goods that have different article numbers. A year ago, we had about 185.

Apart from retailers' private label ranges growing and gaining market share, the lactose and organic ranges have also become more popular. From a sales perspective, retailers are experiencing good and bad consequences of the growing dairy range since consumers are being allowed to have preferences that should be catered to in the stores. At one major grocery store, the store manager thinks that too large a range can be negative for profitability since the consumers cannot take in the full range.

> I also think that it damages the profitability a bit when there are so many different products. The customers don't see the whole range of products. Preferably, you would want 4 faces [front display of product] of a good product, but we don't have room for that, so they just have two and sometimes one [face].
>
> (Erik, Store Management, Foodtail store, 2016)

This challenge also results in frustration in the consumer since he/she can have problems finding what he/she is looking for, which played out when I was guided through a dairy product assortment area.

> The dairy product assortment area looks like just any traditional grocery store, but when having more insight to the logistical aspects required in order to maintain a tidy impression and a clean appearance, it feels more complex. From within one yoghurt fridge I can see hands filling up the shelves with new products. An older woman approaches Erik, wearing Foodtail clothing, and asks for a specific sour milk. They go around the corner, to a chilled area that I haven't noticed where there are additional fridges displaying the lactose free range. Erik returns and comments 'as we said previously, too many products' as a way of linking back to the discussion about the challenges of offering a large product range (Field note extract, 2016-01-07).

Figure 4: Field note extract - range overload

In the current trend of growing product ranges, there are many new products to evaluate during each revision window. During every revision window the product-owner is expected to present a new product in order to stay relevant and also to replace the less attractive range.

> We present something new almost every time [every revision window]. The chains want you to present 'one in, one out'. It's not always the case that we can do that and sometimes there's an additional one, but our aim is 'one in, one out'. The reason is partly because some [products] sell more poorly and partly because a fridge measures just a few meters so we can't just constantly keep growing the range and presenting new products, but we remove the ones that don't sell or aren't profitable.
>
> (Eva, Marketing department, Dairy Corp, 2015)

If, for example, Dairy Corp does not present a new product, such as a new range of yoghurt flavors, they risk losing space in the display shelf to another product-owner's new product range. The market changes have forced dairy industry actors to imitate other fast-moving consumer goods sectors in order to stay competitive. Although the fresh milk range is different from other dairy products in terms of not having the same demands for innovation since there is no general interest in milk offering different flavors, the milk range is affected by quicker market flows that also concern expectations regarding flexible packaging solutions and branding.

Dairy Corp uses the package to ensure a homogenous brand experience, where the same visuals will serve as ways for the consumers to quickly recognize that a product belongs to the Dairy Corp family.

> Basically it is about being consistent, in order to make consumers engage with Dairy Corp products in the same way everywhere, so we need to have consistency in the packages' visual identity. And this we have managed quite well - you see that it's Dairy Corp, you recognize the brand ... so you'll see the wave on the package for example and the brand is always in the same place. The packages are an important part of brand building, in a practical sense.
>
> (Alf, Marketing department, Dairy Corp, 2015)

Moreover, the visual design is also a way to attract consumers, since a visually attractive package can help the final decision to buy a certain product.

> Package contra design, because you should not forget how important it is. There are many – including me – who like to buy nice packages. The face - the front of the shelf is incredibly important when it comes to capturing the attention of the consumer.
>
> (CEO, Consumers I.A., 2015)

The visual appearance of the package is important in terms of convincing consumers to buy this specific product. If the visual design is not taken into account, this can easily be seen in lower sales volumes and the failure to achieve an attractive visual design can for example occur if colors turn out to be too pale or too similar to something else. It should stand out, but some colors, e.g. dark blue and brown, are not seen representative of food products and should therefore be avoided. However, the visual design should not only refer to the face of the product, it is an important tool to help the workers put the products on the right display shelves in the grocery store.

> Now that we have worked closely with the market team, I'm the one who stopped the designs and said 'No no no this doesn't work, have

> you seen what it looks like on the back?' 'But how does it matter?' 'Well, those filling the shelves only see the backside, and they'll get it wrong.' 'Ahh we did not think about that'. So you have to carefully consider how things work in the store.
>
> (Niklas, Sales department, Dairy Corp, 2015)

The changed visual design of a yoghurt package serves as a good example of how consumers rely on visual design in order to find their products. The front of the yoghurt package had previously been illustrated using a large image of a Greek man and a goat. The suggested change was to emphasize the yoghurt as more breakfast-appropriate and replace the man and goat with a bowl and different types of fruits. However, when the new design was tried on consumers in the store, these did not find the yoghurt they usually bought since the visual design had been changed and this was what they used in order to recognize their yoghurt of choice.

> The result was that the old man is what they remember. So when you ask them, people say 'it's an old guy with a cow I think", or "it's a man with a goat' - everyone knew what they were looking for visually, but they did not know if it was vanilla, natural, organic, what fat percentage, etcetera. They had no idea. So you can get lost quite easily in this [visual updates] unless you think about it.
>
> (Niklas, Sales department, Dairy Corp, 2015)

Thus, the design had to be changed again to back to including the image of the old man and the goat, although in a smaller version, in order to satisfy the existing consumers, but also adding the breakfast theme to attract new consumers.

As the market develops and matures demands are made by consumers, those molding public opinion, and other actors about how the package can be more than just a device to protect the food content, but also a tool to help consume the food product. Debates about food waste have focused attention on packages in order to see how they support food consumption in different ways. One of the demands regarding functionality concerns user-friendliness and the fact that a package should be easy to open and close, make it easy to empty out the content, be able to stand on its own, and be easy to recycle. Milk is a food product consumed by people of all ages and since people do not look the same or have the same abilities, it can be difficult to find solutions that are perceived as user-friendly by everyone. Thus companies have to consider an aging population in order to serve their needs.

> What I would like to see more of is precisely those parts of user-friendly packaging solutions for an aging population where good packaging solutions will make it easy to understand how packages should be opened, with the elderly being able to open them.
>
> (CEO, Materials I.A., 2015)

In order for a package's function to be appreciated it must be logical to the users and if not, its functions must be communicated in order for the user to make correct use of it. Thus, the functional demands on packages also compete with all the other interests to be communicated on the package.

Waste management enacted

The final step in a package's life involves waste management. From an industrial viewpoint, there are actors who see value in the package when it has served its role of protecting the food content since these waste management actors view it as an energy or material source. The use of packages and the regulations for securing waste management have resulted in business opportunities that the relevant actors want to safeguard for future processing. Through incineration or material recycling the package can either produce energy for district heating or act as recycled material for other products that will once again enter the market. Packaging materials can have different degrees of usefulness based on how they are combined with other materials, how easy they are to recycle and the value of the recycled material. Government guidelines encourage materials that can be recycled and primarily materials that can be sold with a profit on the market. These instructions guide Dairy Corp in terms of what it invests in and also communicate in line with waste management recommendations that are picked up by the consumers and serve to fuel the discussion if not met or responded to.

> We strictly try to align with the waste hierarchy and think it is very good. We want to use the Earth's resources as many times as possible before it's time to carve out new [resources] from the Earth's crust. That's what sustainability is for me.
>
> (CEO, Waste management I.A.a, 2015)

Eventually the package must be handled in the waste management system. Although the food content is consumed, the package is a physical entity left behind. The consumer is responsible for engaging in waste management and has the decisive power to correctly place the package in recycling containers or to put it in the bin as household waste, which most often requires the least amount of engagement but is the wrong way to manage it. When the food

content is consumed the package also becomes visible to the consumer in another shape than previously. Since the package does not have a direct area of usage anymore it is viewed as annoying and the consumers start to question its existence. This is also when the additional use of plastic became apparent to the consumers.

> Consumers see the package when it is empty too. The package does a job throughout the value chain, but this is not visible to the consumer because then it is taken for granted. But once it becomes visible, it becomes a problem, and then it becomes very annoying.
>
> (Project leader, Materials I.A., 2015)

Furthermore it is argued that the greater demands on waste management make people more engaged with the package, thus also putting tougher demands on it.

> I believe that the [engagement] has increased as recycling demands have become more rigid. Thus you may be more aware of the packages, although you could just throw them out when you're done. But now you have to take care of them afterwards and think about it, and this will make you more committed.
>
> (CEO, Consumers I.A., 2015)

At Consumers I.A., it is believed that the consumers generally feel irritation over the package and what needs to be dealt with when the food content is used. The recycling procedure requires knowledge, but due to all the packages looking different from each other and new materials entering the market, this can lead to failure or a lack of engagement.

> Not least during the recycling stage, I believe that many people are annoyed by the packages. Primarily because it is hard work to recycle and there is a lot [to recycle]. People think it is good to have packages, but they get annoyed. Especially if you live in the city and you have to take care of the packages all the time and bring them to recycling stations etcetera. I can imagine that people get annoyed by that. They want to do good, but it's tricky.
>
> (CEO, Consumers I.A., 2015)

Despite the good intentions it can be the case that the consumers do not manage to recycle to the extent they should be and the CEO at Waste management I.A.b believes that this can also be a consequence of limited knowledge.

> Even I sometimes have to ask 'how should this plastic be recycled'. You have to learn, and it is not all that easy. 'This cottage cheese

> package, what should I do with it now? Ah, the metal part should be taken off… and it should be placed over there…' I'm not sure that a consumer in his/her home environment knows, so I think the industry is over-exaggerating the normal consumer's knowledge.
>
> (CEO, Waste management I.A.b, 2015)

Convenient ways to recycle have become an increasingly important aspect for Dairy Corp. If the package is not easy to recycle or get rid of, it is not seen as a functional product anymore. When describing product and brand value the Senior Brand Manager argues that the brand is a consequence of the goodness of the products that they sell, but that the package is also important when it comes to building on this value. Hence, Sweden's great recycling requirements result in recyclability being a package quality parameter that Dairy Corp is evaluated on the basis of.

> [I]t is the benefits gained from the product that are important. And the package. Both the functionality of the package and the convenience. And today it is also thought that if a package is not easy to recycle, then it is not functional anymore.
>
> (Alf, Marketing department, Dairy Corp, 2015)

Thus it is important for Dairy Corp to stay with the established recycling routines to make it as easy as possible for the consumers and to thus increase the likelihood that they will recycle the package properly. Due to the large numbers of packages produced at Dairy Corp every year the aim is to minimize the amount of material used per package since the weight of the material results in added costs. However, this is a challenge and the risk of taking away too much material is that the package will not be able to cope with holding the weight of other packages or break, for other reasons, before consumption.

This chapter follows the milk package along its supply chain to explore how it interacts with different actors. A milk package encounters different actors during its lifespan. Actors that have differing expertise and expectations depending on where they are positioned along the supply chain, and how they manage the package in different ways. Although some treatment is specifically directed at the milk package in terms of its qualities in meeting milk's demands, it is sometimes treated as one of many other food products that have to align with general industry standards. Moreover, a milk package is no longer just used for functional purposes, it should also be attractive compared to other products. The different interests shape the milk package in different ways and have turned it into a complex object, since all interests must be accounted for in the same physical object.

Chapter 6: Negotiating a new packaging design

At Dairy Corp, the general production of milk products is mostly a task for the dairy factories, but headquarters is only engaged with the numbers of products produced, or unforeseen problems. However, once a package will be improved, updated or exchanged it becomes a project that many different actors at Dairy Corp, as well as other actors in the industry, get engaged with.

Designing a new milk package for the Swedish market requires making many decisions and taking different interests into consideration, since the previous package has been in use for many years and resulted in object and specific treatments and preferences. Until the 2010s, the Swedish dairy industry was set up on a regional basis where different companies were regional market leaders. However, eventually, these barriers started to erode and the dairy companies moved their production areas in order to act more on the national level, which also impacted Dairy Corp to go from a regional to a national market.

Its milk packaging solutions consisted of two different models in different regional settings. In most parts of Sweden, milk was contained in a Brik package, a cardboard package whose inside had plastic protection layers to prevent leakage. However, in the Southern parts of Sweden, they never embraced the Brik package, having a tradition of using the Gabletop package with its foldable opening for pouring. This package range was later also expanded to be sold on the west coast of Sweden.

> In the past, you sold your milk in your own geographical area, but this was opened up, and you moved your positions to the south and north.

> This demands more of the packaging solution as consumers were, for example, not accustomed to Brik [packaging] in Scania. It was unsaleable.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

Eventually, however, there was an opportunity to perform a milk package project and since milk production and distribution went from being handled on a regional level to the national level, Dairy Corp wanted one solution that would be accepted across the whole country as this would entail ways to improve production efficiency.

The trigger for such a packaging project was the need to update packaging machines in the main dairies due to these having more than 30 years of service. This concerned the Brik machines that had become increasingly dependent on service and maintenance. Dairy Corp had to think of renewing the packaging machines and could either buy new Brik machines or envisage other machines providing other types of packaging solutions. The Brik machines were still in use at four of the company's dairy production facilities and buying new machines would result in big investments. However, product development projects, and especially projects that have an impact on national production levels need to be managed correctly and thus many actors are involved in the process. The aim was to find a packaging solution that met present packaging demands.

The packaging project was a large one that involved many actors at Dairy Corp. Project teams consist of people from different departments, who all have the different areas of expertise required to implement a project (see figure 5), such as actors with knowledge of packaging, dairy quality, factories and production facilities, sales and marketing. Moreover, the project team is supported by expertise from other areas, such as sustainability, finance and the steering committee to provide documents and knowledge statements when requested. Hence, the project agenda can differ between the actors depending on their roles and expertise, thus resulting in their aiming to steer the project in different directions.

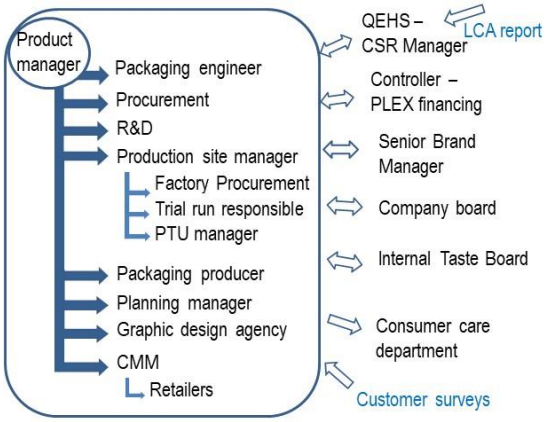

Figure 5: Actors involved in a large-scale project team

Innovative packaging projects that involve renewing the packaging machinery are rare, primarily due to the large investments related to such projects; instead it is more common to have projects initiated in order to adjust existing packages or machines. These projects are primarily initiated by actors in the dairy production sites, the consumer care department and retailers. If a package fails to live up to what is expected of it, this must be adjusted quickly since it can result in great financial cost through wasted products, losses in sales, or damaged relationships with business partners and consumers.

The inclusion of all actors in the project group ensures that all relevant aspects are heard and responded to. In the milk package project, which is the largest type of project that has been performed by Dairy Corp due to the level of machine investment and demands for quick implementation, many actors were included in the project group. Representatives of procurement and the packaging producer are not always involved in a packaging project, but these had important roles in this specific project in order to make sure that the budget was realistic and the packaging solutions suggested met safety demands. Moreover, actors responsible for the dairies have an important say in terms of evaluating proposed machines and packaging solutions in the manufacturing system. The dairies are individually evaluated based on how well they perform in terms of efficiency and revenue and thus they have little willingness to install machines that do not fit the established production area since the space for machines and storage is limited and must be efficiently used. Moreover, the dairies are concerned about the packaging solution's capacity to be efficiently managed and to result in large production volumes without great demands regarding workforce requirements.

> Production representatives are given the task of finding out if it [a packaging solution] works in their production, something they often

> have an answer to already in the given meeting. Because problems occur if a production line is already full, or if it [the new packaging machine] does not meet demands as regards capacity and technical solutions. In this case they [production] can say no or communicate what needs to be changed in order to make it work.
>
> (Magnus, Ass. Site Production Manager, Dairy Corp, 2015)

The new packaging solution should also align with the distribution routines, which are controlled by the supply chain department and the CMM (consumer market manager) since a package's design has both a logistical and a sales impact. However, the outcomes of these two interests are often in conflict with each other since the logistical aspects encourage packages to meet the recommended size measurements, while the consumer perspective encourages designs that 'stand out' in relation to the additional range.

A packaging project must also take 'end of life' processing into consideration when implementing a new packaging solution, since a failure to meet the recommended waste management will result in fees that destroy the budget for a planned package. Additionally, waste management processing has become an important aspect when it comes to communicating 'green' values, something that is increasingly being requested as an attribute by consumers.

These different interests that originate from established routines and regulatory demands must be responded to in the packaging project, leaving less room for creativity and innovativeness in the design process.

Gaining consumer attention

Growing competition and increasing consumer demands have resulted in food packages becoming the face of the product and should thus communicate and advertise the product and brand values. A package is not only the materials that it is made of, it is also the functionality and a space that has information, design and attraction. Thus, a package, except for the regulatory demands regarding food safety and waste, should live up to the functions it offers by protecting and enacting the food content, and by being user-friendly for the end-consumers.

An attractive package is not generic across the world, it is influenced by the geographical context and tradition. Hence, a new and smart packaging solution might not be welcomed by some consumers and this adds another layer of interest to understand and account for when working on package development. A lot of the innovation in packaging solutions is a result of identified consumer demands and requests. Concerns about packages' environmental impact have

grown over the years and at X-Pak a team in the department of environmental performance performs, every other year, a market test to build up the best possible understanding of consumer behavior and needs. This test is applied to two segments, where one segment involves people who sit on boards, in companies, local administrations – people who are in a position to influence the business and the market. The other segment involves the end-consumers of 11-12 countries who are asked questions concerning the environment – how they perceive the environment, climate emission issues, water depletion and similar questions.

Consumer requests regarding specific packaging materials are not the same around the world, but Erik at Supply Chain, Dairy Corp argues that the consumer reactions are largely based on tradition in the sense that people prefer materials they are used to. In Sweden, most packaging solutions have traditionally been paper-based, but in the UK there is a tradition of using poly bottles as milk packages. This tradition also provides the consumers with demands and preferences, which can make it challenging to implement new initiatives.

> It is not so attractive in Sweden to add a lot of packaging materials, but in other countries it might be seen as beautiful to have a soft plastic package placed in a hard plastic container with a sleeve that has decorative features and so on. /…/ That could be [attractive] in South America. It should look fancy. Or in the UK. But we are quite fastidious in Sweden.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Instead of fancy features, Swedish consumers are intrigued by packages that display values such as functionality and the environment and are based on our tradition of cardboard packaging; this is something that is positively related to these values.

> If you want to do something good in Sweden, use paper in some way. It should be made attractive with a nice decor and also inspired by the environment and convenience. Combine convenience and the environment and appearance, and good compatibility with the product, of course.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

The geographical context is important to take into consideration when meeting consumer demands. However finding a solution that manages to combine convenience, the environment, appearance and compatibility can be challenging, especially if restricted to a specific type of material. Visually, the

package is the face of the product and the design has become an increasingly important area where the package's visual design reflects the product's price, quality and uniqueness. An attractive design and material are recognized as increasing interest in the final product.

Industry relationships and interactions

The introduction of a new milk package is not performed single-handedly by Dairy Corp, instead it buys packaging solutions from package production organizations who offer a range of packaging solutions. However, the existing range can be mismatched with the demands of the product-owner company, like Dairy Corp, since there are many more aspects than just the material composition of the package that have to be taken into consideration in a dairy packaging project.

Dairy Corp has a tradition of having cardboard packages, but a milk package can be made out of different materials, which have to be evaluated when choosing a packaging solution. Competing packaging producers promote their own packaging solutions and packaging materials in order to emphasize their own products. Since food packages are often challenged regarding their environmental impact, the packaging producer X-Pak has one packaging assortment category that promotes 'green' packaging solutions which in different ways have less of an environmental impact than the other packaging assortment. However, 'green' packaging attributes are generally difficult to promote in relation to other packaging parameters regarding material strengths and price. At the department of environmental innovations at X-Pak they are convinced about the need to quantify the environmental impact of a product when promoting environmental branding, since that is how most things are evaluated. The environmental packaging innovations belong to the premium category and the price is higher than that of traditional packages. The ability to promote the packaging solution, though, for example, quantified measures, affects the customer's ability to sell the premium package to the end-customer, since this is the traditional way for companies to assess a result. Environmental impact can be conceived of as a fluffy parameter and thus all the possible quantifying elements are ways of communicating using traditional business language.

> We are working on quantifying the value of these environmental attributes, because without quantification this means nothing to customers. It may mean something to consumers, but to develop a strong B2B proposition quantifiable values have to be in place. Otherwise we are just shooting in the dark, just like that.
>
> (Nils, Innovation, X-Pak, 2016)

Performing an LCA (Lifecycle analysis) has become one way of quantifying the environmental impact, and is also an important tool, when discussing a package with other actors in the supply chain.

> One should have an LCA - a lifecycle analysis to learn how it [the package] depletes the earth's resources all the way from cradle to grave. /…/ How much water is used, how much power, is it possible to recycle and from that information you get an LCA and you have to get it to be as good as possible.
>
> (Anna, Innovation, X-Pak, 2016)

Despite the acceptance and increased use of an LCA to present the environmental outcome, some actors are skeptical about the outcome it presents as they argue that an LCA can easily be shaped so as to tell the story the initiator of the analysis intends it to tell. The analysis tends to favor one type of environmental aspect but not to provide a general overview.

> It's very rare that you get an overall picture and it is very difficult for these materials too. All materials impact the environmental parameters in terms of energy, water, air, the value chain, animal populations and so on. You cannot unconditionally measure one against the other and say that it is okay to destroy water in order not to emit carbon dioxide.
>
> (CEO, Materials I.A., 2015)

The package exists within a context and the specific material parameters will have varying effects depending on the context and infrastructure. The CEO of Materials I.A. continues by arguing:

> You can’t put one up against the other. No lifecycle analysis can. But it is actually a combination of different factors, so it makes it difficult to find evidence that one material is better than the other. Further, it depends on how well it is managed in each country.
>
> (CEO, Materials I.A., 2015)

Since the package exists in a system of actors and an established infrastructure, it is also dependent on them showing its full impact. A package that is produced and consumed locally and with an existing recycling system for handling glass reuse would be much better at handling a glass bottle in an environmentally efficient way than a package, which is produced and consumed globally, being exported to different countries with varying arrangements regarding waste management. Moreover, the development of packaging can be a way to optimize material usage or to improve the origin of the materials, but these improvements can be opted out of in relation to more standardized packaging

materials depending on the product-owner's priorities and the specific demands regarding the food content that is to be packaged.

Working with milk means working with packaging

Milk is naturally produced and, except for a variety of fat percentages, lactose free options and organic ranges, most consumers do not want variations in terms of added flavoring or health attributes; milk should stay close to its original formula. Sofia in the Marketing department is responsible for the milk range and argues that people have strong feelings regarding milk: "Well it [the milk] is very traditional. A lot of people say 'don't touch my milk, it should be as it has always been and it should stay that way'." Thus, working with packaging is one of the few ways to stand out from competitors who also sell milk.

> Working with milk means working with packaging. We don't have the same pace of product innovation, but our changes more often involve changes in packaging solutions. This actually provides fairly big changes since there are large volumes and quick flows of products.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

More generally, the package is recognized as an important component of the full consumer product. This result in that large food producing companies have internal packaging competence, although the innovation is performed by the package producing companies. Having packaging expertise internally within the organization is argued as being useful when it comes to realizing suitable options where interests in the food product and internal aspects are taken into consideration.

> The package is an important aspect of the consumer good, which results in all larger food producers having their own packaging developers who have expertise within their own specific implementation environment.
>
> (Project leader, Food I.A., 2015)

Product and packaging development is important for Dairy Corp when it comes to staying up-to-date on the market, but the outcome of these projects brings varying degrees of satisfaction due to many different challenges needing to be handled. Protecting the actual milk content can be a challenging task in itself. The package is in dialog with the dairy content and, since milk consists of living organisms, it can be challenging to meet its varying demands. Over time the outcome has improved through lessons learnt from previous successes and failures. In the introduction phase of the Brik cardboard package there were problems containing the milk, which wet the cardboard material and resulted

in leakages. Erik at Supply Chain, remembers: “The Brik package leaked a lot in the beginning. I remember when I was a kid and there was always milk under the steel crates.” Based on years of experience, packaging experts have learnt that one has to experiment with packaging materials to see how they react in relation to the food content before being launched on the market.

> For several years now we have been trying to reduce the amount of packaging material, but we have learned that it is not easy to change packaging materials. It’s because our products consist of living matter and for example we have seen that when we tried to change the packaging of crème fraîche that that product developed CO_2 during its lifetime and then one can’t have too compact a package.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

In the case of updating the plastics in a crème fraîche cup from polystyrene to polypropylene, the molecule properties of polypropylene turned out to suit the food content differently than polystyrene, reacting by generating a new and unwelcome texture. Thus Dairy Corp had to go back to its previous packaging solution.

> It's still the same polystyrene cup with aluminum foil and a plastic lid. And why is it like that? Well we tried to switch to a propylene cup 6 months ago but it did not work out because it resulted in carbonic acid in the product. It became crème fraîche ‘sponante’.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

The polystyrene cup, in this example, turned out to be too compact a material for this specific food content. However, a less compact material can instead result in odors from other products emerging through the package cover and into the food content, resulting in a bad taste. Hence, a specific material needs to be found to protect the food content from both the creation of carbonic acid and for keeping external odors away from the food content. This makes milk characteristics important to respond to since the wrong material can have an impact on the milk quality.

From a production perspective it can be argued that it is best to continue with the known materials and packaging models since then there will not be any unpredicted consequences. However, over time market-centric interests have become more important to respond to as regards staying competitive. Such interests concern improved product attractiveness by means of investing in a package’s visual design and functionality. Lessons from different packaging projects have increased our understanding that the design and functionality of a package influence the surrounding context and consumer behavior. It has

become more common to appreciate the value and attractiveness that the package adds to the product, and a new packaging solution can be seen as a long-term investment as regards staying relevant on the market, rather than to solely seeing it as a cost, which has traditionally been the case. Erik at Supply Chain (Dairy Corp, 2015) comments:

> Do we get paid for it? No, but on the other hand, we might be active on the market in the future too. We are attractive and have a package which works and which the consumers enjoy.

However, investment in a new packaging solution can encounter protests as production focused actors at Dairy Corp have historically believed that the food content itself should be interesting and attractive enough to convince consumers to purchase the product. Milk packages were initially produced at a time when the package's only mission was to protect the dairy content, having been optimized during the manufacturing and distribution process with these values in mind. Thus, a divided view has arisen on the primary role of the package, where design and functionality have become increasingly important aspects of the dairy package. However, adding design features to a package is expensive and needs to be synchronized with the other product parameters in order to be applicable to the package design.

Finances as a bottleneck

Packaging projects that require investment in all production machines that produce milk are rare since they are costly and exchanging one machine at a time is preferred. Cost-saving activities, led by the purchasing department, occur on an ongoing basis to see if products or procedures can be changed in order to save money. However, such activities are recognized to come at the expense of lower quality, according to the supply chain department. The purchasing department is seen by other departments as being a strong actor that can decide about new qualities of packaging materials without the full agreement of the packaging developers. This has previously resulted in an outcome where there is a lower packaging quality, which ultimately affects the productiveness and limits the product's durability.

> Our purchasing department thinks that they have performed very well when reducing the prices of these lids [plastic lids for a crème fraîche package] by switching to another supplier. But it is not good that this new supplier uses another type of process and another material which have leveled out the benefits of lower cost [material cost] through lower efficiency here [production efficiency].
>
> (Erik, Supply Chain, Dairy Corp, 2015)

A common discussion in the food packaging industry related to the aim of reducing packaging materials is based on questioning the use of a package in the first place. A packaging material is introduced in order to protect the food content thus reducing the quality of the package will result in an increased risk of the package breaking. Thus, savings on materials can instead result in an increased number of broken packages and additional food waste.

> Protecting the food content, that's the most important thing. The priority order should always be: function, health, environment, but then of course there are always certain health aspects and certain environmental aspects that are unacceptable. But in general, the most important task is protecting the food.
>
> (Legal advisor, KRAV Quality Certification org, 2015)

When the project team at Dairy Corp wants to present a new product concept, they know what is expected by the retailers and thus they can create a business case that the retailers would find interesting. The product managers at Dairy Corp know that if they present a product concept with too low a level of profitability, this would not be accepted by the retailers. This has an effect on how new product concepts are shaped whereby some are never realized since, early on in the process, it is identified that they will not meet the retailers' demands.

> [c]ertainly they [the retailers] make demands. We know their requirements regarding profitability, among other things, and we can't develop certain products because we know that the profit margin won't be big enough and that they will never accept this.
>
> (Marie, Marketing department, Dairy Corp, 2015)

In the milk package project the reason for initiating packaging development projects was the need to invest in new packaging machines. Investing in new packaging machines is a large investment for dairy companies and the aim of investing in new solutions is to keep these in use for many years in order to repay the initial costs. Most dairy products, including milk, are low-margin products that are sensitive to added costs.

> Milk cannot be expensive. There is a resistance [to high process] and an agreement that everyone should be able to afford the product. You [Dairy Corp] can't do things like with chocolate holding 70% cocoa, when the price is increased by SEK 10 just because of the increased amount of cocoa ... it doesn't work like that.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

When initiating discussions concerning a new milk packaging solution, one packaging project was performed with the purpose of ensuring a competitive and 'one of a kind' packaging solution. The marketing department commissioned a design studio to make a proposal and this studio designed a cardboard package that had a square base that gradually was shaped with a round opening at the top, with a screw-cap 50 mm in diameter.

> It was very stylish and I invested a lot of time and money in it. We created boxes and got paint spraying tools to make the covers and we had a German machine manufacturer who made a pilot machine to do a test series from it. We filled samples and tested it [the product] on consumers and everyone was happy and satisfied.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Despite the successful market response to this new packaging design, that was when the project halted. It was realized that the milk could not bear the costs of the packaging solution, making each milk product SEK 0.50 more expensive. Many planned projects are never launched due to problems, or unexpected situations, happening along the way, illustrating the many areas to cover when launching a package, even when there is joint agreement in terms of design. Erik at Supply Chain (Dairy Corp, 2015) explains: "[T]his specific packaging solution would clearly differentiate from the competitors, and when you opened the large screw-cap you could see the drink. So it was a nice packaging solution".

In this project the packaging solution managed to meet the demands for an attractive and unique design, a shared understanding on the part of both the internal actors and the consumers. However, a package needs to meet more demands in order to reach all the way to the market; in this case the financial calculations rejected investment in the project. The negative result of this type of project initialization has made visible the connection between innovation and cost, making innovations difficult to implement although there is an interest in seeing a more exciting packaging portfolio.

> They [different packaging solutions] result in production limitations since it will not be efficient or profitable to have completely different production lines [for all products]. In practical terms, we cannot deviate so much from the standard packages as we would wish, because then it usually results in a competitor introducing a cheaper alternative that everyone buys.
>
> (Eva, Marketing department, Dairy Corp, 2015)

The machines have a limited lifetime and a general machine, based on the purchasing manager's estimations, will operate well for at least ten years. Independently of the machine's initial quality, it is argued that machine parts should be available on the market for at least 10 years, with both competencies and contacts available in order to receive help with faulty machines. All this type of information, regarding maintenance and prices are put forward before a purchase is performed.

> At one point a machine will start to break down /…/ and then you start thinking if it's worth keeping that machine as it starts to break down and needs service and spare parts. It costs a bit more to have the old machine than if you were to buy a new one. And then you begin to consider the business case. What will it cost me? Downtime - now it's at a standstill and I can't produce anything.
>
> (Katarina, Procurement, Dairy Corp, 2015)

In the process to learn about new packaging materials and machines there are different package producers that offer different solutions, but the amount of work and uncertainty involved with changing supplier often result in reasons to stay with an already established contact where audits have been controlled for.

> When it comes to packaging and materials, there is an audit of 500 pages that you have to go through and explain how we see it, so it's very hard guidelines. And then one wants to stick to those that have already been audited and know that these can supply and so on. So, not so often.
>
> (Katarina, Procurement, Dairy Corp, 2015)

In order to have security as regards spare parts and servicing over time it is preferable to work with the well-established companies that Dairy Corp is very accustomed to. For bigger investments in, for example, new packaging machines, the project group needs to apply for financing through an investment fund called PLEX (pseudonym). PLEX money is only distributed once a year and, in product areas like the 'to go' market, this is a barrier to investment in new packaging solutions. Since the 'to go' market often needs quick projects that enter the market as soon as possible, it can be the case that they do not have the time to wait for the decision regarding whether or not they will be allotted money for packaging machine investment, resulting in fewer packaging investments than they would wish for.

> They [new packaging machines] are an enormous investment. That is often the biggest problem for new packaging solutions, I would say.

> Most often we want to create a new concept or a new product, and generally we want to do more with the packaging than is possible in the end – partly because we need to invest in something new. But also the time – it takes too long time to receive the investment money, to buy the packaging machine and install it.
>
> (Marie, Marketing department, Dairy Corp, 2015)

Only ten years ago, the time component for installing a new machine would not have been a problem to the same extent, but in a more competitive marketplace, it is important to have quick processes. Marie in Marketing department continues: "It is 'fast moving consumer goods' we trade in, so we don't have time to wait for the full process since there is a risk that someone else will enter the market before us."

A project plan description should describe how the project will meet demands connected to the key performance indicators (KPIs); these are important measures as regards whether a project will be initiated or not. When looking at projects and their qualities, there are certain parameters that are prioritized more highly than others.

> It is our goal that the farmer should get as much money as possible and then the products must be profitable and drive volume so we get rid of it. The least profitable [solution] is to turn it [the milk] into powder, but we want to turn it into profitable products. Therefore, volume and profitability are important parameters for us.
>
> (Eva, Market department, Dairy Corp, 2015)

Volume and profitability are the most important parameters in projects and if further prioritizations are needed, the project in need of the fewest resources would be prioritized over projects in need of heavier investments in terms of marketing and manpower.

A challenging task

From an outside perspective, actors that are not involved in the industry are prone to imagining that packaging development is easy to perform in the food industry. However, this is not a view shared by the employees in the supply chain department who regularly work with improvements and innovation projects for packaging solutions. Erik at Supply Chain, Dairy Corp says that:

> People call from time to time and have these ideas about package development. It's a bit frustrating sometimes when they think they have solved the puzzle and you need to explain why their idea lacks applicability. Package development is not as easy as it might seem.

Before a new product project is introduced it goes through different stages in order to learn about its potential, with the outcome being analyzed in order to see if the product should be invested in. By using a simulation model, in combination with a 'consumer test', it is estimated whether or not the launch will be a success from a market perspective. However, even if the consumer test score has a positive outcome, there will also be many other areas that have to show promising results in order for the project to develop further.

> An important aspect when performing a packaging project is not only listening to market demands, but also understanding what is feasible. The project needs to take the existing system into account. One has to ask the question 'Can the machines do it?' Not only looking at the market interest or in terms of sales, but: 'Are we able to do it in the packaging machine?'.
>
> (Maria, Production, Dairy Corp, 2015)

These areas concern good ratings in terms of volume, profit potential, need for investment, consumer response, and production capacity etc. All aspects involve building up a good business case to show the company board that the project would be a profitable investment.

> You have to build a business case, do your stakeholder management, present it to the board. Say that "we think it will cost this much but we will gain this much". It is always a balance. It's not only a matter of spending money, you do it because there is a profitable case in all aspects.
>
> (Katarina, Procurement, Dairy Corp, 2015)

The main challenge lies in finding a packaging solution that allows all the bits and pieces to fit together. It should be an efficient solution at the production site; affordable packaging materials; meeting consumer demands as regards user convenience; meeting retailer demands for rationality; securing product safety; and differentiating from other competing products. More frequently it is possible to find packaging solutions that have advantages in one or two of the variables being aimed at, but covering them all is more difficult.

> They [product managers] often come and ask if we can change aspects of a package and illustrate which options are available. Then I will contact our suppliers and come back with the solutions that exist and suggest which ones might be suitable. /…/ I make suggestions for a couple of packaging solutions, saying 'this one would be better for this and that reason... the environment or price or differentiation'. It is often

> important to stand out on the shelf too, to be recognized, so that you don't get noticed among the competing products. Differentiation is important.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Finding potentially new packaging solutions is difficult since there are many different aspects that need to work together: the dairy production site's request for a high operative frequency; getting a good price on the selected packaging solution; meeting consumer demands for functionality; meeting customer demands for rationality and product safety; and differentiating in order to stand out from the other products. Therefore, achieving efficiency at all levels is seldom agreed on by the actors that engage with different interest areas, since all the actors protect their own business areas. This means that the different demands need to be analyzed in relation to each other in order to possibly find an acceptable solution. The need to find a solution that responds to all interests (and if not optimizing this interest, it should at least be on an acceptable level) is argued to be necessary since a package that is optimized for just one specific area will not cope with the other tasks and will thus not be accepted by these actors. Erik at Supply Chain, (Dairy Corp, 2015) argues:

> There's no reason to have packaging solutions that people get annoyed by. Not if we're the ones [being annoyed], or our distribution, or if we have to discard the pallets [of products] because they do not work.

Learning about the challenges of performing a packaging project creates insight into why packaging changes are rare in the industry. However, when the machines are too old to function properly a packaging project has to take place.

The project of implementing a new milk package solution was part of the planned project category and the work was analyzed over two to three years before the final decisions were taken in order to analyze different solutions, such as the 'round top, square bottom' design. Knowledge gained from this project was recognized as important, since a failed project outcome regarding the implementation of a new milk package solution at the national level would be very costly. Sofia, marketing department (Dairy Corp, 2015) explains:

> The machines result in heavy investments, which result in importance to make investments that can be paid off for many years ahead. One has to get it right when deciding to do something like this [finding a new packaging solution].

A lot of work was done prior to deciding on the actual packaging solution. In order to learn as much as possible about the consumers, and thus invest in the

right packaging solution, the project group at Dairy Corp performed consumer surveys, tried many different packaging solutions, contemplated investments, and held discussions with packaging producers. Dairy Corp has internal interests and KPIs that serve to guide project development, but most importantly, regulations and standards have to be complied with to ensure that the packaging solutions can legally enter the market.

The package implementation phase

Along with consumer dialogs and discussion groups, one city in Sweden, Karlstad, served as a test area for the new packaging solution and this was sold in local stores for six months. Milk-related projects are especially sensitive compared to other dairy products since milk is produced in large volumes. When a milk-related project is initiated this means that it has to be applied simultaneously at three dairy sites since the same packaging solution should be available throughout Sweden.

> We do not have time to drive from the southern areas up to the northern parts [of Sweden], it is not possible based on the time limitations we have on transporting the goods. Thus, there's a pretty large structure that needs to be established and to function.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

In the search for a new milk package Dairy Corp showed interest in a re-sealable Brik Edge packaging solution. However, this solution had a so called 'two-step opening' whereby the consumer first had to screw off the cap and then remove a protective membrane. There would be benefits to staying with a Brik solution as this packaging performs well in terms of logistical and material efficiency. However, it had its limitations – 'two-step opening' is not very attractive to the consumers. The preferred solution concerned a cardboard package called Gabletop which had an attached screw-cap. The screw-cap on this package had 'one-step opening'. This type of opening was perceived as more convenient for the consumers who were treated as the most influential actors when evaluating a packaging solution. Sofia at the marketing department, Dairy Corp (2015) emphasizes it thus: "If it doesn't suit the consumers, it is out. It can be great in all different ways, but if it is not convenient and user-friendly, it won't last". This dependence on consumer's acceptance makes it obvious to include them in the process of finding new products or packaging solutions.

X-Pak provides expert industry knowledge in the field of packaging materials and ensures that the materials can hold the milk content and comply with regulations, even though this also has to be checked by Dairy Corp. Finding a

packaging solution to launch on the market was a great success, since it managed the challenges of divergent actor interests presented earlier. The chosen package resulted in a solution that has a similar design to other packages on the market and was thus less adventurous, from a design perspective, compared to previous packaging trials. Although the new design was similar to other packaging designs on the market, it was different from the previous packaging design. The Gabletop packaging solution, with its screw-cap, has a slimmer and taller design, while the Brik solution is "brick-shaped" and thus designed to be thicker and shorter[2].

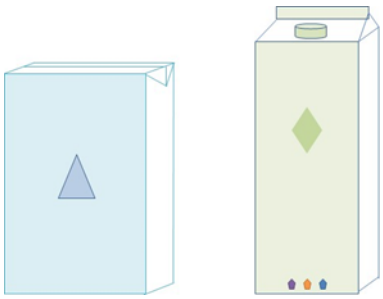

Figure 6: Illustrations of Brik and Gabletop with screw-cap

The Gabletop, with its screw-cap, served as the packaging solution for conventional milk, but for organic milk, the packaging solution was a traditional Gabletop package without a screw-cap. The reason for this was the added plastic that the screw-cap was created using, which would result in a negative experience for consumers choosing an organic option.

The implementation phase is an important stage when it comes to learning how the new packaging solution can be managed during the manufacturing and distribution stages, and when it comes to learning about different reactions.

Packaging project priorities

Consumer convenience came to be perceived as a key aspect of dairy packaging at Dairy Corp, which wanted to find a modern solution. Around Europe, a new milk package with a screw-cap had become popular. This re-sealable solution was seen as a consumer friendly solution and was noted by

[2] The interviews in a dairy factory that produced milk in the Brik package before implementing the Gabletop with screw-cap. Other dairy factories producing the traditional Gabletop package, but without the screw-cap, had already adjusted their manufacturing routines when introducing the new packaging solution.

Dairy Corp. However, not just any type of screw-cap could be placed on the package, it had to be analyzed using different parameters in order to meet the demands of the consumer group. When the Gabletop was chosen to be the new packaging solution, discussions started with X-Pak in order to improve it and make it unique to Dairy Corp. Milk is a product consumed by people of all ages and should therefore be available to all consumers. This resulted in the size of the screw-cap being changed to a larger solution, called XE 34 mm. The smaller cap was rejected due to the safety risk to children, and also because other dairy products, such as processed sour milk, which were possibly also being planned to have this packaging solution, have a more viscous consistency and would be difficult to pour out of a smaller aperture. The Gabletop size measurements were influential in designing the screw-cap since they would not permit a larger cap without changing other parameters of the package, something which would instead impact the logistical volume standards.

In order to meet the demands of consumers finding it difficult to open packages with screw-caps, Dairy Corp and X-Pak involved the Swedish Rheumatism Association (Reumatikerförbundet), which is generally opposed to all packages with a twist-off opening as these are difficult to open if one is impaired. People with rheumatism are included by means of X-Pak performing tests on them to learn about rotatability and openability and there is a test procedure where the results are included. Although these results are taken into consideration, it is not always possible to include feedback in the final solution. Instead openability concerned issues which were solved by the invention of an opening tool that facilitates the opening of the screw-cap.

> Rheumatism-sufferers don’t like screw-caps at all, but we can’t have a full cap on the package and when we hit the 34 mm screw-cap it's the maximum. At that stage we stretched it as far as we had space for on the carton. There is literally no more physical space on the carton. And it is still quite tricky if you find it difficult using your hands and fingers to open a carton. So it's never really popular, but once they have called us and experienced problems they will get an opening tool from us, for free.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

The opening tool is provided to anyone experiencing difficulties opening the screw-cap. The person having difficulty calls Dairy Corp Forum and asks for an opening tool and then it is sent to him/her. No questions are asked, and anyone requesting it is allowed to get one for free. This way Dairy Corp s has lowered the risk of being confronted with not having tried to have a packaging solution available to everyone.

Only a small proportion of people suffer from rheumatism, but the aim of hearing their opinions and trying to cater to their interests illustrates the aim of satisfying everyone when it comes to demands regarding functionality. Despite these inclusive aims, interests regarding functionality were not the only ones to cater to, all the conditions of the manufacturing stages needed to be taken into account in order to hold a successful package. Manufacturing interests had been accounted for by the different actors engaged in the project, which resulted in barriers since the package has to be functional in production stages, influencing the standardized measures in the given packaging model. However, the way the new packaging design will be appreciated is not certain until it is launched on the market.

Manufacturing reactions to Gabletop package

Moving away from the Brik solution resulted in changes during the production phase. The packaging material for the Brik package came from a cardboard paper roll that was then cut into packaging-sized pieces, which were folded, filled with content and sealed. The paper roll was convenient as it only needed factory workers' attention after a longish period of time when the paper roll was empty and needed to be replaced. From a production perspective it was a good and convenient system. In contrast to this, the Gabletop packaging material comes as blanks, i.e. in separate paper pieces, where each block included 220 blanks manually placed in the machine. This meant a big difference for the factory workers and they were very doubtful regarding the change. The new packaging solution resulted in additional manual work for the factory workers, a heavy job that was negative in terms of ergonomics and rationality.

> We went from roll-fed packaging machines to blanks and it was a step backward in terms of usage and ergonomics. Instead of bringing in large rolls of cardboard we had small packets of 220 blanks in each, so it was really the wrong way to go for ergonomics and rationality.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

The Gabletop met with resistance from different parts of the organization since it had a negative impact on the performance parameters being evaluated against. The factory workers were negative toward the change due to the increased workload due to the additional manual work and the non-ergonomic lifting. In addition to the work related issues, the extra workload spills over into general production efficiency since it makes it more vulnerable to machine failure and product output.

When different interests come together it becomes obvious that many of these are in conflict with each other. Machine flexibility is difficult to achieve

without paying the price of lower productivity since food safety activities, cleaning the machine between setting up new production batches, takes time. Sofia at the marketing department (Dairy Corp, 2015) has high aims as regards flexible machines:

> I contact the packaging producers to /…/ see what they can do with new solutions and my abiding wish is for a flexible one [machine], I want to be able to make more [different types of] packages in the same machine so that everything doesn't have the look of the typical milk package. I want to be able to do [produce] something else without having to change the machine.

However, these wishes have consequences, which Sofia is aware of, and she continues:

> This is possible to some extent, it can be done, but it is very difficult. They argue that there will be a lot of setup time instead, and then we lose production time if we have to use one hour to reset things for another format. So it is not very easy.

The Gabletop machines were considered as meeting the most urgent demands for flexibility, which was argued to be enough since they could easily be adapted to other packaging sizes and were quicker to reset between production batches, something that has been time-consuming with the Brik machines.

The new package design results in a less efficient way to transport the products due to new size measurements, compared to the Brik package. The Gabletop has a tilting top, with a screw-cap, resulting in the need to place shelves between the packaged layers, while the Brik package is square and packages can be stacked directly on top of each other. From being able to fill a steel crates with 180 Brik products, instead achieving a maximum of 120 products using the new Gabletop, this had a negative effect on the logistics efficiency. This result was recognized in an LCA report in terms of being a negative consequence of the Gabletop package, compared to the Brik package.

> Magnus, Ass. Site Production Manager: We did get that [the result from LCA] as a minus in the logistics, the economics, and the environment.
>
> Erik at Supply Chain: Yes it adds SEK 0.10 per package just with the crates [going from 180 liters to 120].

In discussions about the efficiency of the Gabletop, it is known that this results in added costs both in terms of the financial and environmental parameters, thus opposing two main goals communicated as key performance indicators of volume and efficiency. Dairy Corp has internal goals of lowering the CO2

footprint of packaging and production and thus environmental measurements are performed before new solutions are introduced. Also the sustainability managers were skeptical toward the new packaging solution since it opposed the sustainability goals of lowering the CO2 impact of packages. The Swedish Environmental Research Institute (IVL) was responsible for looking into the environmental consequences of the new packaging solutions and it showed results indicating a higher environmental impact, compared to the Brik solution. However, the main dislike regarding the new packaging solution was the introduction of more fossil-based plastics since this was clearly departing from the sustainability goals.

> Dairy Corp has decided on a goal of limiting the CO2 emissions from packages and production by 25%, based on previous CO2 emission levels, by 2020. And it is difficult to answer to this goal as we will introduce more plastic into every package [Gabletop package with a plastic screw-cap].
>
> (Erik, Supply Chain, Dairy Corp, 2015)

The internal discussions and conflicting views concern five parameters which, in the best of cases, should all result in high performance. The parameters concern packaging solutions that result in efficient production and logistics, solutions that meet consumer convenience requirements, price per unit, and the environmental impact of the package's material resources.

The Gabletop and Brik packages correspond very differently to these parameters, with the Gabletop package primarily benefiting consumer convenience, whereas the Brik package benefits manufacturing efficiency. The Gabletop package's poorer environmental results caused a big discussion internally within the organization, but from a Market perspective, it becomes obvious that a package cannot correspond to everything, other parameters such as user-friendliness also have to be corresponded to.

> It [the package] should correspond to everything and it is not possible – to be re-closable, stackable and additionally environmentally-friendly. Tetra Brik actually wins on environmental friendliness, but it can't be re-sealed and it gets a little messy when you pour it sometimes.
>
> (Marie, Marketing department, Dairy Corp, 2015)

The environmental results were not ignored by the project leader and the company board, but they also struggled to legitimize a packaging that went against the sustainability goals. However, the company's environmental targets have a lower priority than the target of achieving increased revenues

for farmers, which they hoped the package's contribution would be; the decision to launch was taken.

> So we work toward meeting our environmental goals, but sometimes consumer convenience has to be prioritized – that you have a packaging solution that is competitive and not just good from an ISO performance perspective. But the fact that it is convenient is most important since, if we cannot sell the product, we'll have nothing to do here. That's the truth.
>
> (Hans, Site Production Manager, Dairy Corp, 2015)

Considering the fact that consumer convenience is of great importance, there was no unified view to be found when asking the consumers what they preferred and Dairy Corp soon realized that the consumers also take a package's environmental aspects into account.

Market reactions to the Gabletop package

The Gabletop packaging solution was chosen based on its qualities in delivering user-friendliness because of its screw-cap solution. Since the introduction of the Gabletop with a screw-cap, a change has been identified in consumer consumption behavior. The screw-cap allows the package to lie down horizontally in the refrigerator and also to transport after being opened, a request that summer cottage owners had been demanding for a while.

The package's functionality shapes how consumers interact with the product, but other factors also shape consumer behavior. Dairy products, and primarily milk, have a short shelf-life and, in order to prolong it and keep the product fresh, without UHT treatment, it is kept cold in a refrigerator. Depending on the temperature in the refrigerator, the shelf-life will vary and, in order to control the food quality, an expiration date is set based on the national recommendations for refrigerator temperatures.

> We guarantee a certain number of days remaining on the shelf life when it [the product] is in the store, so if it remains in our warehouse for more than 2 days after being made, we don't send it. Then it goes back into the process.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Industry actors have learnt that consumers have great respect for the expiration date and it is common for milk to be poured out before reaching the date printed on the package, resulting in fresh food being discarded. Dairy Corp tries to communicate with its consumers as regards how to relate to the expiration date,

depending on individual refrigerator temperatures, and the following statement can be found:

> Milk is a sensitive food product that should be kept cold. Put the milk directly into the refrigerator when you come home from the shop, or use it. On the milk package there is a recommendation to store it at up to +8 degrees and the expiration date applies to storage at this temperature. The milk will have a much longer shelf life if you store it in +4 degrees or colder. It has been ascertained that milk will last almost twice as long post-expiration date if it is stored at +4 instead of +8 degrees. This adds 4 days of good quality to over a week (Dairy Corp, 2016).

Respect for the expiration date printed on the package has also been shown to have an impact on food waste. At the marketing department of Dairy Corp it is believed that this respect comes from an increasing mistrust in people's own ability to tell if a product has gone bad or not. So, instead of taking the risk of consuming an old product they discard it as per the date cited on the package.

From analyzing consumer behavior, it has been recognized that consumers perceive qualities on packages with screw-caps and that this is more protective of the content than previous packaging solutions which were not re-sealable to the same extent. This added attribute has been recognized as changing consumers' attitudes toward milk quality and it is argued that they are generally more willing to drink the remaining centiliters as well.

> Once again it is about comfort. When a screw-cap is attached people think the milk has a longer shelf life, and that is great since it means they won't waste the last drops due to thinking the milk is better protected. It's a psychological effect to 100%, but I'm glad if they keep believing it.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Since food waste involving dairy products is most often poured into the sink it is difficult for Dairy Corp to confirm that this misunderstanding has had the discussed effect. However, this is based on consumer interviews performed by Dairy Corp where this has been a recognized trend.

> So there are many people who call and say "Can't you remove the screw-cap?" But then we lose that functionality and if people think it actually delivers better on product life, then there's much more to gain from people daring to use the milk until the expiration date than from removing the screw-cap.
>
> (Alf, Marketing department, Dairy Corp, 2015)

The understanding that consumers waste less dairy content due to the screw-top was unexpected, but good in terms of the food waste challenges that other dairy packages have been confronted with. However, consumers do not only have one wish, instead asking for many different things without recognizing the challenges the industry faces in managing everything in one packaging solution.

This chapter serves to illustrate what happens when an established packaging solution is challenged by a new design, visualizing the possibility in order to challenge the set routines. Moreover, it also communicates the many interests needing to be accounted for when planning a new packaging solution, where Dairy Corp's own company demands are communicated through economic incentives since a packaging investment must be within the company's financial calculations.

In the design process many different interests need to be taken into account, such as safety and quality measures discussed in chapter 4 and the practical engagement with the package through the supply chain (chapter 5) are juxtaposed with each other. Additionally these interests are negotiated with Dairy Corp's own internal interests. The various interests need to be adjusted in order to be applicable to the new packaging design, since the package has physical boundaries in relation to what can be performed within the same package.

Chapter 7: Adjusting design qualities

The previous chapter exposed the different interests accounted for during a design process. Creating a packaging design that can be launched on the market resulted in compromises, since many interests are in conflict with each other, e.g. creative designs can have consequences during manufacturing procedures and exceed the allocated budget. However, when the Gabletop with its screw-cap was launched onto the market, consumer reactions required adjustment of the packaging design. However, this had to be done within the narrow window of flexibility since the machines had already been bought and installed.

Consumer reactions to the Gabletop packaging solution

Prior to launching the Gabletop with its screw-cap, Dairy Corp carried out surveys and group discussion sessions in order to learn about consumer demands. The overall results showed a positive attitude toward a package with a screw-cap. However, not everyone had the same attitude and when the Gabletop package was launched the people reaching out to the consumer care department mostly had negative opinions. Staff working at the consumer care department say that the people contacting them generally have a reason for reaching out – they have had a bad product experience or they are negative to a certain change. People called in to say that they were highly dissatisfied with the packaging model – it did not fit their shopping bags, it was too high to fit the refrigerator and too wide to be placed on the door-shelf, where the Brik package was traditionally stored. Moreover, people also called in to stress that the screw-cap was impossible to open and thus Dairy Corp learned that the initial screw-cap was too tight.

The consumer care department was aware that the launch of the new milk package would result in increased consumer engagement, but it had not been prepared for the massive numbers of calls, emails and messages on social media that the launch actually resulted in.

> If one asks the consumers, 7 out of 10 think it is convenient to have a screw-top, but 3 out of 10 think it is bad; 'why are you introducing more plastic, it is not good for the environment'. So one could say that it is a dilemma".
>
> (Emil, Sustainability department, Dairy Corp, 2015)

A common message from the negative consumers was the increased environmental impact due to the added plastic in the packaging, something which was communicated via blogs and debate articles:

Dairy Corp replaces one packaging solution with another environmentally harmful one

Dairy Corp has now begun phasing out the old packaging solution in favor of a new one - this time with a screw-cap. Despite criticism, it chose to switch to an alternative with a greater environmental impact.

Last autumn, the National Food Administration conducted a study on the difference in CO_2 impact between the two packages. It turned out that the new model with screw cap gave five to ten percent higher greenhouse gas emissions than its predecessor, due to the plastic screw-cap. […]

(Tovatt, 2012)

Figure 7: Post concerning negative environmental impact of Gabletop.

Environmental discussions are strong within the dairy industry since there are environmental consequences and crisis that have happened in the industry history that would be relevant to take into consideration during product development projects. The packaging solution for conventional milk was the Gabletop with its screw-cap, while the organic range got the Gabletop with a foldable opening which did not require any additional plastic. The reason for having two packaging solutions was the added plastic in the screw-cap, which was not in line with the 'green' values communicated by the organic brand. However, the difference in the packaging solution resulted in increased attention being paid to the added screw-cap.

Although there was overwhelming interaction with and negative feedback from consumers, in relation to the plastic screw-cap, it was successful in terms

of sales results. So successful that Dairy Corp noticed a decline in sales of organic milk, which until that point had shown continuous growth in sales. Thus, it seemed like the previous buyers of organic milk were enjoying the new, convenient solution offered by the Gabletop and were being seduced into consuming regular milk instead of organic. Despite the positive results from the Gabletop solution, a decrease in the sale of organic milk is not a positive development for Dairy Corp. Organic milk, along with lactose-free milk, is different from regular milk since it can be sold at higher price margins.

The farmers' earnings per liter of milk follow the 'global dairy trade price index', which is negotiated on a two-weekly basis. In April 2016, Dairy Corp's farmers were paid SEK 2.60 per liter for regular milk (Niléhn, 2016), but when producing organic milk they earned SEK 4.14, entailing more than SEK 1.50 extra per liter of milk. Until then the demand for organic milk had been increasing over the years and, although it entails higher production costs for the farmers, organic milk is a profitable and successful product both for them and for Dairy Corp in general. Thus, this development caused by the new Gabletop package resulted in Dairy Corp deciding it needed to find a 'green' solution as regards offering the same functionality as the screw-cap. Responding to these interests was needed in order to convince the three out of ten consumers who disliked the fossil-based plastic cap solution, and who actively communicated their perspective, resulting in a public debate that Dairy Corp did not want to be a part of.

The shared feedback concerning the added plastics as a negative environmental feature, but also the majority of consumers preferring the functionality of having a screw-cap, resulted in Dairy Corp looking for a solution that would have the same positive effect, but would step away from the negative feedback regarding plastics. The route toward finding a packaging solution that could be aligned with the demands regarding all stages of the production and waste management of the package resulted in different aspects to take into consideration.

Empowered consumers

Rising awareness and the growing number of products on the market have made consumers increasingly aware of food quality and content, and more engaged in food related topics. Companies and organizations having a presence in social media has resulted in a new channel through which consumers can make their voices heard. KRAV, a quality certifying organization, has recognized this increased engagement and the effect of a consumer driven debate in social media. Consumer engagement has made KRAV more interested in the package and the work of further regulating packaging-specific

requirements, since not just any package can be the container of organic food, specific quality demands have to be met. The initiative regarding stricter requirements is perceived to spring from consumer engagement, with an incentive from the Swedish Society for Nature Conservation (SSNC).

> If we take on a tougher packaging initiative it builds very much on the consumer questions and comments that made us proceed with improving packaging rules. You can say that it was the consumers who initiated its upgrade [the rules regarding packaging qualities].
>
> (Legal advisor, KRAV Quality Certification org, 2015)

The members of KRAV prefer to be proactive in this topic instead of suffering from a consumer driven debate, which they know from experience can result in a "storm" of accusations and demands. Thus consumer interest, and the shared understanding of importance of packaging material controls, resulted in action.

> I actually printed what I received in my inbox from 2015 and 2014, so it's not via Facebook that I get too many. So let's see… it's 1, 2, 3, 4 ... erm 5, 6, 7, 8 emails. Okay that's not so many, but we react very strongly and I think that's because we also think it's an important issue. So it's not a storm, it's not really a heck of a lot if you count them. However, we react strongly to every question and take things seriously.
>
> (Consumer contact, KRAV Quality Certification org, 2015)

Organizations learn from others that have been subject to a 'consumer-driven storm' and they know the cost of restoring brand image afterwards; over the years there have been some food related scandals. In 2007 Mats-Eric Nilsson launched a book entitled "The secret chef", about the secret ingredients like e-numbers which were the subject of debate related to health and legislation. This book was debated on the national level and many parts of the Swedish food industry were challenged and exposed by the media and consumers. This critical view of what food products consist of made consumers more aware and also more critical towards the food companies. Many actors were named and shamed in this debate; however, actors such as Dairy Corp, which was not involved in this drama, have learnt from the ramifications of such a scandal.

> We're continuously working toward making products as natural as possible, removing preservatives and flavors and dyes and things like that. Because, engagement started 10 years ago when Mats-Eric Nilsson wrote 'The Secret Chef', so even though we were not affected and did not have any controversial ingredients, as we saw it, we realized that we too had to start working with these topics. And it has

> been a big job in which we have successfully removed preservatives and artificial flavors and colors.
>
> (Eva, Marketing department, Dairy Corp, 2015)

This aim has resulted in proactive activities in order to stay away from a public debate, since such attention can harm the brand even if the products prove to be safe and of high quality. Eva at the marketing department (Dairy Corp, 2015) continues: "You can say that the precautions are taken to avoid the risk of a discussion, rather than facing the risk that it's actually bad or dangerous." This provides some insight into an increased interest in aligning with consumer demands, and how the outcome of a 'public storm' can be costly, especially at times when there are an increasing number of products to choose from and consumers cannot be taken for granted.

What characterizes 'green' packages?

The 'green' package means different things to different actors within the industry. This means that various 'green' qualities are promoted based on the aspects the package should respond to in specific parts of the supply chain. From a packaging producer perspective, the material qualities are promoted while, for a 'green' solution, packages should be environmentally friendly to produce and recycle. However, the best material for a specific area or product is closely connected with the recycling facilities in the area where it is produced and consumed. Moreover, this also means that a product being made for local or global transportation should be treated differently as regards material choices.

> A heavy material such as glass is energy-intensive, but if recycling works well and you can recover the material and have your users relatively close to the manufacturer, then it can be a great material. But it can also be a bad choice if you do not have a functioning recycling system and the manufacturer is far away, so you have to transport heavy glass bottles to be filled with milk somewhere far away.
>
> (CEO, Materials I.A., 2015)

Additionally, from a logistical perspective there is always a striving to minimize the amount of packaging materials in order to lower the CO_2 impact.

Dairy Corp promotes cardboard packages, although it is known that there are other types of containers that are attractive from a consumer perspective, but which are not compatible with manufacturing and distribution. Sofia at the marketing department (Dairy Corp, 2015) explains:

> We try to promote cardboard packaging, but we can see that it is a bit tougher because it is a bit more trendy and fancy to have bottles since that feels a bit more luxurious in some way. The most preferable one would probably be a glass bottle and this is believed to be very environmentally friendly, although it is so heavy and needs to be washed and cleaned and all that.

Although glass bottles are seen as something attractive Dairy Corp has realized that consumers ask for many things before realizing the final price of their requests. Sofia at the marketing department (Dairy Corp, 2015) continues:

> So when we do a product test with something that is in a glass bottle, it always gets the top score. It is super luxurious. There is a little gold edge on it. Cardboard is a little bit 'run-of-the-mill'. It is difficult to make the milk luxurious in a box, we would like the consumer to think so, but it is challenging to accommodate both the product and packaging. And it would be really expensive.

From a food perspective it is argued that the package should be produced alongside food innovation in order to fully meet the food content's demands. The Food Innovation Network argues that more energy is consumed in the production of the food content which thus needs to be carefully protected in order not to go to waste. This promotes the use of more packaging material in order to ensure that it will hold as long as requested. The manager of Public Affairs Plastics at Chemicals I.A argues: "There are many occasions when it is better to increase the amount of packaging material if that means you can reduce food waste."

There are also arguments that the 'greenest' package is the one that allows all the food to be eaten. This involves a package's functional aspects as regards emptying the content out of the package, but also the fact that the package should be the correct size in order for the food content to be consumed before it expires. The CEO of Materials I.A. (2015) explains:

> One good example is liverwurst, where duo packs have started to be sold. This is good if you do not know if you will eat it all within the next couple of days. Because when you have opened it, then it has a relatively short shelf life. So then it may be good to have a smaller package that will allow you to actually eat it instead of having to waste a third of it because you have not eaten it. Then it is better to have a little more packaging material.

These different aspects can result in one and the same solution possibly being seen as both a 'green' and a 'harmful' packaging solution depending on where in the supply chain it is reflected on. Dairy Corp's packaging solutions have

previously been challenged in terms of not matching 'green' attributes. These reactions have come from consumer group organizations, but also from actors within the organization, and are based on different environmental attributes, resulting in different ways to solve the issue.

Due to growing concerns about food waste, food containers have been challenged in terms of their design allowing the emptying of the content. Molder of opinion the Consumer I.A. organization had seminars in this theme and named the yoghurt package as one of the most difficult containers as regards consuming the full amount of food content. This was discussed from both an environmental and a cost perspective and the largest industry actors were confronted. When the yoghurt package was highlighted as an inefficient package solution, the product manager of Dairy Corp recognized a need to meet the demands regarding food waste and to improve the package solution in order to improve the ability to empty all the yoghurt out of the package. Sofia at the marketing department (Dairy Corp, 2015) develops this:

> I was at that seminar a couple of years ago 'Why do we waste so much food' and they illustrated this using the yogurt packaging to show that there is a lot [of yoghurt] still left inside.

The seminar triggered the development of a new yoghurt package, where the whole top can be removed to ensure that the container is fully emptied with the additional advantage of separating the cardboard container from the plastic thus enabling the more efficient recycling of the package. Thus the packaging design process was initiated with the aim of minimizing food waste, but also it was realized that this could be done by improving recycling efforts by allowing the separation of the plastic top layer from the cardboard base of the package.

> So, then a solution was proposed whereby it was possible to remove this plastic top, because there were many who thought it was stupid to have plastic together with cardboard as regards how to sort the plastic, it does not feel environmentally friendly to have plastic. So, it was a combination of internal wishes to reduce the environmental impact and consumers' wishes for more environmentally friendly packaging.
>
> (Marie, Marketing department, Dairy Corp, 2015)

The initiative for package development was to differentiate from the competitors and this packaging solution responded to the critique regarding current yoghurt packages by having a positive environmental profile and functional attributes. The previous package solution had logistical advantages and could easily and efficiently be stacked together. From a consumer perspective it had benefits in the sense that it could be re-closed after being opened and that it lay horizontally in the fridge. The package was primarily

cardboard based, but the whole top was made of plastic, which was reflected on in terms of being a great amount of plastic, and thus it was challenged on environmental parameters, from a package material perspective.

However, the route from initiating a packaging project to the implementation of the yoghurt package was not undertaken without encountering any challenging views. Instead the aim was to launch a product that could innovate yoghurt packages and thus result in Dairy Corp's yoghurt standing out among its competitors.

> For example, we tried one packaging solution that was positioned upside down, but the test group didn't like it at all, they just thought it would be sticky. So they really didn't get it, they thought the yoghurt would just drain out when opened.
>
> (Marie, Marketing department, Dairy Corp, 2015)

Since consumers have different interests it was argued that the, potential, yoghurt package had the advantage of consumers being individually able to decide how they wanted to engage with the food saving and recycling opportunities that the package offered.

> Once we had decided, there were many who would be able to test it [separating the top] at home and they said "no too sticky" and then you don't have to do it if you don't want to. One can do it, either the way some people do, separating and digging it [the yoghurt] out, but I don't do that because I think it's sticky too, so I rinse it out and then I separate the pieces when I recycle. So I don't care about the grams [of yoghurt] still in there.
>
> (Marie, Marketing department, Dairy Corp, 2015)

Due to the criticisms expressed and practical challenges, the Tetra Top became the new packaging solution. Using the removable top solution it was able to respond to both facilitating consumption and improving recycling.

Packages can lower food waste via other measures too. There are actors who advocate a package having a stable package size since other products adapt to the size of that product and thus have an impact on food waste. This is connected with the likelihood of consuming the full amount of food by the time the product has reached its expiration date. The problem can occur when recipes include, for example, only half the food content of a package, not the full amount. However, this also works the other way and package sizes can easily become norms that other products base their amounts on, which can make changes more difficult. The product manager of the cooking range had the aim of producing lactose-free sour cream in Finland to make better use of

an existing packaging machine established at one of their factories. However, due to the packaging machine producing 2 deciliter-sized packages, instead of 3 deciliter-sized ones, which is the norm in Sweden, this product sold poorly and eventually changes had to be made in order to manufacture the product in Sweden in 3 deciliter-sized cups in order to increase sales volumes.

> For the Swedish market it [2 deciliters] is not an optimal size, because here there's a consumer habit that sour cream comes in 3 deciliter packages. I think about 50% of the sour cream is used as a dipping sauce and then the content of the dipping bags is adapted to 3 deciliters of sour cream.
>
> (Eva, Marketing department, Dairy Corp, 2015)

Thus, over time other products can adapt to the standards set by a certain product, resulting in dissatisfaction if changes are made without being synced with the range of the other products it co-exists with.

However, the reactions to the new milk package did not request to perform changes minimizing food waste or re-introducing a lid, but built on a frustration to the added plastic on the milk package. Plastic which is primarily visible to consumers engaging in waste management since that is when it requires the consumers to sort it differently from previous packaging solution.

Launching the Gabletop with bio-based plastics

As development continues and new possibilities become reality there has been a promotion of renewable packaging materials. cardboard has been a well-established packaging material for milk containers in Sweden since the creation of X-Pak in 1951. Moreover, plastic has become an increasingly requested packaging material due to its light weight and low cost compared to other packaging materials. However, as illustrated in this case regarding the milk package, Swedish consumers have been recognized as having a more reserved attitude toward plastics than toward paper materials. As a response to this, biologically based plastic, made from, for example, sugar canes, has become a solution using the benefits of the plastic material without including the fossil-based material.

> The thing that everyone talks about, and about which column after column of text has been written, is using bio-based raw materials to create packages. It’s something that without doubt will continue to be an important parameter. Many of those who have the opportunity to use renewable raw materials for their packaging solutions, and do so with maintained functionality at a reasonable cost, will have an

> advantage in terms of marketing. Because this is likeable and one of those basic values that I think everyone will always appreciate.
>
> (CEO, Materials I.A., 2015)

Although the sources of materials differ from each other, the quality of a bio-based polyethylene functions the same way as a fossil-based polyethylene since the molecule structure is the same. Hence, machines that have previously produced packages made of fossil-based polyethylene can replace that material directly without any complications.

> It is exactly the same molecules, it's just that they have a different origin. So it is possible to recycle using polyethylene. There is no difference in the plastic, it's just that it's made from sugarcane-based ethanol instead of naphtha from natural gas or oil.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

The challenge is rather instead to the availability of the material and how willing the companies are to pay extra for bio-based polyethylene. The benefit of using bio-based polyethylene is a compromise whereby the full benefit of the bio-material in terms of waste management is not made use of. The use of a similar material to that previously used is shaped by existing recycling demands and systems related to traditional packaging materials.

The solution presented to Dairy Corp by X-Pak was putting a screw-cap on the packaging for organic milk, but replacing the oil-based plastic in the screw-cap with a bio-based plastic created using Brazilian harvested sugarcanes. These sugarcanes are made into ethanol, which is turned into ethane, which is turned into polythene and sent as granulates from Brazil to Sweden and then melted into screw-caps here in Sweden. The bio-plastic, called bio-based plastic, is about 30% more expensive than regular oil-based plastic. These extra costs cannot be added to the milk due to the rigid agreements with the retailers. Instead Dairy Corp believes that it will eventually get its investment repaid by selling attractive products that will keep it relevant on the market.

> This [bio-based plastic screw-caps] is part of securing the development of organic products, which sell very well and are steadily increasing in volume. So, we believe that this is a step toward showing that it [the organic range] is a good choice and we believe this will eventually pay off.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

The new Gabletop packaging with its bio-based plastic cap, has so far been a success; in 2015 sales had increased by 30% since introduction onto the market.

> We noticed that the organic milk, on which we did not have a screw-cap, lost some volume when we put a screw-cap on everything else [all the other milk products]. Eventually, we decided to use the bio-based plastic in the screw-cap [material] as a way to put a screw-cap on the organic milk. So we did and it has actually been recovering fairly well since then. So, the organic milk with a screw-cap has increased [its sales] by 30 %.
>
> (Erik, Supply Chain, Dairy Corp, 2015)

Despite positive reactions to the 'greener' packaging solution, there were consumers who challenged Dairy Corp's investment based on the dairy farmers' constrained financial situation. Dairy Corp made use of social media to communicate with these consumers. The Facebook post announcing the launch of 100% bio-based plastics had high viewing figures compared to other more general posts. According to Facebook statistics, it was viewed by 442,000 people, liked by 1,451 people, and had 41 shares and 106 comments (checked on 2016-01-26). This message was posted at a time when dairy farmers where suffering severely due to milk prices being at rock bottom, and general milk consumption declining. The media highlighted the farmers' situation and people were well-informed about the suffering Swedish dairy industry. This was also visible in the comments posted, which greatly focused on the unfair farmers' conditions instead of on the information in the launched message.

When people commented on the new bio-plastics they were questioning the use of monetary resources as they assumed there was an increased cost that could instead have been spent on the farmers.

> Thomas: Pay the farmers instead. I want to drink Swedish milk.
>
> Christin: Who cares [about bio-based plastic], if you don't want to pay the Swedish farmers for their fantastic products.
>
> Per: With [renewable] plastic caps! Can you make renewable farmers too, since you are trying to kill the existing ones?
>
> Jim: All that Dairy Corp has to do now is pay the full price to the farmers filling them [the packages]. Don't cry Eco when you are destroying many people's way of life…

The reactions to the 'greener' Gabletop package illustrate the challenge of producing a package that satisfies all consumers; Dairy Corp realized the need for improved communication in this topic. Dairy Corp's response to these comments was that the bio-plastics were an investment in the organic range to make it even more attractive to consumers. Higher sales volumes of organic milk would be the real environmental benefit, as well as being beneficial to the farmers. When the bio-plastics were launched in all the cardboard packaging solutions, Dairy Corp's percentage of renewable packaging materials amounted to a total of 84 %. The following text was in a comment on the Facebook post informing about the launch.

> Almost all packaging for milk, processed sour milk and yogurt has a screw-cap which is made from a renewable raw material, instead of the previous one made from oil and natural gas. We think this is a step in the right direction. Thanks to the new screw-cap, the proportion of renewable materials in packaging increased by 4.5 percent to a total of 84 percent.

Educating consumers that the plastics had been changed was achieved via commercials, but also via information on the package. Every package of organic milk has information written in eye-catching places to educate the consumer about the qualities of the plastics. Right next to the cap, the following can be read: "All the plastic in this package is green" (on the left side of the screw-cap) and "Plastic made from renewable resources" (on the right side of the screw-cap). See figure 8. Although the changes were realized as soon as the bio-based plastics had been implemented, the event was visualized by the writing on the package since this change could not be realized purely on the basis of looking at the new screw-cap since it looked the same.

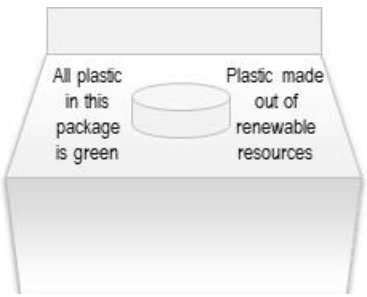

Figure 8: Illustration of the text communicated about bio-plastic.

The consumer care department received a lot of information in order to have answers to consumer reactions when the bio-based plastics were launched, but there were only a few consumers who contacted them.

> We received a lot of material and support to answer, but we did not get many questions to answer to at all. There were a few who wondered what was meant by calling it a green screw-cap when it was actually white.

(Gunilla, Consumer Care, Dairy Corp, 2015)

As the new bio-based polyethylene was a revolution in the cardboard packaging industry it was important for Dairy Corp to educate its consumers about this - both to make them understand the origin of the material and to limit the number of questions concerning how to handle the recycling of the packaging. Educating consumers is seen as a difficult task and Dairy Corp tried to use different forums to spread information. Historically Dairy Corp has been successful in communicating with its consumers via the panel located on one side of the milk package, which reaches about 2 million people.

This is also one channel that Dairy Corp's communication team tried to communicate via regarding the new bio-based plastic materials. Teenagers are the target group of the milk panel and the message on it is written in an educative but fun way to gain their attention. Dairy Corp then hopes that the target group will share and discuss this new information with their family members at the dinner table.

> We try to educate and inform for example via the milk panels. That is not marketing, we actually try to create reader value for a target group that is young, 5th to 9th graders are our target group. And then they talk about this at the dinner table so their parents also gain some knowledge about it [the information on the panel]. So these panels are educating, but it is generally really difficult to carry out consumer education.
>
> (Gunilla, Consumer Care, Dairy Corp, 2015)

Panels that communicate the origin of bio-based material, and the way of recycling it, have been presented using different illustrations and storylines since the introduction of the bio-based plastics.

Aligning with the traditional waste management system

Since the Gabletop package includes more plastics, the recycling system had to be able to separate plastic from paper. By the product managers at Dairy Corp it is argued that the best thing is to keep it simple when it comes to recycling. Even in relation to the traditional recycling system, there are people who are skeptical about the actual extent to which the material is recycled. Therefore it was argued that creating new recycling solutions could risk a higher level of uncertainty and distrust in the recycling system. Before the Gabletop, with its screw-cap, was launched, Dairy Corp was in contact with recycling actor FTI to make sure that the chosen packaging solution could be recycled using the regular recycling program without any problems. If another type of material and waste management solution were to be chosen, than what

had previously been used for milk packages, this would mean a lot of resources being needed to convey this to the consumers. Generally, it is perceived as difficult to educate consumers about product-specific processes.

> We made sure not to implement a package that could not be recycled in the system we have today. We try to do things that fit with the recycling system, as when we selected bio-plastic we chose renewable resources that were not biodegradable, or other types of plastics, as we think the consumer can't handle sifting between plastic for recycling and plastic that goes to compost and so on. It doesn't work. So, we chose a plastic that they can handle [the recycling of the package] the same way they are used to handling their milk packages.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

Thus the inbuilt understanding of how to recycle materials would be challenged by new solutions and would risk causing recycling to fail with a higher environmental impact than when staying with the traditional system. This also results in Dairy Corp needing to adjust its products to the existing recycling system even if there are new solutions that are attractive but are not compliant with the rules of recycling.

Divergent attitudes toward the 'green' solution

From an environmental perspective the bio-based plastic is described as a positive solution compared to the oil based plastic. This is communicated to consumers, with Dairy Corp seeing the new plastic solution as a competitive advantage.

> It is our responsibility as a major player for sustainability, but of course it can't destroy our finances so we can't pay the farmers. Because it's still our number one task to ensure that our farmers get paid. So we believe in this and using bioplastic for our organic milk is a first step.
>
> (Alf, Marketing department, Dairy Corp, 2015)

Despite one of the sustainability managers seeing the benefits of bio-based fuel there are still areas that are troublesome and need to be further improved, e.g. the production of sugarcanes, productivity efficiency and the supplier relationship that they would need to receive more information about to learn about the environmental impact. The inclusion of bio-based plastics was not fully agreed upon internally, but the Sustainability Manager was skeptical toward the actual benefits of these bio-based plastics.

> Well, I think that [it is a little bit like a greenwash]… I mean, growing sugar canes the way they do in Brazil with zero biodiversity, and then

> making ethanol out of it and... The question is: when they make ethanol, what do they do with the by-products? Frequently, ethanol production is not very efficient.
>
> (Jenny, Sustainability department, Dairy Corp, 2015)

The environmental impact, in terms of CO_2 emissions, has thus far not been verified, but the Sustainability Manager expects an impact that is about 20% lower than with oil-based plastics. In terms of the lower impact gained through the investment, which has been a costly, the sustainability Department argues that this gain is lower than in other investments that could be performed and could create a larger impact.

> How much lower is the climate impact from this polyethylene compared with polyethylene from conventional oil? Now we expect it to reduce our carbon footprint by 20%, and that is not very much. But yes, X-Pak was able to convince us that this is environmentally sound, I would say, and then we have moved on in that direction. It's probably a little bit better. A little bit better.
>
> (Jenny, Sustainability department, Dairy Corp, 2015)

Dairy Corp has committed to an environmental strategy for packages of minimizing carbon emissions by 25% by 2020, compared with the 2005 level. The introduction of more plastic into the package went against this strategic goal, but the changeover to bio-based plastics was still not good enough as a solution to reach the level achieved by the package without a screw-cap.

Organic milk is one of few milk products that consumers are willing to pay extra for. The higher price of the new packaging, that Dairy Corp needs to pay, is not added to the retail price; however, it is easier to argue in favor of that since organic products have higher margins. Dairy Corp's main purpose is to make sure that the farmers' receive as much money as possible for their milk; organic milk gives the farmer more money per liter than conventional milk and thus Dairy Corp aims for increased sales of organic milk. However, the consumers in this segment are also more difficult to satisfy than the consumers of conventional milk and thus they push Dairy Corp to ensure good quality changes to the organic milk range. After the introduction of bio-based plastic screw-caps to the organic milk, sales grew positively. Some consumers have commented on the environmental disadvantages of any type of plastic in the organic range, but the official communication material from Dairy Corp responds to this by saying that it increases the consumption of organic milk which, they argue, is where the largest environmental benefits are to be found. If a little bit of bio-plastic results in the increased consumption of organic milk

this will entail a great environmental advantage. From a brand perspective it is thus recognized to be a great success.

> The screw-cap is a way of pushing for organic consumption. There was a remarkable level of resistance and it can perhaps be seen as a negative change in the packaging, but at the same time… if it makes more people choose organic products, just because all of a sudden there's a screw-cap on the milk package, then that's good – then it will have increased the consumption of organic [dairy].
>
> (Alf, Marketing department, Dairy Corp, 2015)

Organic production is growing rapidly based on increased consumer demand. The consumers buying organic products are used to a higher price than with regular products, and this is most often accepted by them.

Bio-based plastic, a competitive move

With increasing competition it is argued that the 'green' market is a way of staying relevant on the market. Thus, introducing the Gabletop packaging solution with its screw-cap was one way for Dairy Corp to make a competitive move. Erik at Supply Chain, argues:

> We want to show that we are market leaders in the green sector. And we have a lot of organic products and packaging solutions, and we put a lot of effort into them, so it is all interconnected.

However, as soon as the solution went onto the market it was also available to our competitors. When the bio-based plastic was introduced this also attracted the interest of our competitors. The news value of the bio-based plastic was however protected by Dairy Corp and the packaging producers to make sure that the investment made would provide some competitive advantage for Dairy Corp before others were also allowed to offer this solution. According to employees at Dairy Corp this was an important competitive move. "It's important to keep an edge towards the competitors, otherwise we'll only be sub-supply" (Erik, Supply Chain, Dairy Corp, 2015).

The retailer Foodtail buys its private label milk from Dairy Corp and eventually have the possibility of using the bio-based plastic solution. However, when Foodtail initiated its milk range it packaged this using Brik packaging solutions. The Gabletop with its cap was available on the market, but since Foodtail aims to be a cheaper solution for its consumers it tries to keep the costs of this packaging solution low. The Brik solution was also chosen on the basis of the argument that it had the lowest environmental impact based on the type and amount of material used, with the logistical advantage that almost no

air is transported. According to Foodtail one of the highest environmental impacts of the food packaging is caused by the logistics.

> We launched our first milk /…/ in the regular Brik [packaging solution], the one without the screw-cap, with the argument that this is actually the most environmentally-friendly solution. It is transport efficient and you transport almost zero amounts of air, which is the biggest emission source from an environmental perspective. And it is efficient in-store, etc.
>
> (Maria, Packaging development, Foodtail, 2015)

The introduction of Foodtail's private label milk did not, however, results in any good sales figures. Consumers complained about the packaging solution and requested the cap solution. After some time Foodtail decided to change to the Gabletop with its cap and, when this was introduced onto the market, sales picked up rapidly.

> We received so many complaints from the consumers who contacted us and we felt that, in this case, [consumer] convenience was something we had to take into consideration so then we switched to the screw-cap.
>
> (Maria, Packaging development, Foodtail, 2015)

Sales volumes are good indicators of which packages are popular due to the product being the same. However, the more homogenous the packaging range becomes, the less chance there will be of seeing whether or not other packaging solutions are even more successful.

The implementation of screw-caps made of bio-based plastic continued. In time, other pieces of the milk package could also be upgraded to bio-based plastic. It was not only the screw-cap that was produced using bio-based plastic, all the plastic in the package could eventually be produced using bio-plastic. X-Pak and Dairy Corp have communicated the new packaging externally to their consumers to make them aware of the improved packaging. The transformation in order to fully implement bio-based plastics in the packaging was a question of money. The solution had been established and, if Dairy Corp was willing to pay for it, it had the opportunity to use it.

> The change took place in June 2015 and was not a major technical change for Dairy Corp since bio-plastic behaves exactly the same as oil-based plastics. Once it had been proven that the packaging producers could also provide Dairy Corp with the bio-based plastic for the relevant packaging solutions for the plastic film inside the

> cardboard, the only thing remaining was to make sure that the cost tallied with the benefits.
>
> (Sofia, Marketing department, Dairy Corp, 2015)

Once the agreement had been settled the new packaging solution was introduced onto the market.

In 2017, package innovation in the organic milk range went one step further. This step was to reduce the numbers of protection layers and thus lower the package's weight. A clay-based barrier was removed and this also resulted in the white milk package becoming brown and easily spotted in the dairy display area. This investment was performed in line with the previous strategy of meeting consumer expectations. Jenny at the sustainability department, at Dairy Corp, says: "[the aim is] to differentiate Dairy Corp's organic fresh milk segment and to meet consumer expectations as regards reducing the climate impact of our packaging".

Along with making continuous material improvements to the Gabletop package Dairy Corp updated its packaging strategy to also include the aim of increasing the amount of renewable and recyclable material by 2020. Additionally, the sustainability department has now adapted to the aim of using the package as a way to inspire consumption of the organic range. Although the sustainability department was not involved in the project team conducting the milk package project it has now been given the larger role of making reports and analyses of the environmental impact of the package. Additionally, the attributes added to the packaging strategy have resulted in a direct environmental agenda, which the sustainability department is directly involved in. It has thus been given, along with the environmentally-inspired packaging adjustments, primarily created to meet consumer demands, a more important role in terms of legitimizing packaging innovation. The packaging strategy goes beyond the milk package range, but still involves all of Dairy Corp's packaging range.

The empirical findings in this chapter illustrate the challenges involved in applying the demands originating from the societal interests level, building on cultural understandings, demands which can be applicable to packaging in different ways. 'Green' values have been implemented through different activities relating to the packages belonging to the dairy industry with the interest in different ways of enacting the value differing with the actors' knowledge and needs.

Dairy Corp is being challenged more directly on its 'green' performance using the Gabletop package when this was introduced onto the market; at this point the major investments and negotiations had already been settled, since

machines had been invested in and the package attributes had been analyzed regarding their applicability to the supply chain. Therefore, the ability to respond to 'green' interests had to be in line with all interests since the consumers did not want to lose packaging functionality, but to add an extra feature instead. The solution of adding bio-based plastics yielded a positive result in terms of achieving consumer appreciation, but was challenged by internal actors since this change did not result in any major changes to the package's actual environmental impact.

Summary of empirical chapters

The empirical story has presented the different roles of a milk package, which tells that a milk package does not mean the same thing to all engaged actors, but is approached based on the field of expertise or general interests. Although the different appreciation of a milk package, their interests are incorporated in the same object which result in friction that becomes visible in a design process.

Since its introduction, the milk package has gained many areas of responsibility as it: maintains the benefits of milk processing after the process is complete; enables milk to travel safely over long distances from its point of origin; and ensures that the milk is wholesome at the time of consumption. Ideally, milk packages should consist of materials that maintain the quality and safety of the milk indefinitely, with no degradation over time, in addition to being attractive, convenient, and easy to use while also conveying all the pertinent information and being made of renewable resources, generating no waste to be disposed of and being inexpensive. Thus, packaging technology must balance food protection with other issues, including energy and material costs, heightened social and environmental consciousness, marketing demands, functional features, and strict regulations regarding pollutants and waste management.

The many interests to account for in a packaging design results in little flexibility in new designs to implement. In a design process, the traditional interests that the milk package is well accustomed with, is challenged by new interests that builds on market expectations and together they negotiate the new package design. However, the design process is not completed until it is accepted on the market, but the first object design, the Gabletop with screw-cap, was challenged by an increased environmental impact, which resulted in a negative feedback that was needed to be acted on. The re-design process was additionally challenged by its physical appearance since a new design should not remove an object quality in favor of a 'green' quality, but it should be added as an additional attribute. Eventually the 'green' interests were satisfied

through a change of plastic material, a solution that initially was considered to costly. The empirical story illustrates that the new packaging design is not a negotiated solution, where one actor's interests cannot be optimized to the cost of other interests, but in order to answer to the different actor interests it is forced to become a design compromise.

Chapter 8: Unpacking inscriptions

This thesis aims to explore how interests, originating from different competencies, perceived needs and beliefs, become inscribed into an engineered object during a design process. However, in order to answer this question, the following two areas must be responded to. The first area means to learn how a milk package is enacted over its lifespan and how these different enactment results in different actor interests to be inscribed. This is important when it comes to learning about the roles and tasks that an engineered object responds to, and thus the areas needing to be considered during a design process. This is done through establishing the concept of inscription domains, which builds on three domains that different interests, advanced by various actors, are categorized into, which serves as the foundation of what the object is evaluated against in a design process. This process result in realizing the different objects that actors engage with, since it over its lifespan, is used in different contexts and for different purposes (e.g., as a container of food, an item in a logistic system, and waste product) and is best described as an 'engineered object multiple'.

The second area is to explore what governs how negotiations of interests are performed which result in interests being inscribed into an engineered object. The negotiation process of a new design processes foremost unfold on the basis of previous inscriptions and become the result of compromises between different, and sometimes conflicting, interests. Since the contextual environment change and serve as an initial trigger for a negotiation process, there are additional interests to account for, but which are forced to answer to the terms of three, in this thesis, identified negotiation approaches - hierarchical, domain-specific and socially appointed approaches.

Chapter 9 adds to the discussion by binding the key findings together that communicates a sophisticated mundane engineered object. Attention is often given to the high-technological objects, but a seemingly elementary objects also reveal considerable complexity on closer inspection. Additionally this study highlights that technological change is often discussed as a matter of innovativeness without reflecting on what is required to implement change in an established setting, which is carefully lined out through the example of the milk package. This is followed by connecting the findings with the practical interest of this thesis and eventually communicate the theoretical, managerial and pedagogical contributions of this thesis. The chapter ends by outlining potential future research.

Inscription domains

When studying the milk package's design process it is possible to see that actors have different perceptions of the milk package's roles and, additionally, what attributes it should have. Making use of the concept of domains (e.g. Bruns, 2013), presented in Chapter 2, allows us to see how an engineered object has multiple roles and offers a way to make sense of these separate or opposing object understandings. I propose that a concept of inscription domains allows us to capture the different object characteristics that actors engage with, which result in the roles and qualities to which it should respond. Actor interests are categorized into an inscription domain within which it shares the perception of an object, which is different from the other inscription domains. In the designing of a milk package it results in compromises not only being performed between the domains, but additionally needing to be handled within a domain.

Actor interests are categorized into the inscription domains of material quality concerns, operative functionalities and economic incentives. These different perceptions have been identified as inscription domains jointly constructing a milk package. An inscription domain is a category that builds on interests with a shared view that puts demands and restrictions on the object and its setting. Although the actor interests within these domains are steered by interests in different object views, which can put competing interests to be managed in the object, they are not mutually exclusive, but to some extent they build on each other (e.g. Bruns, 2013).

These domains serve as the foundation of what an object is evaluated against during a design process. Exploring how these domains influence an object's design process is important when it comes to seeing how changes can and cannot be performed in specific industries or settings. Additionally they also provide the knowledge to explore how previous inscriptions influence coming

design processes. The inscription domains are important not only as regards learning what is accessible in an object design process, but also as regards what an object is restricted by and how it is comprised and negotiated by different interests. The interests in the domains originate from different areas of expertise and see different qualities in the object, which results in an engineered object multiple (Mol, 2002, building on the concept of the object multiple), since an engineered object has different roles and appearances in different parts of its lifespan.

The milk package interests have been applied to the different domains. The actors engaged with *material quality concerns* are active as regards the packaging material parameters and meet the legislative and other quality demands regarding food safety and waste management. The actors engaged with *operative functionalities* are active during the phases when the package has its physical form and meets different functional demands, starting from the production stage up until waste management. These activities are primarily governed by industry standards and consumer expectations. Finally, the actors engaged in *economic incentives* are primarily active within Dairy Corp since this is where the package must economically meet demands as regards being an affordable and attractive part of the consumer good. These activities are primarily governed by company KPIs and sales figures.

In this empirical story, the views on the package are based on a material, operational and economic perception, resulting in different interests being applied to the milk package.

Material quality concerns

The domain of material quality concerns is based on actors with an appreciation of an engineered object's material construction. More specifically it refers to actors that are interested in the molecular composition of the material and the physical qualities it results in. In the case of a milk container it primarily engages actors in the engineering of packaging materials as regards managing different parts of the package's life stages whereby the material qualities should ensure a safe environment for the milk and the efficient use of resources meeting waste management requirements.

Historically there have been challenges associated with the task of keeping milk safe from the external impact of bacteria, dirt and light, which all result in decreased product quality. Managing these challenges has required safe milking procedures and strict hygiene rules in the production of the milk content. Moreover, the milk container has been an important aspect of ensuring a safe milk product due to its being in direct contact with the milk and having thus been developed over time in order to handle the milk's quality demands.

Product safety has become a regulated area and alignment with food safety laws is required in order to bring the products to market.

The expertise regarding packaging materials is held by packaging producer organizations, such as X-Pak, since the material quality must be managed before being accepted by authorization agencies. Moreover, the responsibility of ensuring safety alignment is embedded within Dairy Corp's responsibility and the practical outcome is primarily managed in the manufacturing fields, where the supply chain department has an important, and time-consuming, role in ensuring correct and updated documentation.

Despite the milk container's improved material qualities for protecting milk from external contamination, food containers have also been seen over time as potential contaminators themselves due to food scandals when the molecules that bind the packaging material have migrated into the food content (discussed in Chapter 4). This has resulted in additional demands regarding what constitutes acceptable packaging materials when it comes to securing a safe environment for the milk content. The importance of maintaining trust in the safety requirements has resulted in different punishments in the case of failure. The most rigid food safety legislation must be complied with in order to gain permission to launch the product on the market. These material safety requirements impact what types of packages can be introduced onto the market since food safety measures impact which materials can be used to contain milk in terms of protecting it from light and keeping it fresh for as long as possible.

Additionally, over the last few years it has become increasingly popular to incorporate external validation through quality certifications, such as the KRAV label used on organic food. The KRAV label includes requirements regarding packaging quality due to the food scandals that have occurred over time and has also become a safety parameter for ensuring good quality products. Thus, certification is not of a mandatory nature, but a way of showing commitment. Inscriptions, e.g. quality labels, must be handled with care since their legitimacy can be challenged if the institution fails to ensure the treatment/quality/behavior communicated through these inscriptions (e.g. Denis & Pontille (2015) on the inscribed legitimacy of mundane objects).

Moreover, a package should also have a material quality that meets regulations concerning waste management. In Chapter 4, it is stated that Dairy Corp is responsible for ensuring waste management treatments and product-owner organizations have jointly founded the FTI in order to secure proper treatment, guided by governmental instructions and regulations. These instructions have resulted in activities for handling the waste management of products, making use of the material or energy value of the packaging material. A material recycling process is generally more valuable compared to energy recycling

which results in the promotion of packaging materials consisting of single materials that are the easiest to recycle into new materials. The FTI communicates these types of requests to the packaging production organizations (e.g. X-Pak) and the product-owner organizations (e.g. Dairy Corp) to encourage compliance.

Waste management requirements are maintained via penalty charges being levied if there is failure to meet requirements regarding materials that can be recycled via the national system. Since the food industry generally has low profit margins, these penalties have traditionally sufficed as an incentive for compliance. All actors engaged in material quality concerns are bound to the legislative requirements for producing a milk package that can be brought to market. Thus, the expertise needed to assure a material quality that is safe for the milk content must be managed jointly with the material requirements regarding proper waste management. Therefore, the applicability of the material quality requirements occurs at different stages along a milk package's supply chain, but these need to be considered in the engineering of the packaging material in order to ensure compliance.

Operative functionalities

The inscription domain of operative functionalities concerns an engineered object's applicability to operational expectations. More specifically referring to the practical tasks that the object should respond to, for example, a combustion engine should manage to bring a vehicle to speed and an electric wire should allow electricity to flow through it. A milk package is expected to answer to different services along the supply chain: starting from the manufacturing phase, via logistics and distribution, for consumption and compliance with recycling expectations.

Milk is a fresh product with a limited lifespan which should be managed in efficient ways in order to reach the market and be available for consumption. Cows are milked around the clock and, given the short durability of the milk, this results in demands for a high level of production efficiency in order to bring availability to production flows and to make use of all volumes. The demands for efficient workflows within manufacturing and distribution processes have resulted in the system being highly rigid. Milk quality requirements have also resulted in an efficient logistical flow via the need to fill trucks, and other logistical infrastructure, with as large volumes of milk as possible, which has encouraged packaging solutions that can be tightly packed together.

A milk package travels along a chain of different actors who place individual demands on the package in order for it to be accepted, or to manage the

treatment being performed at the different stages along the supply chain. Timmermans and Epstein (2010) refer to the need for standardization to ensure uniformities across time and space, something which is crucial when it comes to managing the large numbers of products. The milk product is only one product in the wider food industry and must meet standards regarding durability and size dimensions in order to survive automated product handling. In Chapter 5, it is stated that size measurements are synchronized using two different settings. Products should align with the size measurements of a pallet and not exceed the space provided for; they should also have a packaging size that adjusts well to the predisposed display surface in the grocery store. Failed compliance is traceable since it is likely to result in costs arising from failed products, inefficient treatment or poor sales, thus becoming, in Star's (2002) vocabulary, 'poor' infrastructure. Once a product's size dimension has been established this can result in related products adjusting to these measurements, e.g. refrigerator door pockets being adjusted for Brik milk packages (Chapter 7), resulting in a negative consumer experience when changed. The quality of object inscriptions as regards meeting standards of durability and specific size dimensions are checked by retailers, logistical actors and grocery stores; failed compliance can result in costs attributable to failed products, inefficient treatment or poor sales.

A package is also expected to be functional as regards ensuring milk consumption. Although the package is created in order to protect the milk content, it should also meet consumer demands concerning functions like opening the package and emptying the food content from the package prior to consumption. In Chapter 5, it is stated that a milk package should meet the ergonomic demands of a full population range, since it is consumed by people of all ages and the package should be possible to open by most people, including the elderly and those with rheumatics, and not be a danger to small children. Moreover, demands also concern solutions that allow the re-sealing of the package so that it can, for example, lie horizontally in the refrigerator and be transported after initially opened. Actors engaged in a package's functional qualities are constantly looking for ways to improve it since they argue that retailers encourage product updates which result in market actors continuously working with product renewal projects and performing consumer tests on different packaging designs and dairy flavors in order to learn about consumer preferences. Consumer feedback serves to ensure compliance with demands regarding the functional qualities, with customers showing their reactions to products either through feedback or their behavior in terms of either consuming or neglecting products.

Recycling routines have become increasingly important to respond to in the object. The consumers are responsible for managing the recycling of the

package and this should be as convenient as possible in order for them to correctly enact the procedure and not have a negative experience that would result in rejecting the product for future consumption.

The actor interests in the domain of operative functionality all engage with the operative qualities of a milk package and have separate ways to ensure alignment. However, the actor interests encourage different object attributes, which are difficult to fully satisfy in the same object design. This result in negotiations are held also within inscription domains and not only with interests that origin from other domains.

Economic incentives

The inscription domain of economic incentives builds on interests that perform economic calculations. An engineered object must result in a balanced economy in order for a design that can sustain over time. These interests are driven by a role to ensure profits for the farmers, which are controlled for through investments in package's material and production quality. For a low-cost product such as a milk package, this requires that inscriptions align with the established distribution flow in order to optimize the system flow. However, economic incentives not only encourage ways to make efficient use of resources, they also improve product attractiveness in order to sell more products.

In this domain, the milk package is managed by viewing the package as a component of the milk product, i.e. a joint component with the milk content in order to sell a consumer good. In order to ensure an economically feasible milk product, the packaging should make sure to meet the KPIs volume and efficiency.

Economic incentives are highly influential in the designing of a milk package. These constraints primarily originate from the production company's aim of producing profitable products, and from the production consequences that this aim results in. The aim of producing the highest possible financial return for the owners who, during the last few years, have been suffering from low milk prices, results in resistance when it comes to investing in activities that do not result in cost savings or increased income. Therefore a milk packaging project, such as the 'round top, squared bottom' design discussed in Chapter 6, which significantly increases the cost per produced package and which could not be added directly to the consumer price due to the strict milk product pricing policy of the retailers, was not accepted for implementation.

A package's material qualities are influential in the manufacturing and distribution of dairy products. The limited lifespan of fresh milk also impact the economic factors since it must be managed efficiently in order to reach the

market and be available for consumption. The short timeframe between manufacturing the milk product and reaching the expiration date, puts demands on high production efficiency in order to bring availability to the production flows in order to make use of all volumes. The demands put on efficient workflows within manufacturing and distribution processes have resulted in a highly rigid system. The milk's quality requirements have also resulted in an efficient logistical flow via the need to fill trucks and other logistical infrastructure with as much milk as possible, which has encouraged packaging solutions that can be tightly packed together. The efficiency requirement also results in a positive outcome in terms of cost efficiency. Moreover, in Chapter 5 it is explained how the large numbers of products result in demands for storage space prior to these being sent to the distribution hubs, which are costly spaces to provide to the factories who thus want to make logistical flows as efficient as possible to make the products leave the factories. The low margins of the dairy industry require efficient flows since the traditional way of ensuring a profit has been through lower costs rather than increased prices.

Packaging machines and other manufacturing equipment must be invested in on a regular basis in order to ensure the continuous production of milk products; when the equipment breaks down, it must be repaired, possibly resulting in new machine investments. 'Down time', when production is at a standstill, is very costly and work is constantly being carried out to improve routines and tasks in order to minimize the time when there is no output. The need for well-functioning machines, together with market developments that offer modern machine solutions, results in an incentive to invest in new equipment. However, machine investments are very expensive and these are seldom carried out, which results in slow and rare updates in packaging solutions. Moreover, this results in aiming for packages that are attractive during the coming years, which is recognized as obstructing innovative packaging solutions that risk becoming outdated more quickly. The caution related to packaging investments, due to the major investment, has limited flexibility since major investment must be financed by PLEX money that can only be applied for once a year. Since the milk industry is increasingly answering to quick market responses, slow investment programs hinder some possible packaging purchases.

Complying with safety measures during the production process requires sophisticated machinery and equipment, which means costly investments. Investments in manufacturing equipment stabilize the manufacturing process since they are in use for many years and create a co-dependency on each other when one piece is replaced with a new one, but needs to function together with the traditional system. However, priorities can change over time, making some object aspects more valuable than others and challenging components of the

established setting. Such events occur through the actualization of a shift by means of the negotiations performed during a design process, possibly resulting in a shift in priority in order to meet market demands as opposed to production demands.

The economic incentives thus influence the keeping of changes to the packaging range at a slow pace, in addition to creating restrictions to what type of packaging materials can be used based on the material costs and promoting packaging solutions that are efficient in manufacturing and distribution.

Inscription domains – key aspects

This study seeks to learn about the organizing of an engineered object's design process. An engineered object belongs to a setting that holds many interests, which aim to be inscribed into the object, where some interests fail to be inscribed, are modified or fully represented. Therefore, a milk package that is stable on the market can hide interests that construct the different inscriptions. Instead, to explore the constructing interests require 'a crisis' (Akrich & Latour, 1992) that challenges the stable object, in order to trace the actor interests that construct an object (Law & Callon, 1992). During the design process of a milk package it is possible to identify three inscription domains of interests (material quality concerns, operative functionalities and economic incentives), which perceive the milk package differently, but jointly construct it into its given design.

Thus in order to learn how an engineered object is constructed can be analyzed through the lens of inscription domains, which serve to visualize the different object aspects and which illustrate an interconnectedness whereby the different domains are distinct, yet related, since they engage with the same object (e.g. Bruns, 2013). These perceptions result in how the engaged actors see the milk package and what interests they encourage in order to improve it. Moreover, the concept communicates how social aspects, together with the material demands, build the engineered object (e.g. Orlikowski & Scott, 2008). Thus, in a design process, the previous design guides continuous development since the existing inscriptions must be taken into consideration in order to result in a successful output, illustrating a social and material entanglement that jointly results in the object attributes (Orlikowski, 2007). Although inscriptions are traces of a human activity, they are developed in relation to material demands. For example, a dairy package's design can encounter resistance since the dairy is a living material that puts demands on packaging material qualities, something which was realized when the updated design resulted in crème fraîche 'sponante', presented in Chapter 6. Thus, the failure to account for both

the material and social aspects results in the object 'acting back' (Rennstam, 2012) and a re-design process.

Studying how an object is built up using different interests requires identifying the fact that actors in one inscription domain build on different competencies, perceived needs and beliefs in order to manage their tasks which influence how they perceive the object. The table below illustrates the key inscription areas being responded to in the three inscription domains by the example of a milk package. In a milk package the inscription areas of material quality concerns refers to food safety demands and waste management demands. The inscription areas in the domain of operative functionality refers to interests that result in the milk package to manage the manufacturing flows, the logistical process, ensure distribution alignment, consumption demands and the waste management process. The inscription areas in the domain of economic incentives refers to interests that result in the milk package to manage production volume and efficiency and to make the package a competitive advantage.

Table 6: Concept of inscription domains

Inscription domain	**The example of a milk package**
Material quality concerns	Food safety demands Waste management demands
Operative functionalities	Manufacturing flows Logistical process Distribution alignment Consumption demands Waste management process
Economic incentives	Volume and efficiency Competitive advantage

The different interests within one domain share the same view of the package, but their interests can still be competitive in nature. For example, meeting the operative functionality of consumption demands can promote design inscriptions different from ensuring alignment with distribution routines. This results in compromises not only being performed between the domains, but additionally needing to be handled within a domain. However, the negotiations

performed within the same domain build on an appreciation of the reasoning behind the other interest's opinion. Contrastingly, the understanding is less applicable to negotiations between the domain interests, presented in chapter 6 this lack of shared a view between interests in separate domains can be spotted in supply chain actors' irritation at demands originating from actors in procurement.

Negotiating inscriptions

An engineered object cannot fully respond to all the interests embedded in the inscription domains since some of the interests are of a conflicting nature. The interests within the different domains become visible during a design process since that is when the possibility exists of inscribing more interests or improving the applicability of an interest compared to a previous design. There is an interconnectedness between the inscription domains since they hold interests that are accounted for during a design process. This results in a design process being unable to ignore one of the domains in order to optimize the interests' applicability to another domain. Instead the inscription domains build on each other and are not mutually exclusive (e.g. Bruns, 2013). Starting out from the view of the object multiple (Mol, 2002), an engineered object is similar to, for example, a disease or a natural element since it is perceived in different ways depending on the actor's field of expertise. A disease means different things to a patient, a medical doctor and a physiotherapist, and the element of water means different things to an energy engineer, an angler, or someone who wants to quench his/her thirst. However, an engineered object is different to these naturally existing elements since it is constructed, which results in the shaping of the object over time by means of inscribing interests into it. However, performing design changes is difficult since there is resistance within the existing design that must be taken into account.

By gaining insight into how the inscription domains help in defining the negotiation space, it is possible to explore how design changes can be performed in the given setting. Moreover, when there is knowledge of the negotiation space, it is relevant to explore how the inscription domains are related to each other and to thus be able to see the possible design models to perform and how interests negotiate with each other in order to find a balance that results in a new object design. The interests within the different domains which the milk package builds on can be assumed to be similar to competing dairy packages in Sweden, while other engineered objects can respond differently to these domains depending on how the contextual environment they exist in is constructed.

Object stability

The previous text explores the different inscription domains that construct a milk package. These perceptions, held by interests in the different domains, result in a stable milk package since changes are difficult to perform within the established setting. However, during a design process, the existing object is directly engaged with design changes (Rennstam, 2012). Similarly, this empirical story sees a requirement to respond to the previous object inscriptions accounted for by the different inscription domains, something which stabilizes against change. These inscriptions are traces of interests that the object responds to, but they also serve to directly impact the managing of the object (cf. Latour & Woolgar, 1986:1994; Gärtner & Huber, 2018). Thus, an established object can influence how the relevant actors manage it (cf. Leonardi & Barley, 2008).

Another stabilizing factor concerns the routines and standards of the industry setting, which result in new interests to be negotiated based on the established setting (Timmermans & Epstein 2010). Additionally, Sterne (2012) emphasizes the boundaries of previous innovations and illustrates, using the example of the MP3 format, traces of the traditional infrastructures of telephony and digital history although this format was launched within an Internet infrastructure. Thus, the design process concerning an engineered object must result in a solution that can meet the standards established in a previous packaging solution since these standards serve as a foundation for what the new design solution will be judged against. This also results in a distancing behavior when new packaging materials, e.g. bio-degradable materials, are introduced, since these result in a behavior diverging from the adapted recycling treatment that everyone has been trained in and applies to all other packaging solutions on the market.

The consequences of standards are recognized in many technologies, whereby the initial logic of a design can later become outdated, but remains due to the surrounding organizing that is based on this standard. Referring back to David (1985) and his analysis of the QWERTY keyboard, it is communicated how the keyboard's success was a result of path dependency whereby too many actors had invested in the given design, making it a standard. The same development can be spotted in the evolution of the manufacturing, distribution and waste management of milk products, whereby actors have invested in the system and are thus reluctant to change it, even though it is not recognized to be the optimal solution available to the market.

As written above, during a design process an engineered object is not passively given attributes, instead it has an active role (e.g. Barad, 2013). All the interests that have become inscribed into the object provide it with agency as regards

maintaining existing inscriptions in relation to the adding of new interests during a design process. Objects have agency when enacted and, building on Rennstam (2012), it is argued that they have object-control, which makes them an active agent in solving organizing problems. Object-control "directly targets employees' knowledge of their own work" (2012:1085) and influences the organizing relationship between the employee and the object as the key relationship when it comes to solving problems, since it connects directly with the performed work instead of including demands from the normative community.

Evolving object expectations

An engineered object develops over time and can result in adding attributes to its object definition, which results in a negotiation process that results in unexpected outcomes, in the eyes of traditional object expectations (Koivunen, 2009). Sterne (2012) traces how the MP3 file became an industry format, which shows that the format needed to change in accordance with industry expectations in order to stay relevant. For example, the MP3 file's key driver of innovation (sound quality) changed over time and resulted in the deterioration of this attribute in order to improve another attribute (compression of file size). Similarly, the milk package gained interest expectations over time, e.g. improving the attribute of user-friendliness, which happened at the expense of reduced production and logistical efficiency, which were initially the key drivers of innovation.

However, design changes are challenging to perform since the level of flexibility is low. The physical boundaries of an engineered object result in negotiations between different interests, but an object should meet the expectations placed on it in order to result in a successful outcome. Objects have multiple tasks that should be accounted for during a design process and, if the object fails to meet expectations from a material, functional or economic perspective, it can turn out to be a failed product that is ignored or rejected by the engaged actors (e.g. Leonardi & Barley, 2008). However, an object such as the milk package cannot meet all the aspects perfectly since some interests conflict with other interests' intentions that make it a "working device" (Law & Callon, 1992:27).

The design process is an active phase of re-occurring negotiations. Suchman's (2000a) study of a bridge-building project, that engaged a large amount of different actors, whose interests to align with, constantly forces the project group back to the drawing board to adjust the design. A highway project, under which a bridge project is categorized, engages many different groups of actors due to the societal impact of such a project. In the milk package project there

are primarily internal actors who participate in a project group, but these actors have responsibilities that make them represent different parts of the object interest areas. The project team become key actors in order to represent human and non-human interests during the design process. Thus, in contrast to a highway project, a consumer good project being performed by a company has been able, to a certain degree, to decide whom to include in the project group. However, as societal interests have become important to respond to, for consumer goods as well, the Gabletop design process resulted in the need to respond to its 'green' impact. Initially in the milk package's project group, there were no representatives of the sustainability department, but they were just asked to provide the relevant reports and documents. However, as the milk package gained 'green' attributes they got increasingly engaged in the project and were active in the continuous 'greening' of the package including the removal of a clay barrier and additional inclusion of bio-based plastics. Hence, becoming an additional interest to take into account in future design processes.

Negotiation approaches

During a design process the interests within each inscription domain are challenged by interests that consist of timely knowledge, made relevant to the specific object, in regard to what a modern object should respond to. Although industrial requirements can be barriers to change, which is discussed in the previous section, they can also serve to trigger object change since the object design can become outdated in relation to a changing contextual environment that results in new expectations. However, a new interest cannot be inscribed without being accepted within the boundaries of the inscription domains. In Leonardi (2010), the technological development of a car crash system was argued to require innovation within three areas, i.e. technological, regulatory and organizational. In accordance with this empirical case, which builds on an engineered object with limited physical boundaries, it is instead argued that the design changes to be performed require the acceptance of all three inscription domains in order to realize object inscription. It is in this study possible to identify three different approaches to negotiating the inscriptions of interests that result in design change, known as hierarchical, domain-specific and societally appointed negotiations.

First, *hierarchically* initiated negotiation is performed when a hierarchically dominant actor, e.g. a governmental agency, implements new legislation or invests in new infrastructure. It is identified in the design changes performed in order to comply with the implementation of recycling requirements, as discussed in Chapter 4. The legislative requirement resulted in cardboard packages having to comply with recycling requirements, which necessitated technical development (see also Leonardi, 2010). In this type of *hierarchically*

initiated negotiation, there is governmental legislation, or highly influential industry standards, that require an engineered object to implement a changed design whereby the interests within the different inscription domains must compromise their ambitions in order to comply with legislative requirements.

Second, the initiation of *domain-specific* negotiations is performed when a design change is suggested in order to improve an interest within one of the inscription domains. It is identified during the design process of introducing the Gabletop package in order to meet consumer demands. Thus, it builds on the aim of improving operative functionality based on consumer demand. Also, Sterne (2012) communicates the need for objects to stay alert to market changes in order to stay relevant on the market. Thus, the design update had to be accepted by the different interests within the domain of operative functionality. Although it resulted in consequences in other interest areas, e.g. logistics and distribution efficiency, as discussed in Chapter 6, these were acceptable compromises in order to align with modern object demands. Moreover, the suggested change must be attractive to the interests existing within the domains of material quality concerns and economic incentives, whereby the material choices in the new design could be managed in compliance with the adopted legislations and show an acceptable economic incentive vis-à-vis the interests existing within the domain of economic incentives.

Third, the initiation of *societally appointed* negotiations is performed in order to meet a general societal interest. This type of negotiation between the inscription domains is illustrated in the aim of meeting 'green' attributes once the Gabletop with its screw-cap had been launched on the market (as discussed in Chapter 7). A societal interest goes beyond the specific attributes of the engineered object and paves the way for different approaches to managing the demand. Thus, in the empirical story it is communicated that 'green' attributes are identified by different qualities, which builds on what is attractive within the different domains. From a 'material' perspective, there is a focus on the material attributes and packaging producers, e.g. communicating their 'green' materials through arguments based on the logics in the LCA analysis. From an 'operative functionality' perspective there has historically been a focus on efficient logistics as a solution to reducing CO_2 along the supply chain, as well as applicability to waste management systems. Moreover, from an 'economic incentive' perspective there is a focus on ensuring milk protection and the proposed 'green' attributes have been communicated via arguments as regards improving food durability and ensuring less food waste.

Reijonen & Tryggestad (2012), too, illustrate the challenges of adding 'green' attributes to an established market product. Instead the additional 'green'

product attribute was continuously inscribed and could not be applied to the cost of another product attribute. The performed activity of inscribing bio-based plastics in response to consumer demands for 'green' attributes originated from an 'operative functionality' perspective, which could be performed without removing an operational attribute, i.e. the screw-cap. Additionally it was also applicable to the demands arising from the interests in the other domains, without too much restriction. From the perspective of 'material quality demands' it aligned with demands for good material sourcing and compliance with the waste management system. From the perspective of 'economic incentives' it resulted in an attractive packaging attribute, without resulting in too high a price compared to the opportunity to differentiate on the market.

Negotiating a new interest into an engineered object requires organizing activities. Irrespective of whichever negotiation approach occurs, there must be a shared object design, which results in some compromise. Applying a new object design to the market results in changes for the actors involved since these need to approach things differently (Koivunen, 2009). For example in Chapter 6, the new Gabletop needs to have the screw-cap adjusted in order for people to be able to open it and the handling of the production machines requiring new behavior from the factory workers. Thus, some adjustments were performed in order to fully manage the new object (e.g. Winance, 2006). Therefore there are hands-on reactions to a new design solution when it is launched, which can be a trigger for other interests to be inscribed, which is what happened with the Gabletop package.

This chapter discusses what constructs an engineered object. Building on the empirical story it appears that the milk package is used in different contexts and for different purposes over its lifespan, which emphasize various actors' interests in the package, resulting in an 'engineered object multiple'. These object mechanisms are explored through the concept of inscription domains, where actors' interests are categorizing into different domains that builds on the object seen from a material, functional and economic perspective. This way it is possible to identify a stabilizing factor in an object's design and bring insight to a design process unfold on the basis of previous inscriptions. However, since the contextual environment changes over time it results in new interests for an object to respond to, which can only be inscribed into the object if negotiated carefully, in order to be accepted within the perceptions of the different inscription domains.

Chapter 9: Concluding discussion and contributions

Milk containers' design vary between different parts of the world. Pinch and Bijker (1984) argue that objects are flexible enough to be designed in a wide variety of ways: "[t]here is a flexibility in how artefacts are *designed* [emphasis in original]. There is not just one possible way, or one best way, of designing an artefact" (1984:421). Hence, innovation has resulted in different packaging solutions for containing milk, but when a product solution has been established in a market it must meet demands from its contextual environment, making it more stable in its design attributes. This results in design changes being performed during negotiations with the existing attributes (e.g. Reijonen & Tryggestad, 2012), which restricts the variety of changes to perform.

Inscriptions are traces of what an object is made up of (Latour, 1986) and therefore the notion of inscriptions can be used in order to learn about the interests that construct the object. However, in this thesis it is argued that the object's inscriptions cannot communicate enough information in order to learn about the interests that possibly result in the given inscriptions, since interests can be compromised when inscribed. Instead, the engineered object must be studied at the time of 'a crisis' (Akrich & Latour, 1992), when interests become visible.

The concept of inscription domains, introduced in Chapter 8, provides a lens for exploring how engineered objects are constructed and how interests become inscribed. Engineered object inscriptions originate from three inscription domains that build on different mechanisms of an object's qualities. Over its lifespan, the milk package is used in different contexts and for different purposes (e.g., as a container of food, as an item in a logistic system,

as waste product) that emphasizes various actors' interests. On basis of these mechanisms, the milk package is best described as an 'engineered object multiple' (see Mol, 2002), wherein what the thesis describes as inscription domains plays a key role in determining physical, aesthetic, and symbolic properties of the object to ensure to answer to the expected purposes.

The concept is useful for all engineered objects since it illustrates the roles and tasks that an engineered object responds to, showing that engineered objects that are tightly connected with the industrialized setting. The domains of material quality concerns, operative functionalities and economic incentives are expected to be generic for various engineered objects, but adjusted to the object characteristics and the contextual setting. Thus, the degree of influence existing between inscription domains can vary with the type of engineered object. During a design process, interests are negotiated against each other, within a domain and between the domains, in order to be inscribed or re-inscribed into the object. Categorizing interests into domains has made it possible to identify that different competencies, perceived needs and beliefs all strive to inscribe different qualities. Moreover, exploring the construction of an engineered object provides knowledge about why design changes can be both difficult to perform and result in slow changes.

Based on a sociomateriality perspective, the study emphasizes a relational ontology and identifies the social and material conditions that influence the design of an engineered object (e.g. Orlikowski, 2007; Suchman, 2007; Barad, 2007). Hence, during a design process the object is active in order to allow or reject design changes, building on the demands arising from existing inscriptions (Rennstam, 2012), which result in an engineered object is a stable object that it is difficult to perform changes within. Seen in this view, a design process unfold on basis of previous inscriptions and becomes the result of compromises between different and sometimes conflicting interests.

How are interests inscribed into an engineered object?

As previously argued, engineered objects answer to many different interests over its lifespan, since they are used in different contexts and for different purposes. Therefore an object design stabilizes and result in difficulties to change. In a design process, the coming object design must hold qualities to answer to the existing interests and align with the established setting (e.g., David, 1985; Rennstam, 2012). This is a consequence of, for example, industry requirements that have been developed in order to improve production performance. These standards and routines promote continuous management in line with the established object qualities, which results in that a design process unfolds on basis of previous inscriptions and leave little room for

innovative changes (e.g. Allen & Sriram, 2000; Suchman, 2000a; Timmermans & Epstein 2010).

Although the mechanisms that stabilizes an engineered object, it exists in a changing environment, resulting in changed and added expectations over time (Leonardi & Barley, 2010). Consequently, object expectations are multiplying and thus increasing the level of negotiations and resulting in additional compromises. Since interests become inscribed into the object over time, the object inscriptions evolve and actors' enacting the object differently with its additional attributes, which can awaken reactions. In this study the new Gabletop package with screw-cap resulted in reactions leading to design adjustments as an answer to 'green' expectations.

Additionally this study shows that interests are unlikely to be inscribed if not aligned with an inscription area within one of the inscription domains, which is then negotiated within the boundaries based on mechanisms of the other two inscription domains. Performing a design process is an accomplishment shared by all the engaged actors (e.g. Suchman, 2000a; Leonardi, 2010). In Chapter 8, it is stated that there are three different approaches to negotiating design change, known as hierarchical, domain-specific and societally appointed negotiations. The given negotiation approach is determined by the type of interests initiating a design process, since this influence how the process is initiated. However, the inscription of interests always engages all three inscription domains since these build on the object attributes; although they are separate, they are not mutually exclusive (e.g. Mol, 2002; Bruns, 2013).

This thesis builds on an empirical study of a seemingly mundane object, i.e. the milk package; but, when inscriptions are 'unpacked', it communicates an object that is constructed by many divergent interests. While mundane engineered objects are commonplace technologies, widely ignored by their users in terms of their qualities of everydayness, this does not suggest that mundane engineered objects are uncomplicated to either produce or modify. Instead, the term mundane engineered object denotes an object that mostly escapes critical reflection simply because it executes its intended functions successfully, i.e. by being skillfully designed in the first place. The social world is constituted on the basis of a variety of mundane engineered objects that assist individual and social activities, yet operate without much thought or gratitude (e.g. Michael, 2003).

The concept of inscription domains can be used for engineered objects in order to learn about how an object is constructed and what design changes are possible to perform. The concept is primarily applicable to goods that follow a production cycle meeting multiple interests that have to be agreed within the physical boundaries. All three inscription domains are present in an engineered

object when it is firstly initiated in an industry setting, but the interests held are adjusted during design processes in order to manage current interests. Thus, changes are more easily performed when managed in industries that have not yet matured to have industry standards and cultural preferences. Styhre and Arman (2013) communicate a difference between the innovativeness of new industries and that of established ones, using examples of the innovativeness of the renowned entrepreneurs Richard Branson and Steve Jobs in the record industry, and the emerging computer industry, which were "relatively unregulated territories at the time" (2013:190). The different possibilities are the result of established industries having a developed structure of regulations and industry standards that slow the implementation of innovations or new designs. With this in mind, it is reasonable that changes in engineered objects are difficult to achieve and that changes occur over time.

In order to gain knowledge of why objects are constructed in a given way, this thesis explores how interests become inscribed into an engineered object, providing insight into how well the object, for example, is equipped to respond to waste management challenges. The physical boundaries of an engineered object limit design variations and all changes result in consequences for other actors' enactment. Therefore, an engineered object can have a crucial task to manage, from the view of one perspective, e.g. waste management, but the object must respond to many more tasks and they must all be responded to within the same physical object. In line with Bijker and Law (1992:2), this thesis emphasizes the argument that there are no 'best' design solutions, an object always embodies compromize. The findings emphasize the dependence on an object's heritage, since it influences potential new designs and thus becomes an important component of realizing an object's design potential in the given setting. Building on this, the concept of inscription domains is a potential lens for studies in the field of sustainability research in order to explore an industry's or a product's environmental impact, since this is directly negotiated with the other inscriptions. Providing a lens to explore the object's potential instead of different actor interests on 'green' attributes.

The convenience of mundane engineered objects tends to invite lay audiences to falsely believe that such objects are modified at low cost, and with limited investment only. In contrast, seemingly elementary objects also reveal considerable complexity on closer inspection. Lay audiences and 'common sense' thinking are unfortunately unimpressed by such claims, expressing concerns regarding what may be seen as belated responses to the articulation of perceived problems. In today's society technological change is often discussed as a matter of innovativeness without reflecting on what is required to implement change in an established setting. Hence, this thesis aims to bring attention to the many different aspects that need to be met in order to perform

a successful design outcome and how these prerequisites slow technological change. Learning about mundane engineered objects, which serve as stabilizers in society (e.g. Latour, 1992), brings knowledge as regards understanding how objects are negotiated in accordance with contextual interests. This is an important insight that is required when it comes to making a correct decision to push development in a sustainable direction, since actions performed from one actor's perspective can be environmentally justifiable from that given perspective, but different such actions within a supply chain can shutter the benefits from an object perspective.

The empirical study communicated a design process initiated with an ambition to produce a modern packaging solution. Along the design process, 'green' interests awoke aiming to lower the material's environmental impact. In the space for negotiation, Dairy Corp managed to update the plastic material, but general industry changes could not be managed from a company perspective. However, waste related issues have stayed relevant since this thesis was embarked upon in 2014. For example, the EU has initiated a ban on single-use plastics from 2021 (Andrews, 2018), and there is a continuously increasing interest in buying package-free products, resulting in growing numbers of package-free stores (Moss, 2019). Moreover, waste management practices are improving and citizens are becoming better at sorting their waste products, resulting in a positive trend in the amount of recycled materials (FTI, 2018). In an attempt to predict market changes, coming design processes for food packages can be 'triggered' by legislative demands on waste management, resulting in these interests gaining additional negotiation power to secure an efficient use of material resources.

Contributions

This section presents how this study relates to existing research and how it can have interesting implications for practitioners and policymakers. The empirical findings are discussed in relation to the relevant literature to explicate their contributions. The studied object, the milk package, which is an example of a mundane engineered object, communicates the general phenomenon of a production good, causing it to address insights that are relevant to the production industries as a whole, and the policymakers in these areas.

Theoretical contributions

This thesis takes on a sociomateriality perspective in order to account for both social and material components in the design process of an engineered object. The findings communicate the milk package's dependence on the contextual environment, being shaped by, for example, regulations, industry standards

and cultural demands to hold its design qualities (e.g. Timmermans & Epstein, 2010; Suchman, 2000a; Harré, 2002), as well as illustrating how an object have agency to accept and neglect design changes by showing that a new design process builds on the previous inscriptions (e.g. Labatut et al, 2012; Rennstam, 2012; Naar & Clegg, 2016). Thus, the sociomateriality perspective provides an applicable lens for studying how the organizing of a design process builds on constitutive entanglement, something which has primarily been confirmed by examples of information technology and organizing objects (e.g. Orlikowski, 2007: 2010; Orlikowski & Scott, 2008).

Moreover, this thesis adds to the scholarly discussion about inscriptions by introducing the concept of inscription domains, a complementary lens for learning how interests are inscribed into an engineered object, regarded as a missing aspect in the inscription literature (Leonardi & Barley, 2008; Holmström & Robey, 2005). Additionally, Joerges and Czarniawska (1998) explored objects to be the result of institutions, requesting knowledge about the relations between different inscriptions, where this thesis contributes with insight from findings in this case, but also generally through introducing the concept of inscription domains.

Early literature on the notion of inscription has foremost answered what interests an object is constructed by (e.g. Latour & Woolgar, 1979/1986; Joerges & Czarniawska, 1998). This literature explores inscriptions as originating from one primary perspective, e.g. a laboratory where experiments are performed by scientists and inscribed in order to be read by other scientists (e.g. Latour & Woolgar, 1979/1986), and with a bottle's inscriptions being produced by scientific authorities (Joerges & Czarniawska, 1998). Instead, this study widens this understanding by communicating a multiple perspective of inscriptions. Along with the increasing interconnectedness of industrial settings, where engineered objects travel along a chain of actors that enact with different object mechanisms, this results in the need to grasp the different mechanisms constructing an object that is best understood as an 'engineered object multiple' (Mol, 2002). Hence, an object is explored in multiple ways and thus enact and inscribe information based on these perspectives.

This thesis contributes to the business in society literature by showing that object studies bring important aspects exploring sustainability areas of production industries. While existing studies in this research field have engaged science and technology literature (e.g. Älhström & Egels-Zandén, 2006; Martin, 2008; Larssaether et al, 2009), the materiality aspect has foremost been one actant among many other to explore corporate social responsibility. Instead, this study contributes with a sociomateriality perspective that communicates an object's dependence on its contextual

environment. Thus emphasizing sustainability focused research to start from the object when exploring the greening of the industry. An object is not in favor of specific interests per se but, as they are constructed by different inscriptions, these serve to accept or reject additional interests (e.g. Reijonen & Tryggestad, 2012). Moreover, this study also illustrates the multiple demands placed on an engineered object that result in 'green' attributes possibly being responded to in various way depending on actor perceptions. Thus, these 'green' interests should start out from an object perspective instead of actor interests.

Managerial implications

This study contributes to production industries as a whole, since the present case illustrates the challenges entailed in performing a design process that results in a successful new design. This is communicated through the many interests originating from different part of the contextual environment, constructing the engineered object and making design changes difficult to implement. Although production industries build on different structures, whereby some are highly regulated (e.g. medical products) and others are governed by demands regarding logistical optimizations (e.g. EUR-pallets), there are many interests to consider within a stabilized setting, giving little space for object design changes. The lens of the inscription domain allows us to identify how an object design is a compromise between the diverging interests engaged with the object. Moreover, it also results in difficulties responding to new interests in an object design, in this case showing the difficulty of responding to 'green' attributes.

When viewing a design process from an object perspective, it is possible to see where and how potential design changes can be performed. Additionally, it also provides the justification to add industrial and societal agreements in order to achieve more influential changes within 'green' interests, since infrastructural changes are difficult to perform without the support of hierarchically approached negotiations.

Additionally, this thesis is also able to serve as a bridge between 'activist' and 'industry' actors by illustrating how these actors depart from different perceptions of the given object. The empirical story provides insight into possible strategies for environmentally engaged activists aiming to see a continuous 'greening' of the industry, since it communicates the need to explore more aspects of an engineered object in order to learn about its different mechanisms and how these mechanisms see 'green' attributes. Explored on the basis of opinion-molders', or activists', perceptions of packages as waste, this view is not supported by industry actors and there is little commitment to taking these opinions into consideration. Thus, a more successful approach, vis-à-vis generally demanding 'green' attributes, is being

concrete about the necessary object changes and firmly establishing these views with industry actors' interests. In this way, the opinions will be tailored to ongoing industry discussions and will result in a way of meeting in a shared point of departure.

Policy implications

This thesis communicates how the engineered objects within an established industry setting become stable in design since there are many different interests that should be accounted for within the same object design. Moreover, it also communicates the fact that legislative requirements are one way of ensuring alignment with change. However, a well-assembled object design results in consequences when challenged, since there are many interests that rely on different negotiated attributes. This means that a careful analysis must be conducted before applying policy demands, since these can lead to societal and welfare costs, e.g. negatively impacting either milk farmers' financial status or children's health by influencing their intake of nutrients if milk is removed from schools.

Additionally, accessible objects often become the symbol of a trend since they serve as a shared point of reference. Although such products should minimize their own environmental footprint, it is also important to reflect on the product's production value. Hence, comparing the production value with a food product, on the basis of its nutritional value, can lead the way in justifying its environmental impact.

Pedagogical contribution

The present thesis builds on the case of a milk package (a well-known object that most people find familiar), which provides a non-deterrent case for studying object designs and how these are constructed. Therefore, this study contributes, as a pedagogical example, to exploring the organizational perspective of technological development, without starting out from a hi-tech object whose technical specifications can be a knowledge barrier.

Moreover, the thesis also serves as a pedagogical example for use as lecture material when exploring industry interconnectedness and for identifying the barriers to and the opportunities for an engineered object responding to societal demands.

Future research

The thesis builds on an exploratory research approach whose aim is to bring attention to the mundane engineered objects which exist in our everyday lives, but which are often neglected in current research. The study highlights several

promising avenues of future research. First, mundane engineered objects are often ignored in modern research, neglected in favor of more high-technological objects. However, there are many interesting aspects to study from an organizing perspective in terms of the many actors' interests negotiated amongst each other, but all aspects required to result in a successful design. This thesis builds on a single case study, which means that there is a need for additional studies in order to verify the findings being communicated. In such studies, the concept of inscription domains can be developed by the insights gained from the additional cases, learning whether the specific inscription domains are generic to these cases or whether they are different and what results in these differences.

Additionally, this thesis also builds on a design process that is primarily studied from a retrospective perspective; it would be interesting to learn about the additional insights gained from studies performed as ethnographic studies that follow the full design process of an engineered object.

Second, materiality research has become increasingly popular as an organizational research stream (e.g. Orlikowski, 2007: 2011; Leonardi, 2011; Rennstam, 2012) aiming to explore the social and technological entanglements of organizing. In contrast, in the stream of business and society research, this trend is not recognized, which is something that this thesis would encourage. This thesis provides incentives for additional research, from an object perspective, in order to understand production organizations' potential to meet the societal demands placed upon them. Thus, research starting out from the production setting is a suitable way of learning about company sustainability work, in addition to the studies performed from a neo-institutional perspective (e.g. Jennings & Zandbergen, 1995; Delmas & Toffel, 2004; Glover, Champion, Daniels & Dainty, 2014).

Third, research conducted in the field of food packaging has primarily been written on the basis of three perspectives: i.e. a logistical perspective (e.g. Klevås, 2005; Olsson, 2008; Abbasi & Nilsson, 2011; Molina-Besch & Pålsson, 2014); a technological perspective (e.g. Williams & Wikström, 2011; Williams, 2011; Marsh & Bugusu, 2007; Mahalik & Nambiar, 2010); and a market perspective (e.g. Cochoy, 2011, 2004; Hawkins, 2011). However, this thesis uses a food package to learn about the organizing of an engineered object during a design process, which means including all the interests in the package – i.e. the logistical, technological and market interests, in order to learn about the organizing in terms of how the interests, with their different aims, are inscribed into the object. Moreover, the main focus lies within the dairy producing organization, while similar innovations that have been studied have been performed within the package producing organization, and are more

technically driven. Thus, this thesis encourages more studies of food packages to be performed from an organizational perspective.

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