



SCHOOL OF ECONOMICS AND MANAGEMENT

Department of Business Administration

MGTN59 Degree Project – Management Challenges

Spring 2020

A Missed Steak

A Study of the Value Added by Dynamic Best-before Labels

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Date of submission 2020-06-05

Abstract

The competitive landscape mature industries find themselves in tends to make them enforce practices that ruthlessly focus on efficiency and process. This narrow focus makes them slow to adapt to changes in the external environment in which they operate. One such case is the Swedish meat industry. Like many industries, there are downsides involved with meat production and for meat a significant one is waste. New technologies are quickly becoming available aiming to limit this waste, one such being a dynamic best-before label.

This study tested the perceptions towards dynamic best-before labels both by interviewing industry managers and surveying meat consumers. The aim was to understand the currently perceived value drivers of the technology whilst more generally understanding the forces and counterforces to its implementation in the meat value chain.

The results highlighted discrepancies in consumer perceptions which raises managerial challenges for the implementation of the technology in mature value chains. Consumers were observed to value the technology, but not for its waste reduction potential, valuing it instead because it enhanced the other characteristics they perceive to be valuable in meat products, such as sustainability and food safety. Interviews with the supply-side stakeholders revealed a resistance to implementing new technology. By reminding the supply side of the major shifts in the external environment, this resistance can be somewhat mitigated. Moreover, managers can utilize the other value drivers by leveraging them as being enhanced by the dynamic label. In so doing, the dynamic label can be introduced to the market while mitigating short-term losses in profit.

Keywords: Best-before dates, Best-before labels, Consumer perceptions, Dynamic best-before, Food waste, Innovation, Mature industries, Meat, Technology, Value chains

Sammanfattning

I mogna industrier prioriteras ofta verkningsgrad och processen snarare än själva produkten. Detta innebär att dessa industrier anpassar sig långsamt när de externa förhållandena skiftar. Exempel på sådan industri är Sveriges köttindustri. Denna präglas av stor klimatpåverkan, även stora mängder matsvinn. Nya teknologier undersöks i nuläget för att skärpa detta svinn; exempel på sådan teknologi är ett s.k. dynamisk bäst-före datum.

Studien undersökte slutkonsumenternas perceptioner mot ett dynamiskt bäst-före datum genom en enkät. Vidare intervjuades ett antal chefer i köttindustrin. Målet var att kartlägga de faktorer som bidrar till värdet av teknologin samtidigt för att förstå driv- och motkrafterna som ligger bakom implementering av teknologin i värdekedjan.

Resultaten gav att slutkonsumenternas perceptioner inte är fullt konsekventa, vilket innebär vissa utmaningar om teknologin skall kunna implementeras på ett effektivt sätt. Konsumenterna finner ett visst värde hos dynamiska bäst-före datum, dock inte p.g.a. att teknologin skärper svinnproblematiken utan snarare för att teknologin höjer andra värdefulla karaktäristika hos köttet, såsom hållbarhet, säkerhet, mm. Intervjuerna visade att industrin tar viss motstånd till implementering av ny teknologi. Genom att påminna producenterna om de stora förändringarna i de externa förhållandena kan detta motstånd begränsas. Vidare kan chefer utnyttja de andra värdeskapande egenskaperna hos köttet genom att marknadsföra att de förbättras vid introduktion av ett dynamiskt bäst-före datum.

Nyckelord: Bäst-före datum, Dynamiska bäst-före datum, Innovation, Konsumentbeteende, Kött, Matsvinn, Mogna industrier, Teknologi, Värdekedjor

Preface

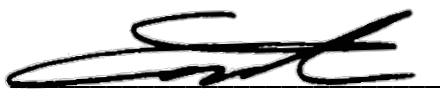
We would like to thank our supervisor, Ola Mattisson; without his advice and insight, the final form of this thesis would have been markedly different.

We are also grateful to Stein Kleppestø for suggesting the thesis topic, and to Erik Månsson for his help in his capacity as CEO of Innoscentia AB. The thesis itself would not have been possible without the interviewees and survey respondents, and they deserve thanks.

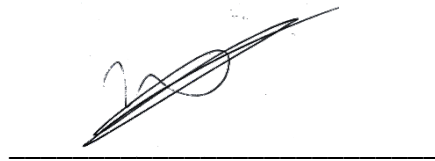
Finally, we would like to express our gratitude to the Swedish state—in no other country on Earth does the duly elected government equip the citizenry with an education of such outstanding and egalitarian quality, while securing for them also such unwavering peace and prosperity.

5 June, 2020

Lund, Sweden



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1 Introduction

“It is not the strongest of the species that survives, but the one most responsive to change.”

—Charles Darwin

The introductory chapter presents the notion of technological change as a key characteristic of a healthy industry. From this, a prevailing knowledge gap is derived on the practical viability of implementing new technology in the mature meat industry. To address this gap, research objectives and constituent research questions are developed regarding a dynamic best-before label, after which delimitations and the disposition of the study are established.

1.1 Background

Some two centuries ago, the ice trade fulfilled the refrigeration needs of much of the Western hemisphere (Rees, 2018). This trade dealt in the large-scale harvesting, transport, and sale of ice, exporting it from as far away as Norway all the way to the eastern seaboard of the United States. Natural ice, commoditized through this industry, remained the principal means of preserving produce until the trade’s peak in the late nineteenth century, when it was upended by the first commercial innovations in modern chemical and mechanical refrigeration (Juma, 2016). In the span of a few short decades, the ice trade was rendered defunct by the modern refrigeration industry. In its aftermath, consumers were offered a method of preservation that was more efficient, safer, healthier, and cheaper (Juma, 2016). Concurrently, supply networks managed to reduce their waste as they switched over from ice to modern refrigeration. The question proffered by the tale of the ice trade is how an entire industry could be displaced, in such a short timeframe, by a technology that was well-advertised at the time (Rees, 2018).

The ice trade is a nineteenth century example of what would now be referred to as a mature industry. A mature industry is characterized by stable, normally plateauing, consumer demand for products that change only marginally over time (Grant, 2018). Having largely achieved desirable market penetration, firms in mature industries tend to focus on reducing costs rather than overhauling their product offering—this policy can be thought of as a process-oriented mindset, which can be contrasted with a product-oriented one. The focus on process normally entails streamlining the sequence of activities involved with the product, from conception to production to sale to recycling, and everything in between. Those activities are collectively referred to as the product's value chain—in essence, a value chain maps out a firm's full range of activities associated with bringing a particular product to life, from its initial conception to its ultimate disposal and discontinuation (Porter, 1985). With the process-oriented mindset, the value chain undergoes incremental efficiency improvements, from optimized logistics to the streamlined usage of raw resources (Kaplinsky & Morris, 2000). The result is improved efficiency and lower costs, which are, in turn, passed on to the consumer through lower prices (Benner & Tushman, 2003; Grant, 2018).

If not managed correctly, this focus on process can give rise to myopic tendencies, in which firms are blind to, or dismissive of, transformative changes occurring in the external environment (Benner & Tushman, 2003; Day & Schoemaker, 2005; Seidel & O'Mahony, 2014; Smith & Tushman, 2005; Stopford & Baden-Fuller, 1994). The ice trade is such a case: rather than opting to integrate newer refrigeration methods, the industry lobbied to restrict innovation in favor of maintaining its own core technology, believing the former to be a superfluous and dangerous distraction from the supposedly superior product offering of ice harvested from Norwegian fjords.

With the decline of the ice trade, one of the industries to embrace newer refrigeration techniques was the meat industry (Juma, 2016). In a fit of irony, there are parallels that can be drawn between the tale of the ice trade and the Swedish meat industry of today. As was once the case with ice, meat is an essential product in a mature industry—indeed, the product offering has remained largely unchanged over the past forty years, with firms having directed their innovative efforts towards incremental efficiency improvements of the supply chain (Buhr & Ginn, 2011; Wohlgenant, 2013). Unsurprisingly, consumer demand has also been stable over the same period, growing largely in tandem with the Swedish population (Swedish

Board of Agriculture, 2019). Today, this predictability is under threat: meat consumption in Sweden appears to be plateauing, having decreased slightly since 2016 (Global Data, 2017; Swedish Board of Agriculture, 2018). This is driven, in large part, by mounting consumer concerns for the environment (Axfood, 2018; Sanchez-Sabate & Sabate, 2019). This is not unwarranted, considering that the meat industry stands for 15% of global greenhouse gas emissions, and 25% of a Swedish consumer's climate impact (Gerber, et al., 2013; Swedish Board of Agriculture, 2018). Clearly, consumer perceptions towards meat are beginning to shift, and thus the stable external environment that the meat industry has grown accustomed to may be in the early stages of being disrupted.

Consumer perceptions play a decisive role in the market because, irrespective of the efforts made by the supply side, it is the consumer who determines whether or not a product offering warrants purchase (Armstrong & Kotler, 2009; Kotler & Keller, 2016). It is thus the consumer's perceptions—the psychological mechanisms that steer our tendency to see certain things in a certain way, all the while ignoring other things—that are critical when marketing a product, either old or new (Axelsson & Agndal, 2016). If perceptions change, so too does consumption behavior—for firms to survive, they must adapt their product offerings accordingly.

As the perceptions of meat consumers become increasingly preoccupied with environmental degradation and sustainable corporate practice, one phenomenon stands out from the rest: meat waste. Waste in any value chain is defined as when the object loses its purpose and ceases to be useful (Pongrácz, 2009). Though managers work to reduce this waste, their focus naturally tend towards their own production, which is especially evident when scrutinizing the food sector: of the million tons of food wasted annually in Sweden, the overwhelming majority of it can be traced to the end consumer, as in many other countries (Andersson & Stålhandske, 2018; Eriksson, 2012; Stenmarck, Jensen, Quested, & Moates, 2016). The problem is acute in the meat industry, given that its products are the most environmentally damaging of the agricultural staples (Andersson & Stålhandske, 2018; Formas, 2008; Gerber, et al., 2013). Thus, despite growing concern over waste and calls for improved corporate sustainability policies, it is the consumer who plays an outsized role (Stenmarck, Jensen, Quested, & Moates, 2016).

This would not be the first time that a producer and consumers find themselves at odds. Actors that are demonstrably involved with a product's value chain—those with a stake in its

production, consumption, and/or disposal—are referred to as its stakeholders. Even though they are linked by a common product, the stakeholders in a value chain often have divergent, at times conflicting, interests (Porter, 1985; Savage, et al., 2010). This is especially true of the relationship between the producer and consumer. How these conflicts play out influences the degree to which waste can be, and is, reduced (Kaplinsky & Morris, 2000).

Curbing meat waste constitutes a profound management problem, not least because much of it seems to have its roots in consumer culture, not just inefficient production (Principato, 2018). Thus, attempts to reduce the waste ought to involve the consumer's participation.

At the interface between the supply side and the consumer lies the unassuming best-before label, which deserves closer scrutiny because a major reason behind the consumer's disposal of edible meat has to do with how consumer's perceive the best-before date (BCFN, 2012; Konsumentföreningen, 2017; Secondi, 2019; Ventour, 2008; Yngfalk, 2012). The best-before date is often misinterpreted to be a date after which meat is no longer edible, when in fact, it signals the date when a manufacturer no longer bears responsibility for its quality (Møller, et al., 2014). Eliminating this misunderstanding has been the object of only limited research, but one proposal for doing so is a dynamic best-before date, one that can update its projected expiry date through continuous monitoring of the meat and its environment. If successful, such a label can yield a more accurate indication of whether the meat product has spoiled, and thereby curb consumer waste (Jevinger, Göransson, & Båth, 2014; Principato, 2018). However, this relies on favorable consumer perceptions towards it, along with a willingness to integrate the technology from the supply side of the meat value chain.

In the aftermath of the ice trade's downfall, society benefited from a better product offering. The moral of the story is that it is through change that, over time, society improves; and in a globalized market economy, it is through technological change that a nation's competitiveness and long-term economic growth are safeguarded (Fregert & Jonung, 2018). For the mature meat industry, shifts in the external environment, especially consumer perceptions towards sustainability, suggest that implementing change to meet those shifts is of mounting importance. Accordingly, the implementation of new technology in the value chain must also consider the consumer's perceptions to that technology, alongside its practical viability in the supply chain.

1.2 Research Motivation and Problem Formulation

Mature, conservative industries that offer essential products to the consumer are a well-researched field (Benner & Tushman, 2002; Benner & Tushman, 2003; Clark & Fukimoto, 1991; Drayse, 2011). Likewise, there is a wealth of literature and case studies on technological innovations that may or may not create sustainable competitive advantage for the firms who adopt them (Albors-Garrigos & Hervas-Oliver, 2013; Betz, 2011; Seidel & O'Mahony, 2014; Smith & Tushman, 2005; Świadek & Szopik-Depczyńska, 2015). As interesting as those investigations into innovative game-changers may be, there is a discernible gap when it comes to assessing the practical viability of implementing those innovations in the value chains. Moreover, how that viability is affected by shifts in consumer perceptions warrants closer attention, recalling that it is the consumer who is the ultimate arbiter of whether or not a product (or technology) has value (Hawkins & Mothersbaugh, 2016; Kotler & Keller, 2016).

The Swedish meat sector is emblematic of the dilemma outlined above: it finds itself in a mature industry, it offers an essential product that sees the lion's share of its changes materialize from incremental process innovations, and consumer perceptions are beginning to shift, with implications for its bottom line (Beermann, 2009; Eriksson, 2012; Eriksson, Ghosh, & Pano, 2016; Margarita & Teng, 2011; Principato, 2018; Sanchez-Sabate & Sabate, 2019). To address this, some work has been done on evaluating the technical viability of myriad new technologies in the meat value chain (Göransson, 2019; Jevinger, Göransson, & Båth, 2014; Tromp, et al., 2012; Vegara, et al., 2014). There is considerably less work on how management should implement these new technologies into the value chain, that is to say what the driving forces and counterforces are to technological adoption.

Dynamic best-before labels are one such technology, and they are a pertinent case because they exist at the interface between the supply side and the consumer, which is important given both the outsized role played by the consumer in food waste, and consumer perceptions towards products and change. Not only is this of theoretical interest, but it also serves as an important first step in streamlining and reducing waste throughout the meat industry and perhaps even catalyzing fruitful societal change. Indeed, considering the enormous waste that characterizes the food industry at large, this may be one of the great management problems facing the world today.

1.3 Research Objectives and Research Questions

The purpose of this study is to investigate the practical viability of implementing dynamic best-before labels in the mature Swedish meat industry. This purpose is discretized through the following two research objectives:

- Identify the driving forces behind, and counterforces to, implementing dynamic best-before labels in the meat value chain.
- Evaluate the perceptions held by the stakeholders of implementing new technology in this value chain.

These objectives are treated through the implementation of the following research questions:

- What does the Swedish meat value chain currently look like?
- What do consumers perceive to be important when purchasing meat products?
- What is the effect of a dynamic best-before label on these perceptions?
- What are the main management challenges for incorporating new technology, such as a dynamic best-before label, in the Swedish meat value chain?

1.4 Scope and Delimitations

The scope of this dissertation only encompasses the meat value chain and its constituent stakeholders in order to study the problem of implementing new technologies in mature value chains. The end consumer is recognized as playing an important role in this topic, and they are delimited accordingly:

- The consumption behavior of end consumers is not studied directly. Instead, consumer perceptions towards meat and technology are investigated.
- Acknowledging that consumption is heavily influenced by national aspects such as culture, social structure, and ideology, it is reasonable to assume that consumers located in different countries exhibit different consumer perceptions (Solomon, Bamossy, & Askegaard, 2006). Therefore, the collection of primary data is delimited to Sweden, i.e. only the Swedish meat value chain, and those stakeholders that are located in Sweden, are studied empirically.

1.5 Disposition

Given the nature of the problem statement presented above, it is implicit that value chain theory is a cornerstone of the study. The study is therefore approached deductively, with the theoretical framework being presented prior to the methodology and empirical data. More explicitly, the disposition of the thesis is established according to the following:

- To nuance the context of the study, Chapter 2 maps out the Swedish meat industry, covering its structure, the waste associated with it, and the interplay between consumers and best-before labels.
- The theoretical framework is presented in Chapter 3, covering value chains, consumer behavior, and their applications to research methodology. Based on this, operationalizations and hypothesis tests are formulated for the empirical component of the study.
- Having reviewed the context and theory, the methodology of the study is presented in Chapter 4, where the development of the empirical study is described.
- In Chapter 5, the empirical data are processed and analyzed.
- Based on the empirical findings, the discussion in Chapter 6 applies the theoretical framework to answer the research questions and fulfill the objectives.
- Chapter 7 concludes the study by broadening the findings to the theory and management at large.

2 Industry Context: Swedish Meat

"And homeless near a thousand homes I stood, and near a thousand tables pined and wanted food."

—William Wordsworth

This chapter presents the context in which the Swedish meat currently industry finds itself. The structure of the industry is described, as are the habits of meat consumers. The regulations on packaging and labeling are then examined and linked to the waste characterizing the industry. Finally, a Section on dynamic best-before labels is presented. The aim of this industry review is to make plain the realities of the sector, the problem of waste, and the consumer's role in this problem.

2.1 Stakeholders and Industry Structure

Swedish food production and distribution is one of the country's largest economic sectors, accounting for 9% of the country's total production value and job placements (Eriksson, Ghosh, & Pano, 2016). Of the more than 3000 registered companies operating in the food sector, only 1% are classified as being large-sized enterprises, and the latter are concentrated in the processing and retail phases of the supply chain. From farm to fork, the supply chain can therefore be conceptualized according to Figure 2-1, wherein a large number of farmers and consumers are linked by a concentrated group of processors and retailers (Eriksson, Ghosh, & Pano, 2016). Critical parts of the Swedish food sector are thus highly concentrated. Indeed, the Swedish supermarkets are dominated by the four largest competitors, accounting

2 Industry Context: Swedish Meat

for 80% of the value in the Swedish food retailer market. These are ICA Group AB (41%), COOP (18%), Axfood AB (14%), and Bergendahls (8%).

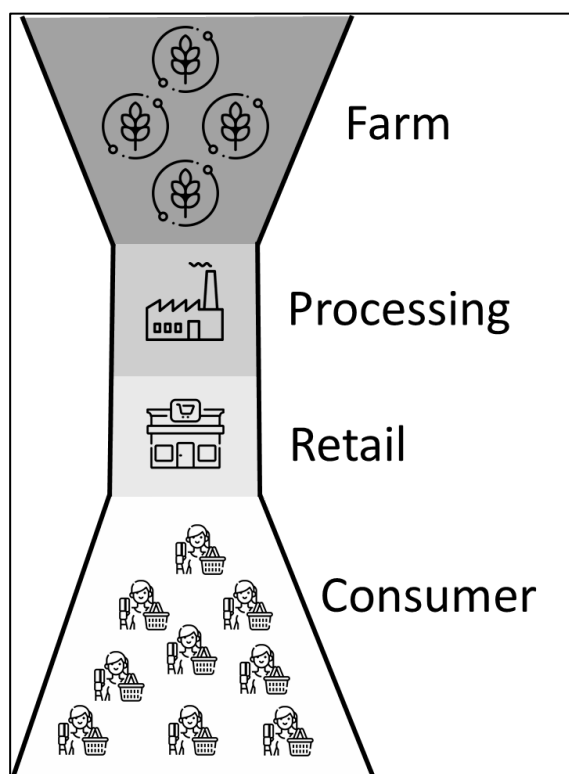


Figure 2-1: The Swedish meat value chain. Adapted from Eriksson, et al. (2016).

It is likely that the retailer bottleneck has created competitive problems for the market insofar as the major supermarkets exert a dominating influence across the rest of the supply chain (Eriksson, Ghosh, & Pano, 2016). Moreover, the Swedish food industry is one of the least innovative ones in the EU, ranked in terms of the industry's investments in research and new technology (Juchniewicz & Łukiewska, 2017).

Swedish consumers favor meat that is produced domestically, with Swedish meat capturing 60-80% of the market, depending on the type of meat (Habgardsson, 2013; Swedish Board of Agriculture, 2020). It is uncommon in Sweden to become sick from newly purchased meat, not least because meat that is marked with a "Kött från Sverige" stamp (translation: Swedish meat) guarantees that the meat has been slaughtered, processed, and packaged in accordance with state and industry regulations (Svenskt kött, 2020).

What consumers prioritize when purchasing meat has been the subject of numerous studies (Greenheck, Johnson, Graves, & Oak, 2018; Habgardsson, 2013; Malley & Southam, 2018). Common among them are meat characteristics such as flavor, whether it is locally sourced, sustainability, food safety, and, of course, price. Factors such as branding and packaging have also been examined in those studies, and the results suggest that those characteristics are of only limited importance to the meat consumer.

2.2 Food Waste

There is little agreement on how to define food waste: some define it as any and all mass that is discarded after the animal is slaughtered, while others argue that the term only encompasses what is thrown out after the consumer has purchased the product; there are myriad definitions that exist between these two extremes (Principato, 2018; Statistics Sweden, 2019). One way to resolve the confusion is by distinguishing between edible food waste (safe for consumption at some point prior to disposal) and inedible food waste (unavoidable, such as carcass bones and skin following slaughter). In Sweden, more than a million metric tons of edible food waste is thrown out annually (Andersson & Stålhandske, 2018). The vast majority of this waste can be traced to households, about 71%, while the supply side, including production, processing, and retail, only accounts for 17%, see Figure 2-2.

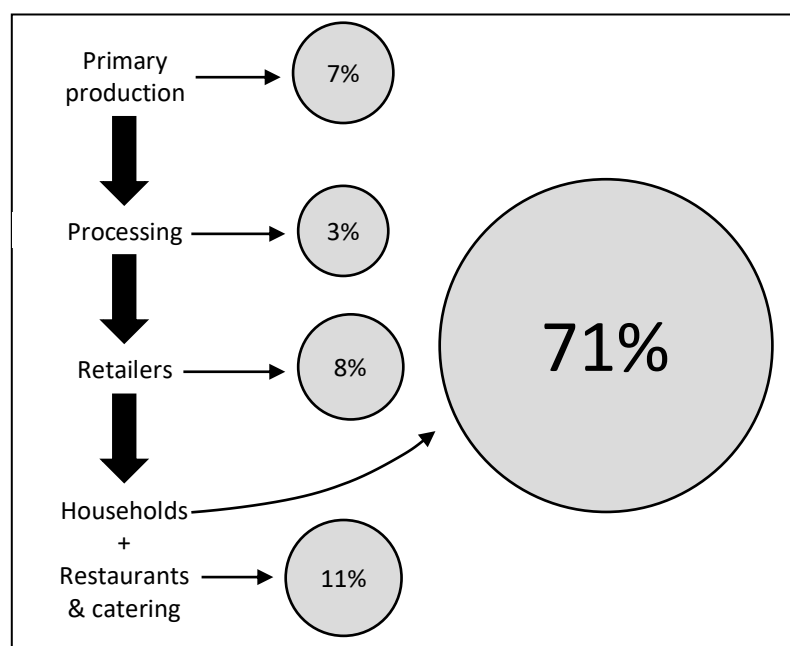


Figure 2-2: Sources of waste, by proportion, in the Swedish food value chain.
Source: Andersson & Stålhandske (2018).

An important component of edible food waste covers raw meat because of its comparatively high production cost and retail price. This component represents 7% of the total edible food waste in Sweden, which, though not the largest source of waste, is one of the most environmentally destructive, constituting 25% of the Swedish citizen's climate impact (Andersson & Stålhandske, 2018; Gerber, et al., 2013; Swedish Board of Agriculture, 2018). Meat production in Sweden emits several times more CO₂, SO₂, and phosphates than any other agricultural product (Andersson & Stålhandske, 2018), and water use is also significantly higher (Formas, 2008).

2.3 Conventional Best-before Dates and Use-by Dates

The best-before date is a chief reason behind consumers throwing away edible food (Downing, Parry, & Plumb, 2013; Gustavsson, Cederberg, & Sonesson, 2011; Ventour, 2008; Yngfalk, 2012). In Sweden, packaging regulation distinguishes between the use-by date and the best-before date (Møller, et al., 2014). Once the use-by date has passed, regulation stipulates that the food item poses a risk to human health. A use-by date is therefore only recommended for food that is highly perishable, microbiologically. The best-before date, on the other hand, reflects a date when the manufacturer is no longer responsible for the quality of the product. All packaged food products are required to exhibit at least one of the two labels.

Consumers have a difficult time distinguishing between use-by dates and best-before dates, and often misinterpret the latter to imply the former (Konsumentföreningen, 2017). As a result, consumer waste is exacerbated by the labeling systems, especially for highly perishable items such as meat and dairy (Yngfalk, 2012). Moreover, it is generally the policy of retailers to treat a product that has passed its best-before date as waste. A common practice therefore is to offer discounts on products that are approaching their best-before dates (Yngfalk, 2012).

Best-before dates are static, which means that they are not updated after the meat is processed, packaged, and shipped out. As a result, the best-before dates have been found to be unsafe in cases where the meat is stored in, for example, an unusually warm fridge (which is common in supermarkets), oftentimes unbeknownst to the consumer (Marklinder & Eriksson, 2015; Vegara, et al., 2014). The unpredictability of food products storage conditions means that best-before dates are therefore determined with a conservative margin of safety

(Møller, et al., 2014; Principato, 2018). This, in and of itself, is not necessarily a problem, except that the proportion of products which have been improperly stored throughout the supply chain are small, meaning that most foodstuffs will be perfectly consumable past their best-before date. Combined with the decreasing reliance on physical senses to evaluate the freshness of food, this means that edible food is now being thrown out on a regular basis (Principato, 2018).

2.4 Dynamic Best-before Dates

The date stamped on a package of raw meat is not capable of dynamically accounting for the insufficient preservation of the meat that often follows the product, all the way from slaughterhouse to household (Principato, 2018). However, a dynamic best-before date can account for this variable environment (Innoscentia, 2020). A dynamic best-before date is a technology actively monitors and models in real-time the microbiological activity/status of a food product, notifying the user if it is safe to consume. The potential effects of a dynamic best-before date have not been thoroughly studied. Similar work has been carried out in Sweden, however, focusing on technologies that actively monitor temperatures throughout the supply chain (Göransson, 2019; Jevinger, Göransson, & Båth, 2014; Tromp, et al., 2012). These studies have concluded that temperature fluctuations during the storage of food are the single largest reason behind food spoiling prematurely, that is to say unexpectedly.

3 Theoretical Framework

“Everything is worth what its purchaser will pay for it.”

—Publius Syrius

This chapter expands on the theoretical concepts that were introduced in the first chapter. The first Section presents the overarching theoretical framework of value chains and their analysis. Emphasis is placed on how value differs from stakeholder to stakeholder, and on the role of technology and innovation in disrupting value chains. The second Section examines consumer perceptions and the interplay between the perceived value and the price. Both Sections also discuss their respective applications to research methodology, which guides how the rest of the research is carried out, consistent with a deductive approach. From this, operationalizations and hypothesis tests are derived and presented in the final Section.

3.1 Value Chains and Innovation

3.1.1 General Overview of Value Chains

A firm’s value chain which maps out the full range of activities that are associated with sustaining a product offering, from its initial conception to its ultimate disposal and discontinuation (Porter, 1985). These activities touch on design, manufacturing, marketing, logistics, maintenance, follow-up, disassembly, recycling, and everything in between, see Figure 3-1. The concept was originally designed as a methodology for examining individual firms and triangulating sources of competitive advantage, but the perspective can also be applied to individual products. That is, instead of having a particular firm in focus, a particular

product is studied as it progresses through its value chain and as various firms add value to it (Kaplinsky & Morris, 2000).

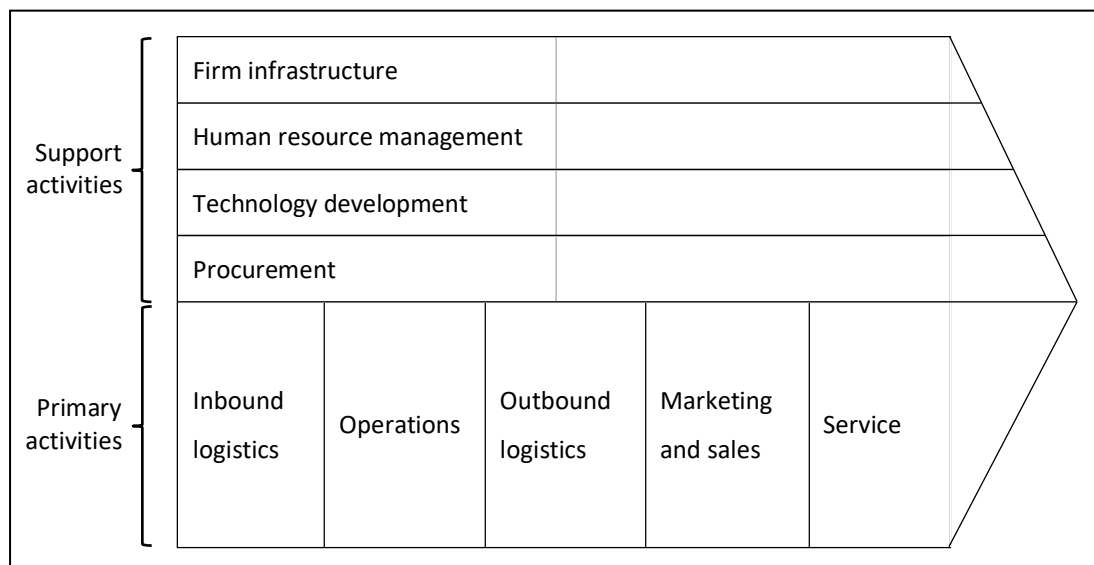


Figure 3-1: The generic value chain of a firm. Source: Porter (1985).

Each product draws value from a variety of sources, termed value drivers. The value drivers of a product depend on its intended use—the value drivers for an imperishable, standardized product such as laundry detergent are not the same as those for a cut of raw meat. Thus, it is the nature of the product itself, along with the environment in which it finds itself, that determines which activities are included in the value chain (Porter, 1985). This entails consideration of, among other things, the industry environment, organizational structure, consumer segments, market trends, and so on.

3.1.2 Defining Value

It is characteristic of a value chain that value is in the eye of the beholder—its meaning depends on the perspective of the stakeholder in question (Porter, 1985). For instance, a firm offering an essential consumer product, say laundry detergent, defines the value of that product differently from the consumer purchasing it. Whereas the former likely approaches the value of the detergent by accounting for its costs and market price, the consumer draws value from it through the utility it provides, namely the utility of transforming dirty clothes into clean ones. Assessing the value of a product to a firm is therefore oftentimes a simpler affair because a firm can measure value in terms of price and profit (Porter, 1985).

From the consumer's perspective, value is more difficult to narrow down to a single number, such as price, although price certainly plays a role (Kotler & Armstrong, 2010; Porter, 1985). One approach is to use a proxy, such as the consumer's willingness to pay for a product offering, to approximate consumer value. Measuring that willingness, however, can be difficult because consumers do not usually compute the precise value that they derive from a product offering. Even so, a common approach in marketing is to defer to money when assessing the utility that a consumer derives from the products they buy (Kotler & Armstrong, 2010).

The derived value of a product is steered by myriad physical and psychological factors, such as build quality, technology, branding, necessity and utility, scarcity, competition, cost, marketing, etc. (Betz, 2011; Porter, 1985) Value chain analysis can be employed to illuminate, and possibly quantify, how each of those factors adds value to the product offering—in other words, the value drivers can be identified and catalogued. To do this, it is normally of interest to map out how value changes as the product is propagated through the chain.

3.1.3 Propagating Value and Innovation

The interconnectedness of modern supply chains means that the costs associated with a value activity are frequently affected by the other activities in the value chain (Kaplinsky & Morris, 2000). This type of relationship, the interplay between certain activities and stakeholders, is referred to as a linkage (Grant, 2018). Linkages can highlight relationships in the chain that might not be immediately obvious, such as between stakeholders that find themselves at opposite ends of the chain. Contrast this with a more simplified perspective, where the product is seen to progress unidirectionally from one stakeholder to the next in a linear sequence of activities. This kind of picture does not capture the natural dependencies between the various activities and stakeholders to the same degree that linkages do. Thus, understanding the linkages between various activities and/or stakeholders is a prerequisite for finding cost-saving areas in the chain and discerning where and how value is propagated as the product proceeds through the chain (Grant, 2018).

Likewise, the nuance added by the linkages means that the effects of a process innovation can be better understood prior to implementation (Akpoviroro, Amos, & Oladipo, 2019). A process innovation aims to reduce costs throughout the value chain by, for instance, streamlining

material and energy usage, reducing labor costs, and improving manufacturing flexibility (Grant, 2018; Leiponen & Helfat, 2010; Utterback & Abernathy, 1975). In short, process innovations are intended to streamline the value chain. This is important because, if managed poorly, a process innovation (e.g. a new technology) may cause more confusion, and thereby waste, than the inefficiency it was originally intended to streamline. Understanding the dependencies within the chain, i.e. the linkages, can help explain where waste is emanating from, and thereby what the likely effects of a process innovation would be on those sources of waste. In a similar vein, the linkages can help identify who the winners and losers might be from a process innovation, and thereby where the sources of resistance are. Naturally, addressing that resistance is a critical component of managing any change, including the implementation of a process innovation (Kotter, 1998).

The propagation of value throughout the value chain, from the harvester of raw material down to the end consumer, is governed by the strategy adopted by the firm. For convenience, those strategies can be lumped into either differentiation strategy or cost advantage strategy (Porter, 1985).

A differentiation strategy focuses on providing a product offering that is unique, thereby appealing to an untapped consumer segment for a premium price. Taken by itself, the uniqueness is of limited interest unless it successfully fulfills a consumer need or desire that is not already offered by the market (Porter, 1985). The value propagated through a differentiation strategy takes its final form as added utility for the end consumer, such as greater convenience, time saving, and distinctive branding. Oftentimes, consumers do not, themselves, know what they will perceive as valuable until the product hits store shelves (Armstrong & Kotler, 2009). To create this value, the value chain of the product must often embrace radical technology that has not been used previously in the industry, and ensure that this technology is consistent with what the buyer is willing to pay a premium for (Grant, 2018).

A cost advantage strategy is common for highly commoditized mass-consumer products. Here, value is instead derived from streamlining supply chains and rationalizing supplier efficiency, which curtails waste in the value chain, ultimately reducing cost margins (Porter, 1985). The resulting value propagated to the end consumer takes the form of a lower product price.

Cost advantage lends itself well to process-focused management, i.e. management that is occupied with improving production speed and organizational efficiency (Benner & Tushman, 2002; Clark & Fukimoto, 1991; Garvin, 1988; Harry & Schroeder, 2000). But this often comes at the cost of only favoring those innovations that build on familiar technology and are incremental in nature, while neglecting those that are alien and disruptive (Benner & Tushman, 2003). This behavior is not entirely unexpected. After all, cost advantage strategy often translates into significant investments in fixed capital and specialized staff. Once made, the sheer price of those investments makes incremental improvements preferable to the purchasing of new assets, that is to say disruptive change. This often makes the firm sluggish in its response to shifts in the external environment (Hannan & Freeman, 1984).

3.1.4 Innovation in the Product Life Cycle

To better understand the relationship between the product and innovation, the product can be simplified into a sequence of phases, collectively referred to as the product life cycle. The life cycle is a strategic concept that maps out the pattern of industry or product evolution in terms of buyer demand, see Figure 3-2 (Grant, 2018). In the introductory phase, new products enter the market and undergo continuous and substantial change. They are characterized by fierce competition between rival designs and limited consumer demand that is marketed through high pricing and building brand awareness—those who do buy the product at this stage are referred to as innovators for this reason (Kotler & Keller, 2016).

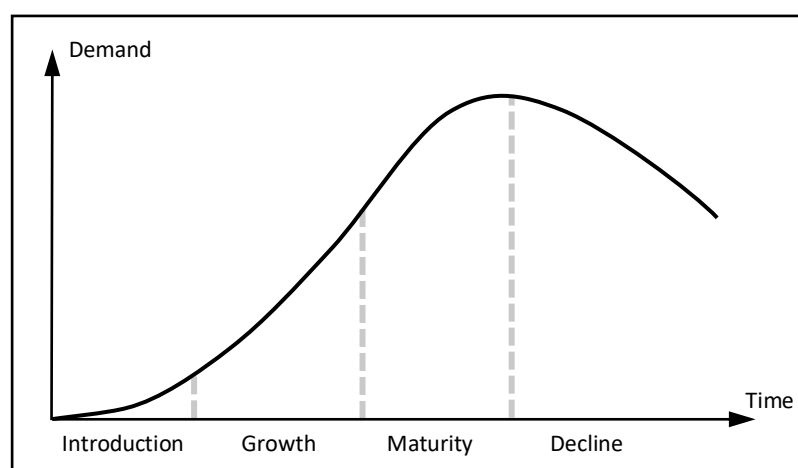


Figure 3-2: The principal life cycle of an arbitrary industry or product.

Assuming consumers are finding value in the product and competition is continuing, the industry converges on a single dominant design (Kotler & Armstrong, 2010). As the dominant design takes hold, emphasis begins to shift from radical product changes to more measured improvements, such as through product add-ons and better service—this inaugurates the growth phase. Greater standardization reduces customer risk, encouraging investment in production capacity to meet rising consumer demand (Grant, 2018). The introduction of the dominant design also signals to some firms that differentiation ought to be replaced by a cost advantage strategy, with an analogous shift away from product innovation and towards process innovation (Betz, 2011; Drayse, 2011). Thus, as manufacturing is streamlined, waste is reduced, costs go down, product reliability improves, and the price becomes more reasonable to the consumer.

Consumer demand for the product normally stabilizes as time goes on, signaling that the product is entering the maturity stage. As the product reaches maturity, the firms that have not been out-competed or acquired by their competitors tend towards price competition (Kotler & Keller, 2016). This is because the consumer, having become familiar with and knowledgeable on the product, is now far more price sensitive than they were in the past (Grant, 2018). As a result of consumer demand stabilizing, firms can use that relative stability, to optimize production through incremental efficiency improvements, thereby reducing costs. This is normally organized by the industry transitioning to process innovation (Benner & Tushman, 2002; Betz, 2011; Drayse, 2011; Grant, 2018).

However, consumer perceptions change with time, and so, without significant changes to the product offering, demand normally declines. But decline is not a foregone conclusion—different industries exhibit different life cycles (Grant, 2018). For some of them, such as in essential sectors like food, decline does not occur, at least not in a manner comparable to, say, products in the consumer electronics industry. Recently, however, concerns about sustainability, in particular growing consumer perceptions on the urgency of addressing the climate and improving societal obligations, have begun to create challenges for industries that were previously considered to be immune to decline (Christensen, 1997; Nidumolu, Prahalad, & Rangaswami, 2009). For those industries, managing this new reality and checking potential decline are of strategic importance.

Products or industries experiencing decline often elect to abandon production and move on (Kotler & Keller, 2016). But others retain the product and attempt to imbue it with reinvigorated properties. This can be done through innovation, technological or otherwise (Kaplinsky & Morris, 2000). If managed successfully, the adoption of new technology, either through product or process innovation, can breathe new life into mature products, see Figure 3-3 (Kotler & Armstrong, 2010; Christensen, 1997). Indeed, companies such as General Electric have successfully innovated for over a century: the company’s flagship product, the light bulb, has been adapted and updated countless times, and now uses LEDs. Thus, even for mature products and industries, technological change can throw industries back into a fluid state, altering the established norms (Abernathy, Clark, & Kanro, 1983).

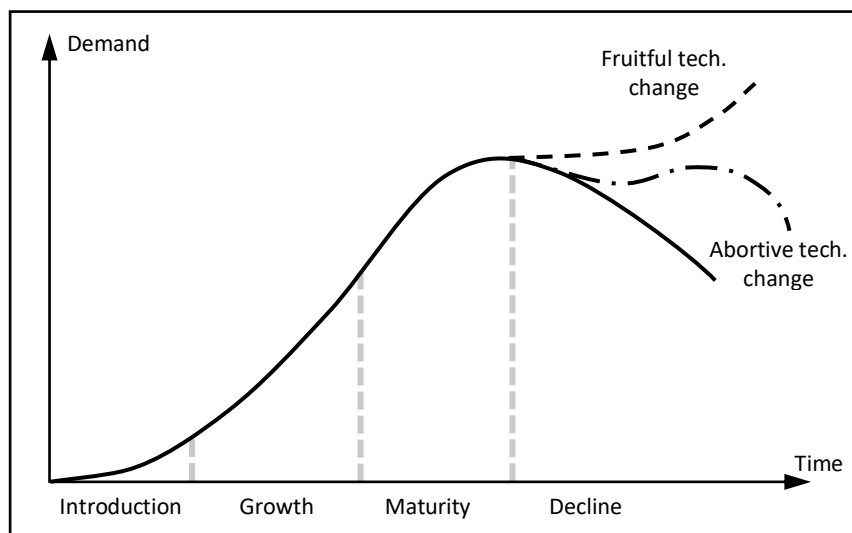


Figure 3-3: Hypothetical trajectories in the product life cycle caused by adoption of new technology and subsequent reevaluation by the consumer.

3.1.5 Innovation in Mature Industries

In mature industries, it is comparatively difficult for firms to establish a sustainable competitive advantage through technological innovation because technology is easily disseminated in those types of industry (Grant, 2018). In other words, the incentive to adopt new technology is limited compared to other industry types—limited, but still very much possible. Not surprisingly, the innovation that does occur is largely process-oriented, revolving around incremental improvements to assets and core technologies. This approach de facto deprioritizes disruptive innovation because the latter increases variability, and therefore uncertainty (Albors-Garrigos & Hervas-Oliver, 2013; Hannan & Freeman, 1984; Tushman &

Romanelli, 1985). But firms that focus solely on process innovation within narrowly defined parameters, that is to say focus on streamlining the status quo value chain, often do so at the cost of strategic flexibility and long-term prosperity (Benner & Tushman, 2003; Day & Schoemaker, 2005; Seidel & O'Mahony, 2014; Smith & Tushman, 2005). Aiming all innovative efforts squarely at preexisting capital and core technology can mean that, if major shifts in the external environment suddenly occur, such as consumer perceptions shifting towards greater sustainability practices, the firm may not be able to adapt quickly enough.

Thus, managers should not be so ready to accept industry practice and conventional thinking and should instead be readier to embrace transformative innovation. Indeed, the case can be made that the phases in the life cycle, such as maturity and decline, have less to do with natural law and more to do with a fixed mindset (Day & Schoemaker, 2005; Kim & Mauborgne, 2015; Stopford & Baden-Fuller, 1994).

3.1.6 Value Chain Analysis as Research Methodology

The aim of a value chain analysis is to identify and evaluate the value drivers. Porter's value chain analysis is a starting point for further, more contextualized, analysis, which has enabled value chain theory to be broad-based and adaptable (Kaplinsky & Morris, 2000).

Even though a buyer may find a product to be valuable, the supply side may think otherwise, believing that the product is unduly expensive to produce and deliver (Kaplinsky & Morris, 2000; Porter, 1985). To extrapolate, the costs associated with adapting a new technology could be significantly higher than the value ultimately perceived by the supply side. As a result, it is important to have a more holistic approach when examining the value associated with a product or innovation—in the case where only the buyer's perspective is considered, it may give a misleading assessment of its market viability. Moreover, the supply-side is not a homogenous actor; it consists of numerous stakeholders with myriad, and at times conflicting, priorities. Understanding their viewpoints can help triangulate where the driving forces of, and counterforces to, proposed innovation are in the value chain (Kaplinsky & Morris, 2000). To identify, and understand the reasons behind, these diverging priorities, interviewing managers and regular employees throughout the chain is one possible method.

3.2 Consumer Perceptions

3.2.1 General Overview

There is a plethora of factors that affect consumer behavior and the purchase decision process. These range from the culture of the country and macroeconomic phenomena down to individual minutiae, such as the consumer's age and psychological factors (Hawkins & Mothersbaugh, 2016; Kotler & Keller, 2016). It is in this latter category that consumer perceptions are found. In marketing, perceptions refer to the process by which consumers filter, process, and analyze the stimuli that are constantly being gathered by their senses. To cope with the overabundance of information they are exposed to, people screen out most of this in favor of continuously updating their view of the world based only on information that is considered important. In so doing, a meaningful and intelligible picture of the world is formed, empowering people to function and enabling consumers to select which products are deserving of their attention (Armstrong & Kotler, 2009).

Not only do perceptions serve to condense collected stimuli down to useful, actionable information, they also prioritize stimuli that reinforce the individual's previous perceptions, while filtering out stimuli that go against them. In the case of the consumer, this means that, through selective distortion, they recall good points about the products they already prefer and tend to neglect positive aspects about competing products. Penetrating this filter is one of the chief responsibilities of consumer marketing, and one tool for doing so is by manipulating perceived value (Kotler & Keller, 2016; Solomon, Bamossy, & Askegaard, 2006). One such method relies on the fact that consumers tend to recall experiences far more vividly than factual information (Sekaran & Bougie, 2016). Thus, the perceived value that a consumer associated with a familiar product can be exploited by leveraging it towards a new, unfamiliar product by way of analogy or vicarious experience (Ait El Houssi, Morel, & Hultink, 2003; Goode, Dahl, & Moreau, 2010; Gregan-Paxton & Moreau, 2003).

It is through perception that the consumer first assesses the value of a product. The consumer does this by weighing the utility of the product against their lifestyle and concept of self, and sizing up the level of agreement between them (Hawkins & Mothersbaugh, 2016). The self-concept and lifestyle of a consumer are influenced by internal factors, such as emotions, and

external factors, such as culture and social paradigms. As a result, changes in the external environment, such as paradigm shifts in what is considered to be acceptable corporate behavior, are internalized by the consumer. This affects their perception, and correspondingly what they perceive to be valuable in a product offering (Hawkins & Mothersbaugh, 2016). Marketers must therefore make use of trends in society if they wish to penetrate the consumer's perception filter and persuade them of the merit of a particular product (Kotler & Keller, 2016).

3.2.2 Putting a Price on Value

Price is intimately associated with whether or not the consumer perceives a particular product offering to be valuable, i.e. if they believe it warrants purchase (Armstrong & Kotler, 2009). Part of this relationship is framed by pricing policy; in recent decades, there has been a marked shift away from cost-based pricing, that is to say pricing premised on cost accounting and economic models, and towards value-based pricing (Nagle & Hogan, 2006; Hinterhuber, 2008). Value-based pricing refers to price policy that is governed by the consumer's perceived value of the product, and there is mounting evidence in favor of its viability in business (Cavusgil, Chan, & Zhang, 2003; Ingenbleek, et al., 2003; Johansson, et al., 2011). Most product prices are set somewhere between these two extremes, see Figure 3-4, but the important takeaway is the implied interplay between price and value. More explicitly, that the price paid by consumers is not just a reflection of the production cost, but also of the added value of the product offering, as perceived by the consumer (Armstrong & Kotler, 2009).

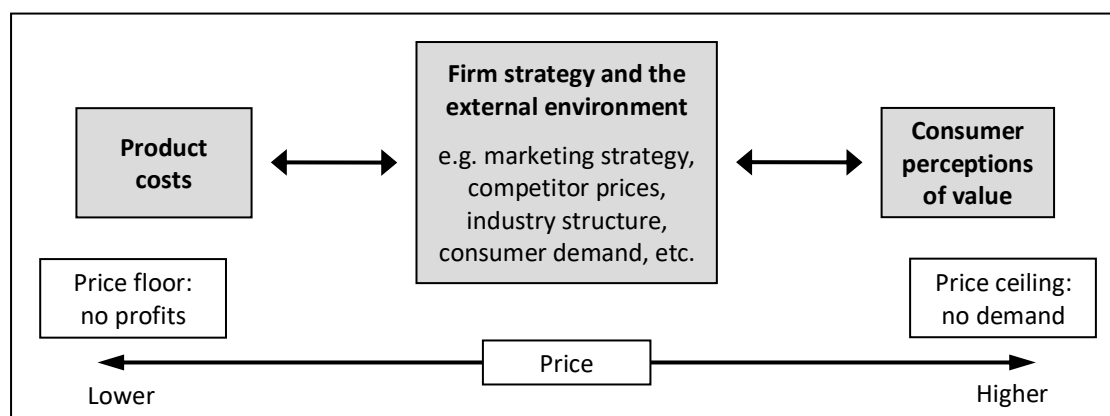


Figure 3-4: Price policy spectrum and considerations in setting price. Source: Armstrong & Kotler (2009).

This interplay can create serious headaches for management because measuring that added value is difficult, often yielding ambiguous results (Armstrong & Kotler, 2009). There are also constituent risks involved: too high a price entails loss of customers, while too low a price can mean making a loss on every item sold. The dilemma is magnified when innovations are thrown into the mix because they constitute an added layer of uncertainty. It is therefore apparent that the consumer warrants consideration when managing an innovation that could also affect the consumer's perceptions of the product.

3.2.3 Consumer Perceptions as Research Methodology

There are numerous research methods devised by marketers to determine the values consumers perceive in a product. Two of these are the multi-attribute survey and the choice survey.

A multi-attribute survey gauges consumer perception towards a brand or product (Ozer, 1999; Schiffman & Wisenblit, 2015). Such a survey asks consumers to rank how important a product attribute is—a classic formulation is a scale of 1 to 10, where 1 is not important and 10 is very important. The aim is to capture how well a product correlates with a consumer's self-image, i.e. the agreement between what the consumer desires and what the product offers (Hawkins & Mothersbaugh, 2016). This can help managers gain insight into potentially overlooked products or untapped consumer segments. Unfortunately, it is often difficult for consumers to answer honestly when they explain the importance of certain factors, not least because they, themselves, may not know the answer. One approach for mitigating this problem is by reframing the questions from an abstract 1-10 scale and instead anchoring them to something tangible, like money (Armstrong & Kotler, 2009). Therefore, it is not uncommon to ask consumers about marginal cost—how much more they might be willing to pay because of a certain product characteristic.

The processes that influence everyday consumer choices are fluid and ethereal (McFadden, 1986). It is therefore prudent to concretize choice problems as much as possible. To do this, one method is to present hypothetical choice problems to the consumer in an effort to gain insight into how they might interpret and react to new products. This is called a choice survey. It presents a list of conceptual scenarios in which the consumer is prompted to describe their reactions. The scenarios are designed to be realistic and relatable—it has been consistently

found that consumers can better describe their attitude towards a new product if they can first relate it to an experience that is already familiar to them (Ait El Houssi, Morel, & Hultink, 2003; Goode, Dahl, & Moreau, 2010; Gregan-Paxton & Moreau, 2003). The choice survey is especially useful when studying the market viability of new products because it updates the consumer's perceptions of what is possible (Schiffman & Wisenblit, 2015).

3.3 Chief Takeaways and Relevance to the Study

The concept of value is central to any product offering, and its definition is dependent on the stakeholder perceiving it (Armstrong & Kotler, 2009). Correspondingly, managing changes in the value chain, such as the implementation of a new technology, ought to involve careful consideration of, and weighing between, the myriad perspectives of the stakeholders. Abridged, an innovation that adds value to one stakeholder may do the opposite for another, and thus some may resist innovation while others favor it.

Indeed, investigating a value chain merits a holistic approach. This covers not only the study of multiple stakeholders, but also of the linkages between them. Those linkages help to illustrate the dependencies between the stakeholders, and thereby shed light on some of the underlying reasons for why a value chain avoids or embraces innovation. This is applicable to the study given that one of the research questions is the mapping out of the driving and counterforces to technological innovation in the meat value chain.

The dynamic best-before label is an example of a process innovation insofar as it aims to streamline resource usage and logistics in the meat value chain. As this is the object of the study, it is recalled that meat is a mature industry, see Chapter 2. Noting that the largest supply-side stakeholders in the food industry prioritize process over product innovation, the supply-side stakeholders investigated in the empirical component of the study are therefore narrowed down to the larger ones (Juchniewicz & Łukiewska, 2017).

Moreover, it is the consumers who are the ultimate arbiters of whether an implemented innovation warrants their attention and subsequent purchase. Given the outsized role played by the end consumer when it comes to meat waste, coupled with mounting public concern over sustainability, waste, and the environment, the consumer is of governing importance to

the study. Investigating the practical viability of implementing the dynamic best-before label should therefore cover the consumers, both with respect to their current perceptions towards meat products and with respect to how those perceptions might change as a result of a dynamic best-before label. Perceptions are difficult to study accurately, but by invoking money, specifying familiar and self-explanatory value drivers, and presenting tangible experiences and scenarios to the end consumer, the ambiguity can be reduced.

3.4 Derived Operationalizations and Hypothesis Tests

Building on the previous Section and Chapter 2, the principal topics to be investigated in the empirical component of the study can now be developed. To begin with, the concepts heretofore discussed are now in a position to be operationalized in preparation for study of the end consumer.

The theoretical concept of value is intrinsic to consumer goods and value chains. Yet the concept has neither a ubiquitous definition nor a universal unit of measurement—the very meaning of the word is in the eye of the beholder. This is remedied by substituting value with money, or price. Using this as a guide, the theoretical concept of “value” is operationalized into “marginal product price,” while the characteristics of meat products are operationalized into measurable value drivers, see Table 3-1. The selection of meat product value drivers is consistent with those cited in previous studies, see Section 2.1.

3 Theoretical Framework

Table 3-1: Operationalizations of theoretical concepts and transformation into measurable value drivers.

Theoretical concept		Operationalization (value driver)
Governing concept	Value of a product from a consumer perspective	Marginal product price
	Culinary quality of meat product	Flavor of the meat product
Sub-concepts	Locally sourced meat that supports national farmers	Perceived quality of a particular meat product stamped with “Swedish Meat”
	Branding of meat product company	Perceived quality of the product brand for a particular meat product
	Sustainability of meat product and the company’s practices	Perceived sustainability of a particular meat product
	Risk of sickness due to contamination of meat product	Perceived safety from food poisoning when consuming a particular meat product
	Preservability of meat product	How long a particular meat product can be stored before spoiling
	Dynamic best-before labeling on meat	Utility of a dynamic best-before label

Utilizing the value drivers above, hypothesis tests can be formulated to estimate the value of the dynamic best-before label in the context of what is already familiar (and valuable) to the consumer, i.e. compared to preexisting value drivers, such as flavor, branding, etc. These hypothesis tests should evaluate if the dynamic best-before label is perceived to be of greater value than the other value drivers—if the dynamic best-before label is less or equally valuable, it can be safely assumed that the consumer does not find significant value in it. Bearing that in mind, a one-tailed hypothesis test H_A is formulated, where

$$H_A = \begin{cases} H_0: & \text{the dynamic label **does not** add more value than value driver } k \\ H_1: & \text{the dynamic label **does** add more value than value driver } k \end{cases}$$

$$\text{i.e. } H_A = \begin{cases} H_0: & \mu_{\text{dynamic}} - \mu_k \not> 0 \\ H_1: & \mu_{\text{dynamic}} - \mu_k > 0 \end{cases}$$

where value driver k is a value driver distinct from the dynamic best-before label and sourced from Table 3-1.

Another set of hypothesis tests is developed based on decision-making scenarios that are presented to the consumer. Building on the consumer perceptions research methodology, these scenarios are designed to be familiar to, and relatable for, the end consumer, see Table 3-2. The scenarios are presented with two variations: the first is without a dynamic best-before label (control scenario), and the second is with a dynamic best-before label (test scenario).

Table 3-2: Scenarios formulated for the end consumer, for use in the empirical part of the study.

Scenario reference	Description of control scenario	Description of test scenario
Shopping	The consumer is about to buy a meat product when they see that the conventional best-before date recently expired.	
Returning	The consumer is heading home from the store when they see that the conventional best-before date on the meat product that they purchased recently expired.	Same as the control scenarios, but now a dynamic best-before label is added that that contradicts the conventional label, i.e. that states that the quality of the meat is fit for consumption.
Cooking	The consumer is about to cook with a meat product when they see that the conventional best-before date recently expired.	
Eating	The consumer is eating dinner with others when they are told by the cook that the conventional best-before date on the meat product recently expired.	

The objective is to estimate the change in consumer perceptions towards meat that is bordering on the conventional best-before date, given that the meat does or does not have a dynamic best-before label. Here, too, a one-tailed hypothesis test H_B is formulated, where

$$H_B = \begin{cases} H_0: & \text{Consumers **do not** perceive themselves to be more likely to use} \\ & \text{meat that has expired according to the conventional BBD, given} \\ & \text{that the dynamic BBD states that the meat is safe to eat.} \\ H_1: & \text{Consumers **do** perceive themselves to be more likely to use meat} \\ & \text{that has expired according to the conventional BBD, given that} \\ & \text{the dynamic BBD states that the meat is safe to eat.} \end{cases}$$

$$\text{i.e. } H_B = \begin{cases} H_0: & \mu_{\text{with dynamic}} - \mu_{\text{without dynamic}} \not> 0 \\ H_1: & \mu_{\text{with dynamic}} - \mu_{\text{without dynamic}} > 0 \end{cases}$$

3 Theoretical Framework

Having applied the theoretical framework to establish these operationalizations and hypothesis tests, the foundation has now been laid for designing the remainder of the study. This is the topic of the next chapter.

4 Methodology

“Never mind the maneuvers, just go straight at them.”

—Horatio Nelson

The methodology chapter examines the research approach taken in the study. Citing a deductive method, the research design was derived from the theoretical framework. The construction of this design is presented and defended here. This is done in an elementwise fashion, with the literature review method being discussed first, the method for the quantitative primary data coming second, and the qualitative primary data coming last. In each of these Sections, the collection, processing, and analysis of the data are discussed. At the end of each Section, the robustness of the research design element, in terms of validity, reliability, limitations, and ethical considerations, is critically reviewed.

4.1 Research Approach

It is recalled that the purpose of the study is to investigate the practical viability of implementing new technology (dynamic best-before labels) in the meat value chain. The very nature of this problem encompasses the concept of value and value chains. A deductive approach was therefore prescribed, i.e. a general theoretical framework was adopted to study the problem and fulfill the research objectives (Sekaran & Bougie, 2016). Such an approach entails that the framework, which consisted of theory on value chains and consumer perceptions, is used to derive specific tests that can then be used to verify the applicability of that theoretical framework to the studied problem. In this case, the first step of generating these tests took place at the end of Chapter 3, where concepts were operationally defined,

and hypothesis tests were formulated based on the literature review. Of note is that hypothesis testing naturally lends itself well to quantitative data, which is to be expected in a deductive process. (Sekaran & Bougie, 2016). Even so, a deductive approach does not preclude qualitative data.

The next step in generating the tests was developing the research design, i.e. a structure for collecting data that could, through analysis and interpretation, be used to test the theory's applicability to the studied problem (Sekaran & Bougie, 2016). Here, too, the theoretical framework played a role. Theory on consumer perceptions makes plain that those perceptions play a decisive role in the market viability of new technology because it is the consumers who decide whether or not an innovation warrants product purchase. Thus, the consumer's views on a dynamic label are of governing importance. Given the large number meat consumers, quantitative data were designated for the hypothesis tests. Furthermore, the theoretical framework on value chains emphasized that, if a more nuanced assessment of the true value of a product or innovation is desired, the views of non-buyers must also be integrated into the analysis. The primary research therefore focused on the collection, processing, and analysis of data sourced from the consumer, while also integrating data from the supply side, including retailers, meat producers, and industry groups.

4.2 Overview of Research Design

The research design was steered by the research approach and by the triangulations that became relevant to the study as time went on. These triangulations touched on theory, data, and method, and are discussed below.

The foundation of the deductive research approach was theory on value chains and consumer perceptions. These theories proffered different analytical perspectives on the subject, i.e. theory triangulation was employed (Sekaran & Bougie, 2016). The former theory demonstrated the importance of integrating multiple stakeholders' perspectives on the value of a given product (or innovation), while the latter drove home the need to consider consumer perceptions. These two theoretical implications were used to design the empirical part of the study and to analyze the data.

Moreover, because the value chain theoretical framework demonstrated the importance of investigating multiple stakeholders' views on product value, it was implied that the data would cover multiple primary sources. In other words, that data triangulation would be employed (Sekaran & Bougie, 2016). This technique was integrated into the research design by creating two streams of primary data: one for the end consumer and one for the supply side.

The data types collected from the abovementioned data streams were selected by first scrutinizing the stakeholders. Given that there are far more meat consumers than there are supply-side stakeholders, a quantitative questionnaire was designed for the end consumer, while supply-side data were collected through semi-structured interviews. This method triangulation meant that more nuanced perspectives could be captured (Sekaran & Bougie, 2016).

To account for these triangulations, a mixed method research design was deployed to carry out the study, i.e. a design that integrated both quantitative and qualitative data (Sekaran & Bougie, 2016). This research design consisted of three main elements: a quantitative questionnaire directed at the end consumer; semi-structured interviews with supply-side stakeholders in the meat value chain; and a continuous literature review, carried out in parallel with the other two design components. Thus, the study used the individual as the unit of analysis, either the end consumer or a representative/employee of a supply-side stakeholder (Sekaran & Bougie, 2016). These individuals were studied on a cross-sectional time horizon, as this was concluded to be appropriate for fulfilling the research objectives. For convenience, a schematic overview of the research design timeline is illustrated in Figure 4-1.

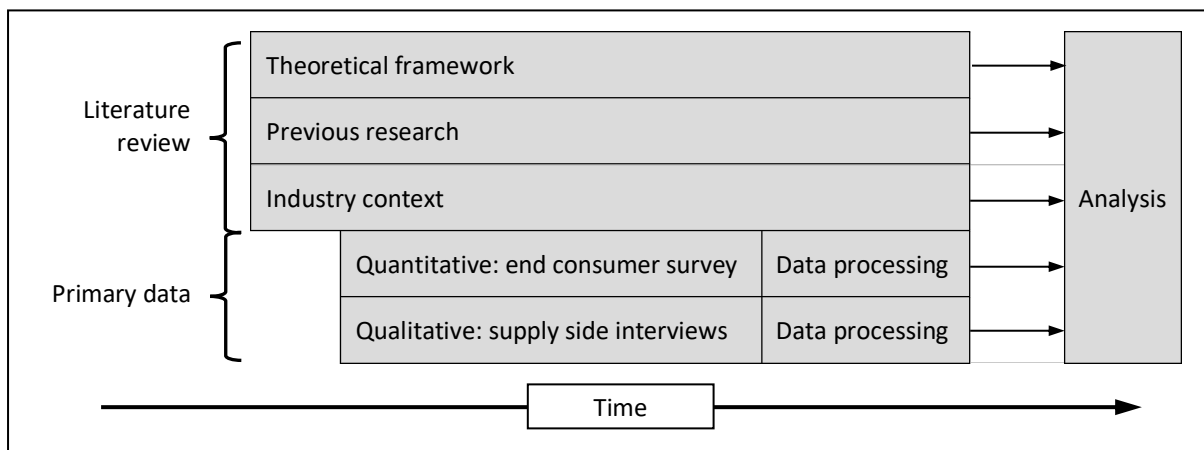


Figure 4-1: Schematic timeline of the mixed method research design adopted for the study.

In summary, a mixed method research design was adopted to carry out a cross-sectional study of the end consumer and the supply side, utilizing triangulation techniques with respect to theory, data, and method. By utilizing the secondary data from the literature review and deploying the operationalizations and hypothesis tests, formulated at the end of Chapter 3, to steer the empirical study, the research design was well positioned to answer the research questions. The construction of this research design can be discretized into the following components, each of which are described in greater detail in their respective Sections:

- The method used for the literature review, including collection, analysis, and robustness, is described in Section 4.3.
- The method used for the end consumer primary data, including its collection, processing, analysis, and robustness, is described in Section 4.4.
- The method used for the supply-side primary data, including its collection, processing, analysis, and robustness, is described in Section 4.5.

4.3 Literature Review

The first element of the research design concerns the literature review, which encompasses the secondary data and the theoretical framework. Collection and processing of both of these began prior to the empirical components of the study. This was done to ensure that the study built on existing knowledge, as opposed to retracing the steps of previous research, and to provide guidance on how to formulate and execute the primary research (Sekaran & Bougie, 2016). Moreover, it certified that the correct terminology and definitions were used for the remainder of the study.

The secondary data used in the study, covering the industry context and previous research, were sourced from peer-reviewed articles and textbooks. The Lund University shared search engine, LUBsearch, was the main conduit used for collecting these data.

The sources used for the theoretical framework are textbooks written by reputable authors and peer-reviewed articles written by academic researchers. Many of the former, such as Michael Porter and Robert Grant, are renowned for their work in their respective fields.

4.4 Primary Data from End Consumers

The second element of the research design is the quantitative primary data collected from the end consumer. Referring back to the research questions, the questionnaire aimed at the end consumer in the meat value chain was designed to shed light on the following points:

- How consumers value the various characteristics of a meat product, i.e. quantify the value drivers, and compare these to the perceived value of a dynamic best-before label. This is addressed with hypothesis test H_A , see Section 3.4.
- How a dynamic best-before label, vis-à-vis a conventional static label, affects the end consumer's perceptions of the freshness of meat products. This is addressed through the scenarios and with hypothesis test H_B , see Section 3.4.

The remainder of this Section describes how this was achieved.

4.4.1 Collection of Consumer Primary Data

The questionnaire is provided in Annex A, having been translated into English from the original Swedish copy that was distributed to the respondents. It was only accessible online, having been distributed via a nationwide network akin to a rotary club.

The questionnaire was divided into four sections:

- Section 1: Demographics
- Section 2: Valuable Characteristics of Meat
- Section 3: Dynamic Best-before Labels
- Section 4: Using a Dynamic Best-before Label

Each section built on the information gained from the previous ones, so as not to confuse or overwhelm the respondent (Sekaran & Bougie, 2016). The demographic section was placed at the beginning of the questionnaire, which tends to increase the likelihood that the respondent completes the survey. Section 1 also asked the control questions for the scenarios in preparation for the choice survey that was later presented in Section 4, i.e. the control questions were asked before the concept of a dynamic best-before label had been introduced.

Section 2 was a multi-attribute survey on meat products intended to quantify the value drivers, for which the operationalizations are described in Section 3.4. Though it is obvious that directly asking survey respondents about “value” will render the results unreliable, it was not self-evident how to measure this concept while preserving validity and reliability. Referring to the theoretical framework, this was remedied by substituting value with marginal product price, i.e. how much more the consumer would be willing to pay for a particular meat product as a result of a stated characteristic. For example, when the respondent was asked to consider the value driver of flavor by answering the question “How much more are you willing to pay for a particular meat product because you feel that it tastes better?” the possible answers were presented as radio button percentages (e.g. “0%”, “20%”, etc.). They were also permitted to answer “Other” and provide their own percentage.

Section 3 introduced the concept of a dynamic best-before label through visual aids, and asked the respondent to quantify the value of such a label in a manner analogous to the questions asked in the previous section.

Section 4 was a choice survey that presented scenarios in which a meat product has expired according to the conventional best-before label, but has not expired according to the dynamic label; the respondent was then prompted to select an emotional state that they most resonated with, corresponding with whether or not they would continue to use the meat. The emotional states were later coded as negative (e.g. “anxious/regretful”) or neutral (e.g. “indifferent/ignore it”). It was assumed that a positive was unnecessary—it does not seem reasonable that consumers would be overjoyed at the thought of receiving conflicting information about the state of a perishable foodstuff. All the same, respondents were also permitted to answer “Other” and provide their own explanation. Their answers were then compared with their responses to the control questions in Section 1.

There were numerous respondents who chose to answer some survey questions with “Other:” and provided their own responses. Where applicable, the views expressed in these answers were treated as qualitative data, and are analyzed separately in the study.

4.4.2 Statistical Analysis of Primary Data from End Consumers

The first data processing in the consumer survey concerned hypothesis test H_A . This was formulated as a one-tailed test because what was of interest was whether the dynamic best-before label was perceived to be more value than the other value drivers, not if there was a difference in the perceived value. It is implicit that what is truly being measured here is the consumer's perceptions towards particular value drivers in meat products, not the true price premium that they pay for in a store. The answers were formulated on a ratio scale, with 0% corresponding to the consumer not willing to pay anything extra for a particular meat product because of a certain value driver; the scale tended to infinity, but most answers were given within the range [0% ,100%]. The test was executed using a one-tailed two-sample t-test in MATLAB, and was performed using different sample variations for the value drivers. This was decided because, after the unusable answers were filtered out, all the value drivers had unique sample sizes. The test was performed at a significance level of $\alpha = 0.01$.

Respondents were then asked if they believe a dynamic best-before date enhances, that is to say adds value to, any of the other value drivers. This is done to control for the case that consumers may not be willing to pay a premium for the dynamic label but still believe there is some value inherent to such a label. No hypothesis testing is performed for this. Instead, the answers "yes" and "no" are simply coded as 1.0 and 0, respectively, and summarily averaged across the sample. Note that the value drivers listed for this question are not the same as those listed in hypothesis test H_A ; after all, it can be surmised that the consumer does not believe that a dynamic best-before label adds value to the value driver of "flavor." Leaving it as a possible option was therefore concluded to create more confusion/irritation for the respondent the scientific merit of keeping the value drivers constant throughout the survey.

The next hypothesis test, H_B , was aimed at the scenarios, using input data from the choice survey. The objective was to determine any statistically significant change in consumer perceptions towards meat that is bordering on the conventional best-before date, given that the meat does or does not have a dynamic best-before label. Here, too, a one-tailed hypothesis test was formulated. All improper answers, such as those where respondents answered "Other:" but did not provide explanations that could be coded quantitatively, were filtered out from both the control scenarios and the test scenarios. This test was executed

using a one-tailed two-sample t-test in MATLAB., and performed at a significance level of $\alpha = 0.01$.

The results of the hypothesis tests were thereafter used as a foundation for further discussion and conclusions.

4.4.3 Robustness of the Consumer Survey

4.4.3.1. Validity and Reliability

For the consumer survey, the target population was the meat-eating population of Sweden. In a country of 10.2 million people, it is estimated that 95% of the Swedish population consumes meat, while only 453 people responded to the survey (Djurens Rätt, 2014). Assuming that the sample is generalizable to the target population, 453 people represent the population of Swedish meat consumers with a confidence level of 95% and a 2% level of precision (margin of error), for which the calculation is provided in Annex B. Note, however, that the sample is not actually generalizable because it was only distributed online through a rotary club-like network (in other words not the entire country). Even so, this suggests that the quantitative study exhibits a satisfactory level of reliability (Sekaran & Bougie, 2016). Moreover, the validity of the quantitative study to the external environment was improved by the fact that the respondents listed their occupations, which, after processing, showed that the sample was a reasonably representative cross-section of the Swedish population. Even so, care should be taken not to superimpose the results of the survey onto the general Swedish population.

The validity of the questions themselves was deemed to be satisfactory, as the general outline of the survey and the formulation of the questions were discussed with academics on food science prior to distribution, and because the survey questions address the research questions of the study. It is also noted that, for the majority of the survey questions, respondents were given an "Other" option, in which they could write out more specific answers. Though this demanded more processing time, the alternative may have resulted in dishonest answers, which would have hurt both validity and reliability (Bryman & Bell, 2018). Furthermore, the fact that it was distributed online may have also improved validity because it gives the respondent time to think and to return to previous sections (Sekaran & Bougie, 2016).

4.4.3.2. Limitations

It is generally difficult to ask an individual about their consumption behavior and to expect a realistic answer, especially if that behavior revolves around a product that is not yet on the market. This is a limitation of the quantitative survey, but it has been partially addressed by investigating consumer perceptions, which is easier to measure than behavior. Moreover, by linking the survey questions to money and tangible, relatable experiences, the problem of concretizing hypothetical products is somewhat mitigated.

4.4.3.3. Ethics

The consumer survey did not request any personal information beyond age, occupation, whether they lived in Sweden, and the number of members in their household. They were also informed of the purpose of the survey, i.e. that it was for academic purposes. In so doing, the quantitative study maintained ethical standards (Sekaran & Bougie, 2016).

4.5 Primary Data from Supply-side Stakeholders

The third and final element of the research design is the qualitative data sourced from the supply-side stakeholders in the Swedish meat value chain. These data took the form of interviews with a variety of representatives employed by organizations situated in, associated with, or studying the meat industry. Referring back to the theoretical framework, the interviews were conducted to gain insight into the linkages between the stakeholders, and thereby the dependencies between them. In so doing, a more comprehensive overview of the meat value chain could be obtained. This would facilitate the work of identifying the management challenges involved in implementing a dynamic best-before label, thereby helping to answer the research questions and fulfilling the research objective of understanding the driving and counterforces to technological change in the meat industry.

4.5.1 Collection of Supply-side Primary Data

The interviews were conducted with a semi-structured approach—that is, each participant was interviewed on the same topics, but the sequence varied and the questions were not repeated verbatim to each interviewee (Sekaran & Bougie, 2016). The selection of these topics was steered by the research questions, and derived from the secondary data and theoretical

framework, in which it was established that innovation in the meat industry is process-oriented, i.e. focused on the integration of new technology throughout the value chain. The questions asked in the interviews therefore covered the following topics:

- the practical and logistical viability of implementing a dynamic best-before label in the Swedish meat supply chain;
- driving forces and counterforces to that implementation, with particular emphasis on the needs and perspectives of the various stakeholders;
- consumer perceptions towards best-before dates, both static and dynamic;
- waste in the Swedish meat industry.

Ten interviews were conducted, with each interview lasting approximately 20 minutes. Metadata on the interviewees is provided in Annex C. The interviewees represented a variety of stakeholders, and these can be categorized into meatpackers, retailers (supermarket chains), industry and consumer groups, and academia and start-ups in food science. All interviews were conducted over telephone.

4.5.2 Qualitative Analysis of Primary Data from Supply-side Stakeholders

The interviewee responses were transcribed during the interviews. Once transcribed, the data were sorted into themes by first attributing codes to the information (Sekaran & Bougie, 2016). In line with the research objectives, the codes were defined as “driving force” and “counterforce” to the implementation of a dynamic best-before label in the value chain. The results deemed to be important were then presented according to stakeholder category.

4.5.3 Robustness of the Stakeholder Interviews

4.5.3.1. Validity, Reliability, and Limitations

The topics covered in the interviews directly pertain to the research objectives of the study. Moreover, the literature review directed the choice and formulation of the topics, consistent with a deductive approach. It is therefore concluded that the qualitative component of the empirical study yielded valid results. However, the reliability is reduced by the limited number of companies that were included in the study. For instance, for the category “meatpackers,” two interviewees were included, but they both represented Scan AB.

A benefit of conducting semi-structured interviews is that the open-ended questions encourage emotional responses and stories, which can be useful because those stories often paint a much more detailed picture of the situation (Bryman & Bell, 2018). However, a random error was introduced by the fact that a script was not utilized for the interviews, nor were the topics discussed in the same order for all interviewees. This inconsistency introduces an uncertainty in the primary qualitative data.

One of the disadvantages of telephone interviews, relative to face-to-face interviews, is that the latter better enable the interviewer to discern emotions, not least by being able to detect body language and facial expression (Sekaran & Bougie, 2016). While telephone interviews were opted for to be able to disregard geographical limitations, this may have negatively impacted reliability, and therefore constitutes a limitation of the study.

4.5.3.2. Ethics

All interviewees were kept anonymous unless explicit permission was given for their name to be published. It was also communicated to them that the interview was for academic purposes. This setup was explained to each interviewee, and care was taken to ensure that they all replied in the affirmative when asked if they understood and agreed. In so doing, ethical standards were maintained for the qualitative research component of the study (Sekaran & Bougie, 2016).

4.6 Symbiosis

Having described the overarching research design, along with that of the constituent elements, it is prudent to reflect on how these parts play off each other. It is clear that the quantitative survey focuses on the meat consumer, of whom there are far more than supply-side stakeholders. Thus, the interviews were designed to capture more detail at the expense of fewer data points. Interviewees are able to describe where they believe the sources of innovation resistance and advocacy are located in the value chain, and what they believe consumer perceptions are towards the product. The latter is verified by the consumer survey, revealing how far off the supply-side stakeholders are in their assessment of the situation.

The outcome of the research design, the results, are the subject of the next chapter.

5 Empirical Data and Analysis

“What can be labeled, packaged, mass produced is neither truth nor art.”

—Marty Rubin

This chapter accounts for the processed results of the empirical data. The first Section presents the statistical conclusions of, and qualitative answers from, the consumer survey, while the second Section summarizes the findings from the qualitative interviews with the supply-side stakeholders.

5.1 Consumer Survey

The results of the consumer survey are presented below. Beyond just statistical processing and brief analysis, the results of the qualitative consumer answers are also summarized and analyzed.

5.1.1 Multi-attribute Survey: Value Drivers

Respondents were asked how much more they would be willing to pay for a particular meat product as a result of a certain value driver. In so doing, it is implicit that what is truly being measured is the consumer’s perceptions towards particular value drivers in meat products. The results are given in Table 5-1, ranked from biggest to smallest price premium volunteered by the consumer. The highest-ranking value drivers are flavor and whether the product is sourced domestically, which is consistent with the findings in Chapter 2. (Those factors also exhibit relatively high spreads, but much of this can be attributed to responses that exceeded 100% but were still assessed to be realistic answers, i.e. were not filtered out.) Note that the

dynamic best-before label (BBL) is ranked second-to-last. This suggests that a dynamic best-before date is not a comparatively important value driver for the consumer, although this must be confirmed through hypothesis testing.

Table 5-1: Value driver samples, means, and standard deviations after non-answers are filtered out.

Value driver	Sample size	μ [-]	σ [-]
Flavor	417	0.322	0.231
Swedish meat	404	0.308	0.183
Sustainability	417	0.206	0.211
Safety	390	0.191	0.226
Brand	421	0.113	0.161
Dynamic BBL	425	0.106	0.124
Perishability	409	0.074	0.121

Hypothesis tests are now performed to verify this assessment by comparing the price premium for a dynamic best-before label with the corresponding premiums for the other value drivers (the precise formulation of hypothesis test H_A is given in Section 3.4.). The tests are performed at a significance level of $\alpha = 0.01$, and the results are presented in Table 5-2, alongside their constituent conclusions, for convenience.

Table 5-2: Hypothesis test results and conclusions on meat product value drivers vis-à-vis dynamic BBL. Tested with a one-tailed two-sample t-test at a significance level of $\alpha = 0.01$. The dynamic BBL sample size is 425.

Value driver	Sample size	p-value	Result	Conclusion
Taste	417	1.0000	Do not reject H_0	Dynamic BBL is not more valuable.
Swedish meat	404	1.0000	Do not reject H_0	Dynamic BBL is not more valuable.
Sustainability	417	1.0000	Do not reject H_0	Dynamic BBL is not more valuable.
Safety	390	1.0000	Do not reject H_0	Dynamic BBL is not more valuable.
Brand	421	0.7568	Do not reject H_0	Dynamic BBL is not more valuable.
Perishability	409	0.0001	Reject H_0	Dynamic BBL is more valuable.

The results confirm that, for the overwhelming majority of the value drivers, a dynamic best-before label is not perceived by the end consumer to be of statistically greater value compared to the other value drivers. The one exception to this is perishability, which is noteworthy considering that dynamic best-before labeling is presumed to reduce perishability insofar as it yields a more accurate, and less conservative, estimate of the meat quality.

Respondents were also asked if they believe a dynamic best-before date adds value to other characteristics, that is to say value drivers, of the meat product. This is done to control for the case that consumers may not be willing to pay a premium for the dynamic label, as suggested by the first hypothesis test, but still believe there is some value inherent to such a label. By coding “yes” as 1.0 and “no” as 0, the results can be presented as in Table 5-3, with the value drivers ranked highest to lowest in the affirmative. Note that the value drivers here are not identical to those in the previous tables.

Table 5-3: Consumer perceptions towards the value added by a dynamic BBL to other value drivers of the meat product.

Value driver	Respondent size	μ [-]
Sustainability	339	0.75
Food safety	236	0.52
Overall quality	229	0.51
Convenience	191	0.42
Product brand	32	0.07

Of the value drivers listed, product sustainability is ranked highest, with 75% of respondents reporting that it would be enhanced with a dynamic best-before date. Of further interest is that roughly half of the respondents state that food safety and overall product quality would be improved if the meat product included a dynamic label. This suggests that, despite hesitation from the consumer to outright pay for such a label, they do also perceive it to deliver some value to the product offering. This added value takes the form of the dynamic label enhancing the value drivers that the consumers *are* willing to pay for, such as sustainability and food safety.

5.1.2 Choice Survey: Scenarios

Respondents were surveyed to determine if there were any statistically significant change in consumer perceptions towards meat that is bordering on the conventional best-before date, given that the meat does or does not have a dynamic best-before label. This was done by probing their reactions to buying, returning, cooking, and eating meat that has been revealed to have just expired, according to a conventional best-before date. They were later asked about the same scenarios, only this time a dynamic label was also present, and it indicated that the meat was still safe to eat. By coding a neutral/positive response to using the meat as 1.0 and a negative response to using the meat as 0, the results can be presented according to Table 5-4. Judging by the means μ , it seems as though the willingness to use the meat increases across all scenarios when a dynamic label stating that the meat is safe to eat is thrown into the mix, although this must be confirmed through hypothesis testing.

Table 5-4: Scenarios sample size and statistical parameters, where $\mu = 0$ indicates an unwillingness to use the meat, and $\mu = 1$ indicates complete willingness to use the meat. The scenarios are defined in Section 3.4.

Scenario	Sample size	Without dynamic BBL		With dynamic BBL	
		μ [-]	σ [-]	μ [-]	σ [-]
Shopping	443	0.190	0.392	0.639	0.339
Returning	448	0.549	0.498	0.848	0.359
Cooking	448	0.844	0.363	0.911	0.285
Eating	450	0.884	0.320	0.927	0.261

Hypothesis tests are now performed to verify this assessment by comparing the willingness to continue using the meat with and without a dynamic label present (the precise formulation of hypothesis test H_B is given in Section 3.4.). The tests are performed at a significance level of $\alpha = 0.01$, and the results are presented in Table 5-5, alongside their constituent conclusions, for convenience.

Table 5-5: Hypothesis test results and conclusions based on consumer choice survey (scenarios). Tested with a one-tailed two-sample t-test at a significance level of $\alpha = 0.01$. The scenarios are defined in Section 3.4.

Scenario	Sample size	p-value	Result	Conclusion
Shopping	443	0.0000	Reject H_0	Consumers perceive themselves to be more likely to purchase meat that has expired according to the conventional BBL, given that the dynamic BBL says otherwise.
Returning	448	0.0000	Reject H_0	Consumers perceive themselves to be more likely not to return purchased meat that has expired according to the conventional BBL, given that the dynamic BBL says otherwise.
Cooking	448	0.0011	Reject H_0	Consumers perceive themselves to be more likely to cook meat that has expired according to the conventional BBL, given that the dynamic BBL says otherwise.
Eating	450	0.0152	Do not reject H_0	Consumers do not perceive themselves to be more likely to continue eating meat that they have been told has expired according to the conventional BBL, given that the dynamic BBL says otherwise.

For three out of the four scenarios, the results indicate a statistically significant increase in consumer perceptions towards using meat that has expired, given that the dynamic label indicates that the meat is still safe to eat. Considering that conventional labels seem to be quite conservative, this suggests that consumer perceptions towards meat that is about to expire, according to a conventional best-before date, would become more positive if a dynamic label were thrown into the mix.

5.1.3 Qualitative Responses

No interviews were carried out with the end consumers, but the survey offered an “Other:” option as an answer to most of the questions. This was exercised by numerous respondents, and some trends can be discerned from these qualitative data. The first of these is that a large proportion of respondents stated, unprompted on the topic of meat waste, that the dynamic label seemed like a good idea precisely because it would reduce waste. Even so, another discernible trend was consumers who harbored skepticism towards the reliability and

accuracy of such a label. Still others wrote that the dynamic label would be of great utility in reducing meat waste, but laid the blame for meat waste even being a problem squarely at the feet of other consumers. In other words, they recognized the problem of meat waste, but absolved themselves from having a part in it.

As a remark, a handful of people wrote that they did not see the point of a dynamic label because they use their senses to evaluate whether or not a meat product is safe for consumption.

5.2 Interviews with Supply-side Stakeholders

See for Annex C for metadata on the interviewees.

5.2.1 Meatpackers

The meatpacker interviewees were optimistic about a dynamic best-before label. The main reason for this is that they believe the technology could extend the time they have to store and process the meat in-house. This is important from their perspective because, in the status quo, the retailers set inflexible demands that all meat products be shipped to them before two-sevenths of the total best-before time has expired. In practice, this means that the meatpackers only have six days to process, package, and ship the meat, which can be stressful. Because of the structure of the industry, the meatpackers have little room to maneuver, and are largely beholden to the demands set by the retailers. With a dynamic labeling system, their hope is that the retailers might become more flexible when seeing a more realistic, hopefully longer, expiry date for the meat.

The meatpackers expressed some concerns regarding the dynamic label. The industry is heavily reliant on strict refrigeration standards, and thus a dynamic label could disrupt this system. In so doing, efficiency could worsen and waste might increase in the short-term, as both meatpackers and retailers adjust to the new technology. There was also concern towards how accurate such a label might or might not be. While the technology seems like an improvement for the industry, its implementation will be difficult without proper regulation or state encouragement.

5.2.2 Retailers

Retailers harbored skepticism towards dynamic best-before labels. Agreeing that best-before labels are a major reason for meat waste, one manager remarked that it might be more effective to teach consumers to “smell, look, and feel” the meat to determine its freshness. Moreover, interviewees kept returning to investment costs. One manager put it best by pointing out that the costs of adopting such a label would likely fall on the retailers, or at the very least the supply side. The segment of consumers interested in the dynamic label would be the early adopters, too small a group to make a business case for it. Even if the cost for implementing the technology were small, the subsequent learning curve would, in the short term, increase waste and thereby costs. Finally, labels would likely require additional manpower at the supermarkets to watch over and remove each individual meat product that suddenly jumps to its expiry date.

One interviewee pointed out that, in Sweden, government directives and regulation tend to promote change and solidarity in the supermarket sector because the individual firm see less risk if they all make the leap to a new technology together. If the government were to legislate dynamic labeling as mandatory, the industry would quickly accommodate it.

5.2.3 Industry and Consumer Groups

The interviewee from the Swedish Meat Industry Association was highly skeptical towards dynamic best-before labels. They cited the uncertainty inherent to basing a best-before date on only a few parameters, such as temperature or gas concentrations, as being a major flaw in relying on such a label.

In contrast, a sustainability strategist at Stockholm Consumer Association was positive towards a dynamic best before label, stating that it is one of the best solutions currently within reach for reducing consumer food waste. They pointed out that, given the environmental commitments that have been made by all of the Swedish supermarket chains, they should be held to account. One way of doing this would be for them to commit to implementing dynamic labeling in their supply chains, which would be possible given their relative power in the sector. As the technology continues to be developed, there are certain regulatory and technical hurdles, but the main issue, in their eyes, is a lack of motivation. Retailers are the

best tool for reducing consumer waste, since they are so integral to consumers' lives. Thus, the industry should play a larger role in researching the technology.

5.2.4 Academia and Startups in Food Science

The CEO of Innoscentia, a startup focused on developing a dynamic best-before label, promoted what they see as the benefits of such an innovation. They explained that the label would be cheap to produce, likely constituting less than 1% of the current price tag of a piece of meat. Thus, price increases resulting from the label's production costs would be negligible. With the adoption of dynamic labeling, they foresee significant improvements to the waste problem, both from the consumer angle and the supply side. They explained that the Swedish food retailers are the critical players in the value chain for its implementation because the major players all keep a closer eye on the other, competing on very thin profit margins. Thus, the moment one major retailer adopts a new technology, its competitors quickly follow suit. The key is therefore to persuade one major retailer to adopt it, which can be attained by first introducing it to smaller players, and successively building up to the bigger retailers.

The interviewee in food science academia mapped out the nuances in consumer behavior and perceptions towards food waste. Having researched the topic for years, they quipped that, despite statistical data to the contrary, not a single survey respondent nor consumer interviewee of theirs has ever admitted to throwing out edible food. That is to say, consumers are either unwilling to admit or are ignorant of their own role in the food waste problem, and, as a result, a dynamic label would perhaps have no effect at all on waste. They went on to explain that the mechanisms that are used to determine the dates on conventional best-before labels are not fully known by those outside of the industry. Thus, the safety margins used for the conventional dates are not understood, and warrant investigation if the potential utility of a dynamic label in reducing waste is to be estimated realistically.

6 Discussion

“People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.”

—Adam Smith

This chapter enlists the empirical findings to address the research questions and fulfill the research objectives. The first Section addresses the industry as a whole by examining its maturity and structure. The linkages in the chain are then presented and discussed with respect to dynamic best-before labeling. Consumer perceptions on meat and dynamic best-before labels are then integrated into the discussion. Finally, the implications of the findings are discussed with respect to management.

6.1 Industry Maturity and Structure

The value chain of the Swedish meat industry is dominated by a handful of actors, such as ICA Group AB, Axfood AB, and Scan AB. As the product has evolved negligibly over the past few decades, these actors compete, first and foremost, on price. To be able to compete on this front, they have approached the business with a process-oriented mindset, with the ambition of reducing costs and streamlining waste out of the supply chain. This is made demonstrably clear by the supply-side interviews, where interviewees state that refrigeration parameters are tightly controlled and monitored throughout the chain (up until the retailers), with the explicit objective of keeping waste, and thereby costs, under control.

The process-oriented approach to costing in the meat industry makes its effects felt on innovation and technology. Just as the supply chain manages an exhaustive regime of

refrigeration requirements mapped out for almost every activity in the value chain, so too does this regime inhibit the adoption of technologies that threaten to disrupt it. This is to be expected, given the inordinately large investments the industry makes in fixed assets, such as refrigeration and static best-before labeling. Any threat to these investments, such as from a dynamic label, is therefore by default met by skepticism.

The dilemma is compounded by the maturity of the industry, in the sense that producers in such an industry discount the adoption of new technologies simply because technology is so easily disseminated in that type of industry. As a result, the supply-side stakeholders presume that new technologies are, to some extent, futile because they do not yield sustainable competitive advantage—once one firm implements the technology, its competitors quickly follow suit. In that sense, the stakeholders' views towards disruptive innovation can be characterized as cynicism, albeit resigned and demurred cynicism. This is supported by interviews with those in food science academia, who posited that if a dynamic label were to be adopted by one major actor, the others would mimic it in short order.

A consequence of process-oriented mature industry is that both the supply side and the end consumer fixate on cost (price). Meat consumers also prioritize price, or at least maximizing value with respect to price. This is made clear by the results of the consumer survey, in which consumers state that they are willing to pay a 32% premium for improved flavor, and a 30% premium if the meat is Swedish, both of which can be seen as proxies for overall quality; contrast this with branding, for which consumers are only willing to pay an 11% premium. Thus, consumers exhibit behavior typical to mature industries, namely price sensitivity and giving priority to value drivers that maximize utility. It should also be noted, however, that the consumer gives a price premium to sustainability, 21%, suggesting shifting perceptions.

In summary, the Swedish meat industry is a mature one, where the supply side is characterized by a handful of dominant actors that offer a product that changes negligibly, a management mindset that prioritizes incremental efficiency improvements to the value chain, and correspondingly hesitation to adopt innovations that are beyond the realm of their core technologies. Consumers care little for branding, and are instead most interested in paying for a product that is of sufficient quality for the price—in the context of meat, this translates to meat that tastes sufficiently good, is produced domestically and is affordable.

6.2 Linkages in the Meat Value Chain

Recognizing the linkages in a value chain can reveal the subtler relationships at play, and thereby the reasons undergirding, for instance, resistance or support for the implementation of new technology. The maturity of the meat industry denotes the dominance of a select group of stakeholders—in this instance, the retailers, as verified by the interviews with the meatpackers. There, it is explicitly stated that the meatpackers are beholden to the requirements set by the retailers. Thus, despite the former voicing interest in a dynamic best-before label, it is the latter that must be convinced if the innovation is to be implemented. Indeed, this was the point argued by the interviewed consumer groups. In a similar vein, the meatpackers suggested that a dynamic best-before label would likely yield efficiency gains for their enterprises, but that those gains would be canceled out by the retailers unless the latter adjusted their policies to account for the improved shelf life resulting from such a label. In contrast, retailer interviewees stated that the label was of little interest to them.

The dissonance between the views of these two stakeholders is curious and goes beyond a simple power imbalance in the value chain. Referring back to the industry context of Chapter 2, it has been demonstrated that retailer refrigeration is often below the standards recommended by the industry. Given that the perishability of meat is conditional on the surrounding temperature, it is therefore plausible that one reason why the retailers are resistant to the dynamic best-before label is because it would lay bare the insufficiencies of its own refrigerators. Moreover, the subsequent customer complaints that would likely result from such a revelation would be dealt with by the actor that sold the consumer the meat, i.e. the retailers, not the meatpackers or logistics companies. Seen in that light, the dissonance between retailers' and meatpackers' views towards a dynamic best-before label are, perhaps, more heralded than previously assessed.

There are also linkages between the supply side and the end consumer. The previous Section discussed the agreement between the cost-focused outlook of the supply side and the priority the consumer has for quality at an affordable price. In that sense, the fundamental linkage between supply side and demand side has yielded favorable results for both parties. However, that does not preclude the notion that there might be disagreement between the two sides, if scrutinized in greater detail.

6.3 Consumer Perceptions towards Meat and Dynamic Labeling

The bottleneck to the implementation of technological innovation in the meat value chain, that is to say retailers, bespeaks the need to source the impetus for change elsewhere. Reflecting on the shifting consumer perceptions described in Chapter 2, this likely takes the form of the end consumer. Indeed, Swedish meat consumption has plateaued in recent years, the demand for vegetarian alternatives is rising, and appeals for sustainable corporate and societal practices are increasing. Accordingly, consumers stated that they were willing to pay a 21% premium for sustainably produced meat, ranked only behind the value drivers of flavor and “Swedish meat,” and on par with food safety. Moreover, unprompted comments made by a multitude of survey respondents remarked on the capacity of the dynamic label as a tool for reducing waste. This further suggests that consumers are, to some degree, aware of the waste problem and that solutions to it are merited. It is not, however, equally clear that consumers recognize their own role in the meat waste problem.

Analysis of the consumer survey yields two chief takeaways. Linking to pricing policy, the first of these is that consumers do not find value in the dynamic best-before date, insofar as they are not willing to pay a greater premium for it vis-à-vis other value drivers. There is one noteworthy exception to this, that being perishability—consumers are willing to pay more for a dynamic best-before date compared to a meat product that exhibits reduced perishability, i.e. meat with a longer shelf-life. Given the implicit similarities between a dynamic label and perishability, this is somewhat surprising. Considering that both of these value drivers were ranked low, however, it can be inferred that neither warrant price premiums in the eyes of the consumer.

The second takeaway is that, disregarding the consumer’s unwillingness to pay for a dynamic label, they still attribute some value to it. This can be seen through two mechanisms. Firstly, most consumers believe that a dynamic label would enhance some of the value drivers that they are willing to pay for, such as food safety and sustainability. What this interplay would like look in a real setting is difficult to predict, but, at the very least, it seems likely that the consumer is able to quickly make the connection between dynamic labeling, food safety, and sustainability.

The second mechanism that highlights consumers attributing value, by proxy, to the dynamic label is showcased by the choice survey. The results suggested that the consumer's perceptions towards using meat bordering on the expiry date (according to a conventional best-before label) would improve if a dynamic label were also attached, stating that the meat were safe to eat. There are two conclusions that can be drawn from this. The first, and most obvious, conclusion is that consumers trust the dynamic label (or at least they trust it more than they do a conventional label). The second conclusion is that the perceptions consumers have towards using meat, from shopping in the grocery store all the way to cooking with it at home, would change such that waste were reduced.

6.4 Managing a Dynamic Best-before Label

Having reviewed the theoretical significance of the empirical data, it is prudent to discuss, more explicitly, the managerial implications of the previous Sections. Referring back to the discussion on consumer perceptions, it is clear that consumers are not interested in paying a price premium for a dynamic label, irrespective of the value it adds to the other value drivers. To some extent, this is to be expected—most consumers are not interested in paying more for an essential product, meat, which they can already purchase in the status quo at a lower price. What is promising on this front is that the food science startup that was interviewed emphasized that the unit production cost of a dynamic label would likely be trivial. Moreover, given the volatile price changes that characterize meat products, that low unit cost would likely be negligible to the consumer. However, this assessment is premised on the notion that the only price increase stemming from a dynamic label would be the label's production cost, which is patently unrealistic. Indeed, interviews with both the meatpackers and the retailers were clear in cautioning that, at least in the short-term, the adoption of a dynamic best-before label would create chaos in the supply chain, increase wastage, and thereby provoke price increases. The degree to which this holds true in the long-term, or for that matter even the short-term, is unclear, given the limited knowledge the interviewees had regarding the intricacies of the dynamic best-before label. In any case, the potential chaos created in the supply chains by implementing the dynamic label is another counterforce to its adoption, which warrants consideration by management.

While consumer perceptions towards a dynamic label were largely positive, insofar as they perceived the information it provides to be at least as trustworthy as a conventional label, a cautionary approach warrants consideration. As for most products, the consumer's basis for purchasing something is the presumption that it will function as intended/advertised. Considering that what is being discussed here is the accuracy of predicting whether or not a perishable is fit for human consumption, this presumption from the consumer side is of supreme importance. If the marketability of the dynamic label is to be safeguarded, then it must function as intended. If it does not, it is likely that the improvements towards the consumer's perception of using meat that is bordering on the expiry date will dissipate. The result will be a negligible change in consumer waste.

Assuming that the dynamic label does work as intended, one of the chief management considerations becomes how to introduce it to the market as effectively as possible. The dynamic label is largely a process innovation, given that its improved accuracy can be used to better coordinate resources as products move through the supply chain, and thus, in the long-term, reducing costs. However, it also affects the final product in the sense that it influences consumer perceptions. The question is how to harness those perceptions towards improved marketability. Harkening back to the quantitative survey, it is recalled that many, but not all, consumers were able to make the connection between dynamic labeling and improved food safety and sustainability, and that both of these factors were somewhat prioritized as value drivers. By leveraging improved food safety and sustainability as key aspects of a dynamic label, the consumer can be marketed to in an effective manner. In a similar manner, the value driver of "Swedish meat" should be considered. By marketing the dynamic label as a uniquely Swedish attribute of meat products, it is possible that even this value driver can be exploited to establish the dynamic label in the market.

7 Conclusion

“We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time.”

—T.S. Eliot

The concluding chapter compiles the key insights gained from the research and extrapolates the findings to a wider context. After presenting the chief conclusions of the results and discussion, a Section is presented on the management implications of the study, while another Section focuses on the theoretical implications. Finally, avenues for future research are suggested based on the limitations of the study.

7.1 Chief Conclusions

The Swedish meat industry is a mature one, slaughtering, cutting, packing, labeling, and selling products that change only negligibly over time. These meat products are offered to a consumer market that grows largely in tandem with the general population, one that has recently begun to plateau with respect to demand. Historically, the industry has approached improvements to its offering with a process-oriented mindset, with an eye to reducing costs and streamlining inefficiency out of the supply side of the value chain. In so doing, the linkages in the value chain have come to be characterized by the dominance of a small group of companies, namely the supermarket chains. In concert, consumer perceptions are shifting towards reducing environmental degradation and better sustainable corporate practice. This has established an impetus for updating meat products to address these growing consumer demands, particularly with respect to waste. It is within this context that the practical viability

of implementing of an innovative technology into the meat value chain, specifically a dynamic best-before label, has been investigated.

By collecting end consumer data and qualitatively and supply-side data quantitatively, a holistic picture of the meat value chain, alongside the constituent driving and counterforces to technological change, has been painted.

Interviews with supply-side stakeholders in the meat value chain, including meatpackers, retailers, industry groups, and so on, has confirmed findings from the literature, namely that the industry is beholden to the retailers through a variety of linkages, and that there is general resistance to adopting new technology. Within this conservative painting, however, are brushstrokes that go against the grain. It has been discerned that stakeholders such as the meatpackers are interested in dynamic labels insofar as they can provide a more accurate (less conservative) estimate of the expiry date, thereby alleviating pressure on their activities in the value chain. However, they, alongside the other stakeholders, have made clear that it is the retailers that must be brought on board if technological change is to be implemented. If the impetus for this change does not come from the supply side, it is the consumers that ought to be harnessed for this role.

Harnessing the consumers is premised on shifting consumer perceptions with respect to environmental degradation and more sustainable corporate practice. It seems likely that these shifts will cause consumers to abandon meat, in a manner not seen before, unless the problems of environmental cost and waste can be meaningfully addressed by the industry.

The findings from the consumer survey revealed two trends. The first is that the consumer does not perceive a dynamic best-before label to provide sufficient value on its own to justify paying a significant price premium. On the other hand, the consumers do believe that a dynamic label enhances some of the value drivers that they are willing to pay for, such as food safety and sustainability. This suggests that they do derive some value from the dynamic label. The second observable trend is that consumer perceptions towards using meat that is bordering on the expiry date improve when a dynamic label is thrown into the mix. This suggests that waste could be reduced from the consumer side if dynamic labels were introduced to the industry.

In short, consumers perceive some value in the dynamic best-before label, but are not yet interested in paying for it. This is partially mitigated by what is projected to be a negligible unit production cost for the dynamic label. In the short-term however, the supply-side stakeholders also predict that the chaos of implementing such a label into the chain would create excess waste, and thereby increase costs and raise prices for the consumer. This short-term loss is a critical source of resistance to the supply side seriously considering the dynamic label. To overcome this, managers must work to balance the long-term risks of not adapting to shifts in the external environment against the short-term financial risks of adopting dynamic best-before labels.

7.2 Management Implications

The study has illustrated the need for managers to close the gap between changing consumer perceptions and the fixed mindset characterizing the supply side of the meat value chain. The fundamental step in this work is paying heed to long-term shifts in the external environment—in this case, consumer perceptions. Once discerned, suggested changes, such as implementing a dynamic best-before label, should be weighed, but not only in terms of costs and benefits. As citizens of society, managers, too, must pay proper attention to the long-term environmental costs of not acting to reduce waste, even at the expense of short-term profits.

The question is how to minimize the short-term risks of a dynamic label, given that it would likely disrupt the intricacies of the current supply chain. In this, the findings of this study can be exploited. Noting that many, but not all, consumers were able to make the connection between dynamic labels and the value drivers of sustainability and food safety, and that those same consumers were willing to pay modest price premiums for the latter two, managers should leverage what is already valuable when introducing the dynamic label to the market. By marketing dynamic labels as a mechanism for sustainability efforts, improved food safety, and as something that is unique to the Swedish meat sector, initial consumer skepticism can be mitigated. For this to succeed, it is of critical importance that the dynamic label be verified to work as intended, that is to say accurately and safely.

Moreover, insofar as the meat industry is a mature one, characterized by price competition and the easy dissemination of technology, it should be noted that there is a good chance that

the first major retailer to adopt dynamic labels will likely be followed by its competitors in rapid succession. In so doing, the risks taken on by the first adopter would likely be neutralized by its competitors staking the same position in short order.

7.3 Theoretical Implications

While change is an important characteristic of a healthy market economy, it is not the first phenomenon that springs to mind when scrutinizing mature industries. The findings of the study are in good agreement with established theory, citing process-oriented mindsets, the importance of linkages, the dominance of a core group of actors, the variability in and disagreement between stakeholders, and a focus on costs in tandem with a myopic outlook on the external environment.

In studying a spectrum of stakeholders in the Swedish meat value chain, the importance of considering the end consumer has been showcased. This importance applies not only as an omen to conservative producers to contemplate implementing change, but also as a vehicle for marketing new technology, that is to say by leveraging established value drivers to market an innovation to consumers.

7.4 Limitations and Avenues for Further Research

While the study was concluded to exhibit acceptable levels of both validity and reliability, there are a number of limitations that curtailed the potential of the findings. The most contemporary of these is the difficulty in gauging normal consumer perceptions in the midst of a pandemic, which has likely limited the capacity to extrapolate the findings to the general population. The second, more common, limitation concerns the problem of consulting consumers on their own perceptions, when they, themselves, are often not consciously aware of these. In that spirit, it is prudent to verify the conclusions of this study by conducting a pilot study with a dynamic label prototype stitched to real meat products in a real supermarket. This would test for consumer purchasing behavior, which would need to be complemented by investigating those same consumers' waste behavior pre- and post-purchase.

Finally, it can be remarked that this study did not distinguish between various categories of meat (beef, pork, lamb, poultry, etc.), despite the fact that various meat types, along with the cuts themselves, steer pricing. This warrants attention in future work so as to more accurately account for the role played by price when assessing consumer perceptions towards dynamic labels.

8 References

Abernathy, W. J., Clark, K. B., & Kantró, A. M. (1983). *Industrial Renaissance : Producing a Competitive Future for America*. New York: Basic Books.

Ait El Houssi, A., Morel, K. P., & Hultink, E. J. (2003). The effectiveness of true analogies for consumer learning of really new products. *Faculty of Commerce - Papers (Archive)*.

Akpoviro, K. S., Amos, A. O., & Oladipo, A. O. (2019). The Impact of Process Innovation on Organisational Performance. *Acta Universitatis Danubius. Œconomica*, 15(2), 115-132.

Albors-Garrigos, J., & Hervas-Oliver, J. L. (2013). Disruptive Technology in Mature Industries: Its Contribution to Industry Sustainability. Valencia: PICMET.

Andersson, T., & Stålhandske, S. (2018). *Matavfall i Sverige: uppkomst och behandling 2018*. Stockholm: Naturvårdsverket.

Armstrong, G., & Kotler, G. (2009). *Marketing: An Introduction* (13th ed.). London: Pearsons.

Axelsson, B., & Agndal, H. (2016). *Professionell marknadsföring* (3rd ed.). Lund: Studentlitteratur.

Axfood. (2018). *Vegotrenden 2018: Mer och allt oftare*. Retrieved May 8, 2020, from <https://www.axfood.se/media-och-opinion/pressmeddelanden/2018/10/vegotrenden-2018-mer-och-allt-oftare/>

BCFN. (2012). *Food Waste: Causes, Impacts and Proposals*. Barilla Center for Food & Nutrition.

- Beermann, D. H. (2009). ASAS Centennial Paper: A century of pioneers and progress in meat science in the United States leads to new frontiers. *Journal of Animal Science*, *87*(3), 1192-1198.
- Benner, M. J., & Tushman, M. (2002). Process Management and Technological Innovation: A longitudinal Study of Photography and Paint Industries. *Administrative Science Quarterly*, *47*(4), 672-706.
- Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of management review*, *28*(2), 238-257.
- Betz, F. (2011). *Managing Technological Innovation: Competitive Advantage from Change*. New Jersey: John Wiley & Sons.
- Bryman, A., & Bell, E. (2018). *Business Research Methods* (5th ed.). Oxford: Oxford University Press.
- Buhr, B. L., & Ginn, B. (2011). U.S. Meatpacking: Dynamic Forces of Change in a Mature Industry. *Choices*, *26*(1).
- Cavusgil, S. T., Chan, K., & Zhang, C. (2003). Strategic Orientations in Export Pricing: A Clustering Approach to Create Firm Taxonomies. *Journal of International Marketing*, *11*(1), 47-72.
- Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (1st ed.). Boston: Harvard Business Review Press.
- Clark, K., & Fukimoto, T. (1991). *Product Development Performance: Strategy, Organization and Management in the World Auto Industry*. Cambridge: Harvard Business School Press.
- Day, G., & Schoemaker, P. J. (2005). Scanning the Periphery. *Harvard Business Review*, *83*(11), 135-148.

-
- Djurens Rätt. (2014). *Hur många vegetarianer/veganer finns det i sverige?* Retrieved June 2, 2020, from <https://www.djurensratt.se/vanliga-fragor/hur-manga-vego-finns-det-i-sverige>
- Downing, P., Parry, A., & Plumb, A. (2013). *Consumer Attitude to Food Waste and Food Packaging*. Banbury: WRAP.
- Drayse, M. H. (2011). Globalization and Innovation in a Mature Industry: Furniture Manufacturing in Canada. *Regional Studies*, 45(3), 299-318.
- Eriksson, M. (2012). *Retail Food Wastage: a Case Study Approach to Quantities and Causes*. Uppsala: Swedish University of Agricultural Sciences.
- Eriksson, M., Ghosh, R., & Pano, N. (2016). *Food Chain Sustainability in Sweden, Value creation through research*. Uppsala: Swedish University of Agricultural Science.
- Formas. (2008). *Water for Food*. Stockholm: The Swedish Research Council Formas.
- Fregert, K., & Jonung, L. (2018). *Makroekonomi: teori, politik och institutioner* (5th ed.). Lund: Studentlitteratur.
- Garvin, D. A. (1988). *Managing Quality: The strategic and competitive edge*. New York: The Free Press.
- Gerber, P.J., Steinfeld, B., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., Tempio, G. (2013). *Tackling climate change through livestock -- A global assessment of emissions and mitigation opportunities*. Rome: Food and Agriculture Organization of the United Nations.
- Global Data. (2017). *Top Trends in Prepared Foods 2017: Exploring trends in meat, fish and seafood; pasta, noodles and rice; prepared meals; savory deli food; soup; and meat substitutes*. Global Data.
- Goode, M. R., Dahl, D. W., & Moreau, C. P. (2010). The Effect of Experiential Analogies on Consumer Perceptions and Attitudes. *Journal of Marketing Research*, 47, 274-86.
- Grant, R. M. (2018). *Contemporary Strategy Analysis* (10th ed.). Hoboken, NJ: Wiley & Sons.

8 References

- Greenheck, J., Johnson, B., Graves, A., & Oak, A. (2018). Giving meat meaning: Creating value-based connections with consumers. *Animal Frontiers, 8*(3), 11-15.
- Gregan-Paxton, J., & Moreau, P. (2003). How Do Consumers Transfer Existing Knowledge? *Journal of Consumer Psychology, 13*(4), 422-30.
- Gustavsson, J., Cederberg, C., & Sonesson, U. (2011). Global Food Losses and Food Waste. Düsseldorf: The Swedish Institute for Food and Biotechnology.
- Göransson, M. (2019). *Dynamically predicted shelf-life service: Exploring and evaluating a potential sustainable food supply chain innovation*. Lund: Department of Design Science, Faculty of Engineering, Lunds University.
- Habgardsson, M. (2013). Country of Origin -- Consumers' perception at the point of purchase of meat. Uppsala: Swedish University of Agricultural Sciences.
- Hannan, M. T., & Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review, 49*(2), 149-164.
- Harry, M. S., & Schroeder, R. (2000). *Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations*. New York: Currency.
- Hawkins, D. I., & Mothersbaugh, D. L. (2016). *Consumer Behavior: Building Market Strategy* (13th ed.). New York: McGraw-Hill Education.
- Hinterhuber, A. (2008). Customer value-based pricing strategies: Why companies resist. *Journal of Business Strategy, 29*(4), 41-60.
- Ingenbleek, P., Debruyne, M., Frambach, R., & Verhallen, T. (2003). Successful new product pricing practices: A contingency approach. *Marketing Letters, 14*(4), 289-305.
- Innoscentia. (2020). *Innoscentia*. Retrieved 05 23, 2020, from <https://www.innoscentia.com/>
- Jevinger, Å., Göransson, M., & Båth, K. (2014). A field test study on a dynamic shelf life service for perishables. Copenhagen: In 26th Conference of the Nordic Logistics Research Network: NOFOMA 2014.

-
- Johansson, M., Niklas, H., Andreas, H., Zbaracki, M., & Liozu, S. (2011). Pricing strategies and pricing capabilities. *Journal of Revenue and Pricing Management*, 11, 4-11.
- Juchniewicz, M., & Łukiewska, K. (2017). ECONOMIC DEVELOPMENT OF THE COUNTRY AND INNOVATIVENESS IN THE FOOD INDUSTRY COMPANIES – SELECTED ISSUES. *Journal of Agribusiness and Rural Development*, 43(1), 87-94.
- Juma, C. (2016). *Innovation and Its Enemies: Why People Resist New Technologies*. Oxford: Oxford University Press.
- Kaplinsky, R., & Morris, M. (2000). *A handbook for value chain research* ((Vol. 113) ed.). Brighton: University of Sussex, Institute of Development Studies.
- Kim, W. C., & Mauborgne, R. (2015). *Blue Ocean Strategy*. Boston: Harvard Business School Press.
- Konsumentföreningen. (2017). *ATTITYDER TILL DATUMMÄRKNINGAR 2009-2017*. Stockholm: Konsumentföreningen Stockholm.
- Kotler, P., & Armstrong, G. (2010). *Principles of marketing* (9th ed.). London: Pearson education.
- Kotler, P., & Keller, K. L. (2016). *Marketing Management* (15th ed.). Upper Saddle River, NJ: Pearson Education.
- Kotter, J. P. (1998). Winning at Change. *Leader to Leader*, 10(3), 27-33.
- Leiponen, S., & Helfat, C. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31(2), 224-236.
- Malley, K., & Southam, M. (2018). *Consumer Insights - October 2018*. Warwickshire: Agriculture and Horticulture Development Board.
- Margarita, E., & Teng, P. (2011). *'Mind the Gap': Reducing Waste and Losses in the Food Supply Chain*. Center for Non-traditional Security Studies.

- Marklinder, I., & Eriksson, M. K. (2015). *Best-before date–food storage temperatures recorded by Swedish students*. Uppsala: British Food Journal.
- McFadden, D. (1986). The Choice Theory Approach to Market Research. *Marketing Science*, 5(4), 275-297.
- Møller, H., Lødrup, N., Madsen, P. L., Rosengren, Å., & Nurttila, A. (2014). *Date labelling in the Nordic countries: Practice of legislation*. Copenhagen: Nordic Council of Ministers.
- Nagle, T. T., & Hogan, J. E. (2006). *The Strategy and Tactics of Pricing: A Guide to Growing More Profitably*. Upper Saddle River,: Pearson Education.
- Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard business review*, 87(9), 55-64.
- Ozer, M. (1999). A Survey of New Product Evaluation Models. *Journal of Product Innovation Management*, 16(1), 77-94.
- Pongrácz, E. (2009). Through Waste Prevention Towards Corporate Sustainability: Analysis of the Concept of Waste and a Review of Attitudes Towards Waste Prevention. *Sustainable Development*, 17(2), 92-101.
- Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: The Free Press.
- Principato, L. (2018). *Food Waste at Consumer Level: A Comprehensive Literature Review*. Cham: Springer International Publishing.
- Rees, J. (2018, December 21). *Before the Refrigerator: How We Used to Get Ice*. Baltimore: Johns Hopkins University Press.
- Sanchez-Sabate, R., & Sabate, J. (2019). Consumer Attitudes Towards Environmental Concerns of Meat Consumption: A Systematic Review . *Int. J. Environ. Res. Public Health*, 16, 1220.

-
- Savage, G. T., Bunn, M. D., Gray, B., Xiao, Q., Wang, S., W, E. J., & William, E. S. (2010). Stakeholder Collaboration: Implications for Stakeholder Theory and Practice. *Journal of Business Ethics*, 96, 21-26.
- Schiffman, L. G., & Wisenblit, J. (2015). *Consumer Behavior* (8th ed.). Essex: Pearson Education Limited .
- Secondi, L. (2019). Expiry Dates, Consumer Behavior, and Food Waste: How Would Italian Consumers React if There Were No Longer “Best Before” Labels? *Sustainability*, 11(23).
- Seidel, V. P., & O'Mahony, S. (2014). Managing the Repertoire: Stories, Metaphors, Prototypes, and Concept Coherence in Product Innovation. *Organization Science*, 25(3), 691-712.
- Sekaran, U., & Bougie, R. (2016). *Research Methods for Business: A Skill-based Building Approach* (7th ed.). Chichester: Wiley.
- Smith, W., & Tushman, M. (2005). Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams. *Organization Science*, 16(5), 522-536.
- Solomon, M., Bamossy, G., & Askegaard, S. H. (2006). *Consumer Behaviour: A European Perspective* (3rd ed.). Harlow: Pearson.
- Statistics Sweden. (2019). *Agricultural statistics 2019*. Örebro: Statistics Sweden, Agriculture and Energy Statistics Unit.
- Stenmarck, Å., Jensen, C., Quedsted, T., & Moates, G. (2016). *Estimates of European food waste levels*. Stockholm: European Commission.
- Stopford, J. M., & Baden-Fuller, C. W. (1994). Creating Corporate Entrepreneurship. *Strategic Management Journal*, 7(15), 521-536.
- Swedish Board of Agriculture. (2018). *Kött och klimat*. Retrieved April 19, 2020, from <http://www.jordbruksverket.se/amnesomraden/miljoklimat/begransadklimatpaverkan/kottochklimat.4.32b12c7f12940112a7c800011009.html>
-

8 References

- Swedish Board of Agriculture. (2019). *Livsmedelskonsumtion och näringsinnehåll Uppgifter till och med 2018*. SCB. Retrieved 05 29, 2020
- Swedish Board of Agriculture. (2020). *Konsumtion och förbrukning av kött*. Retrieved June 5, 2020, from <https://djur.jordbruksverket.se/amnesomraden/konsument/livsmedelskonsumtionisifror/kottkonsumtionen.4.465e4964142dbfe44705198.html>
- Svenskt kött. (2020). *Kött från Sverige*. Retrieved June 5, 2020, from <https://svensktkott.se/om-kott/kott-fran-sverige/>
- Świadek, A., & Szopik-Depczyńska, K. (2015). Relationships with Suppliers and Innovation Activity in Food Industry in Poland. *Journal of Agribusiness and Rural Development*, 36(2), 335-341.
- Tromp, S. O., Rijgersberh, H., da Silva, F. P., & Bartels, P. (2012). Retail benefits of dynamic expiry dates—Simulating opportunity losses due to product loss, discount policy and out of stock. *International Journal of Production Economics*, 132(1), 14-2.
- Tushman, M. L., & Romanelli, E. (1985). Organizational evolution: A metamorphosis model of convergence and reorientation. *Research in Organizational Behavior*, 7, 171-222.
- Utterback, J. M., & Abernathy, W. (1975). A dynamic model of process and product innovation. *International Journal of Management Science*, 3(6), 639-656.
- Vegara, A., Festino, A., Di Ciccio, P., Costanzo, C., Pennisi, L., & Ianieri, A. (2014). The management of the domestic refrigeration: Microbiological status and temperature. *British Food Journal*, 116(6), 1047-1057.
- Ventour, L. (2008). *The Food We Waste*. Banbury: Waste and Resources Action Program (WRAP).
- Wohlgenant, M. K. (2013). Competition in the US Meatpacking Industry. *Annual Review of Resources Economics*, 5(1), 1-12.

Yngfalk, C. (2012). *The Constitution of Consumption*. Stockholm: Stockholm University School of Business.

A Consumer Survey

A.1. Section 1: Demographics

What is your age group?

- 18-25
- 25-40
- 40-60
- 60+

What is your occupation?

Do you live in Sweden?

- Yes
- No

How many people live in your household?

- 1 (only you)
- 2
- 3
- 4
- 5
- 6+

Do you eat meat?

- Yes
- No

How often do you consume meat?

- Everyday
- A few times a week
- Once a week
- I do not eat meat

Imagine you find yourself in the following situations. How do you think you would react?

	Leave/return/throw out/ stop eating the meat	Buy/keep/cook/ eat the meat
You are shopping and see that the best-before date on the meat you were looking at expired yesterday.		
You are on the way home from the supermarket when you notice that the meat product you bought expired yesterday.		
You are about to cook dinner when you notice that the meat best-before date yesterday.		
You are having dinner with friends when you are told that the meat best-before date in the food expired yesterday.		

A.2. Section 2: Valuable Characteristics of Meat

How much more are you willing to pay for a particular meat product because you feel that it tastes better?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

How much more are you willing to pay for a particular meat product because it is marked as “Sweden Meat”?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

How much more are you willing to pay for a particular meat product because it is from a reputable brand?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

How much more are you willing to pay for a particular meat product because it is marked as organic/sustainable?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

How much more are you willing to pay for a particular meat product because you feel that it is safer to eat (i.e. it has a reduced risk of food poisoning)?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

How much more are you willing to pay for a particular meat product because it can be stored longer before spoiling?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

A.3. Section 3: Dynamic Best-before Labels

An "active" best before date is currently in development. This new label differs from conventional best-before dates because it continuously updates its predicted expiry date based on what is happening in the meat. As a result, it accurately shows if the meat is safe to eat or not. The following images are an example of how this would work. (No response is required for this question.)

- Example of "active" best-before label: the sensor shows that the meat is safe to eat



- Example of "active" best-before label: the sensor shows that the meat is not safe to eat.



Do you think that such a label might improve any of the characteristics of a meat product?

- Meat flavor
- Brand quality
- Sustainability
- Food safety
- Improved storage time before spoiling
- Other:

Knowing the information above, how much more would you be willing to pay for a particular meat product because it had such a sensor?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- Other:

A.4. Section 4: Using a “Dynamic” Best-before Label

You are shopping for meat at the supermarket. The meat product you reach out for has both a conventional best-before date and a dynamic best-before date. You notice that the conventional best-before label shows yesterday's or today's date, but the dynamic label still shows that the meat is safe to eat, as seen in the photo below. Would you...?



- Buy it.
- Buy it but expect a discount.
- Not buy it.
- Other:

Having paid for your groceries, you are leaving the supermarket and going home. One of the items you bought was a meat product that has both a conventional best-before date and a dynamic best-before date. You didn't see it earlier when you chose the meat, but as you are about to exit the building you notice that the conventional best-before label shows yesterday's or today's date, but the dynamic label still shows that the meat is safe to eat, as shown in the image below. Would you feel...?



- Anxious/regretful.
- Indifferent/ignore it.
- Other:

You are about to cook dinner at home. One of the ingredients is a meat product. As you reach for the meat from the fridge, you notice that the conventional best-before label on the package shows yesterday's or today's date, but the dynamic label still shows that the meat is safe to eat, as shown in the image below. Would you feel...?



- Anxious/hesitant to cook with it.
- Indifferent/ignore it.
- Other:

You are having a home-cooked dinner together with friends. As you are eating, the host mentions that the meat they used for the meal came with a dynamic best-before date. They also say that, for this specific package of meat, the conventional best-before label showed yesterday's or today's date, but that the dynamic label still showed that the meat was safe to eat. Would you feel...?

- Anxious/hesitant to continue eating the meat.
- Indifferent/ignore it.
- Other:

B Estimate of Sample Size Confidence and Precision

Nonprobability sampling has been used in the quantitative study, which prevents the generalizability of the data to the target population. Thus, the confidence level and precision of the sample size with respect to the target population cannot be calculated. Even so, estimating these statistics, under the false assumption that the data are generalizable, may still be useful so as to gain some very rough insight into the reliability of the data. This calculation is performed below.

In a country of 10.2 million people, it is estimated that 95% of the Swedish population consumes meat (Djurens Rätt, 2014). Swedish meat consumers are the target population. Citing the Central Limit Theorem, the sample size can be calculation according to

$$n = \frac{\frac{z^2 p (1 - p)}{\varepsilon^2}}{1 + \frac{z^2 p (1 - p)}{\varepsilon^2 N}}, \quad \text{where } \begin{cases} n \text{ is the sample size} \\ z \text{ is a function of the desired confidence level} \\ p \text{ is the proportion of the total population} \\ N \text{ is the total population} \\ \varepsilon \text{ is the margin of error} \end{cases}$$

A 95% confidence level, i.e. $z = 1.96$, is the convention in business research (Sekaran & Bougie, 2016). Recognizing that the survey yielded responses from 453 people, the above formula can be rewritten to determine the margin of error,

$$\begin{aligned}\varepsilon &= z \sqrt{p(1-p) \left(\frac{1}{n} - \frac{1}{N} \right)} = \\ &= 1.96 \sqrt{0.95(1-0.95) \left(\frac{1}{453} - \frac{1}{10.2 \cdot 10^6} \right)} = \\ &= 2\%\end{aligned}$$

In summary, the sample of 453 people, if the data were truly generalizable, represents the population of Swedish meat consumers with a confidence level of 95% and a 2% level of precision (margin of error). Note that the data are not actually generalizable. However, considering that the occupations listed by the survey respondents seem to be roughly representative of the general Swedish population, these numbers can still give some approximate insight into the generalizability.

C Metadata on Supply-side Interviewees

Ten interviews were conducted to understand the position of the supply-side stakeholders. The interviewees ranged from employees of supermarket chains to Swedish food researchers, see Table C-1.

Table C-1: Metadata on the semi-structured interviews conducted with the supply-side stakeholders.

Category	Organization	Interviewee	Occupation	Mode of communication	Interview date
Meatpackers	Scan AB	–	Head of logistics	Telephone	2020-05-11
	Scan AB	–	Director of quality	Telephone	2020-05-11
Retailers	Axfood AB	–	Packaging specialist	Telephone	2020-05-11
	Axfood AB	–	Quality assurance	Telephone	2020-05-13
	COOP	Majsan Pense	Category group chief for meat	Telephone	2020-04-21
	ICA Group AB	Martin Hörberg	Packaging specialist	Telephone	2020-05-11
Industry and consumer groups	Stockholm Consumer Association	–	Sustainability strategist	Telephone	2020-05-13
	Swedish Meat Industry Association	–	Managing director	Telephone	2020-05-14
Academia and startups in food science	Innoscentia	Eric Månsson	CEO	Telephone	2020-05-11
	Swedish University of Agricultural Science	Mattias Eriksson	PhD candidate in food waste	Telephone	2020-04-22