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INVESTING IN PREVENTION

Exploring Decision-Making Drivers

Master of Science Thesis
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ABSTRACT

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Investing in prevention is a pressing issue that is still underexplored. Though investing in prevention is common for sectors such as public health and even mandatory for certain aspects like car insurance, it is difficult to assess the value of prevention. Investing in prevention is not as straightforward as other investments given that benefits from prevention are delayed in time and difficult to assess. While people commonly associate products and services of prevention with purchasing insurance policies or other items of public health, there are myriad less evident forms of prevention; these include products and services that seek to deter climate change. Interestingly, when we think about 'clean' technologies, we seldom describe them as preventive. Environmental investments seek to ameliorate climate change; for these investments, the element of prevention is avoiding future negative consequences for oneself, an organization or the community. This variance of scope of an investment in environmental prevention poses additional challenges on how to assess and communicate value.

Understanding why people invest in prevention and acknowledging the preventive quality of certain solutions could shed light on how to influence their rate of adoption. Both for the society's general wellbeing and for businesses whose success relies on preventive behavior, it is imperative to understand how to initiate and push forward an investment in prevention. Therefore, identifying and understanding the drivers of investments in prevention offers an interesting and multifaceted research opportunity, particularly for investments related to environmental protection.

The objective of this thesis is to identify and examine decision-making drivers for investments in prevention. The context of this study was within two case projects with an environmental focus: adoption of black carbon environmental innovations and the selection of sustainable building materials. This objective was achieved through a combination of theoretical and practical work based on the Switching Path Analysis Technique (SPAT), a methodology to study supplier switching processes. For this, a literature review explored the topics of customer value, technology and innovations, decision-making processes, management accounting for decision-making, and investment in prevention. Then, a theoretical framework was created to shed light on decision-making drivers, participants and management accounting tools in use. The framework was applied to study a series of completed investment decisions in prevention related to environmental protection.

Findings on this thesis illustrate a series of decision-making drivers for investments in prevention. This study shows that an investment in prevention starts with a decision-making entity that presents preventive behavior (that is, has a lifestyle oriented towards prevention, or considers prevention as a decision-making criteria). This customer might experience an internal or external stimulus that helps identify that something is not in line with prevention-focused goals and therefore, seeks to invest in a solution that fulfills these goals. Finally, the use of future-illustrating management accounting tools, such as total cost of ownership was identified as purposeful for organizations that supply products or services of prevention as they depict lifecycle benefits, however acknowledging that these tools might not always ensure the best value for money perspective. Based on these findings, this thesis illustrates a series of practical and managerial implications for organizations whose success relies in some way on preventive behavior. This work helps illustrate the versatility of the concept of prevention, thus making findings applicable for diverse settings of prevention.

Keywords: Customer value, Prevention, SPAT, Investment decision, Diffusion, Stakeholders, Management Accounting tools

PREFACE

In our modern milieu, the topic of prevention seems timelier than ever. While we commonly associate this topic with aspects of public health or with the purchase of insurance policies, there are myriad faces of prevention, including environmental matters. Interestingly, when we think about 'clean' technologies, we rarely describe them as preventive. This thesis work seeks to change that.

I want to thank all of those who helped me throughout this process. First, organizations that make this research work possible, as well as colleagues and supervisors, Dr. Jouni Lyly-Yrjänäinen, Prof. Teemu Laine, Prof. Saku Mäkinen, Postdoctoral Research Fellow Natalia Saukkonen, and Senior Research Fellow Tuomas Korhonen who, besides being exceptional role models, considered me a good candidate for these and other projects. Second, colleagues who welcomed me warmly to the Cost Management Center and peers who gave me feedback during the writing process. Third, friends that supported me and brightened my days in Finland. Finally, my family: papá y hermana, thank you for the long-distance support and to my amazing role model and smart mamá, whose morning calls brighten my days, without you none of this would be possible.

Life is the result of a series of decisions and I am thankful for those that brought me to this point. I would have never thought when I first came to Finland for an exchange semester, that three years later I would be graduating from a master's degree in that same university. I am excited for future unexpected events that life will put in my path!

Tampere, 15 October 2020

Deborah Karen Kuperstein Blasco

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LIST OF SYMBOLS AND ABBREVIATIONS

B2C	Business to Consumer
B2B	Business to Business
BC	Black Carbon
MA	Management Accounting
BCFP	Black Carbon Footprint Project
W4G	Wood for Good
CMC	Cost Management Center
CIT	Critical Incident Technique
SPAT	Switching Path Analysis Technique
PM	Particulate Matter
TCO	Total Cost of Ownership
LCC	Life-Cycle Costing
R&D	Research and Development
B2G	Business to Government

1. INTRODUCTION

1.1 Background

When thinking of possible ways to deal with imminent risk to human activities, insurance might be the one of the most rational (Rees & Wambach, 2008). However, people are hopelessly irrational when making logical decisions (Klein et al., 1993, p. 13) and can easily fall into decision biases based on subjective perceptions (Klein et al., 1993, p. 41). This complicated approach to risk and decision-making afflicts businesspeople whose business relies on their customers' preventive behavior.

Predictors for preventive behavior have been studied widely (Cohen, 1984; Bandura, 1989; Bergadaà, 1990; Jayanti & Burns,1998; Simons et al., 2004; Werle, 2011) and among myriad models there are several points of parity. Elements such as perceived vulnerability, perceived severity, perceived benefits, perceived barriers, self-efficacy and subjective norms are present across preventive behavior studies. Subjective perceptions drive individuals to opposite ways: either towards irrational decision-making (Klein et al., 1993, p. 41) or towards rational and preventive behavior (Bandura, 1989).

Preventive behavior is difficult to foster because it requires individuals to be future-oriented and motivated towards an underlying goal in prevention (Werle, 2011). Likewise, investments in prevention are difficult to perceive because they lead to a nonevent or have non-observable benefits (Overstreet et al., 2013). Furthermore, few preventive actions are 100% effective (Cohen, 1984) and their benefits are realized in the distant future (Overstreet et al., 2013). These elements affect the relative advantage of a product or service, which is the most important predictor in the adoption of innovations (Rogers, 2002), and can explain the slow rate of adoption of a product or service of prevention.

Products and services of prevention go beyond perceptions of what these are. Preventive behavior is commonly associated with purchasing insurance policies or with adopting positive health habits. However, there are other not so evident forms of preventive products and services that are worth studying; these include wearing a seat belt, getting a vaccine, saving for retirement, conserving energy and living sustainably, among others.

As with any other innovation, preventive solution providers should communicate the customer value of their offerings in order to create market demand. Customer value is a key driver for customer loyalty, satisfaction and profitability (Kumar & Reinartz, 2016); it is the building block for marketing efforts (Eggert et al., 2018) and customer value propositions (Anderson et al., 2006) and thus, of great importance for any business. Kotler and Keller (2012, p. 125) state that customer value is the collection of benefits that an offering brings to a customer, for which there is a cost involved. While there are differences between consumer-level purchases and business-level purchases (Almquist et al., 2018) businesses and consumers have a multidimensional approach to value: a cost-benefit trade-off (Mencarelli & Riviere, 2015).

Customer value of preventive products and services can be difficult to transmit due to low relative advantage and subjective nature. The main source of value from investments in prevention is through reduced risk which leads to reduced anxiety (Cohen, 1984). Reduced anxiety provides subjective and high-level value both for business-to-consumer (B2C) (Almquist et al., 2016) and business-to-business (B2B) (Almquist et al., 2018) buyers. Reduced anxiety addresses elements that respond to a buyer's individual priorities and emotional concerns such as fear of failure and reputational assurance.

Adopting a product innovation or process innovation is deciding to make a change in favor of something new; yet, individual level decision-making is not the same as organization-level decision making. Decisions in business contexts can be ambiguous, repetitive, have long-lasting effects and usually involve multiple stakeholders (Shapira, 1997, p. 5). However, differences between B2B and B2C decisions are not cut-and-dried (Almquist et al., 2018) and both groups seek for the offering that delivers the highest value (Kumar & Reinartz, 2016). In both cases, accounting information provides valuable insights to make informed decisions (Atrill & McLaney, 2012, p.16). For managers, accounting information is relevant to make plans, decide, judge the effectiveness of the decision and help solve problems that arise from the decision (Weetman, 2006, p. 432).

1.2 Research Questions and Objectives

Beneficial effects of preventive innovations are delayed in time and difficult to assess; therefore, new products and services of prevention are expected to have a slow early diffusion. Preventive behavior has been studied mostly within the context of public health and only a few studies in the diffusion tradition have studied preventive innovations (Rogers, 1988). On the other side, products and services that seek to deter climate can be considered preventive yet when we think about 'clean' technologies we seldom describe

them as preventive. Therefore, recognizing certain environmental solutions as preventive could shed light on how to influence their rate of adoption

The topic of diffusion of environmental innovations has been covered widely from perspectives of policies (Kern et al., 2005), products and services (Clausen et al., 2019). On the other side, there are various studies on the diffusion of preventive innovations, most of them focused on health practices, including disease transmission (Bertrand, 2004) or substance abuse (Rohrbach, 1993). However, there are few studies (Pine et al., 2011; Overstreet et al., 2013) that have analyzed the diffusion of environmental innovations through the perspective of prevention.

This thesis discusses drivers for investments in prevention related to environmental protection in an organizational context. While the focus is environmental, results can be translated other settings of prevention, be it a product, service or even an idea of prevention. To identify decision-making drivers of investments in prevention, this thesis explores the topics of customer value, technology and innovations, decision-making processes, the role of management accounting (MA) in decision-making as well as concepts of investment in prevention.

As previously discussed, transmitting the benefits of products and services of prevention can be challenging due to their low relative advantage (Rogers, 2002). Even though many environmental product and process innovations fall into the preventive innovation category (Overstreet et al., 2013), the adoption and diffusion of products and services of prevention related to environmental protection has been under-researched in diffusion studies. Therefore, the main objective of this thesis is…

… to identify and examine decision-making drivers for investments in prevention.

The context of this objective is within two case projects with an environmental focus: the selection of sustainable building materials and the adoption of Black Carbon (BC) environmental innovations. To address this objective, completed investment decisions related to prevention are analyzed. These decisions can shed light on decision-making drivers related to preventive investments. For this, it is important to understand organizational decision-making processes and, particularly, supplier selection decisions. Furthermore, these case studies offer an opportunity to illustrate how MA information can assist to plan, decide and judge the effectiveness of the decision as well as solve problems that arise as result of the decision (Weetman, 2006, p. 432).

Therefore, a theoretical framework that identifies case-specific decision-making drivers and participants is designed and applied into both case projects. Additionally, the framework presents a series of management accounting tools that could be utilized to assist

the decision-making process. This theoretical framework will be applied to answer the following research questions:

Q1: What type of value-adding drivers are perceived by investments in prevention?

Q2: How is preventive behavior present in an investment decision?

Q3: Which management accounting tools are currently utilized, and which could be potentially utilized to assist the investment decision process?

The first research question seeks to identify what elements make up total customer value of preventive investments. The second question seeks to identify elements that signal the presence of preventive behavior. Finally, the third question seeks to illustrate the practical usability of MA information when making investment decisions in prevention.

1.3 Research Process

This section provides a short overview of the research process; chapters 3 and 4 present further details on the projects and on the development of the research strategy. The research process varied significantly between case projects: “Black Carbon Footprint Project” (BCFP) and “Wood for Good” (W4G) project. As shown in Figure 1, the thesis process started in late September 2019, when the author got a proposition from her university’s supervisor to participate in the BCFP, which a research group, the Cost Management Center (CMC), had just started. Further along, in January 2020, the researcher was asked to participate in the W4G project, which relied on the same methodology as the BCFP project. The researcher was involved in both projects as a full-time worker .

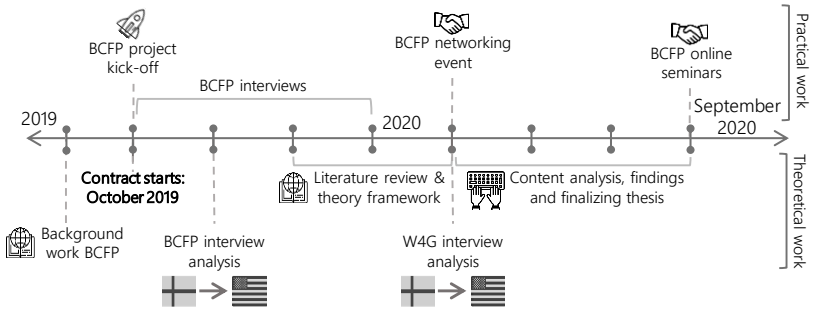

Figure 1. Research process timeline.

The project work for the BCFP was originally set to start in October, with the project’s official launch in Tampere, Finland. However, background work started since September for the researcher to familiarize with the project prior to the project launch event. Regarding the W4G project, background work and project started simultaneously in January 2020. Practical work includes interviews and participation in different networking events whereas theoretical work includes interview translations (Finnish to English), interview

analyses, literature review, and other desk work to analyze data, gather findings and draw recommendations.

1.4 Research Methods

Research refers to a scientific and systematic search for relevant information on a topic; it is the pursuit of truth through study, observation, comparison and experiment (Kothari, 2004, p. 1). The purpose of research is to achieve more and deeper knowledge (Gummesson, 1993) by discovering answers to questions through scientific procedures (Kothari, 2004, p. 2). Research can be done to answer specific questions, learn new facts, solve real-world problems or just to pursue new knowledge (Kothari, 2004, p. 8).

An important decision in research is the choice of methods to use to generate data (Gummesson, 1993, p. 3). Research methods are the analytical tools of research (Kothari, 2004, p. 8) and methods utilized in research unavoidably influence the object of inquiry (Kuada, 2012, p. 128). Detailed accounts of the process of data collection and research methodology allow readers to assess whether reported findings of a research project are properly supported (Kuada, 2012, p. 128).

Various research frameworks and derived methods have evolved in the history of research. According to Kothari (2004, p. 2) there are four main types of research: (1) descriptive vs. analytical, (2) applied vs. fundamental, (3) quantitative vs. qualitative, and (4) conceptual vs. empirical. These basic types of research are described in Table 1.

Table 1. Basic types of research (Kothari, 2004, p. 3).

Type of research	Description
Descriptive research	Seeks to define phenomena as they are at present. In this method the researcher has no control over variables of study
Analytical research	The researcher utilizes facts already available to analyze and make a critical evaluation of them
Applied research	Seeks to find a solution for a pressing problem that an organization is facing
Fundamental research	Concerned with formulation of theories or generalizations that has a broad base of applications
Quantitative research	Based on measurement of quantities; applicable for variables that can be expressed in terms of quantity
Qualitative research	Concerned with qualitative phenomena that relates to type of quality. Especially relevant for behavioral and social sciences
Conceptual research	Related to abstract theories or ideas; used to reinterpret existing concepts or create new ones
Empirical research	Relies solely on observation and experience, disregarding existing theories

Furthermore, there are other types of research that focus on describing, understanding and even modifying a phenomenon within its real-life context, such as case study research (Gummesson, 1993; Yin, 1993, p. 3) and interventionist research (Suomala & Lyly-Yrjänäinen, 2011; Suomala et al., 2014; Nielsen & Lund, 2019).

Case study research seeks to understand complex phenomena characterized by countless variables with intricate connections between them (Gummesson, 1993, p. 6). This method is appropriate when a researcher relies on multiple sources of evidence and seeks to define a topic broadly and cover contextual conditions (Yin, 1993, p. xi). Case study research results useful when the phenomenon of study is difficult to distinguish from its context. However, covering context as an element of study conveys a series of challenges, such as having more variables than data points and having to rely on multiple data collection methods and multiple sources of evidence (Yin, 1993, p. 3).

On the other hand, interventionist research is a form of case study where the researcher is actively involved in the object of study and active participation in the field is an asset (Suomala & Lyly-Yrjänäinen, 2011, p. 4). A project carried out through interventionist research involves close collaboration between researchers and participating companies through a real-life project. Interventionist research aims to create solutions for practical problems as well as theoretical contributions, which occur through partnerships between researchers and practitioners (Suomala et al., 2014). The purpose of interventionist research is to study effects of influence, opinion and intervention (Nielsen & Lund, 2019).

Both these types of research methods are commonly associated with qualitative data gathering methods; however, quantitative methods can also result adequate. Gummesson (1993, p. 6) states that qualitative data generating methods help better understand the complex ecosystems involved in case study research, which quantitative data generating methods are unable to achieve by themselves. For this, Gummesson introduces five qualitative data generating methods, as shown in Table 2.

As previously identified, this thesis is based on two research projects that lie within real-life contexts. Therefore, the research methods that are most suitable are case study research for the first stages of these projects and interventionist research in the latter stages where presenting results will bring changes within organizations involved. Furthermore, various data generating methods seem adequate. The main data gathering method will be in-depth qualitative interviews with one or more representatives from each of the participating organizations.

Table 2. Data generating methods (Based on Gummesson, 1993).

Data generating method	Description
Existing material	Everything that is carried by media other than human beings, such as books, articles, statistics, and recordings. Known as secondary data because it was created for someone else's purpose.
Questionnaire survey	Aims to formalize and standardize interviews to generate quantifiable data. Translates 'how much', 'how many' and 'how often' into numbers that will be later applied into mathematical models.
Qualitative interview	Generates data by conducting conversational interviews that do not appear to be too formal but are in-depth interviews.
Observation	Implies using all five senses plus a sense of intuition to gather data. Observation can be direct (little to no involvement by the researcher) or participant (where the researcher gets involved).
Action science	Occurs when the researcher becomes an active participant of the process being observed; he/she becomes a change agent. Action science seeks to contribute to the organization and to science.

Additionally, existing material from other work packages of case projects will help understand complex connections between project ecosystems. Moreover, action science is also applicable when results are presented, and the researcher becomes a change agent within case organizations, seeking for ways to promote investments in products and services that require preventive behavior.

1.5 Structure of the Thesis

This thesis is divided into six comprehensive chapters. These are presented as follows:

Chapter 1 is an introductory chapter that identifies background, the objective of the thesis as well as corresponding research questions. This chapter also presents the research process for both case projects and for the writing process. Furthermore, research and data gathering methods are identified in this chapter.

Chapter 2 corresponds to an extensive literature review that covers five main topics and introduces the research framework. The covered topics are customer value, technology and innovation, organizational decision-making, accounting for management functions, and investment in prevention. The theory from these topics is further developed into a theoretical framework that identifies decision-making drivers and participants.

Chapter 3 introduces both case projects and relevant information regarding the topic of each (black carbon for the BCFP and wood as a building material for the W4G project. In addition, this chapter describes the goals and structure of each project as well as the role of the researcher within these goals.

Chapter 4 is an overview on the researcher's work on each project. This chapter depicts how the research framework was applied and reflects on the chosen research strategy.

Chapter 5 presents a series of findings from interviews and from events related to both projects. This chapter presents a series of decision-making drivers, relevant stakeholders and MA tools related to preventive investments for environmental protection.

Chapter six is a conclusion chapter for this thesis that answers research questions, presents practical and theoretical implications, identifies possible limitations and makes suggestions for future studies.

2. THEORY BACKGROUND

2.1 Customer value

The essence of business is to create value. A sustainable business has the objective of creating value for customers and extracting some of that value in the form of profit (Kumar & Reinartz, 2016). The importance and strategies for creating superior customer value are widely studied as value drives customer loyalty, satisfaction and profitability (Kumar & Reinartz, 2016). Furthermore, value perceived by the customer receives a multitude of attention from practitioners and academics because of the correlation between customer satisfaction and competitive advantage (Chou, 2014).

The ever-growing interest on the topic of value to managers and researchers (Parasuraman, 1997) has created an endless list of definitions and concepts of *value,* many set up in very different contexts (Woodruff, 1997). One of the multiple streams of the concept of value focuses on the ideas of customer value and customer perceived value. Christopher et al. (2008, p. 20) defines customer value as the ratio of perceived benefits to the perceived sacrifice that is involved. Woodside et al. (2008) identify customer value as a concept that includes the measurement of total benefits realized or perceived and total costs of acquiring, using and disposing a product or service. Kotler and Keller (2012, p. 125) state that customer value is the collection of benefits that an offering brings to a customer, for which there is a cost involved.

Furthermore, Zeithaml (1996) captures various consumer expressions of value into a single definition where perceived value is a consumer's assessment of the utility of a product based on the perception of what is given and what is received. Kumar (2016) defines perceived value as customers' net variation of perceived benefits accrued from an offering and Kotler and Keller (2012, p. 125) define customer perceived value as the gap between total customer costs, such as time, energy and money, and total customer value, such as functional, economic and psychological benefits.

These definitions shed a light on the subjective nature in the concept of value. According to Chou (2014), the concept of value is subjective as only customers can perceive and determine the actual value of offerings. Furthermore, Christopher et al. (2008, p. 20) highlight the word *perceived* as critical, since both costs and benefits are subjective, to certain extent. Zeithaml (1996) identifies that the perception of what is received and what is given varies across consumers.

Traditionally, the subjective nature of customer value is associated mostly with B2C transactions, as consumer-level purchases are emotionally driven, vary with the context of purchase and change over time (Mencarelli & Riviere, 2015). For consumer purchases, efficiency, aesthetics, status, esteem, ethics and spirituality are elements that create perceived value (Holbrook, 1999, p. 13). On the other hand, in B2B transactions, value comes from an optimization of monetary cost of purchases and production, that make it possible to create high-performance and attractive products for customers (Mencarelli & Riviere, 2015). Even though value in B2C transactions faces a different panorama than in B2B transactions, in the end, differences between B2B and B2C decisions are not cut-and-dried (Almquist et al., 2018). Both businesses and consumers have a multidimensional approach to value: a cost-benefit trade-off (Mencarelli & Riviere, 2015).

2.1.1 Measuring customer value

Measuring customer value is a logical starting point with respect to value-oriented management as customers seek for offerings that provide the highest expected value (Kumar & Reinartz, 2016). As the highest expected value -or utility- cannot be measured directly, there are two widely used measurement methods that model consumer preferences: compositional and decompositional.

Compositional methods (Sweeney & Soutar, 2001; Ulaga & Eggert, 2006) start with a series of chosen benefits or attributes and set them as the basis to determine overall value. In this method, expected utility is a function of a product or service's attributes and costs multiplied by hierarchy weight. The main assumption for compositional methods is that key attributes and their hierarchy weights are known to decision-makers, who follow a rational decision-making approach (Kumar & Reinartz, 2016).

Examples of compositional methods include Sweeney and Soutar's (2001) consumer perceived value multi-item scale that describes B2C transactions or Ulaga and Eggert's (2006) relationship value index for B2B transactions. The former focuses on four prespecified value dimensions: emotional, social, quality/performance and price/value for money; these are utilized to create an overall value score on consumer goods. The latter identifies prespecified buyer-seller benefit and cost dimensions and integrates them into an overall higher-order index; the buildup of this method is illustrated in Figure 2.

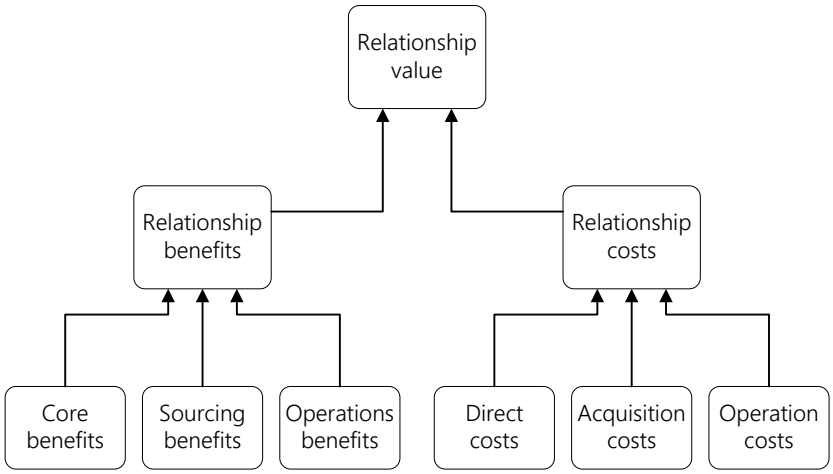

Figure 2. Relationship value model (Ulaga & Eggert, 2006).

As illustrated, relationship value is a higher-order element made up of relationship benefits and relationship costs. When each of the elements of relationship benefits and relationship costs is assigned a weight, relationship value can be quantified.

On the other side, decompositional methods (Sinha & DeSarbo, 1998; Kim et al., 2009) deduct underlying benefits from revealed preferences. These methods start by measuring attributes of offerings and utilize them to infer the value of their underlying benefits. These methods seek to approximate an offering's value based on the customer's willingness to pay (Kumar & Reinartz, 2016). Examples of decompositional methods include Sinha and DeSarbo's (1998) aggregate perceived value or Kim et al.'s (2009) pay what you want (WTP). The former method presents an assessment of overall perceived value based on multidimensional scaling. This scale is created by deriving the dimensions of perceived value for a given category in a pool of subjects. Results of this method are presented with through a matrix that identifies simultaneous estimations of brand parameters in terms of value perceptions and customer segmentation, as shown in Figure 3.

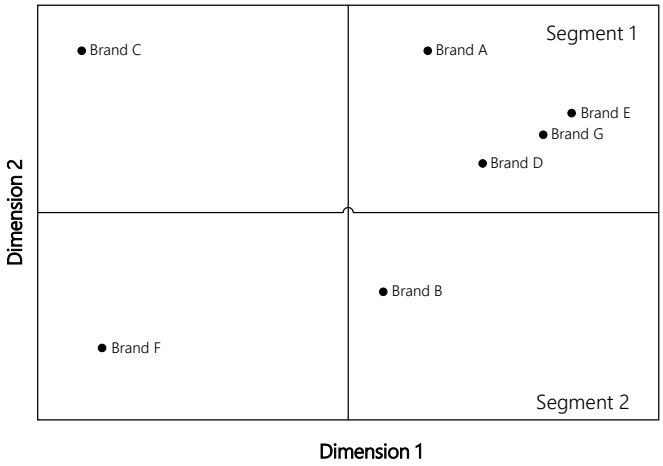

Figure 3. Aggregate perceived value model (Adapted from Sinha & DeSarbo, 1998).

The latter method is a participative pricing mechanism in which consumers have control over the price they pay, thus providing insights into individual levels of value perception. Decompositional methods can be more complex than compositional methods; these often require advanced mathematical simulations and algorithm designs. However, decompositional methods can also offer case-specific measurements of value.

These models confirm that value has a subjective nature as only customers perceive and determine the actual value of offerings (Chou, 2014). Measurement methods and value models not only focus on tangible product attributes, but also consider intangible and subjective aspects. These features include the dimension of brand name (Sinha & DeSarbo, 1998), aesthetic design (Kumar, 2015) or high-level subjective elements such as reputational assurance and network effects (Almquist et al., 2018).

2.1.2 Cost-benefit ratio models

Various authors have applied the principles of cost-benefits into value models that describe the trade-off between give and get elements (Zeithaml, 1996; Teas & Agarwal, 2000). According to Kotler and Keller (2012, p. 125) *give* elements refer to total customer costs, which are made up of time, energy and money whereas *get* elements refer to total customer value, made up of economic, functional and psychological benefits. In short, value results from a trade-off in benefits (desired outcomes) and costs (negative consequences). This idea is illustrated into a simple customer perceived model, as illustrated in Figure 4.

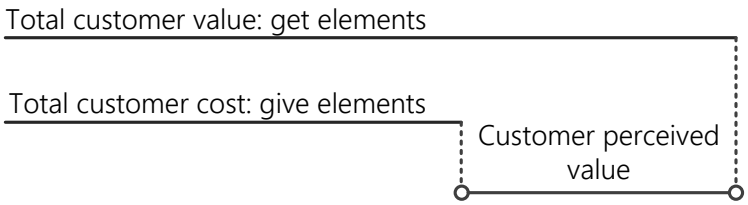

Figure 4. Customer perceived value model (Based on Kotler & Keller, 2012).

On the other side, Christopher at al. (2008, p. 20) describe customer value as a ratio of perceived benefits to perceived sacrifices. Similarly, Grönroos (2000, p. 140) utilizes a series of equations to describe customer perceived value, being one of them:

$$CPV = \frac{(episode\ benefits + relationship\ benefits)}{(episode\ sacrifice + relationship\ sacrifice)}$$

Following the idea of customer perceived value as a ratio between benefits to perceived sacrifices (Christopher et al., 2008, p. 20; Grönroos, 2000, p. 140) and assuming benefits as get elements -or total customer value- and sacrifices as give elements -or total customer cost- (Kotler & Keller, 2012, p. 125), three different scenarios of a product or service's customer perceived value can be identified, as presented in Figure 5.

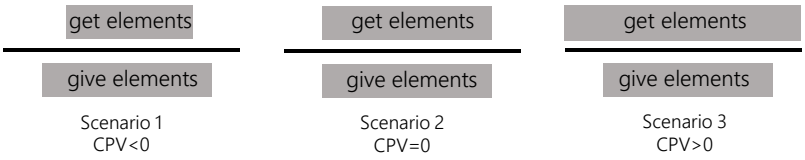

Figure 5: Three scenarios of customer perceived value (Adapted from Grönroos, 2000, p. 140).

The first scenario depicts negative customer perceived value; this occurs when a product or service requires the customer to give more time, energy and money than what is received, be it economic, functional or psychological benefits. The second scenario depicts null customer perceived value, which happens when get elements are the same as give elements. Finally, the third scenario depicts positive customer perceived value, which occurs when the customer receives more benefits than what is given for it. It is important to mention that applying a cost-benefit analysis to environmental matters, which is the context of this thesis work) is not too straightforward as it is difficult to assign an economic value to aspects of different nature, such as economic costs versus environmental damage (Hansson, 2007).

2.1.3 Creating customer value

Customer value is a fundamental building block of marketing (Eggert et al., 2018) and customer value propositions (Anderson et al., 2006). Over the last few decades, myriad case studies have identified what customers consider valuable, both in consumer-level and business-level contexts.

Vast attention on customer value measurement is focused on the benefits side of the offering, identifying attributes that are associated with an offering (Teas & Agarwal, 2000). Typical perceived benefits have been mapped out extensively; these include functional, practical and emotional benefits (Young & Feigin, 1975), physical aspects of products (Gutman, 1982) and product quality (Teas & Agarwal, 2000). On the other hand, perceived sacrifice is focused mostly on the price dimension, specifically transaction price. However, there are various associated costs, including transaction costs, learning cost and maintenance and life cycle cost, which can sum up to be larger than the transaction price (Kumar & Reinartz, 2016).

Recently, Almquist et al. (2016; 2018) grouped a series of objective and subjective elements of value into a structure that extends Maslow's hierarchy of needs pyramid, for both B2C and B2B markets. The B2C elements of value pyramid address four types of needs: functional, emotional, life-changing and of social impact whereas the B2B elements of value pyramid focuses on table stakes elements, functional elements, ease of doing business value, individual value and inspirational value. These elements of value pyramids seek to pin down what both business and individual consumers truly value.

Abridging past and present studies, it becomes clear that customer value can be created through revenue expansion, cost reduction, or both (Rust et al., 2002; Lyly- Yrjänäinen et al., 2019). Revenue expansion implies a customer focus and market orientation (Rust et al., 2002) and it involves modifying customer attitudes and perceptions to create more sales; that is, creating greater customer satisfaction. Customer satisfaction has been proven to affect revenue-creating behavior (Zeithaml et al., 1996). Revenue expansion happens by improving quality and features (Rust et al., 2002), helping customers develop new offerings or increasing production speed (Lyly- Yrjänäinen et al., 2019). An expansion in revenue results in the third scenario of customer perceived value (see figure 5), where increased revenue provides more *get elements*, thus enhancing customer perceived value; this idea is illustrated in Figure 6.

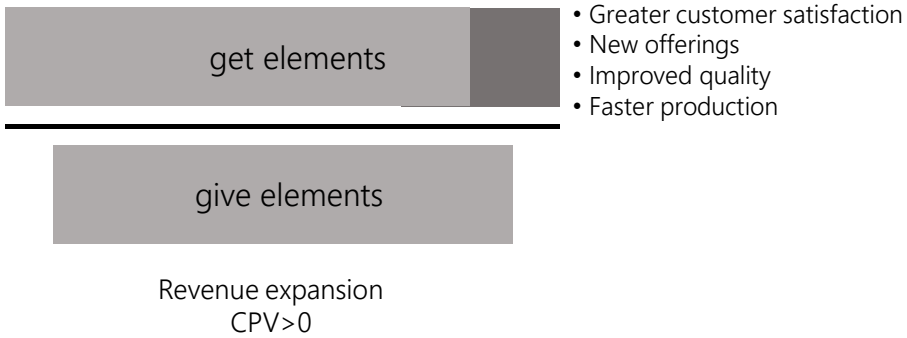

Figure 6. CPV of revenue expansion (Based on Rust et al., 2002; Lyly-Yrjänäinen et al., 2019).

On the other side, cost reduction emphasizes the efficiency of a firm's processes through an internal focus. Cost reduction programs seek to increase productivity and reduce inputs of production, which yields savings directly to the bottom line (Rust et al., 2002). These programs include total quality management programs (Spitzer, 1993) or its modern equivalents, such as Six Sigma (Anthony et al., 2007). Cost reduction can also happen through reduced purchase and lifecycle costs (Lyly- Yrjänäinen et al., 2019). As with revenue expansion, cost reduction results in the third scenario of customer perceived value, where lower costs reduce *give elements*, and creating greater customer perceived value, as shown in Figure 7.

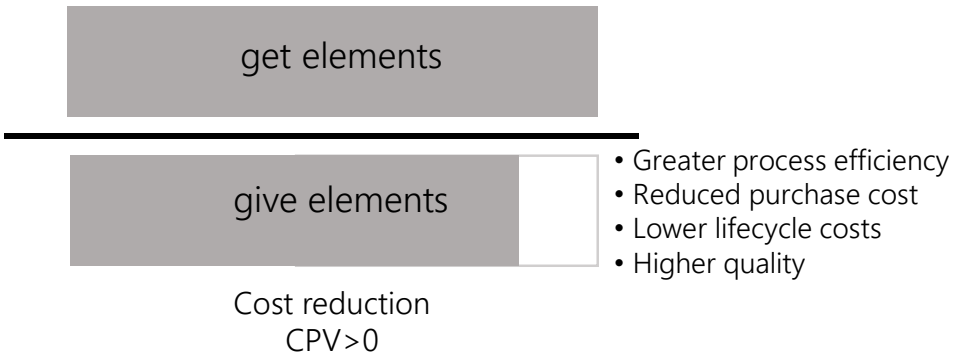

Figure 7. CPV of cost reduction (Based on Rust et al., 2002; Lyly-Yrjänäinen et al., 2019).

It seems evident for firms to try and seek to achieve both revenue expansion and cost reduction simultaneously. Though possible in theory, studies indicate that one approach -either revenue expansion or cost reduction- will dominate culture in organizations because of the intrinsic differences between these two management approaches. Simplification and specialization of management practices improves organizational performance (Leivanthal & March, 1993).

Seeking to achieve both revenue expansion and cost reduction simultaneously is highlighted as *the productivity dilemma* (Abernathy, 1987, cited in Adler et al., 2009). In his study, Abernathy (1987, cited in Adler et al., 2009) identified that short-term efficiency and long-term adaptability are inherently incompatible. Furthermore, a dual emphasis can fail because of limited budgets that make it impossible to focus fully on both ways to enhance customer value (Rust et al., 2002).

This section has reviewed (1) what is customer value and its importance to businesses, (2) the ways to measure customer value, (3) cost-benefit models and (4) how firms can create value to customers. Customer value is a key driver for customer loyalty, satisfaction and profitability (Kumar & Reinartz, 2016); it is the building block for marketing efforts (Eggert et al., 2018) and customer value propositions (Anderson et al., 2006) and thus, of great importance for any business. As B2B and B2C customers seek for the offering that delivers the highest value (Kumar & Reinartz, 2016), measuring customer value is a key activity. Upon measurement, customer value is mapped in cost-benefit ratio models that help identify customer perceived value of an offering. Finally, this section identified that customer value can be created by either revenue expansion or cost reduction (Rust et al., 2002; Lyly-Yrjänäinen et al., 2019) and seeking to achieve both revenue expansion and cost reduction at the same time could lead to a productivity dilemma.

2.2 Technology and Innovation

As with the concept of *value*, there are myriad definitions for the concepts of *technology* and *innovation* and there is a lack of conformance around these definitions (Garcia & Calantone, 2002). An innovation can be defined as an idea, practice, or object that is perceived as new by an individual (Rogers, 2013, p. 12); it is a multi-stage process in which organizations transform ideas into new or improved products, services or processes in order to compete and differentiate themselves in their marketplace (Baregheh et al., 2009). Innovation is a change in a product, service, process or, broadly speaking, in an organization (Rowley, 2011). On the other side, the term *technology* refers to the process by which an organization transforms labor, capital, information and materials into products or services (Christensen & Bower, 1996). Technology is a design for instrumental action that reduces the uncertainty involved in achieving a desired outcome (Rogers, 2013, p. 13).

The definition of an innovation addresses two key elements: (1) the innovation process combines the development of an invention and as its introduction to the market through adoption (individual) and diffusion (collective) and (2) the innovation process is of an iterative nature with varying degrees of innovativeness (Garcia & Calantone, 2002). For an invention to become an innovation, it should be commercially successful, which conveys a successful launch and its diffusion in the market (Aarikka-Stenroos et al., 2014).

In most cases, technological evolution follows a generic S-curve that depicts the innovation's rate of adoption (Rogers, 2013, p.11). Depicted in Figure 8 is an S-curve of technological innovation, where the X axis is time and the Y axis is percent of adoption.

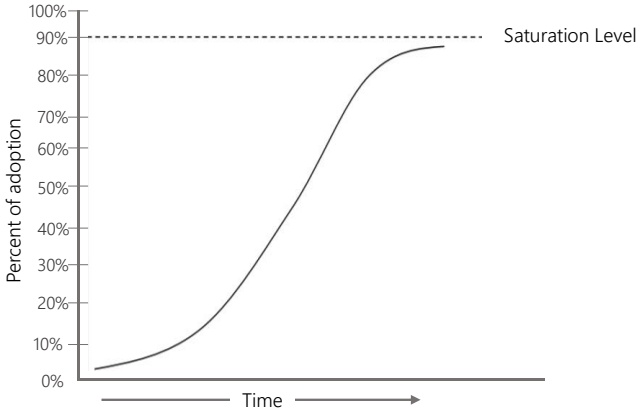

Figure 8. S-curve of technological evolution (Adapted from Rogers, 2013, p. 11).

As shown, the start experiences moderate linear growth. When growth picks up it does so at exponential speed and it then decreases until it reaches a saturation level. The saturation level is where the maximum number of adopters is reached; it represents the

outcome of diffusion from various innovation characteristics (Teng et al., 2002). There are differences in the slope of the S-curve between innovations: those that diffuse rapidly yield a curve with a steep slope, whereas those with slower adoption have a relatively gradual slope.

2.2.1 Characteristics of Technological Innovations

Technological innovations have different impact on a given industry (Bower & Christensen, 1995); while consumer innovations such as smartphones require only a few years to be widely adopted, other new ideas, such as the metric system, required decades to reach complete use (Rogers, 2013, p. 15). Different rates of adoption are explained by the characteristics of innovations (Rogers, 2013, p. 15) and, to measure the rate at which the performance of a product has improved over time, the concept performance trajectory is utilized (Bower & Christensen, 1995). According to Rogers (2013, p. 16) there are five main characteristics of innovations, which affect an innovation's adoption rate, as perceived by individuals: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability, as illustrated in Figure 9:

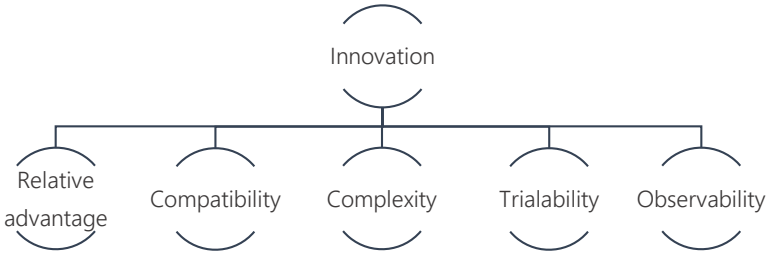

Figure 9. Characteristics of innovations (Based on Rogers, 2013, p. 16).

First, relative advantage is the degree to which an innovation is perceived to be better than the idea it replaces. While relative advantage can be measured in economic factors, other subjective elements such as convenience, prestige and customer satisfaction affect the perception of relative advantage (Rogers, 2013, p. 229). In some diffusion studies, the relative advantage of an innovation is measured as the adopters' rating of an innovation (Tornatzky & Klein, 1982). Perceived relative advantage is the most important predictor of the rate of adoption of innovations (Rogers, 2002).

Compatibility refers to the degree to which an innovation matches past and present values, as well as needs of potential adopters (Rogers, 2013, p. 240). Compatibility can denote a match with values and norms of adopters, or congruence with their existing practices (Tornatzky & Klein, 1982). An innovation that is incompatible with norms and values of a social system will take a long time to be adopted.

Complexity refers to how difficult it is to understand and use an innovation (Rogers, 2013, p. 257). Complexity is negatively related to an innovation's adoption and implementation (Tornatzky & Klein, 1982); that is, innovations that are more complicated will take longer time to be adopted. With technologies, a relatively low level of complexity enhances its ease of use (Teng et al., 2002), thus boosting its rate of adoption.

Trialability refers to how an innovation can be experimented on a limited basis; trying out an innovation is a way for individuals to find out how it works under their own conditions (Rogers, 2013, p. 258). Trialability is also related to divisibility, which refers to how an innovation can be *divided* and so the potential adopter only tries out a small sample of it (Tornatzky & Klein, 1982). Trialability also allows for modifications to cater to specific customer needs (Rogers, 2013, p. 258).

Finally, observability is the degree to which the results of an innovation are evident to others; this characteristic is positively related to its rate of adoption (Rogers, 2013, p. 258). The more visible the results of an innovation, the more likely it will be adopted (Tornatzky & Klein, 1982).

2.2.2 Product Innovations vs Process Innovations

Technological innovations have been classified in various ways throughout the years and one of the most discussed classifications is process innovation versus product innovation. A product innovation refers to an assembled product that can be manufactured and sold to a customer whereas a process innovation enables enhanced performance attributes or enables new products from existing products (Maine et al. 2012).

Utterback and Abernathy (1975) proposed the 'Model of Innovation and Stage of Development', a model that combines process and product innovations by connecting the rate of innovation and stage of development of both types of innovation. This model is built from the individual models of process development and product development.

The model of process development (Utterback & Abernathy, 1975) assumes that a production process consists of a system of process equipment, work force, material inputs, information flows, and work employed to create a product or service. This model establishes that all production processes develop in similar ways towards increased productivity following three stages: uncoordinated, segmental and systemic. During the uncoordinated stage the process is still developing, and operations are unstandardized. Furthermore, the process has unsettled relationships and is considered inefficient. During the segmental stage, production systems are increasingly efficient and, consequently, more rigid. Additionally, tasks become more specialized. Finally, in the systemic stage, the process is fully integrated and rigid, therefore, changes represent a large investment.

The model of product development (Utterback & Abernathy, 1975) has a similar underlying idea as the model of process development, where a product is developed over time in a predictable manner. This model starts with a product performance emphasis, that shifts to product variety and evolves to product standardization. The three stages of the product development process are performance-maximizing, sales-maximizing and cost-minimizing. The first stage, which takes place during the early product life cycle, is characterized by rapid changes and large margins. As there are few supplier firms in the industry, the product will be promoted as being unique and superior in performance. Also, production volumes are flexible as markets are not well defined. The second stage has less uncertainty in market size and technology adoption. Competition lies in product differentiation and companies seek to gain visibility to create larger sales volumes. Finally, in the third stage the product is standardized; this creates price competition and forces production processes to become capital intensive.

There are various similarities between these two models which are depicted in the model of innovation and stage of development, as shown in Figure 10. While the horizontal axis depicts the stage of process and product development, the vertical axis is related to changes in frequency of innovation.

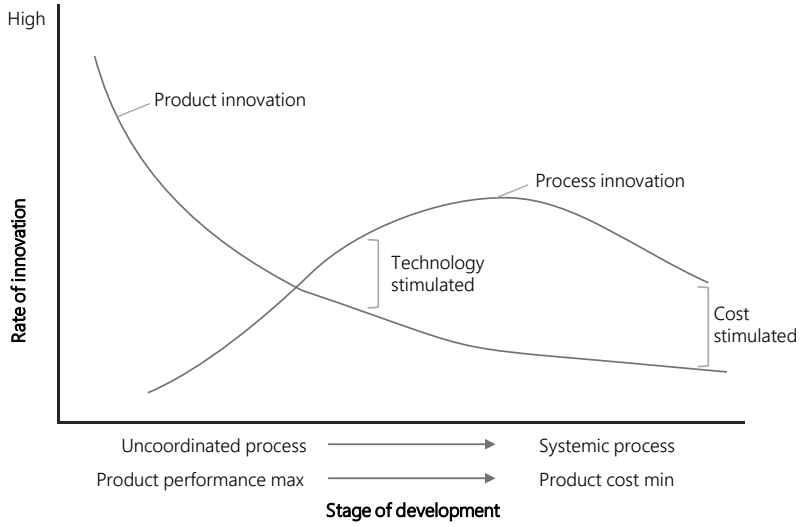

Figure 10. Model of innovation and stage of development (Based on Utterback & Abernathy, 1975).

As shown, these models shift from a disorganized process to a more standard process and, in both cases, product performance is first maximized and is followed by efforts to minimize product costs. With this model, Utterback and Abernathy explore a series of issues when managing technological innovations. The first issue is that the locus of innovation will change depending on the stage of development. For example, in starting stages of the development process, innovation will come from individuals whereas in more advanced stages, innovation needs are defined by the system itself. The second

issue is that the type of innovation that is likely to succeed depends on an organization's stage of development. For example, complex technological solutions will not be well received if the recipient process is uncertain and unstructured. Finally, an array of barriers to an innovation are presented; these include perception of irrelevance in the unconnected stage or resistance to an innovation in the systemic stage.

This model, along with the issues regarding managing technological innovations can result valuable for decision-makers as they suggest which type of innovation a firm could undertake with success. Furthermore, the model's operational relevance comes from utilizing it to identify and overcome potential problems that maybe come on the way.

2.2.3 Diffusion of innovations

Diffusion is a type of communication in which the message concerns a new idea; it is a kind of social change that alters the structure and function of a social system (Rogers, 2013, p. 6). The definition of *diffusion* sheds light to the four main elements that make up innovations: diffusion is the process by which an (1) innovation is (2) communicated through certain channels, (3) over time, (4) among members of a social system (Rogers, 2013, p. 11).

First, an innovation is an idea that is perceived as new by an individual or group (Rogers, 2013, p. 219) and there are five attributes that affect its rate of adoption: relative advantage, compatibility, complexity, trialability and observability. Innovation (Christensen & Bower, 1996) and innovative capabilities (Zaheer & Bell, 2005) influence performance of organizations. However, getting a new idea adopted, even if it has evident advantages is challenging (Aarikka-Stenroos et al., 2014); superior technology does not necessarily diffuse effectively (Rogers, 2013, p. 8). A well-studied example of nondiffusion despite its overwhelming advantages is the Dvorak keyboard (David, 1985; Rogers, 2013, p. 8), which is more efficient than the widely used QWERTY keyboard.

Secondly, communication channels are the means by which potential adopters receive information about the existence of the innovation; there are two main types of communication channels: mass media channels and interpersonal channels (Rogers, 2013, p. 18). Mass media channels involve the use of mass media, such as television or newspapers whereas interpersonal channels involve face-to-face exchange between individuals (Rogers, 2013, p. 300). Differing levels of adoption due to these two types of communication channels are explained in the Bass model, as illustrated in Figure 11, where

interpersonal channels represent adoptions due to internal influence and mass media channels yield adoptions due to external influence.

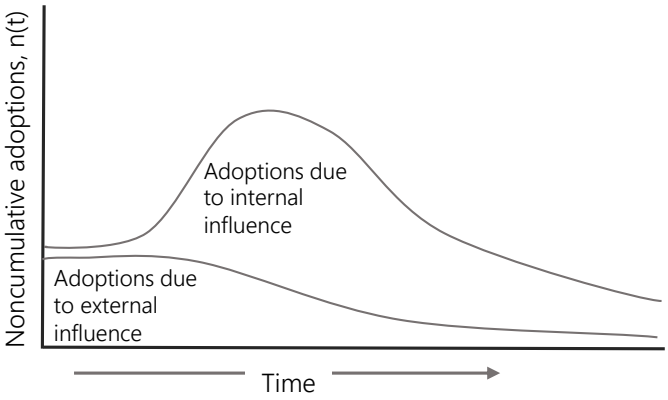

Figure 11. The Bass model (Mahajan et al., 1995).

As shown, individuals are more likely to adopt an innovation due to interpersonal messages about a new product (Mahajan et al., 1995) because people depend on a subjective evaluation of the innovation as conveyed by another individual (Rogers, 2013, p. 18). Communication via Internet has become more important for the diffusion of innovations (Rogers, 2013, p. 18). Furthermore, social media can be considered a type of interpersonal channel as it promotes social communication by allowing users to access information, cooperate and interact with each other (Temel & Ozmelek, 2018).

The third element in the diffusion process is time. In diffusion studies, time is involved through the innovation-decision process, which identifies when a decision-making unit passes from gaining knowledge of an innovation, creating an attitude towards it, deciding to adopt or not to adopt the innovation, implementing the new idea and finally confirming this decision (Rogers, 2013, p. 170). This process is illustrated in Figure 12.

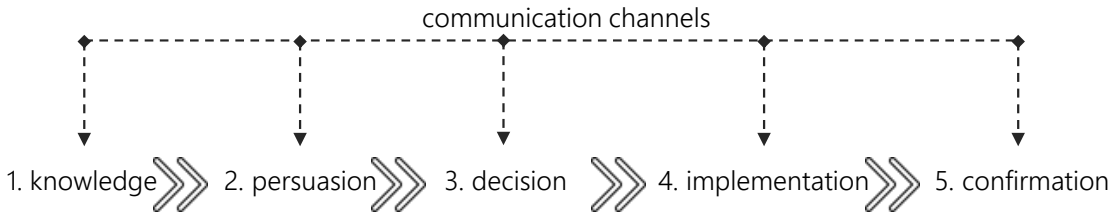

Figure 12. The innovation-decision process (Adapted from Rogers, 2013, p. 170).

As shown, there are five steps in the innovation-decision process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Usually, these steps occur in this sequence and the innovation-decision period measures the time that passes throughout this process (Rogers, 2013, p. 21). The time element in the diffusion process also identifies five adopter categories, arranged according to their innovativeness or de-

gree to which an individual is eager to adopt a new idea. These categories are: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards; adopter categorization is depicted in Figure 13.

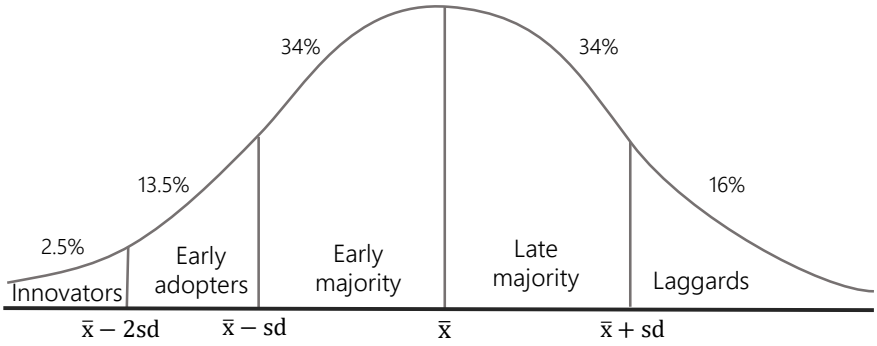

Figure 13. Adopter categorization (Rogers, 2013, p. 281).

The figure above is built from the idea that the S-shape adopter distributions approach a normal frequency, which provides useful parameters to classify adopters, including the mean ($\bar{x}$) and the standard deviation (*sd*), which measures variation about the mean. These five adopter categories are different by their degree of innovativeness (Mahajan et al., 1995, 2000; Roehrich, 2004; Vandecasteele & Geuens, 2010; Rogers, 2013, p. 282) each category and its description is presented in Table 3.

Table 3. Adopter category characteristics (Based on Mahajan et al., 1995, 2000; Roehrich, 2004; Vandecasteele & Geuens, 2010; Rogers, 2013, p. 282).

Adopter category	Characteristics
Innovators	• Technology enthusiasts, venturesome • Have access to new technologies and ample funds • Tolerate uncertainty and technological deficiencies
Early adopters	• Highest degree of opinion leadership; role models • Appreciate promising new technologies • Aid commercialization and identify new applications
Early majority	• Provide interconnectedness to the system • Don't like risks, longer innovation-decision periods • Price sensitive
Late majority	• Conservative attitude, skeptical • Accept change for need or peer pressure • Very price sensitive
Laggards	• May be isolated form the social networks of the system • Suspicious of innovations and/or change agents • Seek the best value for their money

Finally, diffusion occurs within a social system, which is a set of individual units interacting with each other seeking to accomplish a common goal. Members of a social system can be individuals, groups, organizations or entire subsystems. The structure of a social

system affects an innovation's diffusion (Rogers, 2013, p. 24). Ryan and Gross (1950) confirmed that the social structure explains the timing in which certain technologies are adopted when studying the use of hybrid corn in two Iowa communities. Similarly, Katz (1961; cited in Rogers, 2013, p. 25), states that it is unthinkable to study diffusion without knowledge on the social structures in which potential adopters are located.

Change can be endorsed or blocked by norms, which are predetermined behavior patterns between members of a system (Rogers, 2013, p. 26). For example, in India, sacred cows run freely in the countrywide while millions of people are undernourished. Furthermore, within a system there are opinion leaders and change agents. The first provide advice and information about the innovation (Rogers, 2013, p. 27) and the latter influence innovation decisions a desirable way to a change agency (Rogers, 2013, p. 369).

The social system also influences the way an innovation decision is made, which can go in one of three ways: by an individual member, known as optional innovation-decisions, by an entire social system, referred to as collective innovation-decisions or as an authority decision, known as authority innovation-decisions. The three types of innovation decisions can be arranged on a continuum according to the individual's responsibility for the decision, as well as the rate of adoption; this concept is illustrated in Figure 14.

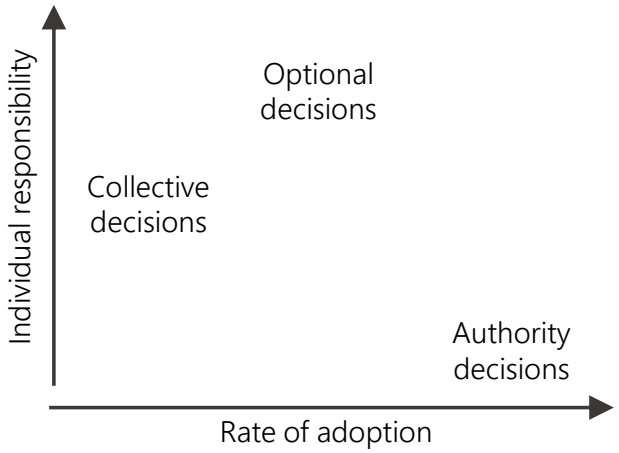

Figure 14. Three types of innovation-decisions (Adapted from Rogers, 2013, p. 403).

As shown, the fastest rate of adoption comes from authority decisions, which also have the lowest degree of individual responsibility for the decision. Here, few individuals of a system that possess power or technical expertise make the decision. Optional decisions can be made faster than collective decisions and they have the highest degree of individual responsibility for the decision. Here, the choice to adopt or reject an innovation is made by individual that is independent from other members of the system. Finally, collective decisions have the slowest rate of adoption and medium level of decision responsibility; here, decisions are made through an agreement among the system's members.

2.3 Organizational decision-making

Decision-making happens when individuals choose among alternatives with the objective of finding the best alternative; it can be studied as a process or as an activity (Cook et al., 2007, p. 3). There are five characteristics that differentiate individual decision-making to organizational decision-making: (1) ambiguity, (2) longitudinal context, (3) incentives, (4) repetition, and (5) conflict (Shapira, 1997, p. 5).

First, in organizations, there is often ambiguous information or vagueness regarding preferences of stakeholders. Second, organizational decision-making happens in a sequential manner and participants of that decision are part of an ongoing process, even if they don't actively take part of the decision process. Third, due to the longitudinal nature of organizational decisions, incentives and penalties are have long-lasting effects. Fourth, it is common for executives to make the same decisions on similar matters. The repetition with which a decision is made can lead the executive to develop a sense of control over the situation, even though his/her skills and control might be faulty. Finally, the hierarchical nature of organizations can have an impact over how decisions are made.

A decision process is not a standard process, in fact, it needs to be tailored to the nature of the decision. According to Spetzler et al. (2016, p. 26), there are five dimensions that help identify the nature of a decision: (1) magnitude, (2) organizational complexity, (3) analytical complexity, (4) content challenge, and (5) likely decision traps.

The magnitude of a decision can be categorized as quick, significant and strategic. As the name suggests, quick decisions are made rapidly, such as everyday choices or those that require immediate response, for example, emergencies. Significant decisions are complex but not so important or, relatively simple but important; these decisions take a few hours to resolve. Finally, strategic decisions are complex and very important, have profound consequences and are difficult to make.

Organizational and analytical complexity are both related to the magnitude of the decision. Organizational complexity depends on people issues, such as interests and values of stakeholders or personality clashes of decision-makers. On the other side, analytical complexity arises when a decision involves a degree of uncertainty or many aspects of a single decision are linked. Understanding both types of complexity illustrates the need for decision support and decision-making tools.

Next, content challenge refers to situations where accessing content might be difficult or complicated to access. In certain situations, relevant data and expertise are difficult to access or don't even exist. Content-related challenges are more frequent in strategic

decisions where specialized knowledge may be needed to collect, analyze and interpret complex information.

Finally, likely decision traps refer to common traps and biases that can be encountered throughout a decision-making path. It is easier to fall into traps in unknown territory where more problems are present, and they might be harder to spot.

Understanding the nature of a decision helps determine what type of decision process to utilize as well as who needs to be involved in the process (Speltzer et al., 2016, p. 32). For example, if a decision is both strategic and complex, then different professionals should be involved than if it is simple and requires a single decision-maker.

2.3.1 Decision-Making Models

Studying decision-making as an identifiable process is one of the first methods used in this task; however, this method assumes that the decision-maker is rational. In theory, a rational decision-maker is completely informed, sensitive to all alternatives and can perfectly order alternatives in such way that maximizes the preferred outcome (Cook et al., 2007, p. 4). As the existence of a rational decision-maker is an idealistic assumption, it is also possible to study decision making as an activity. In this method, some assumptions are that decision-making is not a discrete event and cannot be isolated from its environment and a decision cannot be made without information about the situation, demands and possibilities of action (Cook et al., 2007, p. 6).

In real-world settings, decisions are subject to four key features: “dynamic and continually changing conditions, real-time reactions to these changes, ill-defined goals and ill-structured tasks, and knowledgeable people” (Klein et al., 1993, p. viii). Early research focused on mathematical models that analyzed decision making from an economics and game theory perspective, centered around laboratory experiments (von Neumann & Morgenstern, 1947, cited in Klein et al., 1993, p. vii). However, artificial settings do not represent real-world settings of decision making, therefore, a series of realistic setting decision-making models have been created considering diverse settings.

For individual decision making, Pennington and Hastie (1986) identified that in important judgements, a decision-maker should review and assess a series of interdependent items before choosing an action or attitude. Starting from a model on how jurors make decisions, Pennington and Hastie created a general model of decision making known as the *Story Model of Evidence Evaluation.* This model is based on the hypothesis that jurors create a narrative story that provides information during a trial and this narrative initiates a decision-making process. The model consists of three phases based on the

three stages of trial: (1) story construction (processing the evidence), (2) decision alternative representation (defining alternatives), and (3) story classification (determining the verdict), as shown in Figure 15.

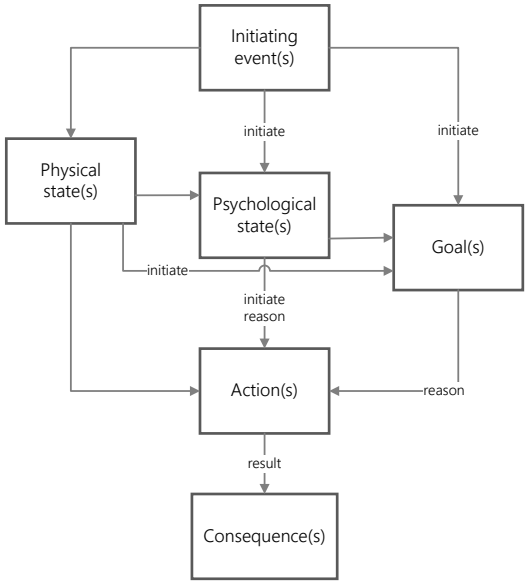

Figure 15. Story construction model (Pennington & Hastie, 1986).

The first phase assumes a basic conceptual model that defines the structure of action sequences; this includes events that give place to a psychological state and goals that provide motives for actions that result in an outcome or consequence (Pennington & Hastie, 1986). The physical state defines the decision maker's condition at the time or as a result of initiating events and, in both cases, contributing to future actions.

The components of this model on human actions have been acknowledged and labeled in various ways. For example, Mandler and Johnson (1977) suggest that a story schema has a beginning, that causes a development that leads to an ending. Rumelhart (1977, cited in Pennington & Hastie, 1986) considers an episode to have a cause (starting event), a try (goal, action and consequence) and an outcome (consequence).

On the other hand, Hinsz et al. (1997) assert that team decision making is an information-processing activity and groups that make decisions are information processors. Hinsz et al. (1997) created the *Information-Processing Model,* which consists of various components: information, processing objective, processing workspace, encoding, storage, retrieval, response and feedback, as shown in Figure 16.

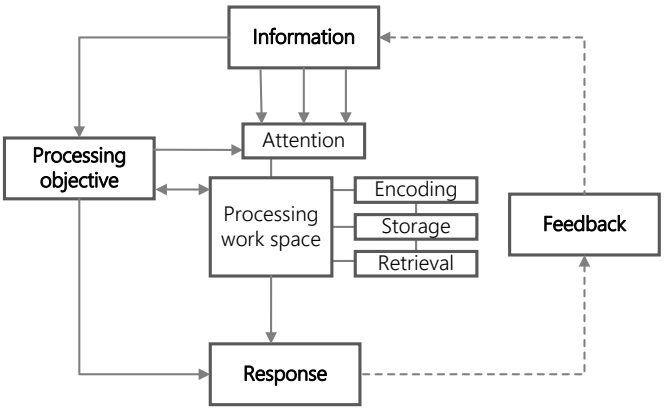

Figure 16. Information-processing model (Hinsz et al., 1997).

In this model, information is enclosed in a context that provides a team goal or processing objective for it. The attention phase is how the information is perceived by team members. Encoding is about translating individual representations into a combined group representation, which allows to interpret and represent the information. This information enters a storage process in the group's mind and is accessed through retrieval processes. Retrieval and attention allow information to be processed according to the objective in the processing workspace, where it occurs according to set rules. After information is processed based on rules and objectives, a response or choice is created which may lead to feedback regarding changes (Hinsz et al., 1997).

2.3.2 Critical Incidents to Support Decision-Making

Organizations rely on key relationships to gain and preserve competitive advantage. For example, a key decision for supply chain management is selecting and managing suppliers (Yoon et al., 2018). Selecting the right suppliers reduces costs of procurement (Ghodsypour & O'Brien, 2001), contributes to product innovation and helps build efficient production processes (Dey et al., 2015). Therefore, supplier selection is critical to create and maintain competitive advantage (Yoon et al., 2018).

Customer and supplier relationships have been widely analyzed through the lens of service encounters. A service encounter can be identified as an incident. According to Flanagan (1954), an incident is a noticeable human activity that is sufficiently complete to allow predictions and inferences to be made about the person that will perform the act. A critical incident is one in which consequences involved are sufficiently evident regarding its effects and the objective of the act is widely evident for the observer (Flanagan, 1954). There are both positive and negative critical incidents (Roos, 2002).

Service encounters serve as domain of critical incidents as they provide rich information regarding relationships between service providers and their customers (Roos, 2002). Critical incidents have been analyzed for various purposes and in different contexts.

Some authors study service encounters to measure and manage service quality (Edvardsson, 1988; Stauss, 1993), others analyze critical incidents in customer relationships (Roos, 1999), business relationships (Selos et al., 2013) or assess the role of incidents in relationship strength (Strandvik & Liljander, 1994).

Throughout the years, various methods have been created to analyze and describe the criticality of incidents. The Critical-Incident Technique (CIT), presented by Flanagan (1954), entails of a set of procedures to collect direct observations of human behavior and identify broad psychological principles. Researchers utilize this technique to find the most frequent quality determinants through a traditional content analysis (Roos, 2002). Furthermore, Olsen (1992; cited in Roos, 2002) introduced a dynamic approach to critical incidents by describing critical episodes and critical acts in a customer relationship, thus contributing to the dynamic aspects of a customer relationship, rather than only the long-term implications of critical incidents.

Moreover, Stauss and Weinlich (1997) introduced the expanded version of the critical-incident technique, the Sequential Incident Technique. This technique contemplates that customers can relate to specific customer processes; therefore, normal service encounters are to be included with critical service encounters. Variations of the critical-incident technique acknowledge the disparities and dynamic nature of critical incidents. In the same line, the Switching Path Analysis Technique (SPAT) is based on a consequence of a critical incident, described by the customer (Roos, 2002) and it provides a broad view to supplier switching processes (Selos et al., 2013).

2.3.3 Switching Path Analysis Technique

SPAT departs from a switching process and seeks to describe the path leading from an intentional switching decision to a behavioral change (Edvardsson & Roos, 2001). In SPAT, a relationship is divided into a trigger, an initial stage, a process and a consequence (Roos, 2002), as shown in Figure 17. These elements will be explained through the hypothetical example of switching suppliers of car insurance plans.

A trigger acts as a catalyst that makes a customer prone to switching; it fuels and gives direction to a switching process without being a visible part of it (Roos, 2002). There are three different types of trigger: (1) situational triggers, (2) influential triggers, and (3) reactional triggers. A situational trigger happens outside of the customer relationship itself and it is commonly linked to the private life of a customer; an example of a situational trigger could be changes in financial circumstances of the car owner (customer of the insurance plan). An influential trigger comes from changes in the market that affect the competitive situation of suppliers (Selos et al., 2013); an example could be when a new

insurance company that enters the market and offers features that customers compare to their current supplier. Influential triggers are the most common catalysts for switching (Roos, 2002). Finally, a reactional trigger is the result of a change within the company that influences the customer´s perception of it; an example of a reactional trigger could be a decline in quality of products or services, such as insurance plan invoices not sent on time.

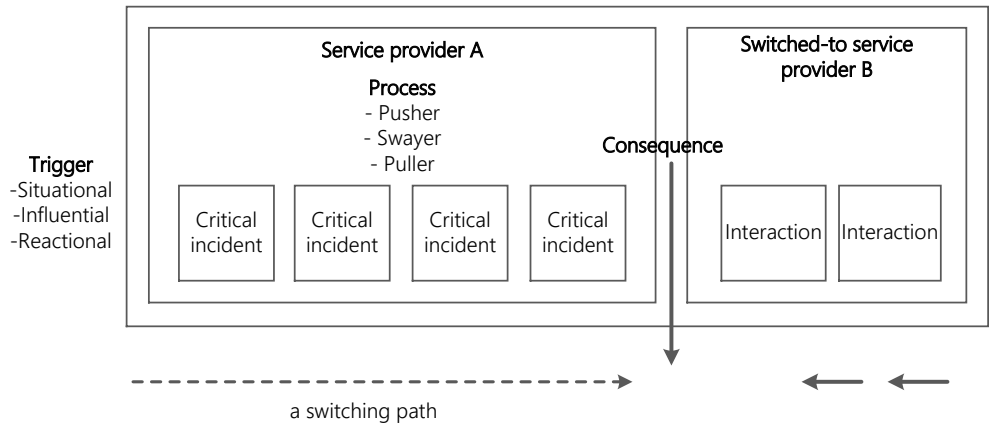

Figure 17. Switching Path Analysis Technique (Roos, 1999).

In a switching path, the trigger is not visible, whereas the process is. The process, powered and steered by the trigger, leads the way towards the switch. The process, depicted through *determinants,* is identified through interviews and customer observations and it sheds light over the customer relationship. There are three different types of switching determinants (Roos, 1999): (1) a pushing determinant, (2) a swayer, and (3) a pulling determinant; these are case-specific. The pushing determinant gives the customer a reason for the switch; it *pushes*, the customer towards another supplier. Following the same car insurance example, a pushing determinant could be a sudden increase of price in insurance plans. A swayer does not cause a switching by itself, but it can accelerate or delay the switching decision. In the car insurance context, a swayer could be the fact that a customer has had the same insurance provider for years and this is delaying the switching decision. Finally, a pulling determinant brings the customer back to the supplier; it *pulls* back the customer. Pulling determinants are present when supplier switches are partial; common pulling determinants include location or habit.

When analyzing the original SPAT model (Roos, 1999), events can be placed into a timeline that includes: what happens before the switching decision, the actual switching decision and what happens after the switching decision. Triggers are arranged before the switching decision as well as determinants, which succeed triggers. The only exception is pulling determinants, which can happen after the switch (Roos, 2002). Arranging SPAT as a timeline has been endorsed by Inger Roos and is shown in Figure 18.

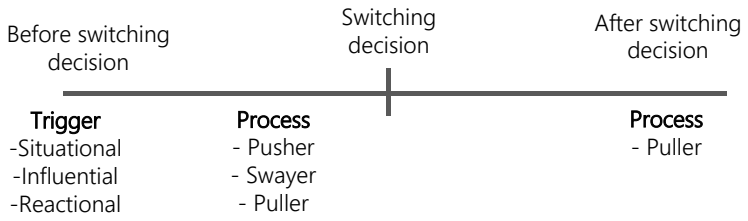

Figure 18. SPAT as a timeline (Based on Roos, 1999).

SPAT was first applied to study switching supermarket suppliers in a B2C context (Roos, 1999). This method has also been useful to study other B2C settings such as retail banking, telecommunications, insurance, retailing and public administration (Roos, 2002). The technique was further developed into a B2B supplier switching process by Selos et al. (2013) in a variety of businesses where service elements played a significant role in supplier choices. This study illustrated the differences when applying SPAT between business and consumer markets; highlighting the fact that the business context makes relationship management a more complex process. Furthermore, Saukkonen (2017) demonstrated the applicability of SPAT to explain investment behavior in technology adoption of alternative fuel vehicles. A plethora of applications demonstrate the versatility of SPAT as a methodology to explain switching processes under different contexts.

2.4 Accounting for Management Functions

Nowadays, accounting occupies a significant position in the functioning of organizations. Accounting practices are not only associated with management of financial resources but are also involved in the design and functioning of organizations (Burchell et al., 1980). The general role of all forms of accounting is to help people make informed decisions (Atrill & McLaney, 2012, p. 16). For accounting information to be utilized in decision making processes, it must be clear for whom the information is prepared and for what purpose it will be utilized (Atrill & McLaney, 2012, p. 17). Within an organization there are various user groups and purposes for accounting information; while financial accounting is utilized by shareholders and creditors, tax accounting is utilized by tax authorities, and management accounting is utilized by internal managers (McWatters et al., 2008, p. 20).

Management accounting (MA) is producing financial information for managerial use (Lindholm, 2018). The National Association of Accountants (1981; cited in Sweeney, 1986) defines management accounting as the process of identification, measuring, analysis, interpretation and communication of financial information used by management to plan, evaluate and control within an organization an ensure adequate use of its resources. Table 4 illustrates a series MA tools relevant for the context of this work.

Table 4. Management accounting tools.

MA Tool	Definition
Cost-benefit analysis (Atrill & McLaney, 2012, p. 58)	Analyzing alternative decisions to identify the one with greatest expected benefit relative to its cost.
Differential analysis (McWatters et al. 2008, p. 39)	Comparing only costs and benefits that differ among the possible alternatives.
Opportunity & sunken cost (Spiller, 2011)	Opportunity cost: benefits foregone by selecting one alternative over another; sunk cost: past cost.
Budgeting (Callahan et al., 2011, p. 141)	Translate goals into financial terms; assist in making forecasts.
Costing methods (Atrill & McLaney, 2012, p. 97-183)	Activity Based Costing, Contribution Costing, Full Costing, Life Cycle Costing: to estimate the cost of a product or service.
Net Present Value (Gaspars-Wieloch, 2019)	Helps determine whether a project will create positive net profit therefore, if the investment adds value to the firm.
Internal Rate of Return (Mellichamp, 2017)	Helps estimate the potential profitability of projects; calculated as the total present value of all cashflows minus the initial investment.

As the table shows, MA is versatile and has proven to support various managerial processes. Management functions have been classified vastly throughout the years; authors have highlighted three (Weetman, 2006, p. 429), four (Conkright, 2015) or five (Fayol, 1949, cited in Conkright, 2015) different functions. For purposes of this section three main management functions are considered: (1) planning, (2) decision making, and (3) control. Figure 19 shows how these functions are interrelated through the example of a manufacturing company that is considering expanding to a bigger production facility.

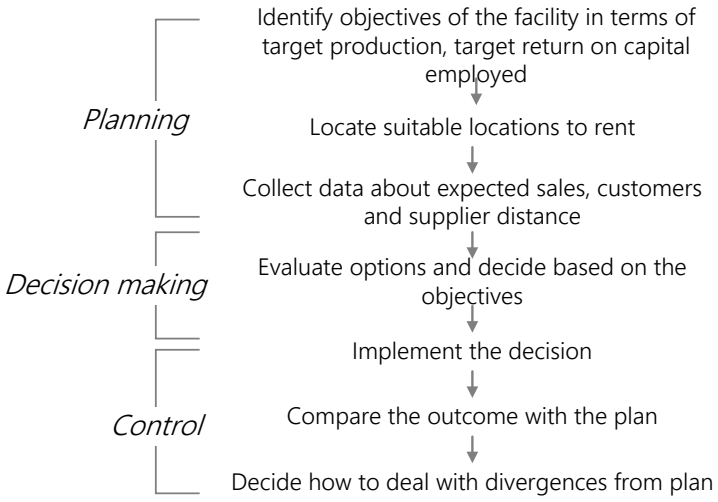

Figure 19. 3 MA functions throughout a decision (Adapted from Weetman, 2006, p. 431).

As shown, these three functions are interrelated in the overall purpose of making decisions and judgements (Weetman, 2006, p. 431). In this scenario, accounting information is relevant to make plans, decide, judge the effectiveness of the decision and help solve problems that arise as result of the decision (Weetman, 2006, p. 432). Throughout all three management functions, different management accounting tools result useful.

2.4.1 Planning

Planning is a natural starting point for managers as it is about making a strategy and taking the organization's mission (Conkright, 2015) and objectives (Atrill & McLaney, 2012, p. 25) to life through long-term and short-term plans (Weetman, 2006, p. 427). Planning requires managers to fully understand the organization's current reality and possible contingencies (Conkright, 2015).

MA provides information for management planning (Zimmerman, 1977, cited in Wouters & Verdaasdonk, 2002; Burns & Scapens, 2000). MA is useful in developing adequate objectives and strategies and can aid in creating financial plans that establish likely outcomes from adopting strategies (Atrill & McLaney, 2012, p. 25). Furthermore, MA helps managers develop knowledge on their work environment (Hall, 2010). As Table 5 shows, several of the previously identified MA tools can be utilized to support this function.

Table 5. MA tools to support the planning function.

MA Tool	Potential use to support the planning function
Cost-benefit analysis (Atrill & McLaney, 2012, p. 58)	Identify what customers to target and satisfy; select which products or services to provide.
Differential analysis (McWatters et al. 2008, p. 39)	Same as cost-benefit analysis but comparing only differences in benefits and costs generated by different options.
Opportunity & sunken cost (Spiller, 2011)	Consistent with cost-benefit analysis; used to measure the cost of each alternative in terms of foregone opportunities
Budgeting (Callahan et al., 2011, p. 141)	Create an organization-wide budget through bottom-up flow of information.
Costing methods (Atrill & McLaney, 2012, p. 97-183)	Identify a method to price products and services.

Planning requires alignment with the company's competitive strategy, corporate culture, mission and values; it is an ongoing process where ideas are adopted or rejected (Conkrigtht, 2015). Information provided by accounting tools results in increased

knowledge about the impact of a decision, allowing managers to make informed plans (McWatters et al., 2008, p. 20).

2.4.2 Decision-making

Managers make complex decisions as part of their day-to-day activities and are constantly seeking for information to support this task (Wouters & Verdaasdonk, 2002). Not only future decisions are to be justified, but also decisions that were once made (Burchell et al., 1980). At some point, decisions involve consideration of financial matters (Weetman, 2006, p. 428). MA information is considered useful to support decisions (Wouters & Verdaasdonk, 2002) as it educates day-to-day decision-making (Burns & Scapens, 2000). Furthermore, MA information helps create knowledge to prepare for unknown decisions (Hall, 2010) and helps estimate the financial impact of a decision alternative on one or more financial criteria (Wouters & Verdaasdonk, 2002). Additionally, MA information helps identify and assess financial consequences of decisions (Atrill & McLaney, 2012, p. 17).

MA information and techniques aid organizationally complex and strategic decision situations (Nielsen et al., 2015). MA helps create an outline regarding a decision's effects, which leads to create meaningful insights that support decisions (Lindholm, 2018). Table 6 depicts how several MA tools result useful to support the decision-making function.

Table 6. MA tools to support the decision-making function.

MA Tool	Potential use to support the decision-making function
Cost-benefit analysis (Atrill & McLaney, 2012, p. 58)	Make-or-buy decisions, resource allocation decisions.
Opportunity & sunken cost (Spiller, 2011)	Can be used to modify production inputs from past data e.g. stop producing one product in favor of a better-sold product.
Costing methods (Atrill & McLaney, 2012, p. 97-183)	Costing methods e.g. life-cycle costing (LCC), utilized to monetize the effects of different decision alternatives.
Net Present Value (Gaspars-Wieloch, 2019)	Basis to valuate any economic asset; useful to identify if an investment will increase organizational value.
Internal Rate of Return (Mellichamp, 2017)	Identify the yield of an investment opportunity; helps set minimum requirements for an investment/project to be acceptable.

As the table above depicts, MA information has a wide variety of potential uses that can support the decision-making function. Other techniques can assist when handling risk and uncertainty; these include adjusting discount rates, creating sensitivity analyses and

or compounding a risk premium (Gaspars-Wieloch, H. 2019). MA information can improve decision-making effectiveness by providing a common base for judgements (Lindholm, 2018).

2.4.3 Control

Finally, MA information is also useful for the control function, which happens after a decision has been made and implemented. The control function identifies if the outcome of a decision goes according to plan and with the objectives resulting from those plans (Weetman, 2006, p. 428). For control processes, managers require relevant, timely and accurate information, which is provided by MA (Burns & Scapens, 2000).

One of the most common applications of accounting information for control processes is through performance evaluation. Performance evaluation refers to comparing plans with actual performance to see whether this is better or worse than anticipated; MA information can help review the performance of the business against set criteria (Atrill & McLaney, 2012, p. 25). A widely utilized tool for performance measurement is the Balanced Scorecard (BSC), a system that measures and manages all aspects of a company's performance (Kaplan & Norton, 1992). The BSC measures performance across four perspectives: (1) financial, (2) customer, (3) internal, and (4) learning and growth. In the BSC, financial performance is measured through revenue growth and productivity, which can be observed in a company's financial statements (Zuca, 2017). Table 7 depicts how several MA tools result useful to support the decision-making function.

Table 7. MA tools to support the control function

MA Tool	Potential use to support the control function
Financial statements (Zuca, 2017)	Identify revenue growth throughout different years and conduct a financial diagnosis.
Budgeting (Callahan et al., 2011, p. 141)	Evaluate performance based on a previously set budget and identifying variances, which shed light on potential problems.
Costing methods (Atrill & McLaney, 2012, p. 97-183)	Costing methods, e.g. ABC, useful to illustrate budgeted vs actual cost information.

Budgeting is one of the most important tools for the control function; budgets motivate managers to perform better, provide a basis for a control system and promote forward thinking and problem identification (Atrill & McLaney, 2012, p. 197). Van der Veeken and Wouters (2002, cited in Hall, 2010) identified that budgeted versus actual cost information was central for senior managers who utilize updated information to identify projects that are causing problems.

According to Zimmerman (1977; cited in Wouters & Verdaasdonk, 2002) internal accounting systems provide necessary knowledge for planning and decision-making, as well as to monitor and motivate people in organizations. MA practices can be shaped and shape the organizations where utilized (Burns & Scapens, 2000). Figure 20 illustrates the MA tools discussed in the previous sections, in the example (see figure 19) of a manufacturing company that is considering expanding to a bigger production facility.

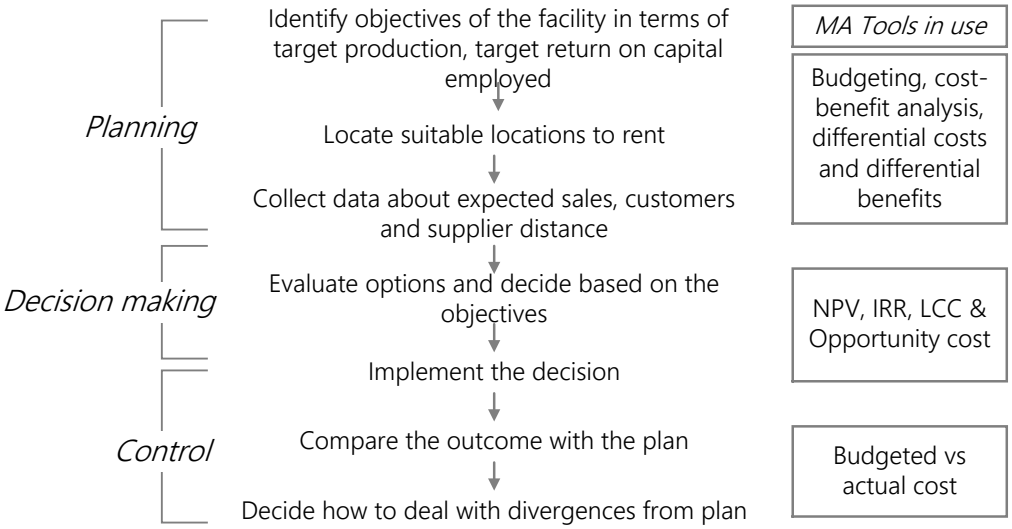

Figure 20. MA tools in use for MA functions (Adapted from Weetman, 2006, p. 431).

This figure illustrates both, the interrelationships between the three management functions (Weetman, 2006, p. 431) as well as the practical use of several MA tools. While there are many more tools available for these functions, the ones here mentioned are relevant for the practical context and scope of this work.

2.5 Investment in Prevention

An investment happens when an individual or organization allocates money expecting a future benefit; it involves outflows of cash causing inflows of cash (McLaney, 2003, p. 71). The benefit from an investment is known as 'return' and naturally, all investors seek for quick and high returns. Investments are considered assets of a company and can be classified as tangible or intangible assets. Tangible assets are those that have physical matter such as property, plant and equipment or fixtures and fittings whereas intangible assets have no tangible substance such as patents and trademarks or trade receivables (Atrill & McLaney, 2012, p. 38).

Investments can be categorized as short-term investments or long-term investment depending on the time passed between investment and return. While the former yield return

in less than one year, the latter may take several years before providing returns (Weetman, 2006, p. 207).

Different organizations make investment decisions for different reasons including firm size (Badrinath et al., 1989), historical performance, market risk (and risk-aversion of the organization) and objectives and strategy that the business is following (McLaney, 2003, p. 92). Investment decisions should be made in the context of an organization's strategic plans, which establish in which direction the organization seeks to go in terms of products, markets, financing, public image, customer satisfaction and wellbeing, among others (McLaney, 2003, p. 126). This explains why some organizations make investments seeking market share growth or low-risk differentiation while others seek environmental protection or public health benefits. Furthermore, another categorization of investment that is seldom discussed, is investment in prevention.

Investment in prevention is a type of investment that individuals or organizations make to reduce the probability of an unwanted event in the future. Investment in prevention conveys preventive behavior and, according to Cohen (1984), preventive behavior involves consumption of goods, services and activities that affect risk. Consumption levels of these items depend on perceived benefits in comparison to perceived costs. As few preventive actions are 100% effective, benefits of consumption of risk-mitigating goods come from reduced risk and reduced anxiety.

An investment on prevention can involve spending resources in something that is perceived as new by a unit of adoption, also known as an innovation. This sheds light to a type of innovation that is not widely covered in diffusion studies and worth mentioning for the context of this work: preventive innovation.

2.5.1 Preventive Innovations

Preventive innovations are those that individuals adopt in order to reduce the probability of an unwanted event in the future (Rogers, 2013, p. 234) or that can only be realized in a point in the distant future (Overstreet et al., 2013). This type of innovation is difficult to perceive because it is the result of a nonevent, that is, the absence of something that might have happened or can have non-observable benefits (Overstreet et al., 2013).

In comparison to incremental innovations, preventive innovations take a longer time lapse to prove beneficial consequences in comparison to other types of innovations, such as incremental innovations. Rewards of a preventive innovation are delayed in time (Bernstein, 2007), as shown in Figure 21.

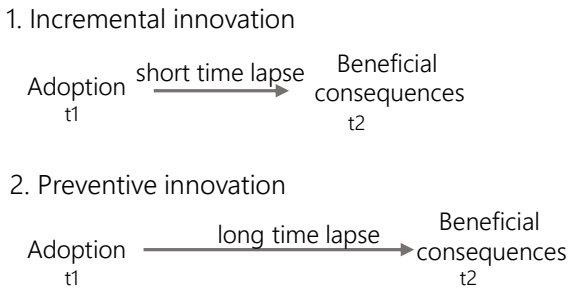

Figure 21. Rate of adoption of incremental and preventive innovations (Rogers, 2013, p. 235).

The five characteristics of innovations can shed light on why preventive innovations have a relatively slow rate of adoption. Preventive innovations have difficulty to transmit relative advantage, they are often not compatible with potential adopters' attitudes or lifestyles, cause-and-effect relationships are complex, trialability is limited and, the innovation's results are not easy to observe and are usually delayed (Rogers, 1988).

Rogers (1988) suggested there are three main obstacles in the diffusion of preventive innovations. First, the adoption of a preventive innovation is rarely motivated by profit but instead by other individuals adopting or by the organizations that promote the adoption. Second, potential adopters are discouraged by rewards, values and professional training; for example, in the medical profession there is greater focus on curing diseases than on averting them. Finally, potential adopters feel their individual preventive actions cannot make a difference in affecting important outcomes.

Examples of preventive innovations include vaccinations that seek to avoid disease contraction (Overstreet et al., 2013), the use of seat belts in passenger cars (Rogers, 2013, p. 235) or the purchase of automobile insurance policies. Some preventive innovations are only adopted thanks to regulations. For example, in the United States, the rate of adoption of automobile insurance policies depends heavily on minimum insurance requirements of each state. Florida, having one of the lowest insurance requirements (FLHSMV, 2019) is the state with most uninsured drivers (over 26% of drivers), whereas Maine, with the highest insurance requirements (State of Maine, 2017), has less than 5% of uninsured drivers (Carsurance, 2020).

Going back to the idea that innovations can be classified as product innovation or process innovation (Utterback & Abernathy, 1975), it can be assumed that preventive innovations are also divided into preventive product innovations and preventive process innovations. A preventive product innovation can be defined as an object that is perceived as new by a unit of adoption (Rogers, 2013, p. 12) whose consumption reduces the level of risk (Cohen, 1984) and probability of an unwanted future event (Rogers, 2013, p. 234). On the other side, a preventive process refers to a system of equipment, work force or

material inputs (Utterback & Abernathy, 1975) that is also perceived as new (Rogers, 2013, p. 12) and its utilization reduces the level of risk (Cohen, 1984) and probability of an unwanted future event (Rogers, 2013, p. 234).

2.5.2 The Logic of Prevention

Preventive behavior has been studied widely in the context of human health, where preventive actions seek to modify the risk of illness or injury (Cohen, 1984). For this thesis, studying preventive behavior through modifying one's health habits (a process) or purchasing healthy insurance policies (a product) are relevant. Furthermore, analyzing these widely studied cases of prevention can shed light on potential ways to promote investments in other cases of prevention.

People are usually aware of the importance of following preventive health behavior in order to lead a healthy life. Preventive health practices include eating a balanced diet, exercising on a regular basis, avoiding drugs and alcohol, getting medical screens and using seatbelts while driving (Werle, 2011). However, some people don't adopt these measures, even knowing they can prevent serious problems in the future.

Various authors have studied predictors behind preventive behavior. Bandura (1989) identified that a strong sense of personal efficacy, which he named 'self-efficacy', drives preventive health behavior. Deep awareness and understanding of health risks set grounds for self-efficacy. Bergadaà (1990) identified that temporal orientation fosters different motivation behaviors, plans and consumption of products, where future-oriented people are proactive towards prevention and past-oriented people are reactive. Jayanti and Burns (1998) identified that perceived value of preventive actions is a strong predictor of preventive behavior. They also identify health motivation and health consciousness as predictors to preventive health behavior. Furthermore, Simons et al. (2004) identified that future-oriented goals create deep engagement in a task and lead to better performance, thus the future time perspective has a role in motivation. Finally, Werle (2011) established that future-oriented individuals are more likely to develop preventive health behaviors than those who are past-oriented.

Similarly, various models have been created to illustrate behavior predictors and explain why individuals embrace or reject preventive behaviors. A series of models that explain preventive behavior are identified in Table 8:

Table 8. Models on preventive behavior.

Model	Approach to preventive behavior
Health Belief Model (HBM)	Establishes that people will show preventive behavior based on: (1) perceived susceptibility, (2) perceived severity, (3) perceived benefits, (4) perceived barriers, and (5) cues to action (Rosenstock, 1966, cited in Oliver & Berger, 1979).
Protection Motivation Theory (PMT)	States that the aim to protect oneself depends on: (1) perceived vulnerability, (2) perceived severity, (3) efficacy of recommended preventive behavior, and (4) perceived self-efficacy (Rogers, 1983).
Theory of Reasoned Action (TRA)	Asserts that attitudes and subjective norms around certain behavior to be performed must be altered before behavioral changes are achieved (Ajzen, 1991).
Theory of Planned Behavior (TPB)	Complements the Theory of Reasoned Action with a new dimension: perceived behavioral control, which states how individual motivation is affected by how difficult a behavior is perceived to be (Ajzen, 1991).
Transtheoretical Model	Identifies behavioral change through six steps: (1) pre-contemplation, (2) contemplation, (3) preparation, (4) action, (5) maintenance, and (6) relapse. In each phase, beliefs are reinforced to enable change (DiClemente & Prochaska, 1982).
Health Action Process Approach (HAPA)	Identifies two stages in the process of adoption and maintenance of health behaviors: (1) motivation, and (2) volition, which is divided into planning, action and maintenance (Schwarzer & Fuchs, 1996).

The first four models present a series of predictors of preventive behavior while the last two models identify different stages present in behavioral change. There are six common predictors to preventive behavior among these models:

1. Perceived vulnerability
2. Perceived severity
3. Perceived benefits
4. Perceived barriers
5. Self-efficacy
6. Subjective norms (social pressure)

The most common predictor in all models is self-efficacy. On the other side, steps in behavioral change include: a trigger motivating a change, preparing for an action, the action itself and maintaining a state of change. These predictors and steps for behavioral change can be identified in a practical manner through the adoption and diffusion of a widely studied product for prevention: insurance policies.

An insurance policy is a contract under which one individual pays an insurance premium in exchange for the promise of compensation in the occurrence of a loss (Rees & Wambach, 2008). An insurance policy is a sophisticated transaction with high degree of uncertainty which requires a well calculated economic infrastructure. In a simplified manner, the expected utility from an insurance depends on the price of the premium rate (which depends on the insurance cover), the size and probability of the loss, the wealth of the individual in the event of no loss and the individual's attitude towards risk, which can be risk-averse, risk-neutral or risk-seeking loss (Rees & Wambach, 2008). Table 9 presents a compilation of case studies on adoption or rejection of insurance policies for real estate (two cases in farming and two cases for private homes) along with the insights behind their adoption/rejection.

Table 9. Case studies on insurance policy purchase.

Case study	Insights behind adoption/rejection of insurance policies
(1) Crop insurance in India (Aditya et al., 2018)	• Low adoption of crop insurance. Main reason: lack of awareness about insurance products • Higher probability of adoption for those who experience crop loss and have higher degree of training in agriculture • Subsidies positively influence insurance purchase decisions
(2) Insurance adoption among Bulgarian farmers (Lefebvre et al., 2014)	• Farm size and farm location influence insurance purchases • Higher risk exposure and perception of risk significantly increase the probability to get insurance • Farmers with diversified activities are more likely get insurance • Educated farmers are more likely to purchase insurance
(3) Catastrophic earthquake home insurance (Palm, 1995)	• Perceived risk is a major factor affecting insurance purchase and lack of confidence of receiving compensation is a major factor not to purchase (despite mandatory requirements) • Geophysical risk (objective) is unrelated to insurance purchase
(4) Insurance coverage for floodplain residents (Gares, 2002)	• Receiving no information regarding flooding potential and insurance availability was the biggest factor for not purchasing insurance (poor information transfer between purchaser, realtor, loan officer and insurance agent) • No previous experience with flooding led to no purchase

The table above illustrates the practical validity of the identified six predictors for preventive behavior. For example, perceived vulnerability and perceived severity, both subjective measures, are present in the purchase of crop insurance for Bulgarian farmers (case 2) and home insurance for catastrophic earthquakes (case 3). In case 3, these predictors are a bigger factor for home insurance purchase than geophysical risk, an objective measure (Palm, 1995). Perceived barriers are present in the case of crop insurance in India (case 1), where high insurance premiums pose a barrier to the adoption of insur-

ance. Lack of perceived benefits is present in the case of insurance coverage for floodplain residents (case 4), where homeowners received no information regarding flooding potential and insurance availability thus, did not purchase any insurance coverage (Gares, 2002). Subjective norms can also be identified through the lack of experience with losses. For example, in case 4, the local population's lack of experience with flooding contributed to many residents not purchasing flood insurance (Gares, 2002).

2.5.3 Value in Prevention

The previous section has shed light on elements of preventive behavior, necessary for investments in prevention. However, an investment on prevention is not only made based on the presence or absence of preventive behavior; as with any other purchase, a customer must see the value behind an investment in prevention. The main source of value from investments in prevention is through reduced risk (Cohen, 1984).

An insurance policy, though providing nothing tangible, creates economic value (Rees & Wambach, 2008) from reduced anxiety, which results from the awareness of being at risk. Therefore, a perceived reduction in risk will yield a reduction in anxiety (Cohen, 1984). Reduced anxiety has been proven to be an element that provides high-level value both for B2C (Almquist et al., 2016) and B2B (Almquist et al., 2018) buyers.

Reduced anxiety addresses subjective elements that respond to a buyer's individual priorities and emotional concerns such as fear of failure. Buyers who are accountable for purchases benefit from investments that offer risk reduction and provide reputational assurance (Almquist et al., 2018). Going back to the idea of higher perceived elements by enhancing 'get elements' or reducing 'give elements', reduced anxiety can be placed in the first category, as shown in Figure 22.

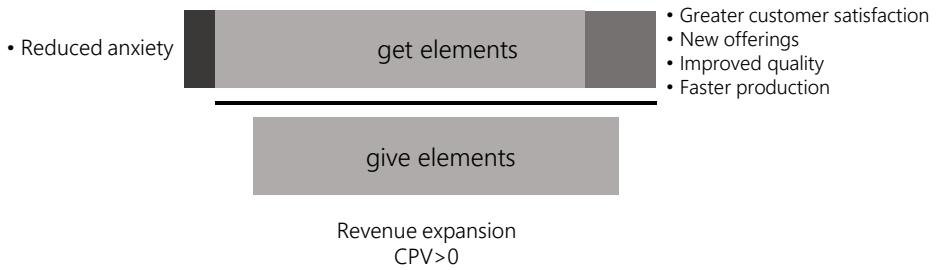

Figure 22. Reduced anxiety providing customer value (Based on Almquist et al., 2018).

In this case, reduced risk leads to reduced anxiety which contributes to 'get elements'. However, value from preventive investments can be difficult to transmit due to its subjective nature. For example, for insurance policies, the premium must be lower than the

buyer's willingness to pay, but also high enough for the insurer to meet costs of claims and stay in business (Rees & Wambach, 2008).

The rate of adoption on a product or process of prevention is slow due to its low levels of relative advantage, which is the most significant predictor in the adoption of innovations (Rogers, 2002). According to Rogers (2013, p. 235), to increase the rate of adoption of preventive innovations, perceived relative advantage must be amplified. Furthermore, Overstreet et al. (2013) identified that attitude (the individual's motivation), social norms (such as opinions of members from the profession), and perceived behavioral control (feeling whether one can make a difference) can have a significant role in the adoption of preventive innovations.

Additionally, preventive health behavior must be encouraged to promote investment in prevention. Jayanti and Burns (1998) studied how to foster preventive behavior in a health context. They identified that marketers should: (1) single out which preventive behaviors are valuable, (2) enable the performance of such behaviors, and (3) convince the target audience about the efficacy of preventive measures. Similarly, Cohen (1984) suggests that preventive behavior towards the consumption of goods of prevention can be affected by modifying perceptions of cost, utility in use and utility in anticipation.

Furthermore, Cohen (1984) suggests that the strategy to modify preventive behavior should be tailored according to the nature of risk and the target audience. In some cases, where the demand of a product or service is highly elastic acting on the supply side might prove to be more efficient to modify behavior than actions targeted at altering any perception of utility. To promote preventive behavior, communication campaigns and incentives have proven to be useful. For example, training material that explains how an adopted behavior can prevent negative consequences in the future can modify perceived behavioral control (Overstreet et al., 2013).

2.5.4 Preventive Investments Across a Business Ecosystem

A business ecosystem is an economic community of actors that interact and affect each other through their activities (Jacobides et al., 2018). According to Teece (2007), an ecosystem is an environment which an organization should monitor and react to. Within a business ecosystem there are various stakeholders present; individuals, institutions, neighborhoods, organizations, companies, and even the natural environment have been perceived as potential stakeholders (Mitchell et al., 1997). While stakeholders have been classified in myriad categories including economic, social, and technological, let us consider two main categories: internal and external stakeholders.

Internal stakeholders are those that belong to the organization such as employees, managers and owners whereas external stakeholders are outside of the organization such as customers, suppliers, governments, the local community and the environment

Figure 23. Stakeholders in a business ecosystem.

(Neubaum et al., 2012), as shown in Figure 23. Stakeholder theory states that in order to survive and thrive, firms must support important stakeholders, managers should develop relationships, inspire stakeholders and create a sense of community where everyone seeks to give their best to deliver value (Freeman et al., 2004).

As identified previously, the main source of value from investments in prevention is through reduced risk which yields a reduction in anxiety (Cohen, 1984). This is particularly the case for the buyer who is accountable for the purchase. However, what does an investment in prevention represent for different stakeholders inside and outside an organization?

For internal stakeholders an investment in prevention is reflected in different ways. Within the team of the decision-maker, knowing that a decision made conveys reduced risk builds a sense of trust, a characteristic essential to a group's effectiveness (Druskat & Wolff, 2001). For managers, an investment in prevention reduces the chances of holding someone accountable over a future consequence, which most leaders want to avoid; in fact, holding people accountable is the most neglected behavior for leaders (Overfield & Kaiser, 2012). For owners, their business attains enhanced corporate competitiveness from taking proactive stance on matters such as public health and environmental concerns (Porter & van der Linde, 1995).

On the other side, external stakeholders are also influenced by an organization's investment in prevention. Customers might prefer a supplier that is proactive on societal aspects and often select the best supplier based on their corporate social responsibility practices (Govindan et al., 2018) as it enhances their own corporate image. Furthermore, the society in which the organization operates can benefit from prevention related to big societal problems. Benefits within the society are bilateral and on average 30% of a company's earnings can be attributed to its relationship with society (Browne, 2016).

When an investment in prevention seeks more than the organization's own benefits, it is creating shared value. Shared value is creating value in such way that also creates value for the society by addressing its needs (Porter & Kramer, 2011); the main premise is that both economic and social progress are sought after. Pursuing financial success in a way that yields social benefits is nowadays an imperative matter where legitimacy of organizations is being called upon and contemporary problems require expertise and business models from the private sector (Kramer & Pfitzer, 2016). Effects of prevention for internal and external stakeholders for an organization are depicted in Figure 24.

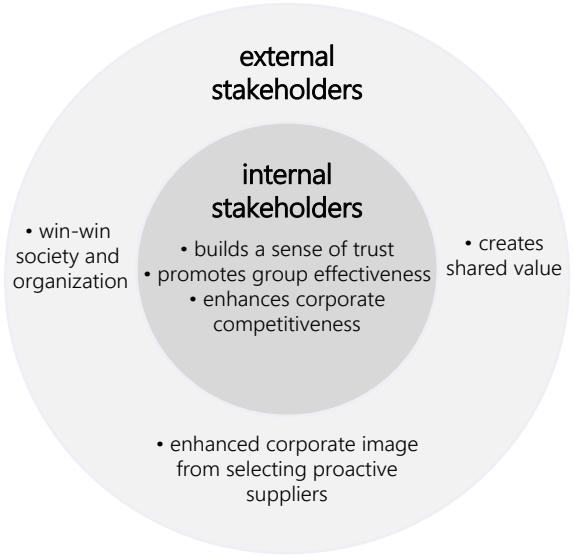

Figure 24. Investments in prevention across a business ecosystem.

It is important to mention that the benefits across a stakeholder network of an investment in prevention might vary according to the nature of the product or service in prevention. For example, an investment in prevention that seeks to deter environmental harm or enhance public health benefits affects stakeholders differently than an investment that will lower the risk of a production machine breaking down. These differences are mainly observable to how external stakeholders are affected.

2.6 Research Framework

Five sections of this theory chapter have covered the concepts of customer value, technological innovations and their diffusion, organizational decision-making, accounting for management functions, and investment in prevention. Briefly highlighting key points of this review will pave the way for the research framework utilized in this thesis, which seeks to fulfill the objective of this work: identify drivers of investment in prevention.

The essence of business is to create value (Kumar & Reinartz, 2016), which can be done through revenue expansion, cost reduction, or both (Rust et al., 2002; Lyly-Yrjänäinen et al., 2019). Customer perceived value can be visualized as a ratio of perceived benefits to perceived sacrifices (Christopher at al., 2008, p. 20), where the numerator is made up of benefits, referred to as get elements, and the denominator is made up of sacrifices, referred to as give elements.

On the other side, an exploratory review of technological innovations, their adoption and diffusion identified that the diffusion of an innovation is the process by which an (1) innovation is (2) communicated through certain channels, (3) over time, (4) among members of a social system (Rogers, 2013, p. 11). This section also identified product innovations and process innovations as two different categorizations of innovations.

A review on organizational decision-making processes found key differences between individual decision-making (Pennington & Hastie, 1986) and team-level decision-making (Hinsz et al., 1997). Additionally, five dimensions were identified to explain the nature of a decision. Furthermore, critical incidents, specifically the switching path analysis technique (SPAT) was presented as a tool to study decision-making processes where the original SPAT framework (Roos, 1999) was simplified into a timeline.

Next, accounting information and its role to help managers make informed decisions was explored. MA proved to be useful for all three functions of management: planning, decision-making and control (Weetman, 2006, p. 429). A series of MA tools relevant for the context of this work were presented including, budgeting, cost-benefit analysis, costing methods and other methods to evaluate capital investments.

Finally, the concept of investing in prevention was explored and special emphasis was placed on preventive innovations and their diffusion (Rogers, 2013, p. 234), where studies related to environmental protection are scarce (Overstreet et al., 2013). This section also identified the characteristics of preventive behavior and the source of value from investments in prevention, which is mainly from reduced risk. Furthermore, this section depicted what does a preventive investment represent across a business ecosystem.

The proposed framework in Figure 25 is designed for group-wide decision-making, where different stakeholders participate at different stages, characteristic of B2B sectors. This framework assumes that shedding light on what happens before, during and after an investment in prevention will help identify decision-making drivers. Therefore, the investment process is studied from the point of view of the SPAT timeline, which describes the path leading from an intentional switching decision to a behavioral change (Edvardsson & Roos, 2001). Understanding a decision through the lens of SPAT can explain the reasons for investing in prevention as well as selecting one supplier over another.

The research framework is intended to assist managers of organizations whose business depends somehow in preventive behavior or researchers studying investments in prevention related to environmental protection. The purpose of this framework is to provide understanding on how an investment in prevention is made, considering what type of behavior is required from the potential customer, which stakeholders are involved, what type of events happen during the investment process and which MA tools are utilized in the process. Applying this framework in an investment decision results useful to identify decision-making drivers, as here applied to investments in environmental prevention.

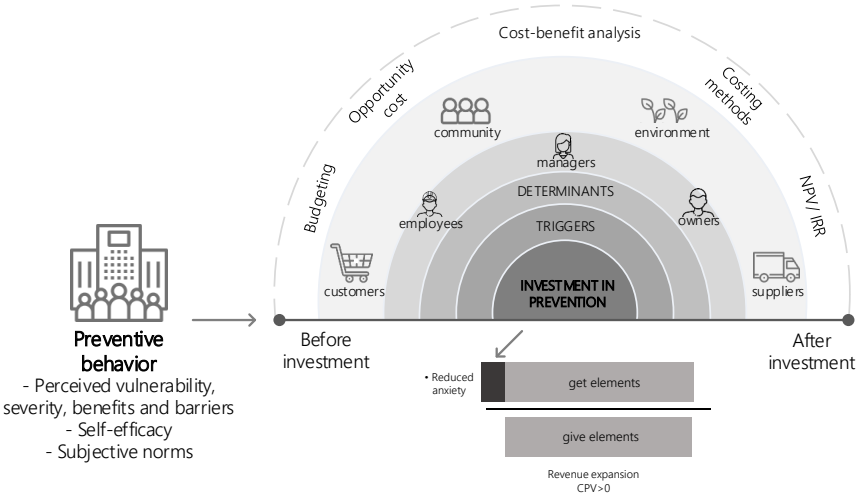

Figure 25. Research framework.

As shown, the investment process occurs within an organization that exhibits preventive behavior. This behavior depends on perceived vulnerability, severity, benefits and barriers, as well as self-efficacy and subjective norms. This framework depicts an investment in prevention as part of a business ecosystem. This ecosystem layout seeks to demonstrate both the relevance of internal and external stakeholders in the decision-making process, as well as the widespread impact of investing in prevention. Through the ecosystem representation, the framework shows that the customer is not only influenced by internal stakeholders, but also considers external stakeholders such as their own customers, the community and the surrounding environment.

The ecosystem is placed within a SPAT timeline, acknowledging that an investment decision has different events before, during and after it is made and that internal and external stakeholders are present throughout that process. In the center of the ecosystem there is an investment in prevention, which occurs thanks to a series of trigger events that make the organization prone to invest and determinants, that power and steer the decision. Triggers and determinants are depicted as generic events within the timeline, as they are case-specific. However, the framework seeks to represent the importance of triggers and determinants for the investment process and are thus placed closer to the investment than other elements.

Furthermore, the framework depicts the value-adding potential of an investment in prevention, potentially enhancing “get elements” through reduced risk. Additionally, a series of potential MA tools that support the decision-making process are presented along the ecosystem, suggesting that these can be utilized in any stage of the decision process. The selected MA tools are were specially chosen from literature to make informed decisions in all three functions of management. Though not specifically highlighted, the elements of diffusion are present in the framework: (1) an innovation is present through the investment in prevention, (2) communication channels and (3) social system through the business ecosystem and (4) time, through the SPAT timeline layout.

For this thesis, investments in prevention will be studied through product innovations (black carbon-related environmental innovations) and through process changes (choosing wood as a main construction material). In the product innovation context, a series of companies are investing in different black carbon solutions for diverse reasons. The investment decision sought after is the adoption of black carbon innovations. In the process change context, a series of organizations are changing from traditional concrete as a main building material to wood. The investment decision sought after is the selection of wood as a main building material.

These cases have varying levels of uncertainty regarding initiating events, the process of gathering and processing information, decision-making tools and outcomes. By carrying out a series of interviews with companies and organizations that invested in these preventive product innovations or process changes, the researcher seeks to discover drivers behind investment decisions. Identifying decision-making drivers of preventive innovations related to environmental protection can shed light on their adoption and diffusion, a topic that is under-researched in diffusion studies.

3. CASE PROJECTS

This chapter will introduce two case projects covered in this thesis work: The Black Carbon Footprint Project (BCFP) and the Wood for Good Project (W4G). To help the reader familiarize with these projects, a section of relevant information will be presented prior to each project's description.

3.1 Black Carbon

Black Carbon (BC) is a major contributor of fine particulate matter (PM) that is formed from the incomplete combustion of biomass and fossil fuels. Complete combustion of biomass or fuel would only result in carbon dioxide, but this is seldom the case. The mixture of particulate matter that results from incomplete combustion is known as soot (CCA, 2018). BC particles are part of the sooty black material emitted from gas and diesel engines, coal-burners and other fossil fuel burning sources (United States Environmental Protection Agency, 2019). Primary BC rich sources include resident biofuel cooking and heating, resident coal cooking and heating, on-road and off-road diesel engines, industrial coal and brick kilns and open burning agricultural fields (CCA, 2018). When BC particles are released, a series of events begins, as shown in Figure 26.

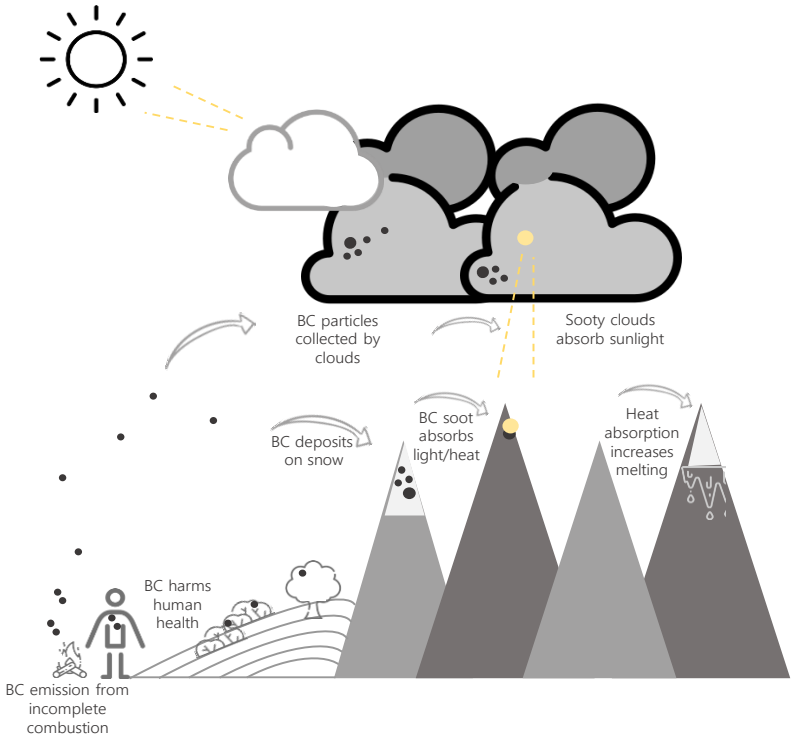

Figure 26. BC particle effects in the ecosystem (Adapted from CCA, 2018).

As an element of PM, BC particles absorb solar radiation and air heat in the atmosphere (Finnish Meteorological Institute, 2013). BC particles are scavenged by clouds, which become sooty clouds. Sooty clouds absorb light unlike clean clouds, which reflect it. Additionally, clouds with soot have different rain patters (CCA, 2018). Furthermore, when deposited on ice and snow, BC particles darken the surface thus reducing surface reflectance, or albedo, which accelerates melting (Hadley & Kirchstetter, 2012). Finally, BC particles have also been proven to be detrimental for human health.

As the figure above shows, BC particles have negative effects for both the environment as well as for human health. Climate models have shown that reduction of surface albedo caused by BC deposition in snow contributes to global ice melting and global warming (Hadley & Kirchstetter, 2012). BC also contributes to global warming because of its heat-absorption properties as well as its influence over cloud formation. BC particles have a warming impact that is from 460 to 1500 time stronger than the impact of carbon dioxide (CCA, 2018). Furthermore, BC particles modify rainfall patterns and when deposited on plant leaves, it increases their temperature, thus hurting the health of the ecosystem (Finnish Meteorological Institute, 2013).

Regarding human health, BC particles are small enough (2.5 microns in diameter) that they can be deposited into the lungs and enhance the transport of toxins to the bloodstream. BC has been linked to heart problems, lung disease, and chronic respiratory diseases and infections (CCA, 2018). Ultrafine BC particles have proven to harm the central nervous system with effects such as early Alzheimer-like pathogenic changes (Shang et al., 2018).

BC is the second contributor of global warming and its strong atmospheric warming potential and detrimental health effects are compelling arguments for governments across the world to dedicate their efforts towards the reduction of BC pollution (Tollefson, 2018). Given that BC has a short atmospheric lifetime, targeted strategies to reduce BC emissions could yield results quickly (CCA, 2018). The Climate and Clean Air Coalition has released a set of measures that, if implemented across the world by 2030, could reduce BC emissions by up to 80% and could be achieved with net cost savings (CCA, 2018). Some of the suggested measures for different sectors are depicted in Table 10.

Table 10. BC control measures (CCA, 2018).

Sector	Suggested BC control measures
Industrial production	1. Shift coke ovens to recovery ovens 2. Modernize brick kilns to vertical shaft brick kilns
Household energy	3. Replace traditional cooking and heating systems with clean-burning biomass sources 4. Modernize wood stoves and burners to pellet stoves and boilers
Transportation	5. Utilize diesel filters for on-road and off-road vehicles
Agriculture and waste management	6. Prohibit open field burning of agricultural and municipal waste

Though a pressing matter, BC reducing efforts are slow advancing; governments across the world are gradually seeking to reduce climate and health impacts of BC (Tollefson, 2018). In May 2018, the Climate and Clean Air Coalition proposed a series of recommendations including the development of emission guidance on short-lived climate forcers, voluntary development of emission inventories and advisory service and guidance (CCA, 2018). Furthermore, at the panel of the United Nations International Maritime Organization (IMO) in 2018, discussion on rules to curb black carbon pollution from ships began; however, writing rules could take a few years' time (Tollefson, 2018). Existing recommendations seek for countries and organizations to compile BC emission inventories and share the information to promote mutual learning; however, recommendations without regulations are non-binding and do not ensure compliance. Currently, there are different projects around the world that seek to create effective policies to reduce black carbon, being one of them, Finland's Black Carbon Footprint Project.

3.2 Black Carbon Footprint Project

The Black Carbon Footprint Project (BCFP) seeks to create a novel concept and metrics to be utilized to quantify BC emissions that will be applicable in several fields of science and technology. For this project, existing scientific information and measurements will be used as a basis for the multidisciplinary consortium. The project's scope ranges from science and technology development to international policymaking. Particularly, the project seeks to enhance international business in industries related to BC technologies, traffic, power production and services (FMI, 2019).

The BCFP is a 3-year project that started in July 2019 which is coordinated by Tampere University (Finland) and it involves three main consortium parties: (1) research institutions, (2) companies that produce BC metering technologies/services, emit BC emis-

sions their industrial processes or work in industries related to traffic and industrial production, and (3) cities and city-owned environmental institutions. For efficient coordination, the project is divided into six work packages (WP):

1. WP1: Validation and calibration methods for BC instruments
2. WP2: BC emissions
3. WP3: BC in ambient air
4. WP4: Creating a concept for BC footprint
5. WP5: Markets and policies
6. WP6: Coordination and dissemination

WP1, explores the fact that the BC footprint should be independent of its measurement method and should individually reflect the impacts of BC. This work package will compare results of different BC measuring instruments with different measuring techniques. WP2 aims to understand the formation and transformation of BC and determine the characteristics of emission factors of various combustion applications. WP3 seeks to understand the origin and influence of black and brown carbon in urban areas, particularly for air quality. WP4 will create a draft of the BC footprint concept based on information and findings from WP1-3. WP5 will connect the knowledge on BC solutions from WP1-3 and the BC footprint concept from WP4 to promote the concept in international policy processes. Furthermore, WP5 seeks for Finnish companies to enhance the market for BC solutions. Finally, WP6 coordinates the work and acts as a link between different WP's and partners in the project. Relation between different WP's is illustrated in Figure 27.

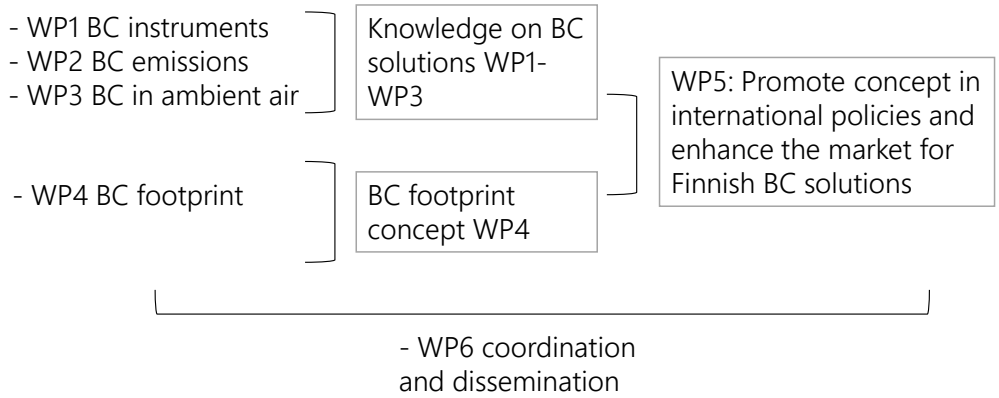

Figure 27. BCFP structure.

The context of this research work is WP5, specifically with the *markets* side with the Cost Management Center (CMC) at Tampere University. This project work requires close collaboration with the Politics department at Tampere University. As part of WP5, the CMC understands that BC solution providers should communicate the value of their solutions in order to create market demand. Therefore, the CMC seeks to identify and demonstrate

the customer value of BC solutions in quantifiable and instrumental form. For this, it is important to identify value drivers and decision-making processes in different industries, chosen from workshops with the project's participating companies. Furthermore, a value proposition based on customers' increased sales potential is to be shown as well as an estimation of monetary impacts before, during and after BC policies. Milestones and deliverables corresponding to the CMC are shown in the timeline of Figure 28.

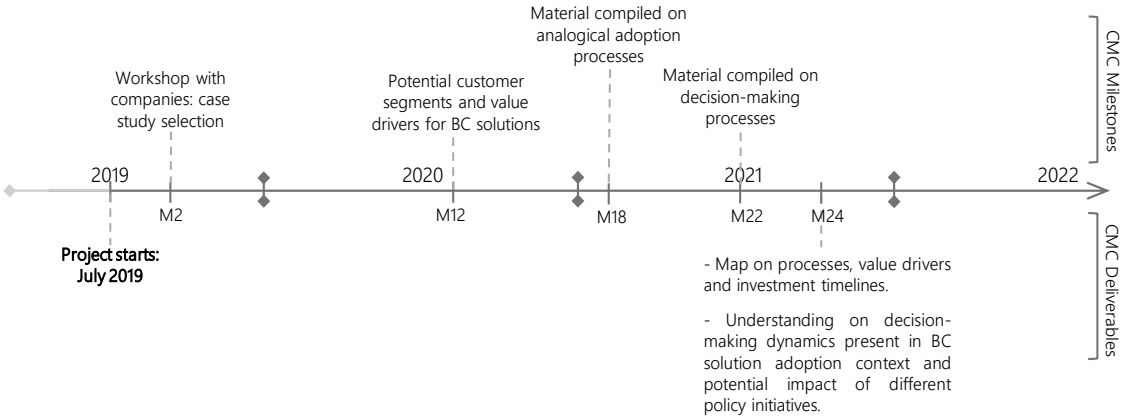

Figure 28. BCFP CMC timeline of milestones and deliverables.

As shown, the CMC has set four dates for milestones and a single date for deliverables. The first milestone, set for month 2, involved workshops with participating companies to select case studies with which to work in-depth. The second milestone, set for month 12 is to identify potential customer segments and value drivers for BC solutions, specifically for those belonging to the project's partners. The third milestone, happening in month 18 is to compile material on analogical adoption processes that customer companies have previously invested in. The last milestone, happening in month 22, is to compile material on decision-making processes, including information on key stakeholders involved in adoption processes as well as critical incidents and triggers that initiated the adoption.

On the other hand, there are two main deliverables, both set for month 24. The first deliverable consists of a detailed map on processes, value drivers and investment timelines from chosen industries. The second deliverable is information regarding decision-making dynamics present in the BC context as well as potential impact from different interventions, such as decision-support materials and policy measures.

3.3 Wood as a Building Material

Wood is considered a health-promoting building material; it is perceived as natural, comfortable, environmentally friendly and aesthetic (Rametsteir et al., 2007). Different types of wood have varying grades of hardness and wear resistance (Miller et al., 2004, p. 172)

but generally, wood has good heat capacity, which makes it good for external wall structures, is naturally resistant to decay and has the ability to moderate indoor humidity, which affects indoor air quality (Virtanen et al., 2000). Therefore, wood offers opportunities to develop wellbeing solutions for a variety of working and living environments.

Other benefits of wood as a building material are environmental and financial. Findings on the environmental impact of wood prove that wood-framed buildings are carbon neutral and have lower global warming potential than steel or concrete structures (Ritter et al., 2011). On the other side, financial benefits from wood lie in in faster project delivery (it is easier to work with and demands less machinery (Mahapatra & Gustavsson, 2008)), aesthetic differentiation that allows to capture higher rental rates (Grable, 2018) and economic development of rural forest areas (Ritter et al., 2011).

Despite these benefits, there are certain reservations and barriers that have curtailed the use of wood as a building material. When it comes to structural construction and outdoor applications, wood is perceived as more expensive to maintain, less resistant to decay and inferior regarding fire resistance and durability, in comparison to substitute materials (Rametsteir, 2007). Perceptions of durability and solidity are predictors in building material preferences (Høibø et al., 2015), therefore the common judgement of less durability in wood materials (Rametsteir, 2007) leads to a preference over other materials, such as brick or concrete (Høibø et al., 2015).

Other aspects such as tradition and path dependency pose a barrier to the widespread use of wood in modern construction projects. The preference of building materials varies across countries due to traditions and culture, which are often the result of availability of materials (Høibø et al., 2015). Therefore, a construction project in countries with greater availability and tradition of working with wood, such as Nordic countries is more likely to contemplate wood as a main building material.

Path dependency means that a decision that is made today is affected by past decisions; most individuals prefer to use existing and familiar technology rather than venturing into an innovation (Mahapatra & Gustavsson, 2008). Path dependency is present in the construction industry where projects are complex, have a high degree of social responsibility and are quite costly. A high degree of path dependency hampers the willingness of construction professionals to select a building material that has a lower degree of standardization than other alternatives and with which they have little expertise (Mahapatra & Gustavsson, 2008).

The European Union has several industry-wide goals for wood construction focused towards increasing the share of wooden construction projects from 2015 to 2030 (Forest

Sector Technology Platform, 2012). However, the prospects of future market diffusion are slow advancing; for example, in Finland, the market share of wooden apartment buildings only increased from 1 to 6% from 2010 to 2015 (Toppinen et al., 2019) and remained below those levels by 2019 (MayorsIndicators, 2020). However, in Finland, the target market share for timber construction in 2025 is now set at 45% for public constructions (MayorsIndicators, 2020).

In Finland, a study (Toppinen et al., 2019) carried out with a group of experts highlighted a series of internal and external factors that influence the future of wood construction in the country. Two main internal factors highlighted are standards and cost efficiency while two main external factors are improving know-how and influence from city planning. Seeking to promote the wood industry, various research groups and organizations have created projects that seek to demonstrate and promote the benefits of utilizing wood as a building material, being one of them, the Wood for Good Project.

3.4 Wood for Good Project

The Wood for Good project (W4G) is a 20-month project that started in October 2019 that seeks to understand the wellbeing effects, both physical and psychological, of utilizing wood as a building material. Better understanding the welfare effects of wood through verified data can improve the competitiveness of wood materials in the construction market. Furthermore, this project seeks to internationally promote the Finnish wood industry.

The W4G project will conduct an empirical experiment that measures indoor environment conditions of two rooms and compares their effects of human wellbeing. Besides experimental research, the project seeks to evaluate the financial benefits of human wellbeing from utilizing wood as building material. The W4G project is implemented as a cross-disciplinary research in collaboration between the Natural Resources Institute Finland (Luonnonvarakeskus, or Luke) and Tampere University (Cost Management Center; measurements, actuators and systems also provided by Tampere University).

For efficient coordination, the project is divided into two main work packages. The first work package, carried out by Luke, investigates the wellbeing effects of wood constructions for people in controlled test room settings. The second work package, carried out by the Cost Management Center, analyzes decision-making processes and studies the financial value that wellbeing effects can provide under different contexts.

The context of the present thesis work is the second work package, identifying decision-making processes and studying the financial value of wellbeing effects from wood. The CMC will study a series of cases in Finland where wood was selected as a building material and will determine the expected impact of this material choice along with its benefits. The CMC's milestones and deliverables are shown in the timeline of Figure 29.

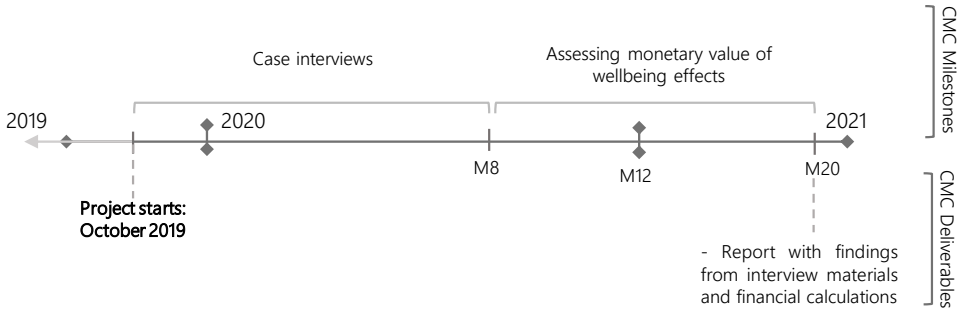

Figure 29. W4G CMC milestones and deliverables timeline.

As depicted above, the CMC has two major milestones. The first milestone consists of carrying out a series of interviews (5 to 10 organizations, totaling 15 to 30 interviews) to identify decision-making drivers related to selecting wood as a building material. The second milestone is assessing the monetary value of wellbeing effects from utilizing wood as a building material. On the other hand, the main deliverable is a report that depicts findings from interview materials as well as financial calculations

3.5 Points of Parity

While the BCFP and the W4G project seem to be very different at first glance, these projects have various points of parity, which allowed the researcher to utilize them in parallel for purposes of this thesis work. First, both projects have an environmental focus and seek to promote sustainable development. Second, both projects involve the adoption and diffusion of an innovation; while the BCFP seeks to promote the adoption of BC-related product innovations, the W4G project pursues the adoption of wood as a main building material, a process perceived as new by its unit of adoption (the construction sector), and therefore, can be considered an innovation. Third and most importantly, both projects focus in decision-making issues in investments in prevention because they promote benefits that are not realized immediately. On the BCFP side, companies that adopt BC technologies are preparing for future environmental regulations or are proactive toward environmental aspects seeking to avoid future environmental consequences. On the W4G side, buildings made with wood bring long-term benefits such as better indoor air quality and lower carbon footprint. The essence of investments in prevention serves as a main bridge between the BCFP and the W4G project.

4. DEVELOPMENT OF CASE PROJECTS

The previous chapter introduced the two case projects in which this thesis work is based on. This chapter presents a detailed overview on the researcher's work on the projects. The first section explains the overall research strategy. The second section identifies the interventionist research element in the project. The third section explains how the proposed research framework was applied through a series of interviews and the fourth section reflects on the selected research strategy.

4.1 Research Strategy

The research strategy consisted of a combination of theorical and empirical work. The work started by familiarizing with the topics of research (articles and other theses), the projects and with previous work done on them. Then, a literature review was carried out to create a main research framework, which was reviewed and modified with the researcher's supervisor. Once the research framework was ready, it was utilized as the main guide to carry out and analyze interviews.

The empirical work carried out between projects was different and the researcher had a different role in each. In the BCFP the researcher had a leading role in the practical work for the markets and business side of WP5, whereas in the W4G project the researcher had an assisting role for a senior researcher in charge of the project. Despite the varying degree of project participation, the same research strategy was utilized in both projects, which allowed the researcher to draw single conclusions regarding the topic.

The main tasks carried out for these projects varied from desktop work, such as content translation (Finnish to English, with the help of online translating tools), to field work, (face-to-face interviews). Tasks carried out with each project are presented in Table 11.

Table 11. Empirical work for each project.

Task	BCFP	W4G
Content translation	First round of interviews as a starting point to identify cases to work in depth	All interviews and materials analyzed were originally in Finnish.
Carrying out interviews	For second round of interviews and for in-depth cases	For second round of interviews.
Analyzing interview material	Interview materials to framework and into findings	Interview materials to framework and into findings
Participation in events	Project kick-off and network event with project companies	Research lunches and meetings with WP1

Content translation was carried out as a starting point for both projects, where previous interviews and material were available only in Finnish. Though it was not essential for the researcher to access Finnish-written content, it brought valuable insights and background information.

Semi-structured interviews were carried out by the researcher as a main data gathering method for the BCFP; these were carried out either virtually or in person. These were carried out to members of the consortium. Getting access to interviews was the most challenging part of the project work. For the W4G project, the researcher participated in a series of interviews during the second round of data gathering. However, the data gathered from these interviews was not included in this thesis work.

Analyzing interview material was the main data gathering method for the W4G project as all interviews were conducted in Finnish by another researcher. In both cases, interviews were analyzed systematically by means of three steps. First, the researcher would take the information from an interview format into a narration format, where each case was explained in detail. Second, SPAT elements (events, triggers and determinants), stakeholders and MA tools were identified and color-coded for each interview. Third, these SPAT elements, stakeholders and MA tools would be placed into the main research framework for further analysis. Placing all elements into the research framework step made the identification of findings a very efficient process.

Finally, to analyze the data and identify findings, the researcher made several tables corresponding to all elements of the framework where each case had its own row, as depicted in Tables 13-16. Elements studied include SPAT elements (triggers and determinants), stakeholders and MA tools as well as additional tables that could provide valuable information, such as potential source of customer value, type of decision-making (centralized vs decentralized), function utilizing the preventive innovation (R&D vs monitoring) or sector of operation (public vs private). This table layout allowed to draw linkages between elements that would not have appeared evident at first sight, such as how stakeholder participation varied through the investment-decision process between bottom-up vs top-down decisions.

Creating tables helped put together all information into a single document, where it was possible to highlight which elements were more prevalent. To identify project findings and draw common conclusions, the researcher focused on elements that are the most prevalent (that is, present across the larger number of cases). This technique proved useful for both SPAT elements as well as MA tools; however, it was difficult to draw

conclusions regarding specific stakeholders involved in every stage of the decision-making as every organization had different people involved in these processes and there was no identifiable trend.

Finally, the researcher participated a series networking events for the BCFP during the duration of the thesis writing process. The first event was the project's kick-off, where the researcher got to meet representatives of the consortium. The second event consisted of a networking day in one of the case companies, where preliminary findings were shared and discussed with members of the consortium. Other events were virtual research seminars with other WPs; more events are scheduled for Fall and Winter of 2020.

4.2 Interventionist Element

This thesis work is based on case study research as well as interventionist research. As previously identified, case study research is characterized by having intricate connections between project variables (Gummesson, 1993, p. 6) as well as relying on multiple sources of evidence (Yin, 1993, p. xi). On the other side, in interventionist research, a form of case study, the researcher is actively involved in the object of study and the project involves close collaborations between the researcher and participating companies (Suomala et al., 2014).

The interventionist element in these projects is not as easy to pinpoint as when a project is centered around a single company that has a problem to solve. These projects have multiple stakeholders with different expectations from their sponsorship or collaboration. However, different stakeholders also represent a possibility to yield various interventions of different sizes. Interventions in both projects were realized as there was close contact to the participating organizations.

For the BCFP, interventions happened through interviews and through a workshop. During the interviews, companies reflected on how their company's interest is vested into the project. In some cases, detailed discussions regarding an investment in prevention made participants identify certain elements that hadn't come to their mind and warranted their future consideration. For example, during an interview question asking if a laboratory's team had considered specific accounting tools to evaluate the life cycle costs of the equipment the interviewee realized that those hadn't been considered. Furthermore, the interviewee added that they will probably be a significant cost component in the future that should have deserved more attention.

Regarding interventions in the workshop and networking event, companies either heard for the first time or reaffirmed their knowledge about which elements customers take into

consideration when making an investment in BC and related technologies. For example, companies were surprised when the researcher mentioned that customers take into consideration the opinion of research institutes with which they collaborate; they also did not expect that the users of the equipment (lab crew) had significant weight over the decision. Furthermore, the researcher mentioned that customers rely on tools such as Total Cost of Ownership (TCO) for decision-making, which one company reaffirmed and said their sales materials present product costs through a life-cycle approach.

Future interventions in the BCFP are expected through more networking events. Additionally, closer contact with customers of the consortium's members should yield more insights regarding which elements customers consider when making investments in prevention. The researcher expects that thorough understanding on what customers currently ponder when making investment decisions could be utilized by consortium companies to create accurately targeted marketing material.

For the W4G project, interventions have been within project stakeholders, where preliminary findings are steering future research paths. Further interventions are expected to be realized as the project progresses. The researcher expects that knowledge on what drives or slows down investment decisions in wood could be utilized by the Finnish wood industry to implement strategies that remove barriers and uplift benefits. For example, the researcher identified that a lack of experience with wood projects creates uncertainty in budgeting among customers. Communicating this barrier to players in the wood industry could help them provide guidance to their customers regarding wood project costs.

4.3 Applying the Research Framework

The research framework assumes that shedding light on the investment decision-making process will help identify drivers of investment. As mentioned above, the framework was applied by placing findings of semi-structured interviews (stakeholders, triggers, determinants and MA tools in use) in it; this process was carried out for each case.

When the researcher carried out the interviews, these were planned for answers to shed light on all elements belonging to the framework. Questions revealed what, who and when an investment decision was made, as well as their drivers and obstacles. For example, the question "Which stakeholders are involved in the decision-making process and in what stages?" sought to identify the stakeholder element of the business ecosystem. A complete example list of interview questions is presented in Appendix A.

In total, the researcher translated and/or studied nineteen interviews corresponding to both research projects. Eventually, nine interviews and ten cases were chosen to be

analyzed in-depth and investigated through the research framework. Out of the selected interviews, the researcher participated in four. The duration of interviews varied from 30 mins to 2.5 hours, most of them lasting 1 hour. Interviews were carried out in English or Finnish, where all of those in which the researcher participated were carried out in English. For each of the cases, a description on the related investment in prevention and the project to which they belong and is portrayed in Table 12.

Table 12. Investment Cases.

Case	Investment on Prevention	Related project
(1) Machinery manufacturer	Emission measuring device for R&D testing	BCFP
(2) Raw material supplier: case 1	New system to control gas and dust leakages	BCFP
(3) Raw material supplier: case: case 2	Continuous monitoring and dust-cleaning system for coke batteries	BCFP
(4) Municipal body A (environmental)	Micro soot sensor to monitor air quality and pollution levels	BCFP
(5) City administration: case 1	Micro soot sensor to monitor air quality and pollution levels	BCFP
(6) University research group	Instrument infrastructure for research purposes	BCFP
(7) City administration: case 2	Construction of daycare center made from wood	W4G
(8) City administration: case 3	Construction of new school made from wood	W4G
(9) Municipal body B	Construction of new school made from wood	W4G
(10) Municipal body C	Construction of new school made from wood	W4G

The studied cases are from both private and public sectors. Interviews were held at the interviewee's premises, Tampere University, mid-point locations or virtually through video calls. For study reliability, interviews were recorded and transcribed only to be used by participating researchers and for purposes of these projects.

4.4 Reflection on the Research Strategy

For both projects, the researcher was presented with previous materials including research proposal, project kick-off material, timelines and project milestones and deliverables. In both cases, project plans had been drafted and the research methodology (SPAT) had been selected. Though the researcher was given freedom regarding to use or not to use the SPAT methodology, it appeared be an appropriate fit for the projects' goals, therefore proceeded with it. In project kick-offs, where the methodology was dis-

cussed there were no concerns about its utilization from members of participating organizations. Furthermore, Inger Roos, who first introduced the SPAT methodology supported the translation of the SPAT framework into a timeline.

However, it was the researcher's own task to adapt this methodology into a single research framework that could serve to answer the thesis' research questions. Thus, the researcher created a new framework based on the SPAT timeline, where relevant elements to investments in prevention were depicted. This framework proved to be simple and a good guide for data collection.

According to interventionist research theory, a researcher must work with members of an organization in order to improve their practices (Nielsen & Lund, 2019). This means that the interventionist researcher should be able to get inside an organization as part of the team. However, for these projects with multiple stakeholders, it was challenging.

The researcher had a particularly difficult time setting interviews that served as data gathering method. Companies involved in the projects had time-consuming tasks of their own which made it difficult to even agree to an interview. Furthermore, the researcher perceived that the long-term orientation of the BCFP (3 years) made the interview process longer than expected. Therefore, not all interviews to be carried out for both projects are to be included the present work. Nonetheless, networking events allowed the researcher to gain better access with participating companies, which will be useful for future interventions. Finally, interview questions seemed to be appropriate to identify all elements included in the framework. Thorough discussions came up from the topic and interviewees were engaged and providing answers beyond the question's scope.

5. FINDINGS

This section outlines a series of findings from the project work carried out for this thesis. While empirical work on the BCFP and W4G projects was carried out separately, findings were brought together both for purposes of this thesis and to present results to project stakeholders. Project stakeholders were also informed and pleased with the approach of "investments in prevention". Findings are presented based on the main elements of the framework, presented again in Figure 30.

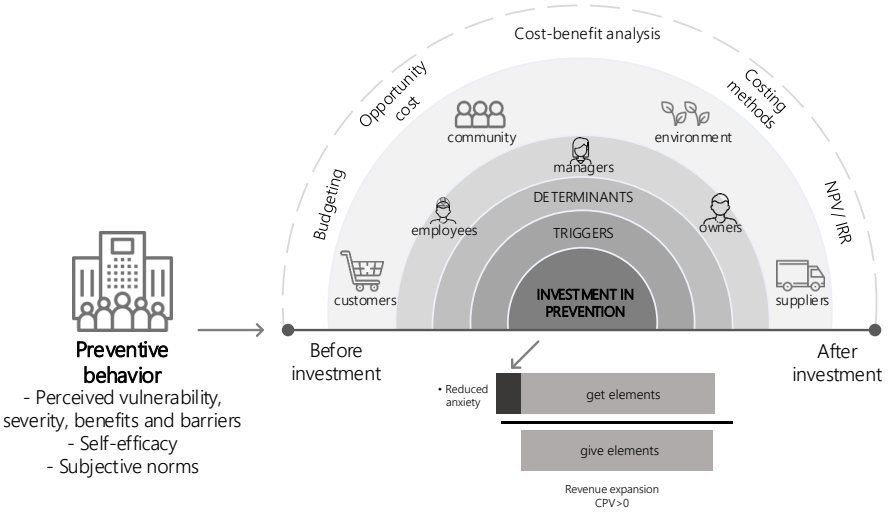

Figure 30. Research framework.

As shown, the main components of the framework are preventive behavior, internal and external stakeholders, SPAT elements (triggers, determinants), MA tools and value in prevention. These elements are contained within a business ecosystem.

5.1 SPAT Elements

As the SPAT timeline is the backbone of the research framework, it seems suitable for SPAT elements to be presented first. For this project, SPAT elements to be identified were investment decisions, triggers and determinants. Investment decisions in prevention varied, even within projects. In the BCFP an investment decision ranged from purchasing an emission-measuring device, to installing a new dust and leak control system. While in the W4G project investment decisions were more uniform and centered towards a new building made from wood, the size and scope of each project varied.

The SPAT elements that are highlighted in this section were identified by pooling all information and identifying the most prevalent items, as mentioned in section 4.1. To identify relevant findings, the researcher focused on conclusions that were applicable to

all cases, allowing one or two exceptions. Another strategy to identify findings was to separate cases into two groups, dividing cases into different categories. The researcher did not draw any major findings from small groupings, as small groups do not provide enough grounds for robust conclusions.

5.1.1 Triggers

By studying the selected cases through SPAT, elements that initiate and push forward an investment decision towards prevention can be identified. In all cases, all three triggers (situational, reactional and influential) were present in certain way (Table 13) and at least one of the triggers in all cases was related to prevention.

In most cases, an investment decision was done (or is expected to be realized) because the previous solution proved to be insufficient (reactional trigger). A clear example is case 10, where the existing solution, a concrete building, was not only deficient, but couldn't be inhabited anymore, therefore a change was mandatory. Another example is case 1, where future regulations will require new investments, as the interviewee stated: "*They just got the new regulation in that area* [CO_2 emissions] *in this spring. It's 2-step regulation* […] *and it's very challenging especially the second one, meaning they have to prepare many, many units with totally electrified, electric battery-powered units.*

Exceptions to this statement are cases 2 and 4, where there was no existing solution. This suggests that investments in prevention are done when the customer experiences a reactional trigger that is not in line with the organization's prevention-focused goals.

Situational triggers (from customer's processes) occur before reactional triggers; except for case 10, where the existing solution was no longer an acceptable alternative. Situational triggers can be clustered into two groups based on the decision-making approach:

- Bottom-up decision from an internal stakeholder or group of stakeholders that propose to invest in a new solution (cases 1-6). This proposal comes either from upcoming legislations that affect the situation of the company (cases 1,3) or a purely proactive initiative (cases 2,4,5,6).
- A top-down decision that dictates that an investment should be done (cases 7-10). This is particularly the case in public organizations.

Table 13. Triggers for investments in prevention.

Case	Situational trigger	Reactional trigger	Influential trigger
(1) Machinery manufacturer	- Upcoming legislation on emissions - Seeks positive brand image	- Current device will not comply with upcoming regulation	- Customer active - Few suppliers available
(2) Raw material supplier: case 1	- Identified potential health issues from emission exposure	- No emission control system in place (initially)	- Customer active - Other players in the area have solutions for this issue
(3) Raw material supplier: case 2	- Environmental recommendations to be regulations - Seek to improve processes and make them transparent	- Current system not very accurate or efficient	- Customer active - Close collaboration with research institute - Independent investment decisions
(4) Municipal body A (environmental)	- Particulate matter was recognized to be regulated in the future	- Did not have the equipment to measure particulate matter	- Customer 'active' - Collaboration within municipalities and device developers
(5) City administration: case 1	- Participated in air quality research project - Deputy major's initiative to purchase fine particle measuring devices - City council sponsoring	- Current metering equipment does not measure fine particulate matter	- Customer 'active' about environmental and public health - Collaboration within municipalities and device developers
(6) University research group	- New measurement needs from existing or future projects	- Current instruments insufficient for future project needs - Current instruments incompatible with new instruments	- Customer active - Research network with other institutes - Following university strategy and country's roadmap for research
(7) City administration: case 2	- Council pointed to build new daycare center in new city district, which will have a wood construction area - Loose timetable gave architect the flexibility to consider new materials	- Indoor quality issues in concrete buildings	- Customer 'active' - City seeks to be carbon neutral by 2030 - Ministry of Environment promoting wood industry
(8) City administration: case 3	- Council pointed to build a new school district with wood as a building material	- Indoor quality issues in concrete buildings	- Customer 'active' - City seeks to be carbon neutral by 2030 - Ministry of Environment promoting wood industry
(9) Municipal body B	- Council pointed to build a new wooden school	- Indoor air quality issues with old concrete building	- Customer 'active' - Nationwide trend to use wood in construction - Good press for wooden constructions
(10) Municipal body C	- City council pointed to build new school that supports secondary education	- Indoor air quality issues forced schools to be closed and students transferred	- Customer 'active' - City-wide strategy: wood in construction projects - OPS2016 program requires dynamic teaching spaces

Situational triggers can help identify an organization's preventive behavior. For example, in case 3, where the technology manager of a raw material supplier stated *"We don't have rules, they are only these recommendations, and this is okay now. Mostly, we are worried, and we think later this will become rules, and we want to make ready before that that we really know what we can make to solve this problem".* Interestingly, the 'prevention' element in situational triggers is stronger in bottom-up decisions than in it is in top-down decisions; this means that bottom-up decision makers present preventive behavior. In top-down decisions, the element of prevention is observed in the influential trigger, which affects the ecosystem (for example, a city or nationwide trend).

According to SPAT theory, influential triggers come from changes in the market that affect the competitive situation of suppliers (Selos et al., 2013). However, this project studies investment decisions in place of supplier switches; therefore, influential triggers presented are those that affect the ecosystem behind an investment decision. There were four main elements identified in influential triggers:

- All organizations were active towards the investment (that is, seeking for potential suppliers rather than being approached by these). In some stances these organizations were especially proactive towards environmental aspects.
- The degree of collaboration with other parties such as research institutes or suppliers themselves has an influence over supplier selection (cases 3-6).
- Organizations follow large-scope trends such as city and nationwide environmental and education strategies (cases 7-10).
- Public discussion through the media can influence the business ecosystem (e.g. positive press coverage towards proactive behavior) (cases 1,3,9).

For influential triggers, in cases of public organizations subject to tendering, the customer was active because the investment process started from inside the organization. However, once the tendering process started, the organization shifted to a passive stance, awaiting supplier proposals; therefore, the trigger was labeled as 'active'.

Trigger findings are in line with results from previous studies (Selos et al., 2013; Saukkonen et al., 2017) that apply SPAT in a B2B context. Particularly, there was a match with Selos et al.'s (2013) findings on how a switch (here investment decision) is done only when the customer perceives a reactional trigger and on how situational triggers precede reactional triggers. Furthermore, these triggers also align with the logic of prevention (see 2.4.2), where subjective norms were identified as predictors to preventive behavior (here present in the influence of public discussion). These findings can also

contribute to the application of SPAT to investment decisions in the Business-to-Government (B2G) context; this idea will be further elaborated in Chapter 6.

Identifying trends for SPAT triggers was a straightforward process. It was simple to draw conclusions that apply to all cases for reactional triggers, with a few exceptions. For situational triggers the researcher identified two major groups depending on the organization's decision-making approach, which can help shed light on the organization's preventive behavior. Finally, for influential triggers major conclusions that apply to at least half of the cases were drawn. There was only one conclusion that only applied to three cases and was thus portrayed as a possibility rather than as a sound conclusion: "Public discussion through the media can influence the business ecosystem".

5.1.2 Determinants

Determinants exhibit elements that push forward or slow down an investment decision (Table 14). In all cases, both pushing and swayer determinants were present. Pulling determinants were only detected theoretically, in cases where the interviewee expressed that an investment decision could be revised under certain scenarios.

Analyzing pushing determinants in these investments in prevention leads to interesting findings. First, there are certain 'traditional determinants' present, such as cost and quality (Sernos et al., 2013); however, price is present more often as a negative swayer determinant. As the interviewee from case 6 mentioned *"it's balanced between money and performance"* when mentioning the research group sometimes wants an expensive device, but the budget is limited. Second, network effects have a significant presence across these cases, where testimonies from collaborators or from partner organizations act as a pushing determinant (cases 2,4,6,8). Third, personal relations and collaboration with supplier organizations are important for supplier selection (cases 1,2,4,6).

Furthermore, it is relevant to make a distinction between cases belonging to the BCFP (cases 1-6, related to product innovations) and those belonging to the W4G project (cases 7-10, related to process innovations) to analyze pushing determinants. In the case of investment in a product innovation, pushing determinants are in line with the attributes that affect the rate of adoption of an innovation: relative advantage, compatibility, complexity, trialability and observability (Rogers, 2013, p. 16):

- Compatibility is present in how a potential solution matches an organization's existing products and solutions (cases 1,5,6).
- Complexity is observed through the ease of setting up a new device as well as its maintenance needs (cases 4,6).

Table 14. Determinants for investments in prevention.

Case	Pushing determinant	Swayer determinant (positive/negative)	Pulling determinant
(1) Machinery manufacturer	- Price - Supplier relationship - Compatibility	- Ownership of devices from same supplier (+ or –)	- *Potential*: if device does not comply with future regulations
(2) Raw material supplier: case 1	- Testimony from other companies - Supplier collaboration	- Solution is a must-have (+)	- *Potential*: system does not comply with future regulations
(3) Raw material supplier: case 2	- Experience with similar projects - Superior in-house development - Trialability of system	- Price (–)	- *Potential*: system does not comply with future regulations
(4) Municipal body A (environmental)	- Trialability - Supplier collaboration - Partner testimonies - Reliability - Maintenance needs	- Price (–)	- Not detected
(5) City administration: case 1	- Partner organization utilizing the same equipment	- Price (–)	- Not detected
(6) University research group	- Innovativeness - Trialability - Ease of setting up - Peer testimonies - Compatibility	- Price (–)	- *Potential:* If other supplier has technological edge and with no significant price difference
(7) City administration: case 2	- Shape of lot suitable for building with wood - Small building, does not require automatic sprinkling equipment	- Fire hazards (–) - Price (–) - Soundproofing (–) - Experience and capabilities (–)	- *Not detected*
(8) City administration: case 3	- Recent wooden construction (case 7) that provides experience and capabilities	- Soundproofing (–) - Fire hazards (–) - Price (–) - Restrictions on wooden buildings (–)	- *Potential:* If it results more expensive: redesign or if there are indoor air quality issues: refurbish
(9) Municipal body B	- Public perception of benefits of wood - Energy efficiency - Low carbon footprint	- Fire hazards (–) - Price (–) - Soundproofing (–) - Experience and capabilities (–) - Restrictions on wooden buildings (–)	- *Not detected*
(10) Municipal body C	- Public perception of benefits of wood - Past issues with concrete structures - Wood construction strengthens local business - Low carbon footprint	- Perception of low durability (–) - Restrictions on wooden buildings (–) - Experience and capabilities (–) - Fire hazards (–) and small local fire department (–)	- *Not detected*

- Trialability is identified on how a free trial of a product helped make an investment decision in favor of that product (cases 3,4,6).

Interestingly, relative advantage and observability, two main predictors of the adoption of an innovation have smaller presence as pushing determinants. This finding also aligns with inherent characteristics of preventive innovations, such as difficulty to transmit relative advantage and benefits are not easy to observe (Rogers, 1988). An exception can be case 6, where potential from utilizing a device" (relative advantage) was identified as a pushing determinant, as the interviewee stated that what matters when selecting device is *"what the result gives to us and what kind of publication potential it has".*

Regarding pushing determinants for cases 7-10, the most common element is the presence of network effects through the public's positive perception of the decision (all cases). Furthermore, future-oriented goals such as low carbon footprint (cases 9,10), energy efficiency (case 9) and country-wide competitiveness (case 4) further illustrate the preventive nature of these investments. As interviewee in case 4 stated "*we collaborate, we have a common goal and not as competing with each other but our network is for business use […] , we see the added value of each other and we are competitors with other places"* (interview excerpt translated Finnish to English).

Swayer determinants also yield findings on the nature of investments on prevention. Price is the most frequent swayer determinant and, in all cases where it is present (cases 3-10) it is a negative swayer. Though it seems unusual for organizations to proceed with an investment despite a price disadvantage, this does go in line with the logic of prevention, where benefits are less tangible (Rees & Wambach, 2008). For cases 7-10 there was a significant number of negative swayer determinants, being a common one, lack of capabilities and experience when working with wood (cases 7,9,10), as the interviewee in case 7 stated "*the problem at that moment was that nobody [used] CLT [wooden boards] because they didn't have that experience, but that experience wouldn't come if no one did"* (interview excerpt translated Finnish to English).

However, this negative determinant appears to be easy to overcome as it happened in case 8, which belongs to the same organization as case 7. Initially, in case 7, lack of experience and capabilities of working with wood made the organization reluctant towards utilizing this material. However, for case 8, once the project in case 7 was complete, the new acquired experience and knowledge, referred to as an *"already a good experience"* towards wood constructions pushed the project forward. Finally, as mentioned, pulling determinants were only detected theoretically as no interviewees had 'reversed' an investment process.

Trends for SPAT determinants were also evident and conclusions that applied to all cases could be drawn for both pulling and swayer determinants. However, for pushing determinants trends seem to be less cohesive; this is because there was a distinction made between cases related to product innovations and cases related to process innovations. This distinction was made to compare this project's findings with previous studies on the diffusion of preventive innovations and the attributes that affect their rate of acceptance (Rogers, 2013, p. 16); as mentioned above, findings of the project are in line with previous studies.

These SPAT elements have shown which aspects can initiate, accelerate, decelerate or even reverse an investment decision in prevention. These findings match theoretical findings on the characteristics of preventive innovations, the logic of prevention and preventive behavior, which is required for investments in prevention.

5.2 Stakeholders

The second set of findings illustrates patterns around stakeholders involved in the decision-making process of an investment in prevention. For this, stakeholders were identified for every case and in each of the three stages of the framework's timeline: before, during and after an investment decision (Table 15).

As expected in B2B settings, there are multiple stakeholders involved in the decision-making process. As observed in triggers, stakeholders involved can be clustered into two groups, according to the decision-making approach

- Bottom-up decision from an internal stakeholder or group of stakeholders that propose to invest in a new solution (cases 1-6).
- A top-down decision that dictates that an investment should be done (cases 7-10). This is particularly the case in public organizations.

However, this grouping only describes what happens before the investment. Figure 31 seeks to describe stakeholder participation throughout the investment decision-making process for bottom-up decisions and top-down decisions. The picture shows how many as well as the hierarchy of those involved in each stage.

Table 15. Stakeholders in investments in prevention.

Case	Before investment	Investment	After investment
(1) Machinery manufacturer	- Legislations Dpt. - Laboratory Mgmt. - General Mgmt.	- Laboratory and general Mgmt. - Finance Dpt.	- Legislations Dpt. - Laboratory Mgmt.
(2) Raw material supplier: case 1	- General Mgmt. - Surrounding companies: passive	- General Mgmt. - Finance Dpt.	- Laboratory Mgmt.
(3) Raw material supplier: case 2	- Laboratory Mgmt. - Technology Mngr. - Collaborating research institute	- Laboratory Mgmt. - Collaborating research institute - Laboratory's team	- Laboratory Mgmt. - Technology Mngr.
(4) Municipal body A (environmental)	- Laboratory Mgmt. - Measurement engineer	- Measurement engineer	- Laboratory Mgmt.
(5) City administration: case 1	- Deputy major - City council - Environmental unit	- Environmental unit - City council	- Environmental unit - Supplier company
(6) University research group	- Research group - Partner research institutes	- Research group - Executive board	- Research group - Partner research institutes - Other faculties
(7) City administration: case 2	- City council - Project architect - Planning team - Specialist	- City council	- City council - Project architect - Planning team - Landowner - Construction team - Construction company
(8) City administration: case 3	- City council	- City council	- City council - Planning team - Construction team - Landowner - Construction company
(9) Municipal body B	- City council - Council chairperson	- Planning team - Construction team - Community members	- City council - Planning team - Community members - Construction company - External consultant
(10) Municipal body C	- City council - Technical board - Technical department - Board chairperson	- City council - Technical board	- Technical board - Technical department - Board chairperson - External consultant - Construction company

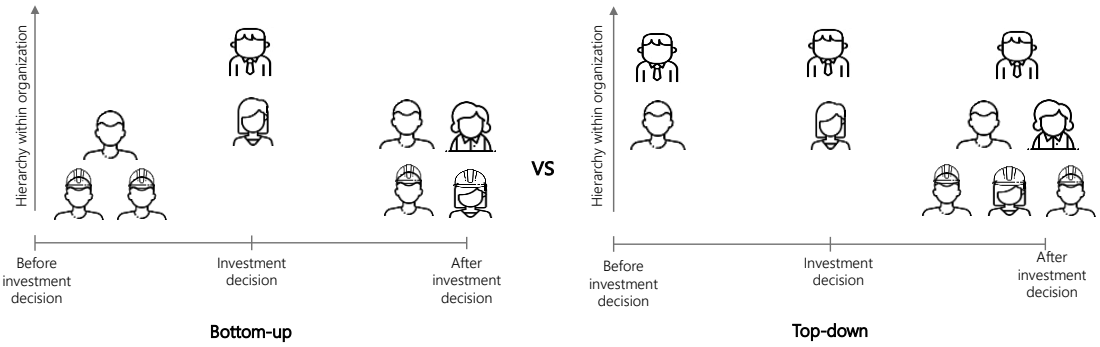

Figure 31. Bottom-up vs top-down decision-making.

As depicted, bottom-up decisions can be described as “many-to-few-to-many”. This means that at the beginning of the process there are various stakeholders, which belong from low to medium hierarchies within the company. The decision is made by a few, middle-to-high hierarchy stakeholders and, finally, after the investment many participants of low-to-medium hierarchies are involved.

On the other side, top-down decisions can be described as “few-to-few-to-many”. This means that at the beginning of the process and for the actual decision there are few, middle-to-high hierarchy stakeholders. After the decision is made, there are many stakeholders from all hierarchy levels involved.

Another finding regarding stakeholders is that in various (cases 3,5,7,9) a single, influential stakeholder took the first step towards the investment; as one of the interviewees in case 5 described *“a former deputy mayor, took the council initiative to now start tracking these tiny particles, and he got over 50 signatures from the council”* (interview excerpt translated Finnish to English). This single, influential stakeholder ranged from an organization’s technology manager, to municipality’s deputy major.

Furthermore, external research institutes were also influential stakeholders in early stages of the decision process (cases 3,6) for organizations that have deep collaboration with them. As the interviewee from case 6 stated when referring to which external influences affect their decision-making, *“we want to buy the best instruments, and how we get the information which are the best [is through] all the sources and often […] we ask someone who owns it, is it a good one? or we have used it in collaboration”.*

Identifying common trends for stakeholders was the most difficult of framework elements and common findings regarding specific positions involved in every stage of the decision-making process could not be drawn. This is explained from the varying size and sector of interviewed organizations, where there are different people involved in the decision-making process. While there are elements in common among cases, especially in cases

7-10 belonging to the public sector, every organization has different people involved in these processes.

5.3 MA Tools

The use of MA tools to support different management functions is the last element of the research framework and last set of findings. For this, the use of MA tools was identified for every case and in each of the three stages of the framework's timeline: before, during and after an investment decision (Table 16).

Table 16. MA tools utilized in investments in prevention.

Case	Before investment	Investment	After investment
(1) Machinery manufacturer	- Budgeting	- TCO	- Budgeted vs actual cost
(2) Raw material supplier: case 1	- Budgeting	- Make-or-buy	- Budgeted vs actual cost
(3) Raw material supplier: case 2	- Budgeting - Differential analysis	- Make-or-buy	- Budgeted vs actual cost
(4) Municipal body A (environmental)	- Budgeting	- Not detected	- Budgeted vs actual cost
(5) City administration: case 1	- Budgeting	- Differential analysis	- Budgeted vs actual cost
(6) University research group	- Budgeting	- Make-or-buy	- Budgeted vs actual cost
(7) City administration: case 2	- Budgeting	- Total cost vs budget	- Budgeted vs actual cost
(8) City administration: case 3	- Budgeting	- Total cost vs budget	- Budgeted vs actual cost
(9) Municipal body B	- Budgeting	- TCO - Total cost	- Budgeted vs actual cost
(10) Municipal body C	- Budgeting	- Total cost vs budget	- Budgeted vs actual cost

The researcher relied on the interview question "What elements did you consider before making the purchase decision?" and made follow-up questions accordingly to ensure the financial aspect was covered. Some interviewees specifically mentioned certain MA tools, such as case 1, where the use of TCO was mentioned as a tool to weigh in purchase costs and maintenance together through the answer *"one big part of the decision is also this total cost of ownership"*. However, in other cases the use of an MA tool was inferred from the answer, for example the interviewee of case 2 mentioned that once a budget it set and the project starts, "*we need to know how much money we are using*"; this was interpreted as budgeted versus actual cost.

Results are more cohesive for this element of the framework, where budgeting is the prevailing MA tool utilized before and after an investment decision. For the decision itself,

organizations rely on different tools. For organizations with extensive research and development (R&D) resources (cases 2,3,6), the question of making-or-buying is present, as they trust on their own capabilities to create a solution as good (or even better) as one from an external supplier. As one of the interviewees from cases 2 and 3 referred, they appreciate when a company approaches them offering a solution, but *"our knowledge is high"*

On the other side, organizations in the public sector (cases 5, 7-10) set a budget for a project that involves a tendering process and a decision is made straightforwardly by comparing the tender's proposal to the budget (total cost vs budget). Total cost of ownership was detected in two cases (cases 1,9) where the organization mentioned that not only purchase cost was considered, but also lifetime maintenance.

Understanding that organizations rely on these MA tools (budgeting, make-or-buy, total cost vs budget and TCO) as well as the underlying context when investing in prevention can shed light to strategies to promote these investments. For example, identifying if a potential customer organization has a strong R&D department would tell a supplier that the customer will probably weigh its organization's own solution against the one that is being presented. With this information, a supplier could tailor its promotional material to highlight how a solution has a type of value that cannot be replicated.

Identifying trends for MA tools was a straightforward task, as table 16 depicts, most organizations rely on the same tools, which are basic MA tools for decision-making, such as budgeting. The fact that organizations don't utilize advanced capital investment tools sparked the researcher's interest. However, after understanding that the sources of value from an investment in prevention can be difficult to quantify e.g. reduced risk (Cohen, 1984) and reduced anxiety (Almquist et al., 2018) it was clear that NPV could result insufficient to capture all elements of value.

6. DISCUSSION AND CONCLUSIONS

This section wraps up this thesis work by revisiting and answering research questions, identifying managerial and theoretical implications and mentioning paper publications based on case work. Furthermore, future work for both research projects as well as insights for future studies will be highlighted. Finally, conclusions will be drawn.

6.1.1 Answer to Research Questions

The focus of this thesis was prevention and what drives customers towards investing in prevention. The main objective of this thesis was to identify decision-making drivers for investments in prevention and the context was within two case projects with an environmental focus. The proposed research framework served to identify decision-making drivers, participants and MA tools involved in investment decisions in prevention. This framework was created seeking to answer three research questions, which will be addressed individually.

The first research question **"What type of value-adding drivers are perceived by investments in prevention"** sought to identify what elements make up total customer value in preventive investments. Theoretical findings established that the main source of value from investments in prevention is reduced risk (Cohen, 1984). Reduced risk yields a reduction in anxiety, which has been proven to be a high-level element of value for B2C (Almquist et al., 2016) and B2B (Almquist et al., 2018) buyers. The concept of reduced risk enhanced 'get elements' in the cost-benefit ratio model (see 2.1.2).

In practice, reduced anxiety was identified along with other elements. Reduced anxiety was present in various ways, either addressing future regulations, or ensuring future compliance with health standards. Reduced anxiety is an element of high value in customer segments with high degree of accountability, such as the public sector. Other elements of value are positive brand image and media coverage that come from an investment in prevention. Case organizations acknowledged that positive brand image in environmental aspects can be a source of differentiation, especially when targeting customers that value suppliers with a strong environmental strategy.

Another element of value is improved competitiveness that comes from staying ahead of others. Organizations that modify processes and invest now for future regulations will be better prepared rather than organizations that make changes on a short notice. Finally, certain organizations perceive value in the greater good, that is, seeking benefits for the

benefit of the public. In the context of prevention this is identified through making an investment to prevent a consequence for many people.

Thus, the identified elements of value: (1) reduced anxiety, (2) brand image, (3) competitiveness, and (4) greater good answer the first research question. Interestingly, the project work also identified that investments in prevention can increase the 'give element' in the cost-benefit ratio model, as preventive solutions can be pricier than the comparable alternative. However, perceived benefits seemed to outweigh higher costs for which organizations with preventive behavior choose in favor of the investment. This new cost-benefit ratio model is depicted in Figure 32.

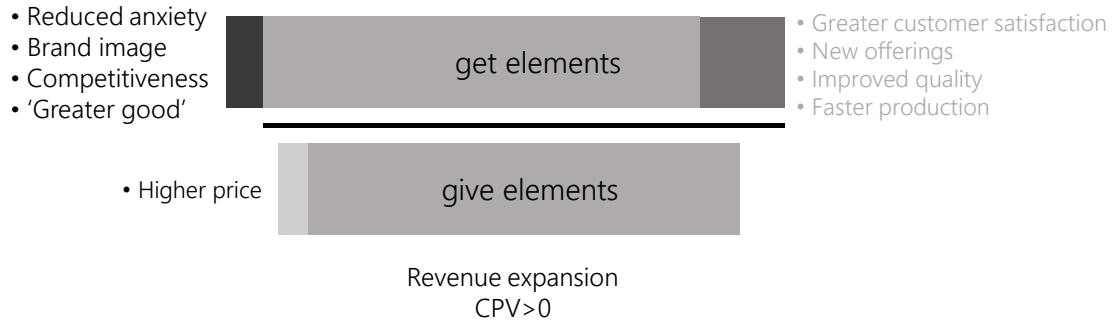

Figure 32. Elements of value in prevention.

The second research question **"How is preventive behavior present in an investment decision?"** sought to identify elements that signal the presence of preventive behavior. Theoretical findings through the analogy of investment in insurance policies identified that preventive behavior precedes investments in prevention. In the same way, six common predictors for preventive behavior were identified: (1) perceived vulnerability, (2) perceived severity, (3) perceived barriers, (4) perceived benefits, (5) subjective norms, and (6) self-efficacy. Furthermore, theoretical findings suggested that future-oriented individuals are more likely to develop preventive health behaviors than those who are past-oriented (Werle, 2011).

In practice, predictors of preventive behavior are in line with theoretical findings and present across all studied organizations. Perceived vulnerability is identified on how organizations monitor upcoming regulations and establish how these could affect their operations. Perceived severity stems from the evaluation of perceived vulnerability and is different across companies, where large-scale operations have higher perceived degrees of severity. Perceived barriers were mostly present in the higher price point involved in a product or service of prevention. Perceived benefits involve staying ahead of the competition, positive brand image and lower costs in the future, among others. Subjective norms involve making a decision that is best for the community or following country-wide

trends. Finally, self-efficacy was identified in organizations that had a strong R&D department and trust their own skills to fulfill their prevention-oriented goals.

Other elements that signal the presence of preventive behavior were identified. For example, participation in seminars, expos or projects related to a specific topic reveals that an organization is interested and proactive regarding the topic. For example, for the BCFP relevant seminars or projects could be about black carbon or general particulate matter pollutants. For the W4G project, relevant projects and seminars could be about sustainable building materials. Another element that signals the presence of preventive behavior is the participation as influencers or lobbyists, in organizations that create common proposals for decision-making entities of upcoming regulations.

Practical findings also identified that a negative experience with a product or service can trigger preventive behavior, seeking to avoid a future negative experience. For example, poor air quality from concrete structures in cases 7-10 pushed municipalities towards adopting a new material that would not yield similar issues in the future. Preventive behavior can also be identified in organizations that brand themselves with future-oriented (Werle, 2011) adjectives, such as ‘innovative’, ‘forward-looking’, or more field-specific such as ‘sustainable’ and ‘green’.

Practical findings identified that preventive behavior was not only present before an investment decision, but also after the investment decision, through feedback mechanisms and constant monitoring of upcoming regulations. The answers to this research question are useful to identify if an organization presents preventive behavior, which sheds light on potential customers in a product or service of prevention. For a customer that does not show preventive behavior, it might be important to first foster it, by pointing out its elements such as perceived vulnerability and perceived risk.

The last research question **“Which management accounting tools are currently utilized, and which could be potentially utilized to assist the investment decision process?”** sought to illustrate the practical usability of MA information when making investment decisions in prevention. Theoretical findings identified a series of MA tools utilized in three functions of management: planning, decision-making and control. The most common tools from theory include budgeting (Callahan et al., 2011, p. 141), cost-benefit analysis (Atrill & McLaney, 2012, p. 58), costing methods (Atrill & McLaney, 2012, p. 97-183) and advanced capital investment analysis tools such as NPV (Gaspars-Wieloch, 2019) and IRR (Mellichamp, 2017).

In practice, the use of MA tools varied depending on the stage of investment. Before an investment decision the most used tool is budgeting. For the investment decision itself

organizations seem to rely on a cost vs budget analysis or make-or-buy analysis. Once a decision was made, all organizations relied on budgeted vs actual cost to ensure the investment was carried out according to budget.

Furthermore, advanced capital investment tools, namely NPV, are not used widely in practice. NPV lies on aggregation assumptions, considering that discounted net benefits are all relevant information for decision-making; however, decision makers in environmental matters are not only motivated by discounted net benefits, but have multiple and often conflicting goals (Knoke et al., 2020). As identified previously, once a decision-maker decides to invest in favor of prevention, certain aspects that would regularly discourage an investment, such as a higher price point, do not seem to end the investment process. Furthermore, the elements of value in prevention: (1) reduced anxiety, (2) brand image, (3) competitiveness, and (4) greater good have varying impact and cannot be quantified into discounted net benefits thus would not be adequately translated into a NPV analysis. This finding on the low suitability of NPV to depict the value of an investment in environmental prevention goes in line with Knoke et al.'s (2020) paper that identifies how NPV can ignore the distribution of net benefits among various groups of people and should be used as only one among various socio-economic and environmental decision-making criteria.

Interestingly, few organizations consider tools such as TCO or life-cycle costing (LCC), which analyze the costs of a product or system over its life cycle. Therefore, MA tools that consider the life cycle of the investment could be further utilized by organizations that purchase or supply products or services of prevention. TCO has been utilized for other environmental innovations, such as electric vehicle ownership (Wu et al., 2015; van Velzen et al., 2019) however, focusing mostly on a single aspect. For this, Wu et al. (2015) suggest that TCO should be applied in combination with a comprehensive and probabilistic view, considering the uncertainty of input parameters (e.g. fuel, electricity and battery cost) and showing the probabilities of possible outcomes. This idea could be applied to other investments in prevention with diverse input parameters that are uncertain. As the benefits of an investment in prevention may take a long time to be realized, it might be beneficial to rely on MA tools that depict benefits over a product's lifecycle.

However, future-oriented tools such as TCO and LCC (Lifecycle Costing) would not be beneficial in cases where decision-making requirements don't ensure value for money from a perspective of lifecycle (Lindholm et al., 2018). Furthermore, these costing methods might be difficult to implement in practice.

6.2 Managerial Implications

This section identifies a series of managerial implications based on findings from Chapter 5. These findings will also be followed by further insights from the original cases to which they relate. Potential actions/suggestions will be identified based on literature findings following two categories: remove barriers and identifying potential customers.

6.2.1 Remove barriers, enhance benefits

Case projects revealed barriers of complexity, trialability, compatibility and switching suppliers. Therefore, it might be beneficial to eradicate perceived barriers, which are an obstacle for adoption among potential customers.

A possible course of action to remove barriers is providing guidance to potential customers. As identified previously, investments in prevention are more complex and require the adopter to develop new understandings and skills (Rogers, 2013, p.16). Project findings identify that the complexity in investments in prevention creates a barrier of experience and capabilities from potential adopters. Perceived lack of experience and capabilities creates uncertainty in various parts of an investment decision, from budgeting to carrying out a project. Organizations seek to minimize uncertainty and risk, therefore, providing guidance in various stages of the project, from planning to carrying it out could reduce the perception of uncertainty which poses a barrier to adoption.

A second course of action to remove barriers could be to increase trialability that is, provide a free trial for the product or service, if possible. The ability to try out an innovation is a good way for an individual to find out how it works under one's own conditions (Rogers, 2013, p. 258). Additionally, project findings revealed trialability as a pushing determinant in favor of an investment in prevention.

A third potential suggestion is to help identify compatibility with a customer's existing solutions. Compatibility is perceived as a barrier when an investment in prevention does not match an organization's existing solutions. In one case, an interviewee expressed dissatisfaction with a new instrument purchase because it was not compatible with their current equipment and could not be combined to create a broader network of equipment. Therefore, a supplier could first review a potential customer's existing fleet and identify if there is compatibility. In either case (compatibility or not), it would be beneficial to communicate it to a potential customer to find fitting solutions for a customer's needs.

A final suggestion to remove barriers is to ease the switch from another supplier to one's solution. Relationships with other suppliers are another barrier identified in the adoption of an investment in prevention. In case projects, customers first consult their existing

suppliers for an investment because it makes the process easier, from contracting to maintenance. Therefore, ensuring the customer that the purchase process will be effortless and that there will be no concerns about scheduling maintenance may remove the barrier of switching suppliers.

On the other side, 'enhancing benefits' is a strategy that any product or service supplier might seek to achieve. However, for investments in prevention it could be beneficial to also enhance subjective benefits, such as reduced anxiety in decision-making. As identified previously, investing in prevention creates economic value from reduced anxiety. This is of special importance in projects with high liability (such as construction projects) where there is already a high degree of concern from stakeholders and investments can be significant (Reichstein et al. 2005). Furthermore, certain customer segments, such as the public sector, have high degree of accountability thus can be reluctant to adopt innovations (Sánchez Graells, 2011, p. 98). Therefore, making evident the reduction of future risk can lower decision-maker anxiety and enhance the solution's benefits.

6.2.2 Identifying potential customers

Regarding identifying potential customers for an investment in prevention, it might be beneficial to understand: how does preventive behavior look like for one's solution? For example, for the BCFP, participation in projects and congresses around the topic of BC reveals that an organization is willing to go beyond what regulations ask. Therefore, identifying if there are projects and events that reflect preventive behavior in one's sector and participating in these could potentially start relationships with organizations that evolve into business opportunities.

This project identified presence of preventive behavior as the first element to start an investment in prevention. Therefore, it would be beneficial to identify if a potential customer presents this behavior or not. For a customer that does not show preventive behavior, it might be important to first foster it, by pointing out its elements such as perceived vulnerability and perceived risk. This recommendation goes in line with Jayanti and Burns' (1998) suggestion to foster preventive behavior in a health context, where they identified the importance of facilitating preventive behavior to later convince the target audience regarding the efficacy of preventive measures.

Case projects also revealed the importance of peer networks when making investments in prevention, where interpersonal networks provide reinforcement in a decision that has high degree of perceived complexity and uncertainty. Therefore, identifying a customer organization's peer networks could shed light on potential customers to address.

On the other side, monitoring regulations that apply to one's sector could offer insights on new purchases. While it can be challenging to anticipate regulations on fast-moving sectors, there are certain sectors whose regulations are a few months or years behind fast-moving sectors and consequently, upcoming regulations are easier to anticipate. Complying with future regulations represents another way to offer the subjective benefit of reduced anxiety. Finally, prevention can potentially bring a positive image and press coverage towards an organization. For example, a company that invests in a solution that reduces emissions that are not yet regulated is well-seen by the general audience; purchase intentions are significantly higher for green products and services in comparison to their non-green counterparts (Borin et al., 2013). This positive image can be promoted if one's sector is known to be positively endorsed from investing in prevention.

Potential customer segments for investments in prevention could fall into adopter categories of innovators and early adopters as they have the highest degree of innovativeness (Rogers, 2013, p. 282). These categories represent potential customers that are willing and venturesome enough to go beyond what is currently required. These adopters are aware of need for change and like to stay ahead of the curve. Interestingly, innovators are known to be risk-takers, which goes against the risk-aversion involved in preventive behavior; however, in this context, risk-taking refers to giving the new technology an opportunity, and does not refer to general purchase behavior.

6.3 Theoretical Implications

The proposed research framework provides insights into investment processes in multiple stakeholder networks, be it in B2B or B2G settings; it helps understand what happens before, during and after an investment in prevention, who is involved, and which MA tools are in use. Findings of this thesis provide understanding to sales and marketing functions regarding investments in products or services of prevention related to environmental protection and serves to extend the SPAT (Roos, 1999) to a B2G context.

Findings in this thesis can be of relevance when considering the scarcity of studies in diffusion of preventive innovations (Rogers, 1988, p. 245) related to environmental protection . As identified previously, there are few studies on the diffusion of preventive innovations related to environmental protection. A review of literature on the subject identified myriad studies in the diffusion of 'eco-innovations', from policies (Kern et al., 2005; Jordan & Hiutema, 2014; Hale & Urpelainen, 2015) to products and services (Schwarz & Ernst, 2009; Clausen et al., 2019); these have been studied from the perspective of diffusion or adoption of the innovation, under labels such as 'eco-innovation', 'green innovation', 'sustainable innovation', among others (Karakaya et al., 2014).

On the other side, there are various studies on the diffusion of preventive innovations, most of them focused on health practices, such as prevention of disease transmission (Bandura, 1989; Bertrand, 2004) or substance abuse (Rohrbach, 1993). However, few studies of preventive innovations are focused in environmental innovations. A predominant study is Overstreet et al.'s (2013) study on predictors to adopt preventive innovations, where health-related and non-health related innovations were considered, being conservation decisions among the non-health related elements. Another study worth mentioning is Pine et al.'s (2011) analysis on the adoption of improved biomass stoves in Rural Mexico, where a product innovation is specifically studied through the perspective of prevention. Thus, results of this thesis work can potentially contribute to bridge the topics of diffusion of eco-innovations and diffusion of preventive innovations.

Analyzing triggers illustrated the presence of preventive behavior, which was recognized as the precursor for an investment process. In most cases an investment process is initiated by a situational trigger, that paves the way to reactional triggers. This means that a customer is more likely to select a supplier that best adapts to changing requirements, be it the old supplier or a new one. Though challenging, the supplier should be aware of changing customer requirements; this awareness may affect the relationship's development (Selos et al., 2013). Findings on SPAT elements are in line with previous studies (Wilson, 1995; Selos et al., 2013; Saukkonen et al., 2017) that highlight the importance of network effects and collaboration in business relationships.

This thesis also suggests new insights regarding determinants. While traditional determinants, such as cost and quality were identified, a new and distinct set of determinants was found for investments related to product innovations. These determinants are in line with attributes that affect the rate of adoption of an innovation: relative advantage, compatibility, complexity, trialability and observability (Rogers, 2013, p. 16). While these attributes will not initiate an investment process, they do steer an investment decision.

As for MA tools, this thesis identified that organizations rely on common and simple MA tools to make investment decisions in prevention for environmental protection, being budgeting, make-or-buy analysis and budgeted vs actual cost the most common. However, investments in prevention have a long-term orientation and benefits are realized sometime in the future (Overstreet et al., 2013). Therefore, this work identified the potential benefits of relying more on MA tools that illustrate costs and benefits of a product or system over its life cycle, such as TCO or life cycle costing. However, a disclaimer was presented on how future-illustrating tools are difficult to implement and may not ensure the best value for money perspective (Lindholm et al., 2018). For organizations that supply products or services of prevention, an effective marketing strategy could consider

sales material that encourages preventive behavior (Rogers, 1988, p. 246), by highlighting its elements such as perceived vulnerability, risk, severity, and, at the same time, depicts the benefits of a product of prevention throughout its life cycle.

Finally, this work can potentially contribute to the SPAT literature (Roos, 1999). Though the SPAT was created to provide a broad view to supplier switching processes, the methodology has proven to be versatile and applicable in myriad settings. The SPAT has been applied to B2C settings such as retail banking, telecommunications, and insurance (Roos, 2004), as well as B2B supplier switching process (Selos et al., 2013) and even to explain investment behavior in technology adoption (Saukkonen, 2017). This work was not the exception to its versatility, where “investment decisions” were considered instead of “switching decisions”, and all other components of the methodology (triggers, determinants and critical incidents) were feasible to apply.

Furthermore, this work applied the SPAT to B2G settings given that seven out of ten studied cases belong to the public sector. While there were no major differences detected between B2B and B2G cases, there was an interesting finding regarding influential triggers. Influential triggers categorize customer behavior as active and passive, where active customers are those who search for information to make a deliberate and conscious decisions whereas passive customers do not search for information (Roos & Gustafsson, 2011). In this respect, Selos et al., (2013) identified that it is challenging to judge the degree of activity or passivity or an organization as B2B settings have various individuals who contribute to business relationships and suggest interpreting this trigger as a continuum of customer and supplier behavior.

Interestingly, for public organizations subject to public tendering, influential triggers were both active and passive within an organization. The customer was first active because the investment process started from within the organization. However, for public investments that are subject to official tendering rules, the organization needs to shift to a passive stance once the tendering process starts and wait for supplier proposals. Remaining active and seeking for specific suppliers in a public tendering process could raise questions of conflicts of interest. Findings regarding the SPAT in B2G settings can be of relevance as the SPAT in a B2G setting is a topic still underexplored.

6.4 Limitations and Future Resarch

Overall, the researcher’s work has received positive feedback from project stakeholders; however, there are certain limitations to be addressed. First, the number of cases studied through for each project remains small for different reasons. In the BCFP, getting access

to interviews was a challenging part of the project work. As mentioned previously, the researcher perceived that the long-term orientation of the BCFP (3 years) made the interviewing process longer than expected. On the other side, there are also few cases for the W4G project as the data gathering process continues up to date.

Another potential limitation identified is the fact that the qualitative analysis relies on the researcher's own interpretations and its validity. Validity relates to the relationship between an account and something outside of that account (Maxwell, 1992). While a systematic approach was utilized to study all interviews, the analysis is based on the researcher's subjective view. For this, findings were verified through discussions with supervisors and other members of the research group and in some cases, conclusions were revisited.

The main element of future research and important part for remaining project work is to include more data gathered by interviews to different actors of the business ecosystem. A richer set of data will help verify current findings and possibly identify new insights. This will be particularly relevant for stakeholder findings, where there were not many trends as every organization had different people involved in investment decisions.

Another interesting opportunity for future research is to further explore the diffusion of preventive innovations related to environmental protection. While this thesis work identified a set of attributes that affect the rate of adoption of an innovation of prevention, future work can study the diffusion of preventive innovations. As there is no regulation regarding black carbon, BC innovations can be categorized as preventive and environmental and could be the object of this future study. Therefore, an in depth-analysis of a specific BC technology that identifies its diffusion over time could yield interesting findings to foster new ideas on the topic. Understanding diffusion processes of preventive innovations can shed light on how to promote the adoption of certain environmental innovations, thus addressing a pressing issue.

Research findings for both projects included in this thesis (BCFP and W4G) will yield a series of research/conference papers, to which the author is expecting to contribute. Currently, the researcher is contributing to two papers in the W4G project, studying institutional arrangements associated with wood as a building material, and identifying decision-making drivers for wood construction; these are expected to be finalized by the end of 2020. Future paper publications for the BCFP will explore decision-making drivers for BC technologies and identify the role of MA in these decisions. For the W4G project, future paper publications seek to explain the dynamics among legislation and different stakeholders interested in wood construction.

6.5 Conclusion

In our contemporary milieu, prevention seems timelier and more evident than ever. However, human beings are irrational when making decisions and fall into decision biases based on subjective perceptions (Klein et al., 1993, p. 41). Though investing in prevention is increasingly more common, it is difficult to assess the value of prevention as benefits are delayed in time and difficult to assess. For businesses whose success relies on preventive behavior, as well as for society's general benefit, it is imperative to understand what triggers and pushes forward an investment in prevention.

For this thesis, an investment in prevention was identified as one that individuals or organizations make to reduce the probability of an unwanted event in the future (Rogers, 2013, p. 234). Benefits from these investments may be difficult to perceive because they lead to a nonevent, that is, the absence of something that might have happened or can have non-observable benefits (Overstreet et al., 2013). Investments that promote environmental protection can also be considered preventive as they seek to prevent a future environmental crisis, such as clean technologies.

This thesis had the objective of identifying and examining decision-making drivers for investments in prevention. To fulfil this objective, a series of completed investments in prevention were studied and analyzed through a theoretical framework that shed light on decision-making drivers, participants and MA tools in use. The context of these past investments was environmental: one belonging to the adoption of black carbon product innovations and one to the selection of sustainable building materials.

Findings of this thesis illustrate a series of decision-making drivers for investments in prevention. An investment in prevention requires a decision-making entity to present preventive behavior (Cohen, 1984), which depends on that entity's perceived vulnerability, perceived severity, perceived benefits, perceived barriers, self-efficacy and subjective norms. It is this preventive behavior that makes the customer prone to invest.

Next, the customer experiences an internal change that shifts status quo and helps identify that something is not in line with the organization's prevention-focused goals. Thus, the customer seeks change through an investment. Though challenging, the supplier should be aware of changing customer requirements (Selos et al., 2013). Once the customer has decided to invest in prevention certain aspects that would regularly discourage an investment, such as high price point, do not seem to put an end to the process. This finding goes in line with the nature of preventive innovations (Rogers, 2013, p. 234), whose benefits are not very observable.

Regarding stakeholder participation, findings on this thesis indicate that distinct types of organizational decision-making, either bottom-up or top-down have an influence over the number of individuals participating in each stage of the process. However, common findings regarding specific positions involved in every stage of the decision-making process could not be drawn as every organization has different people involved in these processes. Finally, the use of future-illustrating MA tools, were identified as ideal for organizations that supply products or services of prevention as they depict the benefits of a product of prevention throughout its life cycle.

Based on these findings, this thesis presented practical implications for organizations whose success relies in some way on preventive behavior; these include removing perceived barriers and fostering preventive behavior in potential customers. Future research aims to verify and deepen current findings and potentially identify new triggers, determinants and MA tools in use for investments in prevention by applying the framework into a broader set of data. Furthermore, future research could focus on the diffusion of preventive innovations, an area in the diffusion tradition that has not been studied widely.

This thesis illustrates the versatility of the concept of prevention. While not commonly associated with prevention, investments that seek to deter climate change can be considered preventive. Findings of this work also illustrate that value-adding drivers of investments in prevention, namely reduced anxiety, brand image, competitiveness and seeking a greater good, might be difficult to quantify and communicate. Currently, to decide in favor of prevention, simple MA tools (e.g. budgeting) are utilized; however, these simple tools might not depict the whole landscape of benefits from an investment in prevention. On the other side, advanced capital investment tools, were also identified as a weak fit to transmit value of prevention as they consider discounted net benefits are for decision-making yet decision makers in environmental matters have multiple and often conflicting goals (Knoke et al., 2020). Thus, this thesis work identified that MA tools that analyze lifecycle costs, such as TCO or LCC, might be a better fit to transmit the benefits of prevention. These tools have been successfully implemented to transmit the value of other environmental investments, such as the purchase of electric vehicles.

Finally, this thesis identified that the preventive quality of certain products and services might explain their slow diffusion. Therefore, understanding how investments in prevention are made could shed light on how to influence their adoption. This thesis work serves as a guide for business that require preventive behavior from their customers, provides recommendations to cultivate this behavior, and illustrates which MA tools are best to depict the value of prevention. Though the focus of this thesis was environmental, findings can be translated other settings of prevention.

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APPENDIX A: INTERVIEW TEMPLATE EXAMPLE

Interview: Switching Path Analysis Technique – SPAT for BCFP

Situation: Short paragraph with background information about the case

Ask for them to present themselves, they get to tell what they are doing (sets the tone and gives some background on their position, time with the organization, etc.).

Questions:

a) Who made the decision? Which stakeholders are involved in the decision-making process and in what stages?

b) Before utilizing this device, which one did you use? How long did you use these devices for? Have you been purchasing these devices for long?

c) How do external influences affect decision-making?

    a. Keep this question open (examples of external influences are regulation or vendor information on cost and environmental benefits)

d) What internal influences have contributed to the decision-making process? How? At what stages?

    a. Keep this question open (examples of internal influences are change agents, changes within the organization)

e) What information was required to select the device? Where is the information for device selection and how are alternatives made up?

f) What elements did you consider before making the purchase decision? (specifically aimed towards MA tools)

g) Are device choices unique or standard decisions? (Is the product a market standard or was it tailored for this organization)

Questions should reveal what, to who, when, the investment decision is made. Was it made from following regulation or gaining competitive advantage? What are its impacts, how they are integrated to decision-making? Are there change drivers or obstacles? Identify all elements in business ecosystem as well as SPAT elements.