What markets do:

from marketing to post phenomenology

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Abstract

Life in contemporary society is riddled by the word "markets". This word is not only used in popular media, but also emerges as a key term in several scientific disciplines. However, this terms is rarely defined and explained. Marketing can be understood as the scientific discipline most concerned with markets. As a discipline, marketing is characterized as ostensive rather than descriptive, meaning that it forms definitions through practice. I argue that this ostensive approach to marketing results in a dualistic approach to categorizing actors, i.e. in terms of consumers and the environment surrounding these consumers. These dualistic categories enable the illusion that relevant actors can be understood as stable entities in the world. I refer to this problem as "the maze of the market". To further explore this maze, my primary research question is: 'what are markets in society and what do markets do to societies'. I respond to this question with an extensive literature review. In this, I construct three major conceptual angles and numerous conceptual tools using Actor-network approaches and hermeneutic phenomenology. The first conceptual angle allows for a description of markets as groups of actors forming distinct social relations surrounding a calculative device, using the actor-network approach (ANT). The second conceptual angle explores the yield of viewing markets as, in themselves, technologies, using insights from phenomenology. In questioning the role of technology in the being of markets, a third conceptual angle appears, concerning the individual actors and their relation to technological devices. This is explored through the lens of postphenomenology. Together, these three angles form a description of what markets are and do. I illustrate the three conceptual angles and their respective tools through application to the Dutch PV market. The case describes both the collecting and stabilizing of a society of producers, consumers and other actors surrounding a technological artefact (PV systems) and the effects these artefacts on the actors. The findings of the case yield several implications for each of the disciplines employed in the thesis. First, it brings together three major approaches in different disciplines, allowing for communication of ideas and a broader discussion of what markets do in society. Second, the conceptual framework encourages the study of technologies in marketing by placing technological artefacts as central to market understanding. Lastly, the conceptual tools allow for questioning of how humans act and perceive the world using calculative market devices.

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1. Introduction

The goal of this thesis is to describe what a market is and what a market does in societies. Life in contemporary society is riddled with talk of markets, to encounter one is everyday reality for human beings. Who has not seen a market, bought groceries, or ordered a product online? What a market is seems to be trivial knowledge, a concept embedded through life in contemporary society. Moreover, thousands if not millions of human beings spend a large portion of their existence interacting with markets without ever questioning what a market is or does. Some might have heard their salary is 'market conform' in response to a requested raise, something which makes little sense when one also understands "markets" as a grocery store. This thesis will attempt to clarify what a market is, while accounting for its diversity in use. The market is studied in a multitude of disciples, but the discipline of marketing is most dedicated to analysing the market phenomenon. I ask the question what is 'a market' and what does it do according to marketing textbooks?

In the first section of this thesis, I will explore what "the market" means to marketers. What marketing sees as "the market" is a space for buyers and sellers to have transactions, and therefore marketing concerns itself with ways to establish a space for interaction between the actors (Blythe, 2008; Kotler and Armstrong, 2008). The space for interaction between actors is what marketing attempts to shape, making it so that both the producing and consuming side gain value. Marketing gives guidelines for the establishments of such a space for interaction. A traditional conceptualization of market space is the so called Marketing Mix (McCarthy, 1960) in which a physical space of interaction is clearly present. The consumer in a market, in turn, is represented by consumer groups with similar physical and/or social needs, ready to be fulfilled by a party of producers (Hakansson, Harrison, Waluszewski, 2004; Kotler and Armstrong, 2008). The consumer and their environment are the center of attention in most marketing literature, focusing on ways to interest the consumer into purchasing a product. A market is even defined in some literature as a group of consumers with similar needs and desires (Blythe, 2008:20). What the marketer does is delineate humans into groups based on environmental factors and characteristics in order to predict, detect, and develop needs and desires. They do so by developing a space for interaction through which a product can fulfil a consumer need.

In explaining what a market is, marketing conceptualizes consumers as engaging in dynamic behaviours in stable environments. On the one hand, marketing literature takes human behaviour as dynamic on the other they describe the environment surrounding this consumer through stable categories (for example GDP, climate, education). I problematize

the view of markets promoted through marketing. Latour (1993) refers to the division of the stable natural and dynamic social as *dualism*, and subsequently argues that this division is often unjustified in the act of defining (Latour, 1993). I argue that marketing as a discipline is practical, meaning that definitions aim to make practice happen, but not necessarily to explain market practice. This means the definitions of markets offered by marketing are ostensive rather than performative (Kjellberg & Helgesson, 2007). To explain what markets do, I pose using works of Laverty (2007) Kjellberg & Helgesson (2007) in order to construct a model that can explain the performativity of markets to explain what markets do in society. This means a model that can account for the acts that make markets happen in society (descriptive), rather than a model for acting in a society (ostensive). These issues will be further elaborated in Sec. 2.4: On the Maze of the Market. This section explores the performativity of marketing theories on markets. In marketing, a market results in a place where successful transaction of a product takes place. It does not tell us the process through which the price is established nor the way which the consumer is grouped or formation of groupings. By providing ostensive definitions of the world and promoting dualistic worldviews, marketing proves an insufficient explanation for what a market is and does to a society.

1.1 Methodology

To circumvent the problematic market definitions of marketing I ask the question 'What are markets and what do they do in societies?' To answer this question, I aim to first overcome the dualistic and ostensive practices of marketing to enhance the insights of marketing. With the intent to enrich the discourse on what markets do to human beings living in societies, I add to market literature (reviewed in 2. Marketing and Markets, Opening the Black Box) using theoretical frameworks inspired by science and technology studies (STS). I propose that an STS-inspired account of what a market does can help circumvent the dualism of marketing. A market is conventionally defined as a space for exchange between actors. To explain what a market does, ANT (actor network approach) allows for more robust description because it understands markets as networks of intertwined actors (both human and nonhuman) (Callon, 1986). ANT, introduced in chapter 3, offers performative descriptions of markets and is able to recognise and describe actors (such as producers and consumers) and devices (such as products) that allow for networks of markets to calculate their moves and act. Using the works of Callon, 1986; 1998a; 1998b; 1999; 2007, Callon& Muniesa, 2005 and the works of Latour, 1993; 2005 and Law, 2009 famous ANT theorists I

attempt to answer the question *what is 'a market' and what does it do through ANT literature*. In turn I develop three conceptual tools to describe what markets are and do, .

The ANT approach has its setbacks I will argue, section 3.5 focuses on the limitations of the ANT based framework. I will note that there are several constraints to describing what markets are and do through ANT literature. These constraints concern the fact that ANT analyses often preclude many (potential) actors in framing and describing a market and the fact that the approach uses technological artifacts to describe relations but don't describe the relations actors have with artifacts. To supplement the conceptual tools of ANT I construct two additional conceptual angles to broaden the framing of actors and to explain human technology relations, this will be done in chapter 4. The role of technology in human life is often questioned by philosophy of technology in general and phenomenology in particular. In this chapter I pose the question *what is 'a market' and what does it do according to phenomenology and post phenomenology*?

The first conceptual angle in addition to ANT questions the act of framing (Callon, 1998b; 1999), this frame produces what one could call an abstract market a list of actors to solve a particular issue in the world. I argue that to explain what markets do to a society I must develop ways to question the actors that compose a particular market society. I use works of two philosophers Heidegger (1977) and Pickering (2004) to construct two distinct ontologies of markets and their actors. These two authors explain two distinct world views one can take up when acting in the world with technology. One focuses at making the world calculable by explaining the calculative tools and actors that are needed to form a market, the other aims at unravelling the dynamic interplay of actors that are not calculable with the tools of the actor network but are embedded in it.

The second conceptual angle in addition to ANT seeks to explain what technological devices do to the actors of a market actor-network. Post phenomenologists Ihde (1999; 2004; 2008; 2015) and Verbeek (2005; 2016) offer models to study relations humans take up with technological devices in the world. I reiterate these models to describe relations between actors and technological artifacts that are conceptualized in the actor-network. By explaining the way humans act through or with technologies I allow for the devices employed in ANT analysis to be described in context to its users. The three approaches constructed in this thesis combined can describe a market from three angles. ANT's conceptual tools describe the actors and devices that compromise a market. Phenomenology's conceptual tools provide two ontologies that allow for inclusion of actors that are affected by the transaction, and reconsideration of problem that the market is conceptualized from. Postphenomenology

allows us to describe the ways in which actors experience the network, and allow for explanation of what artifacts do to and with humans. The three angles will be demonstrated and tested by means of a case, ANT allows us to construct a framework capable of producing a case study.

The Case will be constructed in chapter 5, this case will be an exploratory case serving as a demonstration for the conceptual framework constructed throughout this paper. Additionally the case will serve as a narrative for answering the research question, it will allow me to give concrete examples for findings attained by the conceptual tools. In chapter 5 I will describe the interplay of actors that preceded stabilized exchanges of PV systems in the Netherlands. The Dutch PV market is an interesting and workable case for the demonstration of the three conceptual angles for a number of reasons. First of all there is a wide body of literature dedicated to studying the Dutch PV market in terms of actors and devices. There is a high incentive behind sustainable energy as PV is actively promoted by the Dutch government and EU (RVO 2014; 2016a; 2016b; Frankfurt School-UNEP Centre/BNEF. 2016). Secondly the PV market in terms of product sales and PV power output, is experiencing tremendous growth over the last decade, this means there is a lot of actors this gives me space to demonstrate what markets do. The third reason for studying the Dutch PV market is the fact that the actors surround a clear technological artifact. This will allow me to explore the material dimension of what markets do. This case will be followed by a discussion on what the Dutch PV market is and does to societies.

2. Marketing and markets, opening the black box

Markets are everywhere in contemporary society. To say what a market is, is to assess practices and disciplines involved in the proliferation of markets in society and academics. The major academic field contributing to understanding and propagation of markets is marketing. Marketing provides understanding of 'markets' and 'the market', related to commercial enterprises. This exploratory study into marketing, and marketing's market constructs, will be supplemented by readings from economic and sociological authors. Throughout this chapter the question 'What is 'a market' and what does it do according to marketing textbooks?' is asked. By asking this sub question the way marketing conceptualizes markets is revealed. The conceptualization of markets through marketing explains the market in terms of units of analysis and preconditions. Relevant marketing textbooks and articles will be studied to explore conceptualizations of markets through marketing. The textbooks and articles will be studied in three phases, first textbook

definitions of 'a market' and 'markets' are considered and explicated. This will be followed by an inquiry into the theory of marketing, the marketing mix and theories of markets. Lastly the actors of markets according to marketing theories and concepts are explained. After these three steps the sub question is answered, and its implications can be problematized in light to revealing what markets do. This will be done in section 2.3 in the following subsections the market will be explained in terms of marketing.

2.1 Marketing, The consumer, producers and mutual value.

A market can be conceived of in many ways, for one it is the local grocery store, for another a set of numbers on a screen in Wall Street. Marketing allows for conceptualizations of the markets entailing most of these 'common' notions of markets. The first step in explaining what a market is to marketing, is looking at the definitions offered in marketing textbooks and articles. In order to make sure that the articles and textbooks represent the marketing discipline, commonly used textbooks in academic marketing courses and widely cited textbooks are used to attain definitions and concepts of markets.

Kotler and Armstrong's (2008) well known textbook '*Principles of Marketing'*, offers such definitions and concepts. The authors argue that "The market consists of many types of customers, products, and needs. The marketer has to determine which segments offer the best opportunities" (Kotler and Armstrong, 2008:48). What Kotler and Armstrong (2008) imply with a market is a transaction in which customers with needs are serviced by product offerings. The job of the marketer in turn is to select groups of customers according shared needs and link these 'customer segments' to particular product offerings. The market is the space in/through which consumers actually meet the product. Accordingly Blythe (2008), in his book *'Essentials of Marketing'* defines markets as "…all the actual and potential buyers of the firm's products" (Blythe, 2008:12). Much like Kotler and Armstrong (2008), Blythe (2008) sees a market a threefold reality, as producers in terms of products, consumers in terms of needs, and a transaction between these two distinct actors. Blythe (2008) additionally argues that to the marketer a market implies a "groups of customers or consumers with similar needs and wants [segment]" (Blythe, 2008:20). What matters to the marketer is a segment, a group of consumers with similar needs. What the marketer does is create spaces for transaction between 'consumer segments' and products.

To marketing the market entails consumer needs, products and transactions between these consumers and producers. Kotler and Armstrong (2008) explain that " [t]he marketing concept is a philosophy of customer value and mutual gain, it's practice leads the economy by an invisible hand to satisfy the many and challenging needs of millions of consumers" (Kotler

and Armstrong, 2008: 570). Following the same logic, the market concept is one of mutual gain between consumers and producers, this means to create value by fulfilling needs for each of the two parties. Both textbooks agree that the market concerns three distinct units of analysis, a product, consumers in relation to a product, and producers in relation to a product. What the market signifies is the interaction between the three distinct units of analysis. That which concerns marketing is customer segments and transactions leading to values and prices. The market is the space in which the consumer and producer come together to decide on the value to both the producer and consumer by establishing prices. This concept of marketing gives a general understanding of the consumer producer and their exchange. These understandings through marketing result in concrete 'market' forms based on the clustering and availability of consumer and producer. Terms like Labor, capital, consumer or industrial markets become a reality, each describing properties of certain categorized customer segments and according producers (Swedberg, 1994).

Reoccurring themes in marketing when defining and speaking of markets are *consumer* needs, *products*, and *transactions* creating *value* for both a set of producers and consumers. To explain what a market is and does in the eyes of marketing, these four distinct parts of any market definition must be clarified. In the next paragraphs this will be done resulting in a discussion on what markets are and what they do within the academic discipline of marketing.

2.1.1 Logic of the producer vs. consumer

The previous section introduced what markets are to marketing, in this subsection the notions of producer and consumer will be further examined. Blythe (2008) went as far as defining a market as consumer segments. What is implied with consumers are human agents, grouped by a particular correlating set of needs and wants relating to a product. This interpretation seems dominant in marketing literature, with textbooks focusing on terms such as 'value creation', 'customer relations' and 'buying behaviours' (Kotler and Armstrong, 2008; Blythe, 2008; Aaker and McLoughlin, 2010). The consumer is a group of human actors with concerns, what the market to the consumer is a potential relation with a product resulting is satisfaction of needs. A need is as the name suggest, ranging from the need to consume nutrition or express oneself to a desire yet unfulfilled by the consumer. Needs and desires in marketing are ways the consumer express themselves in relation to a product offering and the world. Consumers are what shape and proliferate the market according to recent marketing textbooks.

The focus on customers is relatively recently established in the marketing discipline.

More traditional models focus on the producer/good and 'competition' between producers/goods rather than the consumer as a key ingredient for markets (Swedberg, 1994). This traditional model can be seen as the *logic of the producer* rather than the *logic of the consumer* pursued by marketing. When talking about markets, both have an equal role in marketing's understanding of markets. The logic of the producer is signified by an 'inside out' approach, one in which the product is treated as something developed by producers, not taking into account needs or desires (Kotler and Armstrong, 2008:10). The logic of the producer attempts to sell a product and sees the market as the space to do so. For the producer the market is a place to sell, consumers will be there by virtue of presence of the product and consumers play no role in development. The logic of the consumer on the other hand follows and 'outside in' approach the marketer attempts to understand the needs of consumers and develop a product fulfilling the needs in a valuable way. In explaining what a market is and does according to marketing each of these 'logics' allow for understanding of the consumer and producer. Both the traditional and modern market views help shape what marketing conceives of as markets.

The modern consumer logic of markets strives for a consumer focused definition of markets, "[this] implies that the goal is to customize offerings, to recognize that the consumer is always a coproducer, and to strive to maximize consumer involvement in the customization to better fit his or her needs" (Vargo & Lusch, 2004:12). The classic logic of the producer on the other hand strives to construct the market around the producer of the product, and sees the product as means to economic proliferation. The consumer is a human actor developing and purchasing a product to fulfil ones needs in a market. The producer is a group of human actors developing and selling a product to create economic value. A market is groups of both producers and consumers, the producer is there for economic value, money. The consumer is there to fulfil a need or desire, by this expressing him/herself creating space for an interaction through a product valued both as price and satisfaction of interaction.

. The consumer and products are mentioned in each definition of markets, but only in relation to a transaction creating value to each of the parties. The next subchapter will explain what is meant with value and transaction by marketing.

2.1.2 Value and transactions within a market

Marketing textbook and articles explicate that there are two forms of logic and two distinct actors present in a market. The two present actors are the consumer and the product/producer, both of these actors have different interpretations of value. Blythe (2008),

argues for a model of markets focused on meeting needs of customers and businesses (Blythe, 2008). The philosophy of the market is one of mutual value creation, but what is value? Value is for the logic of consumer the 'perceived benefits' a product offering brings to a consumer. Perceived benefits relate to a need, a need in turn can be explained as a "state of felt deprivation …shaped by culture and personality" (Kotler and Armstrong, 2008:6). Consumer value is the fulfilment of a need by a product offering, the perceived benefits coming from the consumer in turn is what is at stake in marketing. The product offering is a collected set of benefits to a consumer (Blythe, 2008:11). Value is the benefit a consumer perceives from purchasing a product.

The logic of the producer perceives value different from the consumer, value for this branch of the market is fiscal profits. The value for the producer is the cost of manufacture also called the price of the product (Blythe, 2008:17). A collection of labour cost preceding the actual product, expressed through fiscal stipulation. Value for the producer is the cost of offering a product, to a certain market segment, or consumer group. A market transaction valuates both the perceived benefits of consumer and the fiscal efforts of the producer. This dual movement is what signifies and explains what value is in a market. It is a way in which two different actors come together and are able to commence a transaction. The market transaction as integral part of a market implies the need for actual exchange between consumers and products. What a market is to marketing is both a consumer a product and a place in which these two come together and exchange values. The next chapter will use the findings of the preceding chapter in explaining market theories and theoretical frameworks, after which the first sub question will be answered.

2.2 Market(ing) theories and models

The previous subheadings focused on four elements included in each marketing textbook definition of a market. This implied a view of markets as consumers and products, engaged in value laden transactions. In the following paragraphs, the definitions offered by marketing textbooks are challenged and refined. By paralleling the definitions proffered by marketing textbooks and fundamental marketing theories, the initial four aspect of a market can be broken down and refined. The reconsideration of definitions will end in a discussion on preconditions and units of analysis. This will lead to an explanation of what markets are and what they do, in light of marketing. The definitions offered by textbooks in the previous section were aimed at defining 'the market', this section will give insight in the practices promoted by marketing theory related to the market. By assessing practices, theories and definitions of a market through the eyes of marketing the first sub question 'What is 'a

market' and what does it do according to marketing textbooks?' can be answered. Allowing for initial description of a market.

2.2.1 The Marketing Mix

When involved in marketing, as a scholar attending a marketing lecture or as a marketing manager working on a marketing campaign, one will be exposed to the marketing mix. The famous marketing mix of McCarthy (1960), can be seen as the cornerstone of marketing as an academic discipline (Blythe, 2008, Grönroos, 1994). The actual framework describes four main areas of activity of marketing practitioners and academics in markets. These four areas of activity are the four P's, place, price, product and promotion (Blythe, 2008; Kotler and Armstrong, 2008; McCarthy, 1960). The first category of the marketing mix is the *product*, product implies the goods and services to be offered to customers (Kotler and Armstrong, 2008:50). The product or service itself should satisfy customer needs, the product is the way which a producer comes in contact with its consumers.

The second category *place,* are the actions of the producer to make a product or service available at ease to the consumer. The place includes what one can conceive of as the physical marketplace, a building or a webpage offering products or services. The third ingredient of the marketing mix is *promotion*, the activity of communicating merits of the product to consumers (Kotler and Armstrong, 2008:51). Lastly the fourth P, *price*, which basically implies the amount of money to be paid by the consumer. The value of the product to the segmented customer group should be in par with price expectations in currency. The price implies the process in which the values of the consumer are calculated to values of the producer (producer and consumer as 2.1.1).

The marketing mix is the set of tools producers use to influence the demand for a product. The marketing mix is a set of activities undertaken by producers attempting to create profit while fulfilling a consumer need. Marketing in relation to the four P's see markets as "...the transformation of physical and social elements to resources with an economic value" (Hakansson et al., 2004:260). In relation to the definitions of the previous chapter, the marketing mix explains the actions needed for a producer to reach a consumer. The marketing mix adds two things to the understanding of markets through textbook definitions. On the one hand, the marketing mix what is needed for a transaction to happen, informing us of a place as integral part of the market. On the other hand, the 4 p's show what is done by the producer to estimate the value of both producer and consumer. The marketing mix reveals ways to identify a market in the eyes of marketing. Additional to the definitions offered in earlier subchapters, the marketing mix shows that a market can be identified by a priced product or

service at a place. It also shows that the transaction itself is the result of promotion, a transaction between consumer and producer aimed at communicating customer values.

The four p's of the marketing mix shape a market, disclosing the market as range of characteristics and activities (see Figure 1.). The point of each of the P's for this chapter is to show how efforts of marketing shape our conception of the market. It also shows how the logic of the producer is dominant in the marketing mix. The marketing mix shows how one market differentiates from another, variables listed below product, price, promotion, and place in figure 1 define what one calls 'a market' in relation to 'the market'.
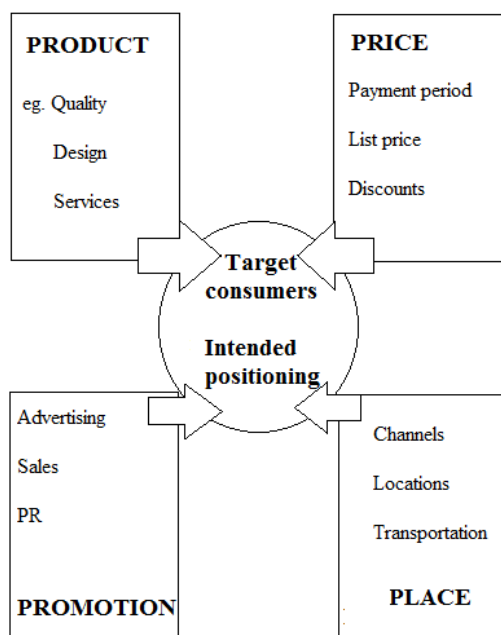
Figure 1, Simplification of the 4p's (as seen in Kotler and Armstrong, 2008:5)

2.2.2 The market environment, what a market is

The previous subchapter showed the actions related to a market in light of marketing. Moreover it indicated a difference in talking about a particular market and a general market. Making space for the existence of a marketing environment, a space in which markets happen. The marketing environment are the factors and characteristics of consumer groups, weighed out to a producers offering. Blythe (2008) refers to this as the "external environment" of the producer (p.25). In the works of Kotler and Armstrong (2008) an example of such an environment is explained, summarized as "indicators of market potential" (Kotler and Armstrong, 2008:553). The indicators are five distinct categories explain demographic, geographic, economic, sociocultural and political factors and characteristics of the environment. These indicators show the way which marketing perceives of the

environment from which a market emerges. A market is a collection of consumers inhibiting the right characteristics and factors, in relation to a product. Through identification with characteristics and factors one can differentiate a group of consumers from another. This makes the distinction between a market and the market possible. This allows for marketers and producers to segment consumer groups in relation to a particular product offering.

The insights from the 'marketing mix' and the 'marketing environment' show the descriptions of marketing's markets. Using the elements in defining markets from 2.1 and the methodological insights from 2.2 the sub question can be answered. Definitions of a market through marketing textbooks indicated that a market was about consumer needs, products, value and transactions. Additionally it defined marketing as the philosophy of mutual value creation. The marketing mix shows how producers create value and how value is not set but negotiated. The four P's show four activity groups for marketers to focus on when attempting to create value. The realization of a market environment allow for a separation between talking about a producers market, and the outside world. By categorizing aspects of the consumer the division offers ways for the producer and consumer to commit in transactions determining the value of a product. When answering the question 'What is 'a market' and what does it do according to marketing textbooks?' it can be said that a market is a multitude of things. A market is a product with a corresponding price, promoted and distributed at a place. The product is offered through producer to a consumer with needs. 'The market' is the categorized environment of the consumer and producers. To marketing a market is a space for transaction between consumers and producers in which product offerings are made. In this space prices are established based on the value for consumers and to producers. What a market does, it allows for consumers needs to be fulfilled through product offerings while at the same time benefiting a group of producers.

2.3 Market(ing) problematization

Markets and marketing revolves around the consumers' needs, wants and the producer's recognition and adaptation of the consumer needs. What marketing offers is the study of the environment surrounding a particular set of consumers. Reoccurring in both the practical and theoretical side of marketing are its units of analysis and their properties. Marketing theory focuses on establishing itself through offering properties present in embedded sciences, serving as categories allowing for metamorphosis of producers good or service. Properties such as the marketing mix and indicators of market potential reveal the focus of marketing in establishing ways to categorize and work on aligning a group of

producers to a group of consumers. In explaining what a market does for marketing it cannot account for the vast changes in society a market causes. Marketing can only account for its own practices and conceptions related to a market. This however means that marketing inevitably cannot explain or describe what markets do. In the next sections I will argue that this lack of explanatory power through marketing comes from its focus on the environment and its focus on consumers. These arguments end up in a view of markets through marketing, and the need for a more descriptive framework of what markets do.

2.3.1 Dualism

Markets can be separated through a market environment, this environment is expressed through categories of consumers based on sociology economics and other sciences (Swedberg, 1994). A market in a market environment is a product offering related to different categories of the environment. The environment in this sense becomes the consumer. The categories of the market environment serve as a way to distinguish consumers. This however is problematic in explaining what a market is and does, beyond marketing. The environment is a grouping of all potential consumers according to stabilized categories. Categories representing aspects of consumers. The market environment gives marketing a stable way to asses a market, a market in turn is described by theorists and practitioners as dynamic (Aaker, McLoughlin, 2010; Hakansson et al., 2004).

Latour (1993) speaks of such divisions between the environment and social as the nature-social *dualism*. Nature is the description of something which is certain and mobilizable. The social on the other hand is something which takes place within the eyes of the beholder, as an infinite abstraction (Latour, 1993: 141). In the explanation of a market by marketing dualism is present, the categories of the market environment are mobilizable and certain, while the consumer itself is dynamic and undefined. What marketing is actually doing is simply putting analogies between nature and the social, segmenting pre-existing configurations of nature, to fit the goal of the product...to benefit both the producer and receiver. Nature is what is given by existing frames of interpretation, such as "behaviours" "geographies" and "demographics" among the many mentioned already in this thesis (Blythe, 2006: 78). The social is the framing of the natural to the purpose of the beholder. Without the natural the social could not possible be explained and vice versa, without a stable conception of the customer, a producer cannot market a good.

The static preconditions of the natural (the environment surrounding a producer/consumer) cannot possible explain the dynamics of markets, nor can the correlates

created by marketers. Dualism in market rhetoric does not add any value to understanding what a market does, but rather repeats itself in light of its prior self. What is meant by this is the fact that a market for marketing is the recollection of labour by a producer, it is an ostensive defining practice. A producer who in the first place segmented using static conceptions of 'the consumer' while the consumer is dynamic by default. What a market does to marketing is create value, what it is actually doing in society let alone the world is left unknown. The toolkit given by marketing in general and the marketing mix in particular does not allow for explanatory understanding of the market concept. The dualist nature of marketing does not provide a framework for answering the research question 'what does a market do?'

2.3.2 The Maze of the Market
The dualistic stable categories offered by marketing pose major problems for explaining what market are and do in society, first of all by categorizing entities as stable a distorted worldview is promoted in which dynamic entities are unjustly stabilized. Marketing as a discipline is practical, this also means that the explanations offered by marketing aim to make practice happen not explain market practice. Latour (2005) refers to such definitions as "ostensive" and explains that the main problem with these definitions is that seemingly no extra effort is necessary to maintain the existence of the stabilized entity (Latour, 2005:35). Ostensive definitions conveys meaning by pointing out examples in the world and lead to dualistic worldviews.

An example of a maze can clarify the problem of ostensive and dualistic definitions, a classic western European maze usually consists of trees and shrubs cut in geometrical shapes. These shrubs have certain predetermined roads between them, allowing for movement within the maze. The trees and shrubs are defined by simply looking and pointing at them, marketing cares about finding ways in between the shrubs and trees. The categories of the environment are result of years of looking and pointing rather than describing and understanding. To describe what markets are and do in a society, I need definitions that describe the trees and shrubs that compose the maze, rather than point out their existence.

Latour (2005) introduces these type of definitions as "performative definitions", he explains that these definitions draw attention to the *means* necessary to upkeep stabilised categories (Latour, 2005:35). Performative definitions aim at describing the shrubs, trees and humans that help make the maze be. This is where this thesis starts honing in. The main problem at hand is to find definitions of markets that are performative rather than ostensive.

To study performative aspects of markets is to study the actors that allow for the maze to exist. Kjellberg and Helgesson (2007) stress the importance of studying markets in the making instead of categorizing market aspects. They additionally explain that there is a lack in performative explanations. There are few studies concerning the way market practices stabilize in society and a lack of studies on the effect of market exchange practices between actor groups and objects on societies (Kjellberg & Helgesson, 2007:153). Fourcade (2007) studies markets in a performative context and argues that explanations markets in the future should focus at the qualification of performative effects and how artifacts connect human relations to markets (Fourcade, 2007: 1027). Both these articles put a number of issues on the agenda, definition of actors, artifacts and exchange practices.

To explain what markets do, the categories and actors from marketing must be redefined with a toolkit meant to identify dualist claims in practice. Both Latour (2005), Fourcade (2007) and Kjellberg & Helgesson (2007) pose that the Actor-network approach offer frameworks to describe actors, artifacts and exchange practices. In the next chapter the ANT approach will be introduced and explained in context to market studies.

3. Towards an Actor-Network model of Markets

The goal of this thesis as aforementioned is to explicate what a market is and what a market does. The previous chapter constitutes an explanation of what markets are and what they do through the perspective of marketing. This results in a dualistic view of markets as a place where priced products are offered to consumers. What it does is it creates value for two parties, on the one hand for the consumer and, on the other, for the producer. Markets understood through marketing are also segments of consumers, who are delineated by stabilizing the context of a market to specific, preconceived factors. This view of marketing gives stable units of analysis and preconditions which allow for delineating the relevant factors for which to account in making models of markets. However, as aforementioned, these models black-box the content of what markets *do,* only indicating the input (the producer) and the output (the consumer) without showing the processes that make these actor come to be. This black-boxing allows marketing to maintain a dualistic view towards markets by establishing stable, separate categories of 'relevant' factors. In the next subchapters these critiques of marketing are used to construct a series of assumptions which can challenge this dualistic approach. The next section, 3.1.1, will review two key conceptual tools offered by Callon (1998b, 2006). These are: *externalities and performativity*. These assumptions allow one to challenge the dualistic, stable categories presupposed in marketing, without entirely

rejecting the insights this discipline provides. Using these two conceptual tools, and the insights of marketing, I propose a theoretical framework for answering what a market does.

Both performativity and externalities are concepts used by Callon to explain the Actor-Network approach in studying economics and markets (Callon, 1998a; 1998b; 2006). The actor-network approach, also commonly referred to as ANT, provides conceptual tools to understand how products and consumers come to be and act as a collective through a market. I will, in turn, use the findings of ANT to answer the question what a market does, this will be done in section 3.4. The chapter will finalize in a critique on the limitations of the ANT interpretation of markets, which also functions as a transition to supplementary theoretical viewpoints.

3.1 A description of markets past the maze

To describe what a market is and explain what it does, one must unpack the black-boxes of marketing. Marketing defines markets as both consumers and a product; therefore, descriptions of a market in practice consist of consumer needs represented through categories of nature and society. What the market does in marketing is answered through the introduction of numerous black boxes. It fulfils the needs of consumers, through the introduction of a product. When marketing says that a lemonade stand is a market, they imply that there is a product offered fulfilling the needs of consumers. The composition of consumers depends on the positioning of product offering its market environment and vice versa. The product is a black box much like the consumer and environment of the interaction. However marketing offers a number of categories (Figure 2.) through which these black boxes can be interpreted.

The black boxes represent the nature and societies of markets, these categories are often changed in marketing, but the logic of explaining society and nature through categories is persistent. When marketing explains a market they "…acknowledge the existence of a plurality of descriptions of Nature without establishing any priorities or hierarchies between these descriptions. However, and this is where the paradox is revealed, within their proposed analyses, these social scientists act as if this agnosticism … were not applicable towards society as well" (Callon, 1986:2). To explain what a market does, the black boxed consumer and producer, much like the black boxed market environment must be reconsidered. This would however mean that most insights from marketing are lost. To make insights of marketing relevant for describing what markets do, the black boxes much be explained in a way which is non-dualist but conforms to marketing's view on markets. To do this two

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assumptions are put forth offering a way past the dualistic interpretation of markets. These two assumptions can in turn be operationalized through ANT literature, forming a framework for to answering what a market does.

3.1.1 Externalities and performativity, what a market is and does

To explain what markets are in a non-dualistic way, one must reconsider the black boxes offered by marketing; both marketing as a whole and its constituent parts tend to be taken as a given, currently defined as consumers and producers. The first conceptual tool provided by ANT to challenge and overcome dualism is the recognition of *externalities* within the framing of markets by marketing. The concept is defined by Callon as such: "…certain agents pursue courses of action the costs of which are borne by other agents, with no visible transfer taking place. The concept is strikingly expressed by the American feminist slogan of the '70s: 'Behind every successful man is an exhausted woman'" (Callon, 1998b:247). Behind every successful market there is a number of exhausted actors, which includes more than the producing actor receiving compensation or consuming party offering payment to fulfil a need – a marketer's typical approach. This notion of externalities indicates that relevant actors can be black-boxed out of the model. These actors may have relevant effects, but because they fall outside of the delineated taxonomy of relevant actors, they are not taken into account. Externalities become most present when marketing fails to take into account a phenomenon happening within its domain which incurs an obvious causal effect.

For example, take the crude oil market, one of the most massive collection of actors, and value exchanges. While a typical approach to this market would just include consumers and producers, it is clear that other, unaccounted-for agents are, indeed, "bearing the costs," such as: coastal ecosystems thousands of miles away from any production, schools of fish circulating the Atlantic, and whole industries such as tourism and fisheries. Despite the increasing awareness that these are relevant actors who are affected and cause effects on the market, they are not taken into account in the typical "consumer/producer" model. The notion of externalities provides a conceptual tool to taken into account the relevance of non-human and unrecognised entities within the boundaries of the value exchange between a consumer and producer. The value of a market, in turn, is demonstrably not entirely determined by the consumer-producer interplay, but by a complex system of networked actors, both accounted for and unaccounted for.

Secondly, we turn to Callon's concept of *performativity*. This concept broadens the traditional marketing approach to markets because it "…goes beyond human minds and

deploys all the materialities comprising the socio-technical agencements that constitute the world in which these agents are plunged: performativity leaves open the possibility of events that might refute, or even happen independently of, what humans believe or think" (Callon, 2006:7). Performativity is a conceptual tool for understanding *how* markets incur so many causal effects that are unforeseen by marketing or other established sciences. Performativity is the understanding that the market is a realization of and realized through actions in the world. Marketing science itself actually *shapes* markets, rather than neutrally describing them. The discourse itself shapes the phenomenon and how it plays out in the world. However, this also does not mean that the discipline *invents* the phenomenon or creates it. Callon (2006) cautions, "As for the notion of performation, it has the advantage of focusing on a question that is essential: it refuses the distance between the object and the discourse about it... When the mayor says: 'I hereby pronounce your man and wife,' he is not expressing something that is already there; he is making it happen... Caricaturally- and generally-speaking we could say that the economy does not exist before economics performs it" (p. 22-23). This means that performativity overcomes any artificial separation between what is described, who is describing it, and how it is described. Each of these factors are understood to influence the shape that a phenomenon takes. In marketing, as in economics, the discourse itself plays a key role in the "making happen" of markets. The assumption of performativity in markets overcomes dualism by challenging separation between the subject making the model and the object being modelled. Both co-shape the phenomenon, so it is neither fully object nor fully subject, and also not fully natural or social.

Externalities help explain what markets are (in terms of what is not accounted for in traditional models), while performativity helps conceptualize what markets do (in terms of how marketing discourse participates in the "making happen" of markets). Taking these two conceptual tools into account provides a way for marketing to overcome its dualistic tendencies. While these assumptions offer ways to mitigate the dualism of traditional marketing model, they are also not sufficient to make a deployable alternative framework for answering what a market is and does. For this, we have to turn to the contextual background of the two principles, the actor-network approach.

3.1.2 The Actor Network Approach as a Theoretical Framework

The concepts of externalities and performativity offer ways to overcome the traditional dualistic approach to markets by marketing. The two concepts allow for questioning of the categories and roles introduced by ostensive marketing practices by posing that markets are

performed by various many times unknown actors. These conceptual tools are situated in the actor network approach (ANT), established by sociologists Michael Callon, (1986; 1998a; 1998b; 1999; 2006) and Bruno Latour (2005). ANT is an attempt to overcome the social-nature dualism by breaking away from stable categorizations of actors in terms of their (stable) environment. Callon (1999) states, "[t]he most important is that ANT is based on no stable theory of the actor" (p.180). By questioning the black-box of the actor -- for example, the consumer, the product and its environment -- Callon (1999) argues for an approach in which the consumer is interpreted not through predefined stable categories but rather through the actor's interaction with material devices. Through this also the anthropocentric practices of marketing are challenged by ANT's crucial inclusion of non-humans in explaining the consumer and product. Callon (1999) clarifies, "with its focus on the role of technical devices and scientific skills in the performing of the collective, ANT highlights the importance of the material devices not only of natural science but also of the social sciences in general" (p. 193). By putting artifacts (material and social) as relevant actors in markets, marketing's black-boxed view of the consumer and producer can be questioned.

The ANT approach offers a way to include non-human actors in explaining a market; moreover, it provides tools for the recognition and description of relevant non-human actors to a particular market. To apply the theoretical insights of the actor network approach, and show its relevance to marketing science, I ask the question: "What is 'a market' and what does it do interpreted through ANT literature?" In answering this question, I provide specific insights on the relevance of externalities and performativity to marketing theory. ANT provides a way to conceive of markets as composed of human and non-human, co-shaping societies and the world. In the following section, I will explicate the sociology of translation, which provides an exemplary cornerstone to the ANT approach. This is followed by an explanation of how to take into account the relevance and measurability of non-human artefacts in modelling a market. To clarify, these sections will not result in an absolute construction of ANT as a fully-fledged theory. As Law (2009) argues, "...the actor network approach is not a theory. Theories usually try to explain why something happens, but actor network theory is descriptive rather than foundational in explanatory terms" (p. 141). Latour and Callon have actually eschewed the characterization of ANT as a theory due to the fact that they see it more as an approach or a series of conceptual tools than a holistic framework for what things are and how they play out in the world. Rather, ANT offers novel ways to consider how we approach these questions. Therefore, these sections proceed by reviewing important conceptual tools provided by ANT which allow us to question markets. I use,

therefore, a collection of actor-network embedded articles which are directly relevant to understanding the market phenomenon (Callon 1998a; 1998b; 1999; 2006; Callon & Muniesa, 2005; Latour, 2005; Law, 2009). By reviewing this selection and responding to the question I posed, I will also demonstrate and question, setbacks, and limitations of the ANT method in answering what markets are and do in society.

3.2 Sociology of translation as cornerstone of ANT.

Sociology of translation is often understood as a cornerstone of market related ANT practice (Callon, 1986; Kjellberg & Helgesson, 2007). Much like this thesis, Callon (1986) questions the dualism offered by sociologists between natural and social; which has, in turn, instantiated the dualism in marketing sciences. To Callon (1986) dualism is the fact that social and natural sciences are treated differently by social and natural scientists. For sociologists, nature is uncertain while society is not, vice versa for the natural scientists. In surpassing this dualism he argues that "[t]he theoretical difficulty is the following: from the moment one accepts that both social and natural sciences are equally uncertain, ambiguous, and disputable, it is no longer possible to have them playing different roles in the analysis" (Callon, 1986:3).When arguing that nature and the social are uncertain one can no longer rely on either the social or nature as stable groupings to build upon, and the black-boxing of the environment and actors must be reconsidered.

The conceptual tools of *the sociology of translation*, offered by Callon (1986), is an attempt to reconsider such black boxes. He shows that "one can question *society* at the same time as the *actors* and explain how they define their respective *identities*, their mutual margins of manoeuvre and the range of *choices* which are open to them" (Callon, 1986:4). I take this approach of Callon (1986) and explain it as it applies to marketing black-boxes such as the consumer, producer and environment. The process of translation shows how a market is defined at the same time as its actors (in marketing consumers and producers), while simultaneously questioning the identities and choices of these actors (values to these actors). With the sociology of translation, one can question what a market is in terms of actors, while at the same describe what these actors do.

3.2.1 Principles for translation

Callon (1986) offers three principles which form the foundation to sociology of translation and prevent dualistic constructions, each of which can be applied to making a model for markets. The first principle, impartiality to the observer, states that: "[n]ot only is the observer impartial towards arguments used … he also abstains from censoring the actors

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when they speak about themselves or the social environment" (Callon, 1986:3). This means that a researcher studying a market should strive remain neutral to each argument used and not censor any actor involved in a market engagement. Additionally, this also means that as many relevant actors should be included. The second principle, generalized symmetry, means that, "we require the observer to use a single repertoire when they [the actors] are described" (Callon, 1986:4). When studying a market, one should strive for a uniform language, creating explanatory symmetry between the acts of humans and nun-humans studied in the market. This means that both humans and non-humans can be producers and/or consumers.

The final principle, the indefinite boundary, stipulates that: "The third principle concerns free association. The observer must abandon all a priori distinctions …He must reject the hypothesis of a definite boundary…" (Callon, 1986:4). This implies that a market is an indefinite arrangement of symmetrically-explained actors, not limited to the units of analysis of embedded sciences represented through marketing. By rejecting all prior distinctions, a market can no longer be explained in predefined categories. These three principles contribute to getting past the maze of the market by offering tools for starting from a non-dualistic standpoint. The next part will explain the case used by Callon (1986) to introduce the sociology of translation, this will be followed by an explanation of the steps and procedures of ANT as demonstrated through the sociology of translation.

3.2.2 A case of translation, the scallops of ST Brieux bay

Callon (1986) explicates the sociology of translation through a case: the scallops of St. Brieux Bay. This case is a retrospective study of formation of scientific knowledge with immediate applications to marketing. It begins with the problem: "scientists and the representatives of the fishing community were assembled in order to examine the possibility of increasing the production of scallops by controlling the cultivation of these crustaceans" (Callon, 1986:5). The case itself explains a failed but insightful process of translation in which different actor groups, human and non-human are explained and treated equally in the process of knowledge development. What is implied with failing in translation is not that the approach failed but that the process of translation for the particular setting of actors failed, no lasting action was translated. Law (2009) explains that translation is an attempt to order or stabilize the actions of a group of actors. He terms this process as the development of "an experimental technology for rearing young scallops" (Law, 2009:144). The process of translation is an attempt to describe the stabilization of this experimental technology in society. Much alike one could pose that markets are about the stabilization of values surrounding a product. The product itself can be seen as the experimental technology

developed, by translating meaning and action to various actors by placing devices. What is relevant for marketing is the fact that the units of analysis of marketing studies are present: there are consumers, producers and value creation surrounding a certain product and service. Keeping this in mind, I move to the explicating the sociology of translation in terms of the four steps of translation related to the controversy (here presented as the scallop's case).

3.2.3 The four moments in Translation

What did Callon (1986) do to develop a non-dualistic language, or more importantly, what did the researchers do to make scientific knowledge? The first step is to establish a problem in the world. As Callon (1986) clarifies, "They determined a set of actors and defined their identities in such a way as to establish themselves as an obligatory passage point in the network of relationships they were building. This double movement, which renders them indispensable in the network, is what we call problematization" (p. 6). The researchers posed a question regarding the increase of scallop production, to construct this question the researchers identified actors which are relevant to posing the question. This is the first moment the moment of problematization. Each of the actors included have some sort of gain, for the scallop, its increased population and survival, and for the fishermen continuation of their profession. By showing that the fishermen need the scallops as much as the scallops need the fishermen, the researchers were able to validate their existence as mediators between these actors in the problem posed. Problematization for the market should be similarly interpreted, by posing an indispensable link between consumer and producer (when keeping to the three principles in defining), the marketer is able to describe mutual value creation in a non-dualistic way.

This phase is followed by a phase of *interessement*, a French word employed for its specific meaning. Callon (1986) defines, "Interessement is the group of actions by which an entity (here the three researchers) attempts to impose and stabilize the identity of the other actors it defines through its problematization. Different devices are used to implement these actions" (p. 8). After the problematization, questioning and defining, the researcher acts by setting up devices. In the case of the scallops, they put up nets to measure scallops, in other markets, they do so through test trials and consumer research. Creating value for the consumer and producer is a foundation upon which the market can grow, but it also requires that devices are places to make the consumer measurable to the producer, and possibly vice versa. By exposing the consumer, through focus groups, interviews etc. the marketer places devices in order to define the consumer and producer and their relevant needs. The work of

the marketer allows for grouping and segmentation of the producers and consumers. Callon (1986) adds, "[t]o interest other actors is to build devices which can be placed between them and all other entities who want to define their identities otherwise" (p. 8). The *interessement* step of translation opens the black-box of devices which act to network relevant actors. For this thesis, this *interessement* step is where we propose what a product does to its reciprocal environment, the routes the producer takes to deliver value, and the devices which coordinate this activity.

Devices, however, can take many shapes and forms, including person, thing, method, theory, and potentially anything that can be placed between a researcher and an actor. *Interessement* is followed by an enrolment of actors, or the actual commitment of actors to "making happen" a specific market. *Interessment* does not necessarily warrant action or successful performativity, this is achieved with actual enrolment. Callon (1986) clarifies, "...the device of interessement does not necessarily lead to alliances, that is, to actual *enrolment*. The issue here is to transform a question into a series of statements which are more certain" (p. 10). The device, when successfully *enrolled*, will provide certainty for the researchers, I.e. the scallop larvae stuck to the nets, or, for the marketer, that the particular groups of relevant customers consume the product. The focus group, interview or any device used improves success, by modification of product to consumer needs, and certainty, by providing segmentation of relevant actors. The marketer can now make claims with more certainty, there is a particular need for a product, 'the world needs my goods.' Devices for marketing can vary, such billboards, social media marketing, and an uncountable panoply of devices ready for the marketer to employ. What matters is whether the interessment of devices successfully enables the next step of actual enrolment. Callon (1986) defines, "Interessement achieves enrolment if it is successful. To describe enrolment is thus to describe the group of multilateral negotiations, trials of strength and tricks that accompany the interessement and enable them to succeed" (p. 10). *Interessement* is what causes *enrolment* to a specific program, for marketing the actual enrolment is the successful connection between different actors and devices.

The final step is what Callon calls the *mobilization* of allies. He clarifies that this hinges on the issue of representation when he writes, "In one case, the epistemologists speak of induction, in another, political scientists use the notion of spokesman. The question however is the same. Will the masses (employers, workers, scallops) follow their representatives?" (Callon, 1986:13). More simply put, Callon asks: will the devices inform you correctly, and will the assumptions made in this particular setting represent the world as a

whole? Do the scallops measured in the experiment of St. Brieux bay represent the whole population of scallops? Do the intermediaries between researcher fisherman and scallop lead to an accurate or successful representation? As Callon puts it, the final step is when "[a] series of intermediaries and equivalences are put into place which lead to the designation of the spokesman" (Callon, 1986:13). This final step is achieved when, for example, the researchers decide the representations of scallops in St. Brieux can represent the population as a whole. Instead of exhibiting the larvae and the towlines to their colleagues at Brest, the three researchers show graphic representations and present mathematical analyses. Callon explicates (1986), "The scallops have been displaced. They are transported into the conference room through a series of transformations… which result in the designation of the three researchers as spokesmen" (p. 15). For the development of a market, the final step can be described as the mobilization of allies, when the *interessement* device both successfully causes enrolment and is understood to be satisfactorily representative of the relevant actors. This final step results in a market representable in numbers and diagrams, the kinds which permeate our daily lives. The final phase is when the spokespersons meet the real world, it is when the predictions and representations are put to test resulting in actual transactions.

To summarize, translation is the process by which scientific knowledge stabilizes. It provides a foundation upon which to assess all the relevant actors, human and non-human, involved in the production of successful scientific knowledge. Similarly, the success of a market is dependent on the marketing intermediaries employed. This approach demonstrates how to begin an inquiry without reliance on pre-given categories of relevant actors. Callon (1986) summarizes, "Translation is the mechanism by which the social and natural worlds progressively take form. The result is a situation in which certain entities control others. Understanding what sociologists generally call power relationships means describing the way in which actors are defined, associated and simultaneously obliged to remain faithful to their alliances" (p. 19). Translation is that within a market which causes it to exist, it is a process initiated by humans with needs and an interest in mutual value creation. The sociology of translation offers a model which describes a process of stabilization, but which also symmetrically describes the human and non-human actors.

By applying ANT in markets, one can explain the process by which the world takes shape around a market or the market takes shape within the world. This means two things for the being and functioning of a market in relation to marketing. The first relates to what a market *is*. Markets are, according to this approach, composed of producers, consumers and products, as well as the non-human and human reciprocal environment of the consumer

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producer and product. The second relates to what a market *does*. What a market does, according to this approach, is performatize the world through coordinating and fulfilling the needs and desires of millions of actors.

3.3 Markets, translations and the actor-network

The sociology of translation is exemplary of the ANT approach in general. Callon (1999) indicates these similarities when he writes, "ANT highlights the importance of the material devices not only of natural science but also of the social sciences in general and economics in particular, in the performing of the economy" (p. 193). The importance of the ANT view expressed by Callon lies exactly in its focus on technological devices in relation to actors in explaining performativity and externalities of the market. Through translation, Callon (1986) demonstrates how each of the actors coordinates with devices and how these devices play an integral role into the formation of markets. Rather than informing about the success rates of marketing devices, it describes how these devices contribute to the performatizing of a market. ANT, in contrast with marketing, can provide a conceptual tools for performing a symmetrical analysis of the role human and non-human actors play in performatizing a market, whereas marketing takes stable categories which preclude the role of non-human actors and increase the perceived neutrality of their discourse.

This fundamental difference allows the construction of an answer to the question what markets do which does not presuppose dualistic categories. By describing the relations between actors in a particular setting, and beginning with questioning what actors and devices are relevant, rather than explaining what these actors are to the sciences, ANT is able to describe a value interaction between various actors without resorting to stable categorizations. Rather than providing fundamental categories in explaining the actor, ANT proffers an analysis that *begins* by inquiring into these actor categories and describing these actors in relation to other (human and non-human) actors and devices.

By taking the four steps of translation one can demonstrate how socio-material devices play a role in the establishment of spokespersons allowing for enrolment of actors into a network. This process creates a starting point for conceptualizing an ANT modelled market. By problematizing while keeping to the symmetry proposed by the ANT approach, non-human actors become part of the study of markets. Performativity implies that devices play an active role in the creation and dissemination of market conceptions, meaning that the devices employed change the way a market is represented (Callon, 1999). To explain what a market is and does to societies and actors, a clear description of how relevant actors are recognised must be provided. Translation starts at the identification of a controversy through

problematizing. Translation does not fully explain the process that precedes problematization. In the next section, I explore the preconditions of ANT problematization.

3.3.1 Framing and calculative devices.

To ask what precedes problematization in translation is to ask what is needed for the recognition of actors. Callon (1998a; 1998b; 1999) in turn introduces the conceptual tool framing. The concept of "framing" stems from famous sociologist Erving Goffman (1974). He argues that "definitions of a situation are built up in accordance with principles of organization … frame is the word I use to refer to such of these basic elements as I am able to identify" (Goffman, 1974:11). Goffman (1974) explains that people classify experience in accordance to prior encountered frames of reference. A frame, in turn, is a context through which experience takes shape and are made sense of. To analyse a frame is to examine the social context through which a market is experienced in society. Callon (1998a; 1998b; 1999) reiterates this concept of framing, he argues that the logic of framing looms behind performativity and externalities as conceptual tools (Callon, 1998b:248). These tools allowed for the questioning of actors and acts. Framing concerns the ability to identify actors and acts, this allows for problematization.

Callon (1998b) argues in that in context to markets "framing is the possibility of identifying overflows and containing them" (p.248). Overflows are caused when a given frame fails to account for relevant happenings in the world. Overflows, in turn, are externalities which are yet unrepresented through prior processes of translation, implying that they are unrepresented by a material device. Callon enumerates that, "[n]o externality can exist without relationships; no link can exist unless it follows a trajectory plotted by a material object acting as the medium for the externality" (Callon, 1998b:257). Externalities and overflowing are inevitably linked to the framing of the researcher. Overflowings are endemic to framings, even necessary, as Callon (1999) explains, "…framing can function and survive only if there is overflowing" (p.193). Framing explains a moment preceding translation, but any framing also enables overflowings and externalities. This is the recognition of new acts within society.

Callon (1998a) argues that the action of framing results in "…a clear list of the entities, states of the world, possible actions and expected outcome of these actions" (p.19). This indicates that in order to take something as black-boxed, one must first assume a framed stance, but also that a frame is hypothetical and relatively easily changed. It provides researchers taxonomies of issues and actors upon which can be problematized, leading to a

process of translation. An example of a frame preceding translation could be an automotive grade petroleum fuel market frame. Consumers are automobiles as they require fuel to operate, the product is consumer grade petroleum. By offering automobile fuel the automobile can function fulfilling a consumer's need. By listing a group of entities and giving them a purpose, boundaries are set to frame the market, allowing for problematization and the delineation of relevant entities.

The concept of framing is further developed by Callon (1999) in his article *Actor-network theory—the market test* in which he argues that markets produce constructions of calculative agencies. If calculations are to be performed however they require a process of disentanglement of actors and products. This means to separate actors from the existing actor-network of relations he/she is embedded in. Frames are the result of such separations or purifications .The frame, composing of a finite list of hypothetical market actors, allows for a researcher, a consumer, or producer to calculate. The concept of calculation also plays a key role in understanding what precedes a problem statement in ANT. Callon & Muniesa (2005) argue that calculation, much like framing, "…starts by establishing distinctions between things or states of the world, and by imagining and estimating courses of action associated with those things or with those states as well as their consequences" (p. 1231). A frame constitutes a precondition and the result of for any calculation, but a calculation solidifies a frame into stabilized relations upon which real actions can be made. Whereas market frames are relatively unstable and changeable, calculations, by necessity, strive for stability. Callon and Muniesa (2005) argue that "[a] market can be described (at least partially) as a collective device for the evaluation of goods [interpreted as products Ch2]. This calculation is possible only if goods can be calculated by calculative agencies whose encounters are organized and stabilized to a greater or lesser degree" (p. 1245). To deploy a frame into actions, one needs to be capable of calculating along stable lines. A frame is not necessarily stable, as it only is relevant to the researcher and can be highly discipline-specific. Calculations, on the other hand, are instigated from devices, which went through the process of translation in order to be stabilized, meaning that the greater collective of actors hold the same meaning for what these translations yield. The first blueprint of a market (the frame) serves as a device through which actors can be interested and calculations can be stabilized. By "interessing" things to a product, the frame takes shape over time and develops into a stabilized calculative device. The market device, at this point of stabilization, allows for calculation of costs and values by consumers and producers, forming the foundation upon which transactions are made.

I now move to proposing an answer to the question "what is a market and what does it

do interpreted through ANT literature?" While performativity and externalities offer a way to overcome the dualistic tendencies of scientific disciplines, they are not sufficient to answer this question. According to my review, ANT offers three main conceptual tools to understand what markets are/do. These are: framing (Callon 1998b), translation (Callon, 1986), and calculativeness (Callon & Muniesa, 2005). The framing of a market, also seen as the show a certain value proposition between listed entities. The translation of a market, describes how the frame is distilled into problematization and how the designation of spokespersons play out though placing devices between things consolidating networks. The calculation attempts to elaborate on value trade-offs through devices, as different devices are used to interest customer groups and provide a foundation upon which they can establish transactional value(s) with the other actors. Value is defined through a transaction, the translation of a frame into a calculative device. These tools, viewed together, make a strong case for why the market environment includes things, or relevant actors, in their own right; devices which are placed between things, consumers and producers and play a crucial role in making markets happen. Through ANT, the marketing mix and other approaches to markets, can be seen as devices used to frame a market. Moreover the general concept of a market in ANT is a calculative device, which is relatively stabilized through a process of translation. A market, in turn, is usually represented through calculations resulting in price agreements. These price agreements are the product of the interessement of devices and the enrolment of relevant actors. Examples of such devices range from Ebay.com to supermarket chains, stock exchanges, and even lemonade stands.

What a market does according to ANT is somewhat more difficult to explain, but the two principles (section 3.1.1) to study markets past the maze offer a ways explaining what markets do. ANT may seem to imply, at first sight, that a market is nothing more that offering the capability of calculating for actors who wish to make profit, or fulfil needs. A market changes the world through ANT as it displaces products, these product are then again introduced into a new actor world. Markets, and the broad range of devices and actors they enrol, shape the way actors perceive of products and define the value actors seek in relating to a product. What markets do according to ANT can be summarized as follows: Markets allow for calculated transaction, these transactions are stabilized through a process of translation. Markets in return allow for framing and construction of new translations. Markets determine what goods are recognised and used in the world. A market shapes the world by stabilizing pathways through which actors calculate value. While at the same time, a market shapes real-world practices by necessitating the arrangement and relating of devices and

actors. The chapter started with the assumptions performativity and externalities to overcome dualism, followed by an explanation of the sociology of translation and the ANT approach in market studies to provide an alternative, non-dualistic starting point. In the next subsection the setbacks of the ANT approach will be explained based on the findings of chapters two and three.

3.4 Critique of ANT, a pathway to phenomenology in markets.

In the last paragraphs an understanding of markets was formed which describes a market using several conceptual tools. The hypothetical market frame and externalities the process of translation and performativity, and the calculative collective device. The methods, actors and calculative devices define what a market is. Displacing things and introducing them in a new context through translation while allowing for calculativeness to producers and consumers is what a market does. In relation to the maze of the market, ANT allows for description of a maze its trees shrubs, while at the same time explain the roles of actors in the particular maze setting. Non-human actors are included and treated equal to humans, both understood as fundamental part of an actor in the translation process.

There are fundamental problems for ANT and explaining what a market does. The approach delineates humans and non-humans as actors represented by devices, but the effects of these devices on humans and non-humans in return is not explained. ANT allows for the construction of lists and effects, and some account of how these stabilize among actors. The stabilized market in result is a device employed by consumers and producers. Through employing a device, the calculativeness of human actors changes, the device performatizes as much as the device is performatized. ANT, in return, offers few tools to address the effects of devices on human beings, let alone things. A market is a calculative device allowing for value creation for consumers and producers in particular, however, the presence of externalities means that an ANT analysis of a market would not pertain all things affected by the actions of agents, only those necessary to make the device successful in its context. In explaining what markets do according to ANT, we gain little insight into the effects of devices coordinating things. To explain what markets do is to explain what devices do, ANT does not do this. ANT, according to Verbeek (2005), focuses on "[t]he network of relations that allow entities to emerge into presence" (p.168). ANT does not describe the way which devices alter realities, it describes the way devices come to such a relational position where they *can* alter realities.

To describe what a market does, the effects of devices on things must be explained. In addition, it can be said that remaining problems of ANT and markets can be seen through the

scallops of St. Brieux bay case (Callon, 1986). The case offers a list of actors and effects, in addition the researchers through employing a device resolved a controversy regarding larvae. The frame of the researchers described a list of things: fishermen, scallops, a river, starfish etc. This frame, however, was aimed at describing scallops behaviour in terms of their effects on the consumers and producers, not the effects of netting, or increased scallop population on starfish or the river, or overpopulation. Certain relevant actors, such as the river itself, were not delegated representatives, and therefore precluded from the final step of translation, despite its clear relevance to the network. To question what markets do, there must be ways to challenge framing which precludes non-human value recognition. For example, the ANT approach does not provide tools for understanding a market which involves no human actors. In turn, the effects of technological devices and particular framings must be questioned before a market can be problematized or subsequently understood. In the next chapter, the findings of ANT and the three levels of inquiry derived from it are put to test. I contrast the ANT approach with phenomenological and post-phenomenological approaches from philosophy of technology, which augment the conceptual tools offered by ANT in crucial ways.

4. Three Conceptual Angles of Markets

The aim of this thesis is to clarify what markets are and what they do. The previous chapters explain markets in light of marketing and ANT. This resulted in the view of a market as a calculative device through which producers and consumers establish mutual values. ANT allows for a non-dualistic interpretation of markets by creating 'generalized' symmetry between human and non-human actors. The symmetry is attained by illuminating the importance of technological devices in describing markets, both devices of *interessement*, and devices of calculation are an example of this. The resulting market view of ANT describes a series of conceptual tools aimed at understanding the way a market manifests in the world. The conceptual tools offered through ANT in turn allow for a threefold description of markets. First of all, markets are instigated through a *framing*, the resulting frame is exposed to groups of actors using interessement devices. If this is successful we can speak of *translation* of a frame, leading to a calculative device, locking the actors in place. This process explains the transformation of a network of entities into a single society surrounding a device. The insights of ANT form a first conceptual angle in studying markets. Allowing for explanation of what markets are and do in context.

The insights of ANT however have its limitations, the conceptual tools of ANT offer a

way to construct and identify *frames* and different technological and/or calculative *devices* in discourse. Framing brings back focus to **t**he human being (the researcher, or person that attempts to describe a market), but offers no sufficient way to explain human behaviour in context with devices, such as a calculative market device. The conceptual tools of framing and calculating are about ways to describe experience in the world (the way humans experience and perceive the world through a device), ANT and translation focus on describing the existence of socio-material networks in the world (the existence of actors, artefacts, and devices represented through a device). Verbeek (2005), in his book *What things do: philosophical reflections of technology agency and design* argues,"… actor-network theory offers more than a 'backward' approach to technology, but pays attention to what technology actually does in its context" (Verbeek, 2005:103). ANT allows for a description of what calculative devices are and do in context (in a society as a whole). ANT does not describe the way humans experience the world through such calculative devices. To explain what markets do to actors of a society regardless of their role within the actor network, the role of technologies in experiencing the actor network must be clarified and described. Philosophy of technology in general and phenomenology in particular dedicates itself to questioning technologies.

To explain what markets do, the frame and calculative device must be unpacked to clarify what a market device does to 'actor experience' using insights of phenomenology. To do this the question "*What is 'a market' and what does it do according to hermeneutic phenomenology?*" will be asked throughout the upcoming sections. Hermeneutic phenomenology offers a starting point in explaining a frame, and calculativeness. Laverty (2003) argues that "[h]ermeneutic phenomenology is concerned with the life world or human experience as it is lived" (Laverty, 2003:24). In the next sections two phenomenological approaches will be introduced to ANT's market conceptions. Both these phenomenological will offer answers to the asked sub question by providing conceptual tools supplementing the earlier explored ANT market description (Chapter 3). This will eventually lead to a three levelled market approach in describing what markets do. The conceptual tools offered in this thesis, explaining a market past the maze, will eventually be put to test through the real life case of the (Dutch) PV panel market (Chapter 5).

4.1 Taking a step back from ANT: Framing and Heidegger's hermeneutic phenomenology

The insights acquired through conceptual tools derived from ANT literature allow for

questioning of 'markets' in societies, in explaining the society devices play a central role as mediators between actors and the world. A calculative collective market device is the result of successful translation, translation in turn is instigated by the act of framing. In line with this the act of framing is the formation of an abstract market, an attempt to make the world calculable. Callon and Muniesa explicate that "If the economist can talk of (abstract) markets, it is because markets can be considered as sociotechnical algorithms whose shape and properties he or she analyses" (Callon & Muniesa, 2005:1244). Frames as abstract markets are dependent of sociotechnical algorithms. Algorithms they argue, "Cannot be described and defined in an abstract way, independently of the material conditions of their enactment" (Callon & Muniesa, 2005:1241). This means that an algorithm is a way of calculating instigated from material conditions. He uses the example of a supermarket (a calculative market device), and explains that algorithms arise from material conditions such as the doors, windows, queues, and displays within the building. The action of market framing is instigated by the material conditions of the world.

This however reduces the accuracy of the ANT analysis in explaining what markets do. By assuming that markets are about calculativeness we close off the potential for finding additional meanings. The market device is a collective of actors with devices keeping the various actors together. Financial markets, a stock exchange, or forex trading platform, is such a calculative market device. Callon and Muniesa argue that "Financial markets offer the example of an intense struggle between the designers of market technology (conceived of as places of encounters)" (Callon & Muniesa, 2005:1243). So much like the supermarket, stock exchanges have physical aspects which allow for a different calculated world views. For ANT's framing, technolical devices have a calculative function, the frame is there to 'spot' calculative features of the world. In the next sections I will develop two conceptual tools which will allow for questioning of ANT analyses, in particular ANT interpretations of markets as framings of abstract calculative collective devices.

These two conceptual tools will be developed using the works of Heidegger (1977) philosopher of technology and Pickering (2005) Philosopher of science and history. ANT's notion of framing (as a way of revealing calculative aspects of material artefacts 'algorithms') connects to the works of Heidegger, a seminal philosopher of technology. Heidegger argues in his well-known essay T*he Question Concerning Technology* that, "[t]he current conception of technology, according to which it is a means and a human activity, can therefore be called the instrumental and anthropological definition of technology" (Heidegger, 1977:5). Callon's (1998b) frame can be grouped under this definition of

technology, it serves as a means (i.e. to explicate a calculative relation) and a human activity (i.e. delineating relevant actors). This means that a list of actors, acts and consequences (framing) can be conceived of as technology when using Heidegger's definition, as it serves as an instrument. However, Heidegger (1977) argues that the prevailing "current instrumental conception" is limited, and proposes an alternative approach in which technologies are understood to enable "a way of revealing" (p.12). Rather than understanding technological instruments as neutrally uncovering the phenomenon into which they investigate, he understands them as "revealing" phenomenon in a specific way. Revealing is the process through which the world presences itself through technology to humans (Heidegger, 1977). Framing as currently conceived of in ANT can also be understood in these terms, as a way of revealing, but is typically approached in an instrumental way, as a means through which calculativity is established. This view will be further explained in 4.4.1, the view of framing as 'a way of revealing' will be explained in 4.4.2.

With the help of Pickering's *new ontologies* (2005) who addresses the two ways of revealing through technology introduced by Heidegger (1977) as two distinct ontologies of the world. I synthesize the two conceptual tools for questioning what markets do (aside from their calculative properties). The conceptual angle that is attained through this allows for questioning of early notions of framing and ascribing calculativeness as the sole property of technological market devices. This will allow for a better understanding of what markets do as early works of Callon (1998b) explain that a narrow framings in translation instigate externalities. I offers two distinct ontologies which open the black box of framing and technological devices aside from its calculative instrumental function. This will allow us to reassess human-technology relations within the actor network.

4.1.1 Enframing as Framing

A frame is necessary before problematization in ANT, and also something put in place to reveal the networks by which a market is/can be established. The first conceptual tool is one which attempts to describe the functioning of framing in ANT, developing calculativeness. The Frame of ANT is informed by physical properties of market technology (as the place of exchange). Heidegger elaborates on a specific type of framing, that of "enframing," which he views as characteristic of modern technological modes of viewing the world. Heidegger (1977) explains such a framing as: "[e]nframing means the gathering together of that setting-upon which sets upon man, i.e., challenges him forth, to reveal the real, in the mode of ordering, as standing-reserve"(Heidegger, 1977:20). Enframing is the way through which the world is gathered and ordered into comprehensibility and usability.

Framing in ANT aims to gather the world through technology as a mode of calculating. Heidegger sees this gathering as a "setting-upon" or "challenging forth," indicating that some force is involved in enacting such an ordering. This ordering results in humans, technologies, and the world being understood as "standing reserve," or, in other words, material whose only potential is use. In marketing, this can be understood in the framing, through which actors are gathered and ordered, putting consumers and producers into standing reserve. In a sense, everyone and everything in the actor-network is both using the standing reserve and being used for standing reserve. What this framing essentially, in Heidegger's (1977) terms: "[i]t is a 'challenging claim,' a demanding summons, that 'gathers' so as to reveal" (p. 19). By listing actors (gathering and ordering), a researcher can problematize (challenge-forth), as to reveal the networks and actors behind a calculative market device. By listing a series of actors interpreted through market technology, the actors are challenged forth to reveal their calculativity.

The frame is a device which allows for a researcher to enact enframing on the world, actors become gathered, ordered, and placed into standing-reserve for the use of the actor-network. What enframing does, Heidegger (1977) argues, "it designates nothing less than the way in which everything presences that is wrought upon by the challenging revealing. Whatever stands by in the sense of standing-reserve no longer stands over against us as object" (p.17). Enframing, therefore, is a specific type of revealing in which the subjects and objects are challenged into an ordered collection in which everything is usable and dispensable. Framing as calculativeness implies that the researchers perform an enframing, and in offering a list of ordered acts and consequences they challenge forth all the actors into standing-reserve. It is important to note that even as the researchers attempt to impose their enframing on the world, in Heidegger's view, they also become enframed themselves. They also become standing-reserve for the actor-network at large. Enframing is often the step which precedes ANT's problematization, the corresponding frame a human sets upon the world. The world is experienced through enframing (a market frame) as standing reserve, ready to be challenged forth to reveal its underlying actors and devices for use within the frame. In a hermeneutic sense, enframing, or in other words, experiencing the world as standing reserve, is a stance that allows for performativity (see chapter 3.1). As a conceptual tool enframing attempts to put analogies between the role of technological artefacts in ANT and the role of technological artefacts in Heidegger's challenging-revealing of the world.

4.1.2 Poiēsis: framing beyond the enframing

Enframing explains the hermeneutic dimension of an ANT framing, it explicates how the researcher experiences the world as calculable. This serves as a precondition for translation, the gathering and ordering of actors and calculative devices, and the eventual performatizing of the world. Heidegger (1977) suggests an alternative to enframing when he writes, "Enframing is an ordaining of destining, as is every way of revealing. Bringing-forth, *poiēsis,* is also a destining in this sense" (p. 24-25). Poiēsis is also a way of revealing which explicates how actors experience the world with technology; however, it is distinct from the experience of enframing. Bringing-forth and challenging-forth are both acts which reveal that which is yet unconcealed. However, enframing is anthropocentric and instrumental, meaning the values of a frame and use is only to humans, the calculation yields only to humans. Importantly, Heidegger also adds that humans become part of the standing-reserve by engaging in enframing practices, even when they assume an instrumentalist stance towards their devices.

Heidegger (1977) explains that poiēsis implicated a worldview in which, "through bringing-forth, the growing things of nature as well as whatever is completed through the crafts and the arts come at any given time to their appearance" (p.11). The poiēsis approach to revealing allows an individual to experience the world as more than an instrument for human disposal e.g. to calculate. Rather than challenging forth, and gathering and ordering into lists, *poiēsis* offers an alternative approach to technology, as a way to bring forth and describe the way which actors experience the world through technology. Heidegger (1977) argues that nature or the outside world *"...*is, indeed *poiēsis* in the highest sense. For what presences by means of *physis* has the bursting open belonging to bringing-forth" (Heidegger, 1977:5). Nature, like arts and crafts, does not superimpose an ordered frame (challenge-forth) in order to act and exist. These act dynamically, revealing things in a multitude of ways, or even allowing things to reveal themselves (bringing-forth), rather than enframing, which can only reveal things as standing-reserve.

I use an example to help illustrate what kind of market could fall under Heidegger's conception of *poiēsis*. By using an unconventional example of a market (or what many might call a market), I show how one can deploy the framing of *poiēsis* as a device to spot transactions and build actor worlds necessary for translation. The market I will use is a hermit crab real estate market (DeFranza, 2010; Laidre, 2016; Laidre & Vermeij, 2012). It starts when species of hermit crabs grows beyond the limits of its own shell and begins to search for a new one. Furthermore, some particular hermit crabs are known for remodelling the homes to make them fit their own needs (Laidre, 2016). These homes are not only crucial to

the hermit crab's survival, but also shape their social relations (DeFranza, 2010; Laidre, 2016). When attempting to find a new home, the crab searches the beach for an empty shell larger than its own and positions itself next to it. Other shopping hermit crabs pass by and see the shell, they form a line ranging from largest to smallest. Once a crab comes along large enough to inhabit the largest shell, they hastily exchange shells, each swapping for the one slightly larger than theirs. The home to the crab is of such value that it engages in transactions, these transactions define their role in society, and define the way the crab will perceive, be, and act in the world (Laidre & Vermeij, 2012). The technology of the shell influences their role and position, and they exchange these technologies in ways that can aptly be described as a market. This shows a market based in *poiēsis,* wherein the shells are experienced by the crabs without being gathered and ordered into standing reserve by a framing. These spontaneous markets show that transactions and the establishment of mutual value does not require a worldview through technology which presumes calculativeness through a frame. Additionally, by understanding these transactions as a market, we gain insight into what a non-anthropocentric approach to the meaning of markets might reveal.

     Poiēsis and *Enframing* are two hermeneutic conceptual tools which allow for unpacking the ANT notion of "framing," and challenge it by constructing a parallel frame capable of providing alternative insights into the same actors. *Poiēsis* and *Enframing* are ways of describing a frame, the former resulting in a gathered and ordered list, and the latter resulting in a story of being in context. Heidegger offers the fundament for a conceptual tool to overcome anthropocentric framing while focusing on the devices and externalities of devices. Heidegger (1977) argues that the danger behind enframing as a sole activity is that it "…conceals that revealing which, in the sense of poiēsis, lets what presences come forth into appearance" (Heidegger.1977:27). When enframing, one precludes other meanings and values besides standing-reserve or to calculate, whereas *poiēsis* allows things to be revealed in a multitude of ways, and therefore ascribed a multitude of values. To further develop this conceptual tool, I will explicate an approach to the ontologies of *poiēsis* and *enframing* as ways of being in and conceiving of the world through technological devices.

4.1.3 Developing an ontology for market framing

     Phenomenology's descriptions of relations to the world aims at bringing together human experience and technology, something black-boxed in the traditional notion of framing through ANT. This is done in order to develop a conceptual tool which helps reverse black-box the framing of a market. I will apply Heidegger's ontological claims about

technology to the market using the argumentation of Andrew Pickering, a sociologist and philosopher. Pickering argues that enframing is a particular stance, the calculative and ordering aspects of technological devices are one aspect of reality when operating with technology. Technology is also a way of revealing the world as the way it always is and will be a becoming.

Pickering (2008) explains two ontologies in relation to Heidegger's (1977) *enframing* and *poiesis*. He does so through an exemplary philosophical inquiry on two paintings, one of Mondriaan and one of de Kooning. The Mondriaan painting is characterized by "...geometrical abstracts [that] are instantly recognisable: a vertical and horizontal grid of solid black lines, filled in by patches of primary colour" (Pickering, 2008:2). The painting of de Kooning differs in that it displays "…an open-ended fashion to canvasses that no-one, including the artist himself, could ever have planned or anticipated in advance" (Pickering, 2008:2). Pickering argues that the two paintings represent different ways of conceiving the world, one in which the world is represented through recognisable abstracts superimposed on the canvas, and one as an unpredictable dynamic interplay of materials which engage in a process of "becoming" on the canvas. Pickering (2008) explains that "…the ontology I associate with de Kooning is…one that reminds us of how being in the world always has been and always will be—while the Mondrian-esque style has to be seen as thematising *a certain stance* in the flow of becoming" (p.3). Pickering (2008) represents the two frames offered by Heidegger (1977) through paintings. *Poiēsis,* much like de Kooning's paintings, represent a mode of being of the world, which Pickering terms the "dance of agency," in which subjects and objects co-shape one another in constant dynamic interplay. Enframing is more like Mondriaan's painting, represent a certain stance in the world which superimposes (challenges-forth) order and reifies calculativeness present in the world, approaching the canvas and the materials as instruments rather than active players.

Stating that technology is there to order and reveal into standing reserve ,or similarly to calculate and deliver value **"**can be associated with dualist projects of domination of matter and the denial of time" (Pickering, 2008:4). Enframing on its own cannot explain what markets do as it disregards the being of the world around the framing.

This ontological inquiry (into modes of being) offers several tools for understanding what markets are and what they do. Heidegger offers the notions of enframing and *poiēsis,* which allow for insights into the role humans and technology have. By questioning framing of ANT, phenomenology offers two ways to understanding the ontological character of markets. The first mode of being (the Mondriaan, enframing approach) is described as a

stable, superimposed, recognisable abstract, which gathers and orders things into instruments for use. This approach is in line with marketing and ANT's framing. The second way of mode of being is exemplified in Heidegger's *poiēsis* and Pickering's 'dance of agency,' a dynamic revealing in which subjects and object co-shape one another and revealings are not precluded in advance. This alternative ontology also offers a way out of the anthropocentric aspect of the maze of the market (introduced in section 2.3.3), by explaining that calculativeness is a certain stance in the world with technology rather than the world. The conceptual tools of enframing and poiēsis reassess the position of the researcher in framing. This reassessment allows for questioning of technologies as mere calculative devices in the market actor-network.

4.2 Calculative collective devices and hermeneutic post-phenomenology

The preceding section provided a way to question the role of technology in framing and the calculative market device. However technology (as the place of a calculative device) as ANT showed in earlier sections is only realized through many different technologies. Interessement devices, framing devices, material devices etc. etc. In the last conceptual angle I attempted to question the calculative being of markets. The technological device employed to frame a problem and delineate relevant actors engages different modes of revealing, one which challenges forth into standing-reserve while the other describes the dynamic engagement Pickering terms the "true ontology," which is "how being in the world always has been and always will be" (Pickering, 2008:3). This inquiry shows that ANT and phenomenology shed light on different issues. ANT explicates the world in a third-person perspective, but is unable to account for the first-person experience of human-technology relations (Rosenberger & Verbeek, 2015:20). Phenomenology and post-phenomenology are characterized by taking the first-person experience as a starting point. In this sense, these approaches address different angles. As Verbeek (2005) explicates, "the network of relations that allows entities to emerge into presence [ANT], however, is something different from the network of relations that humans have with those entities [human-technology relations]" (p.169). By posing that ANT is unable to account for the network of relations humans have with entities aside from calculative properties relevant to explaining markets, a need arises for conceptual tools to understand the *experience* of human technology relations when exposed to these calculative devices. This is exactly what Verbeek (2005) does is his book *What things do*, he questions the role of technologies in human life.

The third conceptual angle is aimed at describing these first person human technology

relations. The first angle aimed at describing the being of markets as calculative collective devices, networks of actors linked together by interessement devices. The second angle aimed at questioning the role of devices and the material world in framing a conceptual market. This angle complements the previous two by offering a way to describe human relations with technologies. By describing what markets are and do in context through ANT, while questioning the framing of the world in markets we can question what markets do to actors belonging to particular societies. Postphenomenology allows for description of relations humans put up with technological devices. This will allow for explanation of ways in which market technologies act within a collective calculative device and to the collection of actors involved.

Don Idhe, the so-called father of hermeneutic postphenomenology, compares and contrasts ANT with his own work. He observes,

> ...both ANT and Postphenomenology are materially sensitive. In ANT sensitivity to materiality took the shape of its distinctive human and non- human actants. ANT also holds to a general and equalized notion of sym-metry between the humans and non-humans.... Postphenomenology does not hold to a strict symmetry, but to a series of gradations between types of activity. But it, too, is materially sensitive—for example, postphenomenology recognizes *instrumental intentionalities* or built-in selectivities in technologies. I am developing a *material hermeneutics* modeled upon the use of contemporary science instruments to "let things speak." (Ihde, 2015: xv-xvi).

What unites post-phenomenology (phenomenology) and ANT is the focus on technological devices as playing an active role in human lives. Technologies form an alternative lexicon of tools to explicate what the market device does from the third-person positioning of ANT and the first-person insights from postphenomenology. Ihde observes that sociologists tend to favour ANT approaches and while anthropologists tend to favour postphenomenology, and concludes that "Clearly the two styles of analysis are more complementary than combative" (Ihde, 2015:xvi). They explicate two sides of the same issue – how the human world relates to the world of devices and artefacts.

These approaches share a crucial difference in their objects of analysis. As Rosenberger & Verbeek (2015) clarify, "While ANT focuses on following the *actors* around specific technologies or scientific practices or results, postphenomenology aims to analyze the networks of *relations* around technologies" (p. 32). ANT is aimed at describing the actors that form around a specific technology and how the interplay of actors and devices stabilize

into their observable roles. In application to the market, ANT can explain how a product comes to be part of an actor's network, and how the actors are gathered and how meanings, roles, and values are established through translation. Postphenomenology aims to describe the construction of individual meaning, action and perception through technological devices. Verbeek (2005) justifies the focus on the role of technological devices in mediating action and perception because: "Technology has primacy, not because the technological mode of thinking is presupposed in scientific thinking, but because contemporary science is helpless without technologically mediated instrumental perceptions" (Verbeek, 2005:140). Much like the conceptual angle of Heidegger and Pickering, postphenomenology takes that technologies play an active role in perceiving. By posing that interessement devices, technologies, and calculative devices are indispensable to market sciences' attempts to explain a market, post-phenomenological insights become relevant in answering the question what markets do. ANT Phenomenology and Post-phenomenology agree that technology is not neutral (Latour, 2004; Verbeek 2005; Idhe 1999; Heidegger, 1977). Posing that devices are not instruments or mere extensions of human behavior, but rather shape the actor and its acts, means that in order to explain what a market (as a technology) does, I must explain what technology does in relation to (human) beings.

4.2.1 Technological mediation and ANT

Postphenomenology is concerned with human technology relations. ANT is concerned with actors that emerge around a technology. Both approaches offer the term "mediation" to understand how humans and technologies interact. This term emphasizes that technologies play an active, but not determining, role in human lives. Latour offers an ANT perspective on "mediation" when he "offers a set of concepts to study how programs of action get translated when human beings form associations with technical artifacts" (Verbeek, 2016:193). Callon's representation of ANT explains this process from the position of the researcher and poses that technology translates a course of action. Latour (1994) explains the process of translation from the perspective of the device. The act of the actor according to Latour (1994) is mediated by technology through a program of action. Mediation, according to ANT, is about how artefacts shape the acts of the actors in their networks. In postphenomenology, mediation concerns the relations humans set upon when interacting with a technology. Verbeek (2016) emphasizes "… in order to arrive at such a theory of technological mediation, one crucial step needs to be made. In all attention for the mediating roles of technologies, the processes of appropriating these mediations by human beings have remained largely unstudied" (Verbeek 2016:192). He demonstrates that the principle of generalized symmetry in ANT means that

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the human experience with technologies is often neglected. Although ANT offers ways to understand how technologies mediate behavior (which takes a third-person perspective), postphenomenology explicates how technologies mediate first-person experience.

4.2.2 Four mediations of ANT's technological devices

The task ahead it to develop a series conceptual tools which can be used complementary to the insights of ANT. In the previous conceptual angle I argued that technology cannot be reduced to its calculative properties, in return technologies are more than mere tools for calculating values between consumers and producers. Mediation offers four ways of constructing human technology relations allowing us to reassess what markets (as devices) do to the actors of its societies. Technologies make action calculable in the calculative device, "the intentional relation between the human beings and the world is thus, as if it were, extended or stretched out through artifacts" (Verbeek, 2005:125). Actors act with the use of devices in societies, these devices allow for calculativeness—the construction of a frame. In framing role of technological devices is to create indispensable linkages between human and non-human or human and technology.

Verbeek (2005) in his book *What things do: philosophical reflections of technology agency and design* uses the works of Idhe and constructs four dimensions of human technology relations from a first person perspective. By using these four dimensions a definition of technologies can be stipulated and its role in the actor-network can be analysed. The first relation that Verbeek (2005) introduces is the *Embodiment* relation of mediation. Actors in this relation perceive the world through a technological device. Verbeek (2005) explains "human beings take technological artefacts into their experiencing, and thereby broaden the area of sensitivity of their bodies to the world" (p.125). In an actor network actors and researchers take up such a role with many artefacts. Glasses and microscopes can be perceived of in such a way when interacting Verbeek argues. One could even ague that a television a computer or a smartphone can be embodied. What is key in embodiment when handling technology, Verbeek argues is the fact that "I do not look at the but through them at the world" (p.125). Marketers involved in social media for example embody numerous technolical devices, take computers and smartphones modern day marketing is impossible without such artefacts.

The second human technology relation is a *Hermeneutic* stance with technological artifacts. In an embodied stance the body of the actor is extended to amplify the already perceived physical properties of the outside world. In the hermeneutic stance this is not the

case, the way the world is represented in a hermeneutic relation is in line with that of Heidegger's enframing, it orders the way we perceive the world. In this stance Verbeek (2005) argues "the world is not perceived *through* the artifact but by *means* of it" (p.126). Rather than representing the world as perceived by naked eye or as an embodied reality, a technological artifact provides a representation of the world. Verbeek himself illustrates this with use of a thermometer which reveals one aspect of the world. Economic markets are an example of this, they reveal complex actor networks through numerical representations. When observing the NASDAC or AEX one can say that economic markets represent themselves as a series numbers represented on a screen or technological device. These numbers again represent values gained by entities in the real world. The relation one takes with a TV screen is embodied, the relation one takes up with the world with the NASDAC index is hermeneutic.

The third position humans can take up with technology is an *Alterity* relation. In this setting technologies appear as "quasi-other", technologies possess a type of "independence" that allows for interaction representing that of an independent actor (Verbeek, 2005:127). A technological artifact, a calculative device for ANT, can seem as if acting independently from the human actors involved, which allows for explanations of technologies as actors. Verbeek (2005), uses a comparison of a horse and an automobile to explicate the difference between a technological device and an 'other' as full-fledged actor. One might care for the automobile like the horse, however when some disturbance hits the road the horse runs off while the automobile functions as designed. When technological devices take up an alterity relation, they seem to interact with the user while at the same time keep a certain independence. These technological devices however are not really independent, or a true 'other', ergo the term "quasi-other". Take for example the forex trading device vs. a human broker. It can never be a true independent interaction, the forex trading platform cannot be a true other. The human broker can act as an independent other in transaction allowing for uncertainties, the forex trading device only gives the illusion of dealing with a human actor.

The final human technology relation is one in which the technological artifact is perceived of as *Background*. Verbeek (2005) explains "artifacts in background relations do not play a central role in our experience…technologies shape the context of our experience in a way that is not consciously experienced" (Verbeek, 2005:128). Verbeek uses the example of central heating, one does not notice the technological artifact actively when experiencing. These artifact shape experience by being part of the background, I believe this is what Callon and Muniesa (2005) imply with algorithms. Background relations with technolical artifacts

are not noticed up until it ceases to function. The presence of central heating is usually questioned when it ceases to function, a similar example could be a roof. One from day to day does not notice its presence, up until water enters the house, at this point the roof is no longer background but a concern.

In questioning what markets do to actors within a society, post phenomenological inquiries emphasize the first-person experience on the hermeneutic dimension of perceptions of Phenomenology and the existential dimension of practices of ANT. The conceptual tools of postphenomenology allow an explanation of actors in terms of how they experience relating to a technological device. Mediation is understood as four different ways of dealing with technologies on the first person. These mediations however are not the same for each actor within the actor network or to each human being when dealing with technological artifacts. The notion of multistability allows for questioning of the multiple mediating roles of technology in performatizing markets, and in return allows for an explanation of why there will always be externalities. A market as a technology mediates calculativeness (or the act of calculating values), allowing for transactions. Mediation as a conceptual tool allows for a multiplex description of relations when engaging market devices. What markets do to its actors in response can be answered using the conceptual insights of mediation, the concept of multistability offers a way of describing how these relations are anything but stable.

4.2.3 Multistability and calculativeness

The construction of a conceptual angle of post phenomenology with ANT is completed when taking the notion of multistability in relation to these four mediations.

However, Ihde argues that taking account for multistability in human technology relations brings its own implications. First of all, Idhe (1999) argues that "Multistability is not the same as 'neutrality'. Within multistability there lie *trajectories* - not just any trajectory, but partially determined trajectories…No technology is 'one thing', nor is it incapable of belonging to multiple contexts" (Idhe, 1999:47). With this, Ihde emphasizes that the way in which technologies stabilize can be multiple according to the four meditative trajectories, and is often context-dependent. While this does not mean that one can engage with *any* interpretation or practice with a technology, it does mean that these meanings and practices are variable. The variety of these meanings are dependent on the four positions humans take up with a technological device, which for each individual actor differs. The four ways of mediation allow for description of an ontological multistability of markets and the employed technological artifacts in translation.

A market can be conceived of as a set of technological devices through which actions are mediated, multistability implies that the same technological device can be identified with in different ways and that the resulting act differs as well. Externalities in the actor network are an example of this, when the costs/ or benefit of an action are borne by actors unknown to the actor network inspecting which engages with only one technological trajectory. To act upon these insights as a researcher would mean asking what possible trajectories are viable for a particular technology (The fishing net as an interessement device is a background device for the scallops but a hermeneutic one for the researchers). Idhe (2004), argues in relation to the insights of multistability that"…material operations display patterned, structured, and while multistable, *limited* sets of possibilities. It is this structure that philosophers may examine and analyse" (Idhe, 2004:92). So this means that the researcher does not assume that the technology is neutral, but also does not assume that it is entirely determining. Rather, he assumes that this technology can mediate multiple stabilized relationships in accordance with the four types of mediation.

Ihde explicates that there are two dimensions to understanding the multistability of mediation in addition to the four mediations. He clarifies, "I am attempting to show that the design situation is considerably more complex and less transparent than it is usually taken to be. Both the designer-materiality relation, and the artifact-user relations are complex and multistable" (Idhe, 2008:59). It can be said that technologies are multistable for the user/consumer and the designer/producer. This means that when designing a product, one cannot possibly account for all possible ways of using and experiencing the world through a market technology. This in response also means that there will always be externalities when explaining and/or performatizing markets. Bijker and Pinch (1984), the seminal authors of the Social Construction of Technology (SCOT) approach, denote a similar idea with their term "interpretive flexibility." They define "by this we mean, not only that there is flexibility in how people think of, or interpret, artefacts, but also that there is flexibility in how artefacts are designed" (Bijker and Pinch, 1984:421). Technology does not follow one program of action, in design perhaps numerous programs are embedded without the intent of the designers. Not only can different designers hold different meanings for a technology, but this multistability is amplified when the different meanings of the users come into play.

Interpretative flexibility emphasizes the multiplicity of user meanings, and multistability adds the multiplicity of designer meanings and the technologies themselves. Users experience and act through and with market technologies, this mediation is multistable, meaning that there are multiple partially determined trajectories for use and perception when

one engages with a market. These partially determined trajectories, however, are hard to predict. Idhe (1999) argues that "technologies 'contain' multiple possibilities for use, direction and trajectory - are essentially multistable -making clear prediction of effect, use and outcome difficult if not impossible" (Idhe, 1999: 48). Multistability offers a way of describing human technology relations, positing that humans and technology are indispensable when it comes to experiencing and acting in the world. To take the role of technology seriously is to examine the way it allows for humans to act perceive and experience in the world. Even though technology is multistable, the context through which it emerges from and is interpreted through offering ways of comparing calculativity. By assessing the multiple modes of calculativity mediated by the market, we can begin to establish the multiple stabilities in which it emerges. At the same time, this postphenomenological approach offers ways to complement the ANT approach by providing ways to account for externalities and varying ontologies as part of the multiple trajectories mediated by the technology. What the markets devices does is to ask what market technologies do in a particular set up, in response humans act in correspondence to the technology based on the mediated experience we take up with it as researchers or actors.

4.3 A summary of the three conceptual angles and their conceptual tools

Throughout the preceding chapter, I have discussed phenomenological approaches to studying technolical devices. The two approaches, phenomenology and post phenomenology, offer ways to study technological artifacts which are introduced by ANT but not fully explicated. ANT explicates markets as networks of actors and devices which come together and, through a process of translation, settle into stabilized relations in the world recognised as calculative market devices (a society of market actors). This movement is explained by three distinct conceptual tools framing-translation-calculative devices. ANT offers no way to study what precedes these steps or what comes after them, phenomenology and post phenomenology fill in this gap. By explaining human technology relations, from a first person rather than third person perspective, both phenomenological methods give relevant insights to the findings of ANT.

To answer the research question asked throughout this section *'What is 'a market' and what does it do according to phenomenology and post phenomenology?'* a number of issues come up in relation to the findings and methods of ANT. First of all the conceptual angle constructed using concepts from Heidegger and Pickering help us question the conceptual framings behind calculative collective devices. By taking a somewhat essentialist stance on

technology we allow ourselves to question the roles ANT subscribes to technologies within the actor network. By developing two distinct ontologies for markets we can question framing of problematization in ANT based analyses. The conceptual tools of the phenomenological angle inform the researcher about ways in which framing allows for a researcher to question his/her ontological presuppositions, therefore mitigating the potential preclusive nature of enframing. The role of technological devices in this angle as framing in markets usually is centred on economic problems rather than societal problems. The questioning of this angle help break open explanations of what markets do in society offered by ANT. Additionally the findings of the phenomenological conceptual angle urge us to reconsider the black boxed relation between humans and technologies.

The third conceptual angle developed in this thesis provides tools to understand how experience of the world is mediated by technological devices. Postphenomenology strives to explicate the way humans experience the world with a technology and how the technology plays an active (mediating) role in this relationship. Mediation as a conceptual tool offers four ways of explaining humans and their experiences with technological artifacts. The insights from postphenomenology complement ANT, not only does it provide an ANT analysis with conceptual tools to question technological devices it allows for better explanation of actors and their experiences within the actor-network. The second conceptual tool multistability describes possibilities for multiple experiences with the 'same' artifact. It demonstrates that a technological artifacts can only partially determine an act, and that it can sustain multiple meanings. In the next chapter, I will apply the conceptual angles developed throughout the last two chapters in addition to marketing, by using the conceptual tools offered throughout this thesis. I will use the question of what the PV market is and does to society to explicate how these conceptual tools provide insights into the study of markets. This move will offer a parallel way of testing the conceptual tools in practice. This will be followed by a general conclusion of the thesis, a short entry on limitations, and suggestions for future research.

5. Applying the conceptual tools: the Dutch PV case

In the previous chapters multiple conceptual tools, ranging from a multitude of disciplines, have been introduced and described in context to markets. Marketing set a fundament providing ways to conceptualize a market and provided an initial starting point from which to problematize, these marketing conceptualizations proved dualistic (Section

2.3.1). Science and technology studies (STS) offers ways to overcome the dualism of marketing, ANT offer ways to describe a society, its actors and devices and the identities and choices of these actors simultaneously (Callon,1986). Through ANT the network of actors and material devices that performatize a market can be described. ANT allows for a network of relations to be represented by a single entity as a calculative device, a product. ANT offers a way to frame a market and in turn describe it as a calculative device, representing a network of relations. The market as a device in turn allows for Philosophy of technology to explain human technology relations, through this explains what a calculative devices do to human beings and vice versa (Chapter 4). Each of these disciplines offer distinct conceptual tools for explaining what markets do, formulating what I have introduced as, the three conceptual angles of markets. In this chapter the theoretical insights of the conceptual angles will be applied to a real life case. By applying the steps, procedures and conceptual tools of the previous chapters, both the question what a market does can be answered while simultaneously explaining and clarifying the conceptual viewpoints in practice.

The case used in this chapter is the 'Dutch PV market', the case of the Dutch PV market is in particular interesting because of immense growth in the last decade. A study of the RVO (2014) notes that "The Dutch PV market is on the rise. In only two years time its installed capacity has increased fourfold to a total value of 722 MW at the end of 2013. About 90% of this capacity is installed at households" (Franken & Meijer, 2014: 3). PV is on the rise, not only is the installed capacity growing, commercial sales in the PV sector are thriving. Popular media report that the solar power is booming with sales of PV system up a 100% in the first quartile of 2015 (Van Roojj, 2015). The PV market is rapidly growing with sales and capacity on the rise, PV is becoming an established market in the Netherlands. This activity proves an interesting case to 'probe' my conceptual framework for analysing markets. This is done by asking the question 'What is the Dutch PV market and what does it do?' In the next sections the methodology is explained.

5.1 Case Methodology

Throughout this thesis different conceptual angles and tools were introduced to familiarize the reader with the different aspects of understanding markets in society. This understanding is needed I argued, because of the dualistic nature of marketing leading to ostensive practice when explaining what markets are and do in society. To circumvent this problem in the case ahead, I will apply the conceptual angles introduced prior to the case. These angles were developed using theoretical insights from various disciplines, including, sociology,

marketing, economics, science and technology studies, philosophy of technology, among many. The Case is an attempt to bring these disciplines together to explain what markets are and do in context. Accordingly the case will be structured in the same order the literature review circumvented the problem of dualism in markets.

The selection of relevant literature will also be structured according to the three theoretical insights. To explore what actors and devices are societies included in the Dutch PV market, I look for 3rd person accounts of the PV market. Policy documents and researches concerning the Dutch PV market by various national and EU governmental institutions offer such a positioning (Verbong and Geels, 2007; Verhees et al., 2013; RVO, 2014, 2016a, 2016b, Holland Solar, 2016, Elektriciteitswet 573, 2013; Frankfurt School-UNEP Centre/BNEF. 2016). This literature will be synthesized using the conceptual tools of ANT (chapter 3), translation as a process of stabilization in meaning of calculativeness. The ANT angle applied in section 5.2 will show how the market is performatized and what entities are currently performatizing. By taking a governmental framing of the problem which instigated actions representing a PV market, we can question the role of technological devices and actor groups in the understanding of the society surrounding the Dutch PV market (4.1). This will be done in section 5.3 will allow us to reframe the problem which ANT translates, giving light to externalities of the initial framing. The third and final frame assessed in section 5.4 questions the calculative collective device (market society) established by ANT. ANT stresses that the material world playing a huge role in 'markets,' creating a need for explaining what technological artifacts do to actors within a society. The ANT analysis will reveal various actor groups, including producers and consumers in the market (Nuon, 2016: Eneco, 2016; Brenkert & Beauchamp, 2012; Tsao, 2016; Heinberg, 2012). The third conceptual angle will use first-hand accounts of these actor groups interacting with PV systems. Personal accounts appear on online forums of producers and consumer (Van Beekum, 2015, Stansat, 2013, Gemeente Breda, 2013). Giving the empirical material needed to question technologies.

In the next section I will explicate what PV systems are as a product using explanatory tools from marketing literature. This will be done in order to give insights in dualistic explanations of markets, this will be followed by the first conceptual angle of ANT.

5.1.1 Exploring the PV market

To explore what the Dutch PV market is and does the next sections will follow the methodology explicated in the last section. The literature review following in the next sections will be structured using the conceptual tools of marketing, STS and philosophy of

technology. First literature regarding the PV market will be presented using the conceptual frameworks of marketing. In the marketing section I aim at describing the product, producer, consumer and value transaction. These findings will serve as an initial framework for questioning what the Dutch PV market does.

To do all this first the product, or technological device and its technologies must be explained. PV systems can be seen on rooftops in calculators or many other places. Technically speaking "photovoltaic (PV) cells are semiconductors that directly transform sunlight into electric power" (Schleicher-Tappeser, 2012: 65). These PV cells massed into a panel, representing the first, most recognisable part of a PV system markets as a product. These PV cells however require a system to do transport, store and put the generated electricity to use. The California Energy Commission (2001) note that the typical commercial PV system has five components, a PV Array (massed PV cells) the balance of system equipment (BOS) composed of mounting systems and wiring. An electrical Inverter allowing for the panel to be connected to other appliances. Last of all metering equipment and batteries allow for storage and measurement of the generated electricity (California Energy Commission, 2001:5). In principle what the PV system does it provides electricity to an electricity consuming party. This process starts by the collection of PV cells into arrays, the formation of recognisable solar panels seen on calculators and houses. These PV panels are supplemented by a number of technological devices, allowing for the generated electricity to be put to different uses. A PV system is the product involved in the PV market. This product however is offered by a number of actors. These actors are analysed under the notion of producers and will be explained in the next section together with the main consumers in the Netherlands.

The producers are the actor that contribute to the manufacturing of the product. These parties account for the costs of providing the product. The Netherlands enterprising agency (2014) in their article on the international positioning of the Dutch PV sector give a detailed description of the producing parties involved in the Dutch PV sector. The report written in 2014 accounts for 105 Dutch producers working on 14 different PV systems (RVO, 2014:4). These collectives in turn fulfil eleven distinct functions in the Value chain of the Dutch PV markets. These functions range from R&D to aftercare each having reprehensive producing actors (RVO, 2014:4). The producing side of the PV market is explained, each accounting for parts of the PV system, its integration in society and aftercare. The companies represented range from small tech start-ups to established energy companies like NUON and Essent and other Dutch established companies like Akzo Nobel. Each of these companies gain value out

of interacting with the PV market, as they bare costs for manufacturing. All the named companies are the actor of the producer in markets. This value is gained in interaction with consumers, the consumers will be explained in the next paragraph.

Consumers those who gain value by product can be explained in terms of consumer segments (section 3.2.2). The Netherlands enterprising agency (2014) describe 6 main segments in the Dutch market. These 6 segments can be grouped in two main categories. So called 'Grid-connected systems' which can be large medium or small depending on the output of the PV system. Or 'off-grid' which can be separated as stand-alone systems (Street lights, buoys), mobile systems (ships, caravans) and consumer goods (watches, radios, garden lighting) (RVO, 2014:4). The six segments indicated by the RVO describe different users of the product. One important distinction is made, 'Grid connection' and 'Off grid.' Further segmentation by the Zion research firm denotes three application segments within national segments "Residential, Non-residential, Utility" (Zion, 2016). The segments explain contexts in which PV systems are used by consumers. Each of these categories represent a certain composition of human and non-human, also called an actor in ANT (Callon, 1986). The largest segment in the Netherlands is the Residential, the RVO states regarding the total capacity of the PV products "About 90% of this capacity is installed in households" (RVO, 2014:3). Consumers of the Dutch PV market are mainly grid connected households. Even though PV systems have diverse application possibilities and segments the main value of the PV market is located at consumer households. Therefore I will focus on consumer household PV applications, when using the three conceptual angles.

To explain what the market is in terms of marketing the transactional values must be described. For this we turn to actors that promote PV systems. Nuon and Eneco two giant Dutch energy providers promote on their website that PV offers a solution to polluting energy sources. Secondly it allows for savings on the electrical bill, and lastly it allows for consumers to earn money by selling excess electricity (Nuon, 2016: Eneco, 2016). What the PV market does to marketing it offers, mostly households, PV systems which allow for electricity generation. This generation is clean, cost saving and creates revenue for the owner. The electricity generation of the PV device is calculated in terms of Kilowatt per peak hours, which allows for comparison with the classic electrical price in kWh/Euro. The Dutch PV market can be described as a twofold transaction. It is a place where mostly homeowner's exchange money for PV systems, this in turn allows for exchanges between homeowners (consumers) and producers (energy providers) in electricity.

5.2 ANT's conceptual angle of Dutch PV market

The brief marketing description of the Dutch PV market, listed a number of producer groups, consumer segments and calculative devices for transactional values. The problem at the moment is that these findings mean little, it shows an ostensive framework of practitioners. These practices result in stable categories of the world homeowners, boats etc. These categories however will not help us explain what a market is in context to societies and individuals and does to societies and individuals (2.3.3). It does help orient the problem and give context to the term the "Dutch PV market" in terms of producers, consumers and technologies, which in turn can be interpreted with the tools of STS. The next step is to look for externalities and account for performativity of marketing practice in this conception of the Dutch PV market. This is done by explaining the actors and networks that were called upon to establish the producers, products and consumer segments known today in practice. This implies that the insights of marketing (and the Dutch PV market in return) are the result of discourse, discourse explained in this case as the mobilization and translation of groups of actors. The product in marketing, the PV system, is the result of a process of translation in an actor-network (Callon, 1986). In the next section this process of translation is explained to describe performativity (the establishment of the PV market as known by marketing) and set presence for the identification of externalities. This is done by analysing the emergence of PV in the Dutch energy sector in terms of actors, networks and devices. In the next sections I will go through the four steps of translation using the works of Verbong and Geels (2007) and Verhees, Veraart, Smuth and Kern (2013) on PV markets in the Netherlands. These two works explain transitions in the Dutch energy regime and introduction of PV, between the 1970's and late 2000's. In synthesizing the findings of these two readings, the three principles of translation (section 3.2.1) play a key role for describing the moments of translations correctly. These three principles urge the researcher to remain neutral, treat each entity equally and have no apriori distinctions. By using the three principles in describing the actors of the Dutch PV market, the actions and consequences performatizing Dutch PV market conceptualizations and constructs can be mapped without falling in a dualistic mode of thinking.

5.2.1 Dutch PV market problematization

Translation never really starts or stops, what is explained below are four distinct moments which precede any temporal stabilization. These four moment are problematization, the establishment of indispensable links between actors to solving an issue. Interessement is an

attempt to deploy devices to stabilize the problematized actor roles. This is followed by a moment of enrolment, when actors start acting in accordance with the device. This is followed by a final phase mobilization, which is putting the devices to the test to see if devices inform you correctly. The first moment is that of problematization, PV as a technology is fairly recently developed into a feasible product by NASA, in their communications satellites and the public gets first exposure of PV systems. This is around the time of the energy crisis in the 70's, Verbong and Geels (2007) note that, "The energy sector faces serious problems, e.g. oil dependency, reliability and environmental problems" (Verbong & Geels, 2006:1025). The moment of problematization starts where a shortage of oil (due to an Arab league embargo in 1973), the predominant source of energy at the time, caused actors to reconsider the position of oil in society. These changes in positioning resulted in first attempts to research PV applications in the Netherlands. "Photovoltaics cells were first used in space. After the first energy crisis, research also focused on other applications such as remote locations without grid connection, e.g. streetlamps, harbour beacons. Rural areas in developing countries formed an early niche market for stand-alone solar home systems. But in the 1970s PV was not (yet) part of sustainable energy visions" (Verbong & Geels, 2006:1034). PV applications in the early 70's started differing from space to off grid applications, integrating houses into the use spectrum of PV technologies. In 1973 in reaction to the oil crisis, researchers hosted a symposium to discuss potential solutions to the energy issue. PV came up as a possible solution among many others including natural gas and nuclear energy. The symposium was visited by the minister of economic affairs responsible for energy policy, however he considered PV as too expensive and meant for space (Verhees et al., 2012:278). Even though unsuccessful in convincing the Dutch government of PV the 1973 symposium attempted to put PV technologies as indispensable in solving the energy problem in the Netherlands.

This is the first attempt in which groups of researchers attempted to put PV as a possible solution to the Dutch government, and can act as the first (failed attempt) of defining an obligatory passage point (OPP, see 3.2.3). The obligatory passage point is when actors render each other necessary to solving a problem, however at this point (1973) the Minister of Economic Affairs prioritized nuclear energy and other grey fuels. The involvement of the government as an actor in the coming PV market was getting clear when "The oil crisis of 1973 formed an external landscape shock, to which the government reacted with its first Energy White Paper (1974). This document addressed environmental and scarcity issues, and formally increased the government's influence in the electricity regime" (Verbong & Geels,

2006:1027) .The 1974 white papers offers a first OPP which rendered the government as indispensable to the energy sector. This government involvement would only intensify when in 1979 a second oil crisis struck increasing global energy prices even more. In reaction the Dutch government published a second Energy White Paper in which the new goal of energy talks became energy saving measures (Verbong & Geels, 2006:1028). The 1979 white papers present a second OPP, and the government as distinct actor in what was to become the PV actor-network.

Additional from the Government the 1970's posed an OPP for several other actors, which will eventually pose PV solutions as indispensable to solving the energy crisis. Verhees et al., (2012) explain that,

"In response to 1970s energy crisis, Eindhoven Polytechnic employee Daey Ouwens and his colleagues e.g. at Utrecht University, had been key PV champions by initiating a small network of academic researchers interested in alternative energy sources. This network gradually expanded and exchanged information with colleagues abroad as well as outside academia. A small number of specialized firms emerged that supplied solar panels for off-grid projects in the early 1980s, and by the mid-1980s, a small network of Dutch PV manufacturers existed. Gradually, the network grew and the sector organized itself in trade organizations which represented the interests of both solar thermal and solar PV producers as well as installation companies" (p.284).

Two more actor groups define themselves in light to the OPP of the 1973 and 1979 white papers. With increasing interest of government in alternative energy sources, several groups of researchers, and small production companies of PV systems were able to continue research and development. At this moment the OPP was at place with minimal actors, government, PV producers, researchers and PV technology. In reaction to the establishment of actors, Verbong and Geels (2006) argue that "[t]wo guiding principles remained important: provide cheap energy for large industries, reliability of supply. With the White Paper two new criteria were added: diversification of energy resources to reduce dependency, and energy efficiency to reduce environmental impacts" (p.1027). These four rules combined with the list of actors allows for a problematization: To solve the energy shortage PV technology must be, cheap, reliable, sustainable and complement to existing energy infrastructure.

5.2.2 Interessement of the Dutch PV Market

The second moment in translation is the interessement problematized actors through an interessement device. By the late 1980's government reacted to these developments and

formulated the 1989 Electricity Law. Verbong and Geels (2006) argue that "[t]he 1989 Electricity Law implied major changes in formal rules and social networks, initiating a transition in the electricity regime. Aiming to enhance dynamism and efficiency, the Law enforced separation of electricity production and distribution and created a new actor: the energy distribution company (EDC)" (p.1029). With the energy system reformed, the government made the first step to interessement, the locking in of 'other' actor roles. While the government changed the networks of the energy regime, researchers and manufacturers continued to develop the technology. Verbong and Geels (2006) explain "[r]esearchers formed a PV lobby to persuade policy makers, industrial companies, utilities and environmental organisations to support research and demonstration projects" (Verbong & Geels, 2006:1033). The researchers, attempted to create what marketing might call a consumer. By demonstrating uses of the PV technology researchers defined a new yet unspoken actor. This is what we now know as the PV-consumer, the house/building owner described in section 5.1.1. Verhees et al., (2012) note that "early experiments with autonomous solar PV took place abroad and especially in rural areas which had no (reliable) grid connections and/or where solar incidence was far higher than in The Netherlands…Framing the projects as autonomous PV systems prevented these systems from being judged from the perspective of the existing centralized energy system, which would render them economically unfeasible" (p.280). By creating a space for demonstration the researchers define a future consumer actor role (households). This space did not exist prior to these experiments, this is because of the agenda of the Dutch government and large energy distributors which only considered economical viable options of energy generation.

The establishment of EDC's and a tentative consumer were locked in place by yet another white paper. The third energy white paper of 1995 set goals for the Dutch government 10% renewable energy in 2020, this however did not mean that PV would inevitably become relevant to the Dutch energy sector. Energy saving was still a big point on the agenda, leading to more PV applications for saving measures (Verbong & Geels, 2006:1032). The way in which the consumer and distribution companies were locked in place are through an energy saving ideal rather than looking at the PV system as a way to provide energy, it was put forth as a way to save energy. Additionally the third white paper offered incentive for government to invest in subsidizing the PV sector. By mobilizing groups of consumers and energy distributors, the incentive of PV added to a sustainable way to generate energy, to new values that of energy saving and cost saving. The incentive for PV changed by the addition of new actors and devices used in translation. Verbong and Geels (2006)

explain that expectations were high, however electricity was still expensive compared to other renewables and grey electricity. This lead to an increased focus in developing cheaper PV cells (Verbong & Geels, 2006:1034). To become cost saving and sustainable the PV manufacturers and traders changed their focus to cost reduction and higher PV efficiency. This leads to an interested actor network compromised of seven actor groups. These are production companies of PV systems, production companies abroad, electrical grid operators, EDC's and the government, the consuming actors in return there are Households and Large industrial users as consumers (Verbong & Geels, 2006:1031). The white papers, energy law and model PV houses act as interessement devices leading to predictable actions by a number of these actors.

5.2.3 Enrolment of market actors

Enrolment is when roles of each of the actors from the interessement phase becomes present. The consumers and distribution companies at this point have no meaning yet, however the 1996 energy tax changed this. The enrolment is when the interessement device in locked in place and put at work. Or put simply when a device enables the intended actor roles to be fulfilled. The 1996 energy tax can be seen as such a device. Verbong and Geels (2006) explain that, "There were two important drivers for the growth of renewable electricity. One driver was the stimulation of market demand, following the introduction of an energy tax in 1996. Because renewable energy sources were exempted, the price gap between 'normal' and 'green' electricity was lowered, stimulating demand... The second driver was activism from EDCs. …they also stimulated 'green electricity' through advertising campaigns to boost their green image" (Verbong & Geels, 2006:1032). Both the PV technology now could be presented as cost saving and sustainable, making both the EDC's and consumers locked in place. The distribution companies are able due to the energy tax to exchange green energy to consumers at competitive price. "In effect, green electricity was about the same price as normal 'grey' electricity" (Verbong & Geels, 2006:1032). In reaction to this the actor group of the consumer started enrolling in return, as the number of green electricity consumers in the Netherlands rapidly increased from 16.000 in 1996 to 1.4 million in 2002 (Verbong & Geels, 2006:1032). Green electricity does not imply PV necessarily, it however does show an increased sentiment and movement towards PV related technologies in electricity production.

The rapid spread of PV technologies can in turn be explained through the actors within the network, "Greenpeace and Nuon began ambitious projects to encourage the diffusion of PV panels among Dutch households" (Verbong & Geels, 2006:1034). However

in enrolment one of the main actors, the government withdrew its interessement device (the energy tax) as a result from elections. Verhees et al., (2012) argue that"...a domestic [PV] market seemed within reach in the late 1990s (e.g. participants in the 1997 covenant had articulated the goal of increasing the installed capacity of solar PV to 10 MWp by the year 2000)... But when the government withdrew its support for solar PV in the early 2000s... Over the 2000s, the remaining Dutch solar PV industry actors articulated new expectations about the PV as a high-tech export product based in part on Dutch successes in the export in PV production equipment" (Verhees et al., 2012:285). The enrolment of the actors abruptly changed when the government withdrew causing actors to reconsider their positions within the arrangement. The change of the 1996 energy law and establishment of the 1998 law did not mean collapse of the market. Rather than forming a PV market, the industrial producers experienced success venturing on their own.

5.2.4 Mobilization of Producers and Consumers

The last moment in translation is the mobilization, in this moment each of the actor roles is mobilized and represented by an actor. Mobilization is signified when all represented actors are put to action by interessement devices. To explain this moment is to explain the moment the government changed its views on PV due to increased interessement by the producers, Verhees et al., (2012) argue that the mobilization started when, "some actors in the Dutch PV industry felt that it was relatively invisible to the government. While the 'raw material' for a high-tech PV industry existed in The Netherlands, expertise was distributed among many relatively small firms which had no common representative" (Verhees et al., 2012:280). The industry was underrepresented by the late 2000's due to the exit of national government, in particular the manufacturers of PV technology. Verhees et al (2012) argue that,   "By that time [late 2000's], the failure to create a substantial domestic market had

> negatively impacted the Dutch PV industry (e.g. Shell terminating its solar PV production facility). Yet solar PV production expertise was fragmented rather than absent: it was simply distributed among many relatively small firms. For this reason, a solar PV industry platform was established in 2011 to unite and represent these actors and actively lobby in an attempt to create awareness in policy circles of the substantial size (and turnover) of the Dutch PV manufacturing industry" (Verhees et al., 2012:285).

In the period following 2011-2012 the PV industry found representation when numerous small businesses united and formed various platforms promoting PV. The producers

mobilized themselves by finding collective representation as platforms lobbying to the Dutch government (Holland Solar, 2016). The actions of the producers and distributors of PV systems caused the government to react. This happened when in 2013 the 1998 was rewritten and two interessement devices were introduces to lock producing and consuming parties into place. The 2013 energy law caused two major changes for the actor-network of the Dutch PV market (Elektriciteitswet 573, 2013). These two interessement devices are 'Postcoderoos' and 'Soldering' and aims at mobilizing the consumer as an actor. This meant the role of various actors that were established in the early 2000's. Saldering is a proposal by the government that allows for stable pricing for consumers, it allows the consumer to be priced by energy companies according to their total consumption and production at a predefined rate (RVO, 2016a). The second device is 'Postcoderoos', this allows for collectives of households to invest and profit from solar panels within the postal code area. Households living in the same postal code area (each postal code has roughly the households), form collectives which in turn are benefited by the government in tax cuts (RVO, 2016b). In 2016 a series of actors are mobilized and represented, energy distribution companies, foreign producers, domestic producers, industrial users, and households. A Consumer (homeowner or industrial user) can either buy a system through the EDC (Nuon, Essent etc.) when integrated with the electric grid domestic producers or directly from foreign or domestic producers or when tech savvy or independent. By translating a problem into a market, I have been able to identify actors and societies, identities and the range of choices available to the actors. While at the same time verify actors identified by marketing and set presence for a questioning of the PV technology. The product PV system, in return reveals through a process of translation how meanings were ascribed, and actors mobilized to create the PV system.

By analysing the four moments in translation two things can be done, first of all the performatizing role of various actors and devices can be described. What is shown in the four moments are the actions it took to establish the PV market discussed by marketing. This allows for the understanding of The PV market as 'producing 236Gwh in 2013' or being valued '$3-5 billion in 2013.' Secondly externalities can be examined. By describing a process of translation, numerous actors have been involved. The most important ones are the small collectives of researchers which developed the first framing to the problem. The Dutch government and producers of PV technologies become increasingly involved in turn, this leads to the establishment of EDC's and grid operators as indispensable in solving the energy problem through PV. The last actor to enter the actor-network is the consumer as households and industrial users. In the establishment of a Dutch PV market as a calculative collective

device, allowing for exchange between all mobilized actors. However there are unrepresented actors, both the foreign producers and households are left untouched by the literature. Gaps in accounting actors allow for the recognition of externalities. In the next sections the performatized PV market will be assessed by looking at the framing of the problem by researchers and actors in the Dutch calculative market device nowadays. The final conceptual angle attempts to clarify the role of technologies (interessement devices and the PV system itself) in explaining what the Dutch PV market does.

5.3 Framing of the Dutch PV market

The ANT analysis allowed for analysing the role of societies and actors and how these developed in relation to a problem. Findings show that in the PV market, the current framing of the problematization developed in the wake of the energy crisis in the early 1970's. A group of actors emerged, their identities defined in relation to the problem and the technological devices. The frame presented by the ANT conceptual analysis allows a one to identify a number of actors: the national grid, electric distribution companies, national production industry, foreign production industry and household consumers. The energy crisis created a state of the world which allowed for calculativeness by researchers as well as actors to develop their positions in relation to the abstracted market. Inquiry into the finding of ANT indicate that PV systems are framed and developed in terms of energy production, cost saving and sustainability.

The findings of the ANT conceptual angle allow for questioning the framing which precedes the problematization of sociology of translation. Specifically, the framing in which PV is viewed as a solution to the energy crisis. ANT explains what actions constituted the current state of market relations and practices. The actor-network has performatized (via translation) the PV systems as calculative devices for personal electricity production or payback per hour. This conceptual angle is concerned with conceptual markets societal-level values which precede the framing and problematization which takes place in the meso-level. Heidegger introduces terms in his theory, I transformed this into workable conceptual tools to clarify the framing step and its relation to externalities. The conceptual tools illustrate how a technology provokes certain ways of perceiving the world. By questioning how the problem is framed in the actor-network using the two ontologies introduced in the conceptual tools, underrepresented actors become apparent. This constitutes a challenge to the current translation of the Dutch PV market, and incites new framings and new problems from which to start new translations. In the next section I will explain the two ontologies (4.1.3) in relation to the present framing of the PV market.

5.3.1. Re-Framing of the Dutch PV market

Heidegger (1977) introduces two modes through which the world is perceived through technology: enframing and poiēsis. I with help of Pickering (2008) developed two parallel ways of explaining the PV market Heidegger uses an example of a renewable energy source to illustrate his notion of enframing, that of a hydro-electric dam. He concludes that this dam does not allow for the river in which it is situated to be revealed in a multitude of ways, as in poiēsis, but that it is (not only) revealed as an energy source, and therefore standing-reserve. The Dutch PV market bears a resemblance to Heidegger's example. The PV network reveals several aspects of the world in new ways; namely, sunlight, roofs and for larger industrial users acres of ground. Sunlight can now be understood as a resource for use, to be gathered and ordered by the PV network for standing reserve. The pervasive marketing of PV in terms of payback hours, or euro/kwh is indicative of this enframing. The majority of actors presented this technology in terms of payback hours and/or cell efficiency (Franken & Meijer, 2014; RVO, 2014; Eneco, 2016). Although the technology may have been developed under the pretences of reducing the human impact on the environment, it is currently marketed almost exclusively in terms of how much money it can make for the consumer (who, in turn, becomes a pro-sumer because he/she is now producing electricity by consuming the PV product). For example, on Nuon's website, they promote their PV panels in terms of three categories: "Sustainability", "Savings" and "Earnings" (Nuon, 2016).

Sustainability constitutes one-third of the interest, while two-thirds are decidedly economic. Prevalently, sustainability is not articulated as a goal at all, and the technology is framed entirely in terms of its efficiency and its payback. Only by engaging with this technology is possible to think of a sunny day as a payday, and Heidegger asserts that such a technology tends to preclude other revealings, such that sunny days can *only* be understood as paydays. The process of translation has effectively performatized PV panels as a calculative device for harnessing the productive capacities of sunlight. This constitutes an enframing because the technology gathers and orders into standing reserve. It is also important to note that this is not a simple dichotomy in which the consumer uses the sunlight because Heidegger asserts that, by engaging with modern technology, all things are enframed as standing reserve. So while the PV panels enframe the sunlight as a resource, they also influence how we perceive of, for example, the land upon which the panels are built, the many materials extracted, produced, and refined in these processes, and the many individuals who produce and consume all the products and services that go into this technology. When operating within the enframing, and perceiving the world through the technology in such a

way, everything is perceived as standing-reserve.

By approaching the framing of ANT critically we can see that not every actor affected is represented in its framing or resulting actor-network, take let's say the PV system itself its presence in the world affects roofs and fields these however are not actors in ANT. The PV system in ANT is represented by a technical description and is represented as a product. What this does it creates externalities which could not be anticipated or overcome as it was the result of a process. What this thesis does is clarify what markets do and are to a society of actors. The PV system is represented in ANT by various producers, but the system as a whole is not questioned as having a place in the world. The material composition of the PV system is enframed to produce energy in the framing of ANT. What this section attempts to show is that the ANT analysis of the Dutch PV market gathers a series of actors to solve an energy crisis.

5.3.2 The danger of the Enframing via the PV market

Heidegger claims that enframing constitutes a significant danger because it precludes other potential relationships between humans and the world. He asserts that the "greatest danger" is only viewing the world through modern technology in terms of standing-reserve. The PV case illustrates his concern because its emerging externalities demonstrate real effects of viewing the world in terms of standing-reserve. Additionally, these externalities are rarely acknowledged because they occur beyond the (en) framing of the problem, which is, in essence, how to make the PV market competitive to the fossil-fuels market. To explain what the Dutch PV market does I need to explain the effects of framing PV technology in relation to oil shortages. When looking at the world through the framing of ANT we enframe the technological PV device as calculative to solving an energy crisis. Rather than looking at the being of the technological device in the world. The bringing together of PV technologies is mostly forgotten in ANT. The foreign producers of PV panels are not interested by a device aside from the PV system itself, so their role in the actor-network is not stabilized for the Dutch PV market. This also means that prior to investigating PV systems were already perceived of as energy producing technologies making their process of assembly or being in the world undiscussed. Take PV panels at the raw materials level. These materials, in being taken as standing-reserve – gathered, ordered, and challenged-forth – provoke significant externalities which are unaccounted for in ANT approaches.

One of the main emerging controversies is that Chinese manufacturers ultimately dominate the raw material production in this market, but are rarely factored into the actor-

network. For example, even in Verbong and Geels' (2007) schema of the 1990's PV actor-network, producers abroad are outside of the main circle of actors, and only vaguely mentioned. Chinese manufacturers are not revealed through ANT, nor through using the technology, and yet they perform an integral role in performatizing this market. The CEO of a Dutch company, Solarclarity, reported that eight out of ten panels are actually imported from China (qtd. P. Desmet; in Oettinger, 2015). These Chinese manufacturers constitute textbook externalities, "agents bearing the cost" without being taken into account in the frame. The reason these Chinese panels are so desirable is because the Chinese have the cheapest production and the main framing of the problem of PV is how to make energy production cheaper. This cheap production owes to the lower safety standards of the Chinese and the high toxicity of mining and refining the raw materials (Brenkert & Beauchamp, 2012: 82). Brenkert and Beauchamp (2012) note that European production is significantly more expensive because of its waste management requirements and add, "It is estimated that to recycle the waste would increase the cost of Chinese polysilicon by somewhere between 50 to 400 percent" (Brenkert & Beauchamp, 2012: 82). This would effectively push the price of PV electricity to a level surpassing grey energy, making it economically unviable.

By questioning the framing and problematization of the meso level with Heidegger's conceptual tool of enframing, these externalities become apparent. It is not only the sun that is perceived as standing reserve, but also the raw materials, and the individuals who bear the cost of this toxic mining process. Brenkert and Beauchamp (2012) are among the only scholars to articulate that, "The polysilicon factory clearly produces what economists call a *negative externality* on the Affected Farmers: it's productive activity negatively impacts their livelihood" (p.82). This means that the polysilicon has its own actor-network which has not been sufficiently represented in the translation process. This very year (2016) has brought more visibility to this issue due to a number of lawsuits between European, Chinese, and American companies which seek to increase the accessibility of Chinese panels while also increasing safety standards. These agendas have thus far proved to be incommensurable (Tsao, 2016b).

Additionally, it is becoming apparent that, safety standards or not, polysilicon is an infinite resource but invokes huge costs (both economically and ecologically) in its production. Already it is predicted that the demand from manufacturers will outstrip the capacity of producers to supply them with the raw materials (Van Sark et al., 2007:3124). Fridley (2012) adds, "Expressing the costs of alternative energy only in monetary terms obscures potential limits from the resource and energy inputs required. Successful

deployment of a range of new energy technologies (and some nonenergy advanced technologies) would substantially raise demand for a range of metals beyond the level of world production today" (Fridley, 2012:72). He draws our attention to the externality of the raw materials, which have been relegated to standing-reserve. Another author draws our attention to the externality of the energy usage in this production when he asks, "...when tallying the energy required to build a solar photovoltaic panel, what should be included in the accounting? The energy needed to mine the bauxite for the aluminum frame? The energy needed to manufacture the heavy equipment that did the mining? The energy needed to construct the factory that produced the panel? Where the boundaries are drawn affects the final net energy ratios" (Heinberg, 2012:8). He emphasizes that if these costs are taken into account, the whole notion that PV reduces energy usage, or even fossil fuel usage, is quite misleading. If the framing recognizes the broad reach of enframing, and includes the production process, it becomes apparent that PV ultimately might use more energy (and fossil fuel) than it provides or mitigates. This technology perpetuates enframing and approaching a broad range of related factors as standing-reserve. By undertaking a Heidegger-inspired angle in inquiry we take a critical stance on technology and the framing of this issue, many externalities present themselves. Furthermore, an almost paradoxical relationship presents itself – that of the tension between presenting PV panels as a way to decrease adverse human impacts on the environment and presenting PV panels as a way to make profit at the expense of the environment.

5.3.3 The revealing of the PV market

Poiēsis is Heidegger's alternative mode for revealing the world. Heidegger also illustrates this approach with a technological example, that of the bridge over a river. In both the hydro-electric dam example and the bridge example, the technology "reveals" the world (in this case, a river) in specific ways. The hydro-electric dam enframes it and reveals it only as standing-reserve, while the bridge reveals it in such a way that it can "be" in multiple ways. A bridge does not preclude different engagements with the river, while a hydro-electric dam does. PV panels do not enframe the sun in this manner, other relations with the sun can still be maintained. Even more PV technologies allow for construction of new relations with the sun. In the next paragraph I will explain this using the example of sustainability and PV panels.

Returning to the above-mentioned paradox, there are two major ways by which PV technologies are presented: as a way to profit, or as a way to decrease adverse human impacts

on the environment. This latter approach falls under the umbrella term "sustainability," a term which appears throughout the PV literature. For example, Greenpeace's magazine on the *Energy [r]evolution* and WWF's *Solar PV Atlas* promotes PV as a "renewable energy solution" for a "sustainable future" (Teske et al., 2012; Archambault, 2012). "Sustainability" is a complex term, but it is often understood to denote three primary meanings: economic sustainability, which is maintaining wealth, social sustainability, which is maintaining healthy communities, and environmental sustainability, which is maintaining healthy human-ecology relationships (Goodland & Daly, 1996:1002). It is apparent that PV is often promoted in terms of economic stability – as a lasting investment, but it is also promoted in terms of ecological and social sustainability, as ways of ensuring the same quality of life for future generations. This alternative approach certainly contrasts with enframing as standing-reserve, and seems to cohere more closely with poiēsis.

When PV is approached as a sustainability technology before being an economic asset or a way to compete with oil, the engagement with it changes. The way it is marketed changes, and it is no longer presented in terms of payback hours. Also, the contexts in which it is applied changes, one prime example of which is the application of PV in off-grid living. In these applications, it is less about how much money the consumers can make, and more about improving their quality of life with a minimal impact on the environment. This view is however precluded in the ANT analysis as it is biased towards explaining what actors performatize the being of the market in the socio-material world. This approach results in more de-centralized applications, in which the goal is not to make everyone a profitable pro-sumer connected to a central grid which orders, gathers, and distributes their energy. The goal in these alternative approaches is to promote an independent, self-sufficient lifestyle with minimal infrastructural requirements. These applications often result in modest changes, such as retrofitting a few solar panels onto individual's houses, while the alternative approach is more likely to result in enormous tracts of land being set aside for central solar fields. Fridley (2012), for example, goes so far as to speculate whether the goals embodied in alternative energy are actually incommensurable with "the structure of our current large-scale, centralized energy system," and whether they are simply more suited towards de-centralized approaches (p.70). These de-centralized approaches to PV are more akin to the poiēsis of the bridge because they allow implicated actors like the land and the sun to "be" in a multitude of ways. This is apparent in the fact that these applications use a number of different calculative methods to promote themselves (such as benefit to future generations, or as increasing the longevity of ecological services), while the enframing applications all result in similar

calculative methods (payback hours, $/kWh).

5.4 A postphenomenological angle of PV markets

In the angle developed in reaction to postphenomenology we change from a 3rd person view to a 1st person view, and start accounting for the relations humans have with the world when using PV systems. To explain what the PV market does we must explain the possibilities for perceiving and acting in the world through the calculative devices. In the last paragraphs it became clear that PV systems allow for different ways of perceiving the world. Together with the findings of ANT one can speak of a mediation of experience and acts through the calculative device, while at the same time account for the device as multistable.

5.4.1 Mediation of the Dutch PV market

The calculativity of the market device does exactly what Ihde describes is characteristic of technologically-mediated perceptions – it amplifies some aspects of the world, while reducing others (Verbeek, 2005:131). This technology reduces aspects of the world in terms of peak watt hour/euro and the device itself is reduced in terms of efficiency (of the polysilicon PV cells in %). The calculativity is embedded by the society surrounding the technology and the actor(s) performatizing the market. The Dutch PV market in particular amplifies realities concerned with costs and savings. Moreover the mediation of the PV market in particular in relation to its consumers is heavily amplified. The consumer when entering the Dutch PV market, renders as both a consumer and a producer. By purchasing the product consumer become part of a producing value chain.

To give a proper postphenomenological analysis of PV technologies I will take the four ways in which technologies can mediate and attempt to explain how PV systems mediate the experience of perceiving in the world. This is done by describing the mediations of Verbeek (2005), these were hermeneutic embodiment, alterity and background relations, and using first-hand accounts of actors interacting with the PV technologies. I will focus on homeowners and the way they perceive the technologies of the market device. This will help me answer what the PV market does to actors within a society, even though the PV society consists of numerous actors displaying the position of one actor will show what value postphenomenology yields for marketing and ANT.

The first account is by Beekum (2015) a Dutch homeowner with PV systems installed. He refers to his PV system as a solar factory, this is an alterity relation he takes up with the PV system as a whole. He experiences the technological device as an 'other' acting seemingly independent. Second of all Beekum explains that he interacts with the technologies

mainly through Apps on smartphone displaying kWh, enabling him to calculate cost payback time and predict profits (Van Beekum, 2015). This second relation Beekum takes up with the technologies of PV is a hermeneutic relation, the world is displayed by means of the technological artifact. The energy is experienced as kWh through the display of the smart meter app. Stansat experiences PV systems in a similar way, PV allows for monitoring through a smart meter giving him Kwh output which with an app on PC or smartphone can calculate savings (Stansat, 2013). Stansat experiences the smart meter as a hermeneutic relation to the world, representing sunlight as kWh.

In a magazine published by the Municipality of Breda on the experiences of homeowners with PV, first-hand accounts are presented. The family Troost reports that having solar panels on their roof makes them happier when the sun shines as it allows for savings, Mr Hulleman reports that he is able to check the savings he makes with the system (Gemeente Breda, 2013). Both these citizens of Breda are engaged in hermeneutic relations with the technologies. PV panels are experienced everyday as a background, when living in a PV house or walking at the street PV panels retreat into a distance. The failure of PV panels would likely not even be noticed as electricity would still remain in most household. PV panels are often perceived of as a pure background relations. To explain the PV system as a whole, its five components Panels, BOS, meter, inverter, battery, I can discuss the relation humans take up with each of these technological artifacts. Panels, inverters and BOS such as wiring and battery is exclusively experienced as a background relation, none of these artifacts have interactive capabilities or are interpretable in any way other than the environment. The meter and apps informed by the meter are in principle the only artifact humans interact with. The meter engages in an alterity and hermeneutic relation, this means that a human could identify the readings presented through and functions of the meter as an individual actor.

5.4.2 Multistability of PV systems

Multistability of the Dutch PV market implies the fact that the technology can be perceived of in a multitude of partially determined ways the four relations of Verbeek (2005) are an example of this. The previous subchapter illustrated how different mediations happen with PV systems and how different technologies take up different relations. Most of the PV system is perceived of as a background technology, not playing a big role in experiencing the world for humans. Different relations are mediated through the meter and software. There are many accounts of hermeneutic relations, people perceiving the world by means of the technology. The representations of the world is especially important here as this meter

displays kWh and allows for comparison of usage and generation. One user also experienced an alterity relation, experiencing the PV system as a separate other. The fact that one actor could identify with the technology in this way is interesting as it shows hoe different actors deal differently with the same device. This is what is meant with multistability, a technological artifact can stabilize in a multitude of partially determined tracks.

Even within the same relation, for example a hermeneutic one different actors within the same relation type can experience differently. Some actors in the precious sections noted that they could calculate their economic savings, others could calculate what time it took for earning back the investment of a PV system. In this thesis only a limited number of 1st hand accounts is collected, and even is the small sample many varieties are explained. The technologies however are not very multistable in relation to their meaning in ANT. In the ANT analysis the technologies were presumed to only have a hermeneutic relation, allowing for economic calculation. Multistability and mediation explain how technological artifacts cause actors to interpret the world. The actors of a market actor-network are connected by devices, the hermeneutic properties of market technologies in particular show such connections. The meter allows for translation between various actors, the way humans interact with the meter is multistable however in principle. Aspects of the technological artifact, e.g. the fact that it only displays kWh and $ saved or a variant of it might guide the way we perceive the world through the meter but it does not determine it. It does however offer a way to explain why these metrics are predominant in PV markets.

The multistability of the Dutch PV market can be explained in fullest extend when looking at its uses and representations. Multistability allows for multiple partially determined ways of interpreting and acting through technology. Early PV deployments indicate a variety of uses of the technology (Jackson & Oliver, 1999:377). Off grid deployments of PV systems reveal different stabilized trajectories of interpretation and acting. As most these deployments don't focus on payback savings or cost reduction. They focus on the ecological and social side of sustainability expressed through non-economic measures. Dutch PV market technologies *are* multistable, however the relations actors have between one another are not.

6. Concluding on the market

In the next section the question 'what is a market and what does it do?' will be answered. The findings presented in answering the question will allow for discussion. The discussion of findings will commence after the research questions are answered. The discussion will be followed by a short summary on limitations and setbacks of the approach.

In this thesis I developed three conceptual angles in response to the problematization of marketing and markets. This problematization argued that there is lack of studies on the effect of artifacts on human beings in markets and a lack of performativity studies in marketing (Fourcade, 2007; Kjellberg & Helgesson, 2007). In response, the three conceptual angles help construct a narrative in which it is possible to describe both the performativity of actors and devices on market societies and the relations humans take up with technological devices. The first conceptual angle, constructed using ANT literature, allows for explanation of a market as a constant effort of numerous human and nonhuman actors being networked via various means, including other humans and nonhumans. The sociology of translation as a conceptual tool helps us understand that values in markets are negotiated; moreover, it shows that the actors never truly 'stabilize' the acts of actors involved in a market shape a market causing constant changes in the actor-network. Interessement devices, which can practically take any shape, allow for actor roles to stabilize and values to be externalized. The PV case offers examples of interessement devices it introduces the the PV system and its technologies, laws and policies, and numerous other interessement devises. These devices in turn allow for calculation of values and shape the transaction which takes place in a market. What the case shows is the performative role of different actors in enacting the Dutch PV market, a market that is currently booming.

The second conceptual angle allows for questioning of such performatized descriptions of markets. By posing that technological devices are only signified through their calculative properties, two ontologies can be developed for the market. These two ontologies urges questioning the findings from the first conceptual angle, which seems to define the market device in terms of calculativeness. Framing and externalities play a key role here as conceptual tools as the ontologies aim to make us reconsider the framing that is enabled by the actor-network. In the case, this results in a deeper questioning of actors that are underrepresented but mentioned in the ANT analysis. The Dutch PV market speaks of foreign producer but fails to describe them, upon questioning the actor and its framing it seems that foreign manufacturers are signified by a problematic role in stabilizing the calculativity of the Dutch PV market. The case demonstrates that numerous externalities arise upon transaction, allowing us to make claims such as: the Dutch PV market is (adversely) affecting Chinese farmers.

The third conceptual angle allows for a description of human-technology relations. By using the concepts of mediation and multistability, we can account for various relationships in the market between humans and technologies. In the case, I demonstrate that the PV

technologies – in particular the smart meter – play a significant role in conceiving the market. The hermeneutic relation of smart meters allows for the famous kWh/ euro trade-off to stabilize, signifying transactions in the Netherlands. The conceptual tool of multistability adds that relations can be explained as partially determined and that a single technology may be available to several stabilities. To answer the question 'What does a market do?'- What the market does can be explained according to the three angles of inquiry constructed throughout this thesis. Markets performatize the world through actions by various actor groups. Furthermore, markets facilitate transactions by offering devices which allow for translation by actors. In this sense, they shape the societies' experience of the world. These devices can in turn also be explained as changing the way individual humans experience the world in four distinct manners (embodiment, hermeneutic, alterity, and background relations). For example the Dutch PV market consists of various actor groups, many of which are locked in place through intervention by various calculative devices. Markets distribute products which allow for humans to conceive of the world in a different manner than before. While at the same time markets shape societies and offer ways to study the effects of this shaping on the society.

6.1 Discussion

Throughout this paper I have attempted to develop conceptual tools that will allow us to describe markets. In the thesis, I described the Dutch PV market, its actors, calculative devices, and the possible relations actors can take up with these (calculative) technological artifacts. To develop this understanding of markets I used literature from three major scientific disciplines. In the next paragraph I will elaborate on the insights I attained by putting marketing, STS and philosophy of technology together in describing markets.

First of all, I employed marketing theories and methods to describe markets. Marketing, I argue, is insufficient to describe what a market is and does due to its ostensive and dualist definitions. This thesis developed an analogy that allows for studying markets by taking terms from marketing and translating them into descriptive statements. Consumers and producers calculate according to calculative devices, to describe a consumer is to describe the calculative devices through which he/she perceives the world. Translation as a conceptual tools allows for marketers to study the various roles they delegate in performatizing markets, while at the same time describe the actors that comprise the market environment. By doing this marketing can not only develop marketing tools honed to specific actor groups, but also describe these actors as part of a larger collective. The actor-network approach to markets offers marketing tools that can extend the playing field of marketing as a discipline allowing

for integration of other scientific disciplines. What I suggest is a democratization of marketing, to put marketing's conception in the open allowing for problematization by different scientific disciplines.

Science and technology studies allow for this democratization of marketing as a discipline. Currently STS is widely used in political studies and innovation studies. I argue in this thesis that ANT serves as a conceptual tool for marketing as well. This thesis also showed that ANT can be supplemented by philosophy of technology, in particular, phenomenology and postphenomenology. By explaining how humans experience the world with a technological device, we can start developing understandings of *why* some actor-networks succeed or fail to develop into a market, and also *how* those markets, in turn, affect the actors' experience of the world. Postphenomenology can offer ways to develop the notion of calculativeness, particularly in terms of how it is enabled or mediated by specific devices. ANT, on the other hand, can give explanation of which devices and use contexts are relevant.

Moreover, I promote market as an ongoing experiment, this thesis can supplement to ongoing attempts to clarify what markets are. Take for example Callon's (2009) *carbon markets;* he problematizes climate change by bringing together different disciplines to experiment on a carbon (greenhouse emission) market (Callon, 2008). This thesis allows for describing technological artifacts that can help making carbon a calculable good by different actors. Postphenomenology can help conceptualizing a carbon market by studying technological artifacts that can serve as interessement devices allowing for calculativeness by different actors. Much like PV, the carbon market is dependent on government intervention through policy, translation offers ways to describe parties that are concerned with an ongoing issue, postphenomenology can describe artifacts that allow for these parties to come together. I use this example of Callon because in this thesis the questioning of the PV market lead to a questioning of emissions. This shows how different markets are interrelated in societies.

6.2 Limitations setbacks and future research

In the last section I discussed potential uses for the theoretical framework offered in this paper and I discussed what the three disciplines in this paper can gain from working together. In this section I discuss limitations of this framework. In the marketing sections, I have attempted to describe marketing practice, the view I provide however is limited focusing on classic and embedded marketing literature and terminology. I claim that marketing is dualistic and ostensive in defining, this is limited to classic marketing literature. This does not mean all marketing literature is dualistic and ostensive, merely classic theories and approaches are.

There are also tensions between the conceptual angles. Postphenomenology is made as critique for phenomenology, while in this thesis I use them complementarily. The use of Heidegger (1977) is prone to critiques, in this thesis I construct two conceptual tools using his work on technology. His approach to technology is often criticized, in particular his demonization of technology. I do not attempt such a thing, this thesis uses his work as a way to create analogies between ANT and two introduced ontologies in Heidegger's' work. A second limitation is that to discuss human technology relations we will have to break generalized symmetry. I appropriate the meaning of humans to always being composed of human and non-human.

This thesis takes light off the meanings developed on markets through marketing, by doing so I make space for debate on the actors that perform the market. Future studies using these theoretical angles on markets might look at comparing different calculative collective devices using the same technological artifacts. This will deliver a broad empirically grounded analysis of, human behavior with technological artifacts and the effects to other actors of using these artifacts in larger societies.

7. References

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