PERCEIVED RESOURCE SCARCITY IN SUPPLY CHAIN MANAGEMENT: IMPLICATIONS FOR BUYER-SUPPLIER RELATIONSHIPS

Ву

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ABSTRACT

PERCEIVED RESOURCE SCARCITY IN SUPPLY CHAIN MANAGEMENT: IMPLICATIONS FOR BUYER-SUPPLIER RELATIONSHIPS

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Perceived resource scarcity, which refers to the anticipated future shortage of resources, is an important consideration for managing global supply chains. Responding to perceived resource scarcity is especially challenging as managers do not know when, how long, and to what extent a specific scarcity issue may affect their firms. The lack of valuable resources and the level of uncertainty surrounding the future state of a resource influence how managers and firms evaluate and respond to scarcity threats. In my dissertation, I study the impact of perceived resource scarcity on buyer-supplier relationships and on managerial decision making. I address this research problem in three essays.

In the first essay, I define resource scarcity in supply chains, identify its characteristics, discuss the difference between actual and perceived resource scarcity, and propose its effects on buyer-supplier relationships. This discussion results in a conceptual framework of organizational responses for managing perceived resource scarcity in supply chains.

In the second essay, I investigate organizational responses to mitigate perceived resource scarcity in buyer-supplier relationships using survey data collected following the critical incident technique. Results suggest that firms are less likely to respond to scarcity threats when there is high uncertainty surrounding the expected shortage, illustrating avoidance behaviors. Furthermore, in times of expected resource shortage, firms are less likely to select organizational responses that involve collaborating with major suppliers. Despite this effect, when managers choose to collaborate, the findings highlight that collaboration improves effectiveness of the mitigation strategy, emphasizing the importance of active engagement with the major supplier as a means to effectively manage scarcity threats.

In the last essay, I conducted a scenario-based experiment to examine the impact of managers' scarcity biases on buyer-supplier relationships. As predicated by behavioral decision theory, the findings indicate that expectations of a resource shortage increase managerial self-interest, which, in turn, decreases managers' propensity to collaborate with major suppliers. Even if certain organizational responses, such as collaboration, are considered to be effective in mitigating resource scarcity, managers' decision-making may be influenced by cognitive biases that reduce the likelihood of collaboration. The findings emphasize the importance of both behavioral and organizational responses when examining responses to perceived resource scarcity.

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INTRODUCTION

Managers consider resource scarcity as a major threat to their businesses and see an increasing relevance of resource scarcity across many industries, especially those related to minerals, water, services, and labor. What is more, they consider resource scarcity as an interorganizational issue as it can affect firms across the supply chain (i.e., downstream and upstream a firm's supply chain). Despite media discussions on resource scarcity, managers believe there is a lack of awareness of resource scarcity among internal and external stakeholder groups, such as suppliers, customers, and employees. On top of this, managers are challenged to effectively assess and mitigate resource scarcity, because there is uncertainty about the expected shortage. In turn, this uncertainty influences managerial perceptions and, consequently, decisions to mitigate resource scarcity. Due to the importance of resource scarcity within and across firms, academic researchers need to investigate more holistically how resource scarcity influences buyer-supplier relationships.

This dissertation focuses on *perceived resource scarcity* that describes an expected, but uncertain, future resource shortage and is, thus, conceptualized as a combination of *expected resource shortage* and *shortage uncertainty*. As such, the perceived scarcity of a resource has not yet occurred, but it is anticipated to affect firms in the future. Managers may expect, but do not know when, how long, and to what extent the shortage will occur. Due to the lack of information about the resource scarcity and managers' finite information processing capacity, managers rely on their perceptions when responding to resource scarcity – and these perceptions are likely to be incomplete. The discrepancy between managerial perceptions and the reality can influence the effectiveness of the selected strategies to mitigate resource scarcity. In this dissertation, I investigate how perceived resource scarcity is managed in the context of buyer-supplier

relationships (i.e., on the inter-organizational level) and how it influences managerial decision making (i.e., on the individual level).

In the first essay, I define perceived resource scarcity and distinguish it from other concepts, such as actual resource scarcity. Furthermore, I conduct a comprehensive literature review by presenting and discussing research on resource scarcity from scientific fields such as management, economics, sociology, and psychology, and I argue why resource scarcity is a relevant concept in supply chain management research. Based on organizational theories, I also present and discuss firms' potential responses to perceived resource scarcity and their effects on buyer-supplier relationships. Finally, I propose a framework of organizational responses to manage the two dimensions of perceived resource scarcity (i.e., expected resource shortage and shortage uncertainty) and to assess the impact of each dimension on buyer-supplier relationships.

In the second essay, I test the conceptualization of perceived resource scarcity as proposed in the first essay. In a survey, which combines open-ended and exploratory questions as well as Likert-type scales, with 203 purchasing managers and buyers, I investigate the effects of perceived resource scarcity on organizational responses to mitigate it, and, in turn, on buyer-supplier relationships. The findings show that the majority of participants have either over- or underestimated the severity of an expected shortage, which emphasizes the importance of managerial perceptions. Moreover, the findings suggest that expected resource shortage and shortage uncertainty result in different organizational responses to mitigate perceived resource scarcity. When there is an expected resource shortage, firms select strategies to mitigate this problem without much regard for their major suppliers. However, when there is shortage uncertainty, firms hesitate to implement any strategy to mitigate the problem. In contrast, collaboration with major suppliers was found to be a key factor for effectively mitigating perceived resource scarcity. Therefore, firms need to actively engage in collaboration with suppliers rather than focus solely on

their interests in times of perceived resource scarcity, if they wish to mitigate resource scarcity effectively. Finally, considering the preference for self-interested versus collaborative strategies to mitigate resource scarcity, the findings suggest the influence of other, potentially behavioral, factors when managing resource scarcity.

In the third essay, I conduct a scenario-based experiment with 358 managers to examine the effects of perceived resource scarcity on managerial decisions when managing scarcity. The findings confirm the impact of the scarcity bias on managerial decisions, when there is expected resource shortage. In these situations, managers tend to act in a more self-interested manner focusing solely on their firms' needs, which translates into reduced collaborative efforts with the major supplier. More importantly, this scarcity bias influences managers irrespective of whether their firms' relationship with the major supplier is strategic versus transactional.

This dissertation is the first study to investigate perceived resource scarcity in supply chain management. The findings demonstrate that there is inconsistency in terms of what response strategies seem to be more effective in mitigating resource scarcity and what managers actually select when faced with this problem. Although collaborative strategies with a major supplier are effective to mitigate resource scarcity (findings from the second essay), managers are influenced by the scarcity bias and, as a result, end up selecting self-interested strategies that consider solely their firms' needs and ignore the major supplier and the relationship to the major supplier (findings from the third essay). The findings of this dissertation shed light on managerial and organizational responses in times of perceived resource scarcity and suggest pathways to derive strategies that are more effective in mitigating scarcity threats in buyer-supplier relationships.

ESSAY 1

MANAGING PERCEIVED RESOURCE SCARCITY IN SUPPLY CHAINS:

A COMPREHENSIVE ANALYSIS

1. Introduction

Predicting resource scarcity becomes more difficult in global supply chains. Various trends that affect the availability of resources contribute to this challenge. First, firms source resources globally and, therefore, depend on complex and intertwined supply chains. Ensuring stable supply is increasingly challenging due to more actors in supply chains and more complex logistics planning (Meixell and Gargeya 2005). This makes the steady flow of goods and services more vulnerable to disruptions. Local incidents can have global consequences affecting the resource availability in seemingly disconnected supply chains (Barry 2004). Second, complex supply chains are more often affected by environmental, economic, and political events. Such events not only create volatile commodity prices, but can also affect the availability of resources. For example, more severe and uncertain weather conditions, partially due to climate change, threaten the stable supply of agricultural products and, therefore, result in constant scarcity threats (Winston 2014). Third, unprecedented population and economic growth in emerging markets lead to high resource consumption (Krautkraemer 2005). Concerns exist if limited natural capacity as well as production capacity are sufficient to sustain the increasing consumption of food (Voeller 2010) and natural resources, such as rare earth minerals (Yap 2013).

With different trends affecting supply chains, managers consider resource scarcity as a permanent threat to their firms and anticipate an increasing risk of resource scarcity across numerous industries (Schoolderman and Mathlener 2011). Quickly changing conditions can affect the availability of resources that may or may not lead to resource scarcity. Therefore, resource scarcity issues are inherently uncertain due to a lack of information about when, how long, and to what extent a potential shortage may affect a firm's supply chain in the future. Uncertainty about upcoming scarcity issues influences how decision makers assess and manage the shortage threat. Managers may rely on their perceptions about the supply market to assess the likelihood of

upcoming scarcity threats. Inaccurate assessments of potential future resource scarcity can result in ineffective and costly organizational responses. Research needs to address the role of managers' perceptions about resource scarcity and how these perceptions influence responses to scarcity. In this research, we examine the effect of perceived resource scarcity (i.e., expected, but uncertain resource shortages) in supply chains.

Resource scarcity is generally described as the "lack of adequate supply (...) to meet required demand" (Bell, Autry, Mollenkopf and Thornton 2012, p. 159). In the supply chain management literature, Bell et al. (2012) are concerned with resource scarcity from an upstream supply chain perspective and a focus on the physical availability of natural resources, such as water, precious metals, and food. However, the majority of executives in a recent study identified their most pressing factors leading to resource scarcity to be growing demand in emerging countries and political turbulences, rather than natural resource availability (Schoolderman and Mathlener 2011). In addition, managers believe there is insufficient awareness of the broad implications of resource scarcity among internal and external stakeholder groups, such as customers and employees (Schoolderman and Mathlener 2011).

Given this, supply chain research must address natural resource scarcity and investigate the scarcity of other tangible and intangible resources. In addition, supply chain research should also examine forces that influence the availability of resources downstream (e.g., 3PL capacity) in a firm's supply chain in addition to upstream shortages. Further, resources relevant within a firm (e.g., talent, capital) can also be affected by shortages and, thus, are relevant to supply chain research. Following this characterization, resource scarcity must be discussed more holistically in the context of supply chain management. A more thorough characterization of resource scarcity is needed to help managers identify effective mitigation strategies. Research presents contradicting results and finds that scarcity can have both positive and negative effects on interorganizational

relationships. Understanding the impact of resource scarcity in supply chains will also provide guidance regarding how to effectively manage resource scarcity in supply chains.

With respect to resource scarcity, George, Schillebeeckx and Liak (2015) observe that "as long as we are agnostic about the determinants of scarcity, our understanding (...) remains limited" (George et al. 2015, p. 1600). To investigate the determinants, we address several research gaps. First, supply chain research has not sufficiently discussed resource scarcity beyond natural resources. Second, extant literature has not captured the breadth of scarcity by considering that resource scarcity in supply chains can be caused by events that are external (i.e., upstream and downstream) as well as internal to a firm. Third, resource scarcity should not only include the actual shortage of resources, but also uncertainty about the time, duration, and the magnitude of scarcity. Given uncertainty influences the decision making process of managers, we also need to consider the behavioral consequences of experiencing and managing resource scarcity. To address these gaps, we investigate the following research questions:

RQ 1: What is perceived resource scarcity and what does it mean in a supply chain context?

RQ 2: What are the effects of perceived resource scarcity in supply chains?

RQ 3: How should firms manage perceived resource scarcity?

The remainder of this paper is organized as follows. First, the literature is reviewed to summarize resource scarcity from different disciplinary perspectives. Next, we provide a conceptualization of resource scarcity to distinguish the phenomenon from other terms in the risk management literature, such as disruptions. We differentiate actual and perceived scarcity to highlight the role of perceptions in managing resource scarcity. Finally, we present a conceptual framework to categorize organizational strategies relevant for mitigating perceived resource scarcity in supply chains.

2. An Interdisciplinary Framework of Perceived Resource Scarcity

2.1. Resource Scarcity

Resource scarcity is described as the "quality of something that is unavailable, insufficient or not plentiful" (Cunha et al. 2014, p. 202). Most definitions emphasize the "lack of adequate supply" in order to satisfy a given demand (Bell et al. 2012, p. 159). However, comparing supply and demand does not describe how long a scarcity threat lasts and how difficult it is to rectify. A longlasting shortage poses greater risks in supply chains than demand-supply imbalances that can be solved quickly. Buechner (2014) extends the traditional view and specifies resource scarcity as resource that is unavailable when unavailability "is difficult or impossible to repair" (p. 7). Further, as we are primarily interested in the resource scarcity as a phenomenon affecting supply chains, we consider various types of resources. Limiting the discussion of resource scarcity to a certain type of resources (e.g., tangible resources only) "appears deeply flawed" (George et al. 2015, p. 1600). We follow Hunt and Davis' (2008) understanding of resources defined as "the tangible and intangible entities available to the organization that enable it to produce efficiently and/or effectively a market offering that has value for some market segment(s)" (p. 13). To that effect, we extend previous discussions that only considered certain types of tangible resources, such as natural resources (e.g., Bell et al. 2012), and also incorporate intangible resources, such as human, relational, and knowledge resources.

Resource scarcity has been studied by different disciplines (e.g., economics, organizational management, sociology, psychology) with a focus on either organizational or behavioral implications of scarcity. Management and economics commonly take an institutional view and investigate how resource scarcity affects firms and economies, respectively (George et al. 2015, Krautkraemer 2005). In contrast, behavioral research, conducted by psychologists and sociologists, usually emphasizes the cognitive effects of scarcity on individuals and on social networks (e.g.,

Mittone and Savadori 2009, Shah et al. 2012). While psychology research focuses on the effect of scarcity on individuals, sociologists investigate the impact of resource scarcity on groups of individuals, such as communities and social networks. Table E1-1 highlights foundational research in each discipline (i.e., economics, organizational management, sociology, psychology) and categorizes the research according to the behavioral or organizational focus. Further, we distinguish between research that mainly focuses on the impact of resource scarcity on either the firm/individual level (i.e., monadic view) or on a network of firms/individuals (i.e., dyadic view and interfirm networks). Each category can aid in understanding resource scarcity in supply chains. The following section provides an overview of each disciplinary perspective.

2.1.1. Economics and Organizational Management Research

The discussion about resource scarcity goes back to, at least, Hume (1739) who discusses scarcity as a source of conflict. Robbins (1932) considers scarcity as the underlying nature of economic action and defined economics as "the science which studies human behavior as a relationship between ends and scarce means which have alternative uses" (Robbins 1932, p. 15). The literature continues to discuss the existence of resource scarcity in the economy, ways to measure resource scarcity, and definitions of resource scarcity. Each aspect is discussed below.

With regard to the existence of resource scarcity, two competing schools of thought discuss the importance of resource scarcity in the economy. Resource pessimists consider scarcity as a main challenge for economic development, while optimists refuse the idea of scarcity as a long-term problem. With regard to the pessimistic view, early economists, such as Malthus (1826) and Hotelling (1931), focus on how human population growth can be sustained with a limited supply of natural

Table E1-1: Categorization of key disciplinary views on resource scarcity

	ORGANIZATIONAL	BEHAVIORAL
	Organizational Management → Extent to which resources available to a firm are plentiful or scarce and whether capacity of the environment can support the firm and its strategies (Koka et al. 2006) Context of studies: • Scarcity as a source of conflict (Staw and Szwajkowski 1975)	Psychology → "Scarcity is not just a physical constraint. () When scarcity captures our attention, it changes how we think" (Mullainathan and Shafir 2013, p. 12) Context of studies: • Psychological explanations for increase in desirability and in value • foreway many flows 1000 lump 1000
	 Firms focus on internal efficiency and less on innovation in times of scarcity (Starbuck and Hedberg 1977) Scarcity leads to internal adjustments in organizations, such as administrative and personnel changes (Koberg 1987) Impact of (financial) scarcity on innovation, product expansion/growth (Mishina et al. 2004) Factor market rivalry leads to increased competition (Markman et al. 2009, Capron and Chatain 2008) Resource management and resource orchestration through structuring, bundling, leveraging to mitigate scarcity (Sirmon, Hitt, Ireland 2007) 	 of scarce resources (Lynn 1989, Lynn 1992) Heightened attention to scarce resource (Bozzolo and Brock 1992, Mullainathan and Shafir 2013, Shah et al. 2015) Cognitive changes due to scarcity described as "scarcity bias" (Booth 1984, Mittone and Savadori 2009) Individuals seek short-term solutions, such as over-borrowing (Shah, Mullainathan and Shafir 2012) Loss aversion creates cognitive biases in times of scarcity; people dislike losing resources from consumption bundle (Kahneman et al. 1991, Tversky and Kahneman 1991) Individuals look for shortcutting strategies to get access to scarce resource and to avoid complex situations (Dirks 1980)
DYADIC & NETWORK	 Economics → "Good or service that is insufficient when the insufficiency is difficult or impossible to repair" (Buechner 2014, p. 6) Context of studies: Various macroeconomic scarcity concepts (Daoud 2010), such as universal scarcity (Mankiw 2006), absolute scarcity (Malthus 1826), relative scarcity (Robbins 1932), economic scarcity (Buechner 2014) Positive economic growth sustained through technological progress that increases effective resource stock (Stiglitz 1974) Scarcity of resource commodities and resource amenities (public goods) (Krautkraemer 2005) Investigation of strategies to measure resource stocks (Norgaard 1990, Barnett and Morse 1963) 	 Sociology & Social Psychology → Value of existing social standards and norms decreases and changes structure of social networks (Dirks 1980) Context of studies: Scarcity is created by societal events, such as famine (Dirks 1980), natural disasters (McAllister et al. 2010) Social behavior changes in times of scarcity: Competitive and antisocial behavior, decline in relationship quality, traditional problem solving strategies with focus on authorities (Booth 1984, Laughlin and Brady 1978, Dirks 1980) Resource scarcity can lead to more selfish behavior (Holland, Silva, Mace 2012) and/or to more generous behavior (Kraus et al. 2010, Pfiff et al. 2012, Roux et al. 2015) Social networks in times of scarcity decrease in size, but have stronger ties (Ramirez-Sanchez and Pinkerton 2009)

resources. Malthus (1826) argues that human food requirements are quantitatively greater than available supply. While Malthus' prediction turned out to be wrong, the view continues to be popular in a world of uncertainty, short-term supply disruptions, and rapid population growth. Malthus (1826) mainly focuses on food supply; Neo-Malthusians extend the discussion to resources beyond food. In contrast to the pessimistic Neo-Malthusian view, optimists (also called Cornucopians) believe innovation and technological progress are the driving forces to mitigate any scarcity threats. In other words, resource stock can be improved through technological innovation to support sustainable economic growth (Stiglitz 1974). As indicated by lower long-term prices for many resources (Krautkraemer 2005), resource scarcity is not considered to be an economic problem. While the argument between resource optimists and pessimists is still ongoing, the Cornucopian view dominates the discussion.

While the economic idea behind resource scarcity, defined as the lack of adequate supply to satisfy people's subjective demands and wants, is straightforward (Robbins 1932), challenges occur in measuring the extent of resource scarcity. To quantify supply-demand imbalances, economists discuss ways to measure resource stocks in an economy (Norgaard 1990). Resource economists investigate the relevance of market prices and extraction costs as proxies for measuring resource availability (Hotelling 1931). The challenge is to identify economic measures (e.g., market price, extraction cost) that reliably predict the actual and future threat of resource scarcity (Barnett and Morse 1963). For instance, commodity prices in the spot market are assumed to reflect the cost for extraction and usage. However, prices for resources are freely determined in the market and may be distorted by transient events, such as disruptions, and speculation (Gorton and Rouwenhorst 2006, Winston 2014). Also, extraction costs only represent the current technological state on the supply side, but do not incorporate future developments, such as the use of resource deposits that are currently not accessible (Krautkraemer 2005). For example, new hydraulic fracking techniques

allow the extraction of oil stocks that were not previously available. Static cost measures are not reliable predictors of future supply and actually may misrepresent actual resource stocks and, consequently, lead to ineffective managerial decision (Krautkraemer 2005).

With regard to the last aspect, researchers propose different definitions of resource scarcity. The variety of definitions reflects the difficulty of interpreting and quantifying scarcity. For example, Buechner (2014) concludes that the scarcity concept was never defined sufficiently, emphasizing the need for a better definition of "resource scarcity". Economics research has presented different conceptualizations, some of which are summarized in Table E1-2. The concept of *universal scarcity* assumes that a price greater than zero indicates scarcity else consumers would have an infinite amount of resource score for consumption (Mankiw 2006). In other words, a price above zero means demand for the resource exceeds available supply. Here, the concept of scarcity (i.e., there is no unlimited supply) is interpreted similarly to the concept of limited availability or rareness (cf., Barney 1991).

Concept	Definition	References
Universal Scarcity	• Every good and service is scarce (if the price of a good/service is greater zero)	Mankiw (2006)
Relative Scarcity	 Goods and services are scarce relative to the scarcity of other goods 	Robbins (1932)
	 Measured by prices of goods and services in comparison to one another or to itself 	
Absolute Scarcity	 Human requirements are quantitatively greater than available resource quantities 	Malthus (1826)
	 Quality of something that is unavailable, insufficient, or not plentiful Measured by quantity of resource that is insufficient 	
Economic Scarcity	 Unavailability of goods and services caused by market forces (i.e., supply and demand) Insufficiency is difficult or impossible to repair Relevant for firms when emergency situation occurs 	Buechner (2014)

Table E1-2: Traditional definitions of resource scarcity

Relative scarcity, mostly used in neoclassical economics, describes the scarcity as the relationship of one resource stock to several alternative but competing uses (Daoud 2010, Robbins 1945). Relative sufficiency exists if the sum of the different requirements (demand points) is greater than the available resource stock (Daoud 2010). Therefore, the consumer needs to prioritize his/her different needs while accounting for the resource constraint. The goal is to find the optimal allocation of resources based on rational choices. Therefore, an increasing/decreasing price indicates higher/lower relative scarcity (Daoud 2010). In contrast, absolute scarcity is defined as "an aspect of individual goods considered in isolation, that is, the quantity of a good is insufficient to reach one's end" (Buechner 2014, p. 13). Hence, absolute scarcity compares the available supply of one resource to the actual requirement or use (Malthus 1826). The concepts of absolute and relative scarcity are discussed on a macroeconomic level, and, therefore, are not appropriate to investigate the scarcity threats that firms experience. In the context of firms, Buechner (2014) discusses the concept of economic scarcity that describes "a good or service that is insufficient in supply when the insufficiency is difficult or impossible to repair" (p.7). In "the context of a normally functioning economy" (Buechner 2014, p. 7), economic scarcity characterizes a condition that can be solved easily through substitution. For example, an out-of-stock situation of a consumer's favorite chocolate brand is not a resource scarcity as the "problem" can be solved easily by choosing another grocery store or by changing the brand. However, in global supply chains that are often affected by disruptive events, firms experience economic scarcity threats that cannot be solved easily, and must, therefore, be managed. In this study, we focus on the concept of economic scarcity when the unavailability of a resource cannot easily be solved in a firm's supply chain.

Research in the organizational and strategic management literature describes resource scarcity as a structural characteristic of an organization's environment that needs to be managed (Pfeffer and Salancik 1978). The organization's environment is characterized by the scarcity or

abundance of resources. Researchers in the management literature generally do not investigate the distinct effects of resource scarcity on firms. Resource scarcity is seen as the lack of resource abundance and considered to be a special case of environmental munificence (e.g., Castrogiovanni 1991, Yasai-Aredkani 1989). Similarly, Koka, Madhavan and Prescott (2006) define munificence as the "extent to which resources available to a firm are plentiful or scarce, (...) and is an index of the capacity of the environment to support the firm and its strategies" (p. 726). Oftentimes scarcity and abundance are discussed in conjunction and seen as factors that may affect a firm's competitiveness and its potential for sustainable economic growth (Starbuck 1976, Dess and Beard 1984, Goll and Rasheed 1997, Wade and Hulland 2004).

The organizational management literature describes different forms of scarcity, such as (1) the limited number of suppliers and limited supply, (2) costs of acquiring, keeping or providing a resource, (3) restrictions limiting possession of a resource, and (4) delays in providing resources (Brock 1968). Early research focuses mostly on the effect of resource scarcity on a single organization and its internal structure. For example, Koberg (1987) studies how an organization would respond to scarcity by implementing the least costly changes to process and structure, such as administrative and personnel changes. Goll and Rasheed (1997) identify the importance of rational decision making in dynamic and munificent environments to achieve high organizational performance. An organization should focus on generating internal efficiencies to mitigate the scarcity threat rather than on emphasizing innovation and/or growth (Starbuck and Hedberg 1977, Whetten 1980, Whetten 1981). In contrast, other researchers study resource scarcity as a source of division and conflict in organizations (e.g., Pondy 1969, Staw and Szwajkowski 1975).

Understanding the detrimental effect of resource scarcity on firm performance led to increased attention on how to effectively manage resources. In their seminal work, Sirmon, Hitt and Ireland (2007) define resource management as "the comprehensive process of structuring a firm's

resource portfolio, bundling the resources to build capabilities, and leveraging those capabilities to realize a competitive advantage" (p. 273). The goal is to understand how firms mitigate external shortage issues through structuring resources effectively. While the discussion on resource management primarily focuses on the importance of organizing the resources internally, recent research emphasizes the interdependence of firms in their resource environments, such as in factor markets (Capron and Chatain 2008). Factor market rivalry is defined as "competition over resource positions" (Markman, Gianiodis and Buchholtz 2009, p. 423). The concept focuses on non-strategic resources, which, not leading to a competitive advantage, become important in times of scarcity (Markman et al. 2009). While factor market rivalry considers the competition for resources in a firm's entire value chain, the focus has been on the impact to a firm and not on the entire supply chain. Factor market rivalry can affect interorganizational relationships at any level. For instance, firms may be interested in disrupting a competitor's resource flow as it affects downstream operations and potentially decreases competitive strategy but does not address how firms, suffering from scarcity, can effectively mitigate the environmental threat across supply chains.

2.1.2. Behavioral Research

Sociology research describes resource scarcity as the unavailability of important resources generated by political, economic, and societal events, such as famine or financial crises (Dirks 1980, Ramirez-Sanchez and Pinkerton 2009). Scarcity is viewed as an external threat that cannot be avoided or mitigated. Sociologists study the social consequences of resource scarcity, focusing on how individuals change their social behavior in groups such as communities and societies. For example, Dirks (1980) studies the effect of famine on human behavior in resource scarce societies. Individuals who suffer from starvation forget their social background creating "an essentially bestial nature" (Dirks 1980, p. 31) as cultural norms disappear. Laughlin and Brady (1978) and Dirks (1980)

are among the first to describe the cognitive shift from innovative and socially complex strategies to simplified, concrete, short-term solutions in times of resource scarcity. Similarly, Booth (1984) observes the preference for more traditional and, consequently, less innovative strategies. In times of resource scarcity, human beings do not have the time to pursue socially complex strategies to gain access to the desired resource and, consequently, choose opportunistic actions like theft (Dirks 1980). Dirks (1980) calls these direct and simple strategies "a kind of shortcutting" (p. 32) to secure access to scarce resources.

Further, research in sociology has examined how the changes in social behavior affect relationships among groups in communities. For example, a study, conducted by Ramirez-Sanchez and Pinkerton (2009), found relationships between fishermen in fishing villages experiencing high resource scarcity were weaker unless the relationships represented friendship and kinship (Ramirez-Sanchez and Pikerton 2009). However, McAllister et al. (2010) conclude that communities in arid desert regions in Australia experiencing lower resource availability tended to develop smaller social networks with a higher proportion of strong ties and within a hub structure, which allowed for effective leadership and fast adaptability to environmental threats (McAllister et al. 2010).

Psychology research considers how behavioral biases under scarcity conditions affect individuals and their social and economic networks (Mullainathan and Shafir 2013). Systematic behavioral biases, a form of bounded rationality, describe the difference between managers' beliefs and the decisions made under optimal, full information circumstances (Gigerenzer and Gaissmaier 2011). In complex environments, or "large worlds", managers do not have information about all possible resource stocks and must rely on their perceptions when evaluating resource availability (Gigerenzer and Gaissmaier 2011). Gigerenzer and Gaissmaier (2011) conclude that "decision making in organizations typically involves heuristics because the conditions for rational models rarely hold in an uncertain world." (p. 474).

Psychology literature has not addressed situations in which resource scarcity can occur, rather it is interested in the underlying psychological phenomenon that occurs in times of scarcity. Specifically, researchers focus on a concept called scarcity bias (Booth 1984, Mittone and Savadori 2009, Shah, Mullainathan and Shafir 2012). Scarcity bias occurs "when the subjective value of a good increases due to the mere fact that it is scarce" (Mittone and Savadori 2009, p. 453). Different studies have shown that higher scarcity is linked to higher perceived value of anything that can be possessed and is useful to the owner (Lynn 1991). Also, Lynn (1989) finds that scarcity affects the desirability of experiences or objects and is mediated by expensiveness. Two mechanisms may explain the scarcity bias. First, less available resources increase the uniqueness of ownership and limit the options of owning the scarce resource (Verhallen and Robben 1994, Verhallen and Robben 1995). Both fewer choices of ownership and the need-for-uniqueness were shown to be important contributors to higher perceived value of scarce resources (Brehm 1966). Second, the difficulty to obtain a resource was also shown to increase perceived value and the desirability to own the scarce resource (Lynn 1989). The consequences of the scarcity bias are multifaceted. Among other effects, individuals show greater attention to scarce resources (Mullainathan and Shafir 2013) and tend to focus on the scarce resource while neglecting other problems (i.e., goal inhibition) (Shah et al. 2012). As the focus on scarcity reduces the mental capacity (or bandwidth), individuals become less insightful, less forward-thinking, and less controlled (Mullainathan and Shafir 2013).

More recently, Roux, Goldsmith and Bonezzi (2015) describe the social consequences of resource scarcity by conducting behavioral experiments. The researchers were specifically interested in the psychological process that is activated through resource scarcity. Individuals experiencing resource scarcity show tendencies to act more selfishly, except in situations where personal gains are attainable through generous behavior (Roux et al. 2015).

Regarding resource scarcity, various themes emerge from the literature across the four disciplines. First, there is an ongoing discussion about the meaning of resource scarcity in the economics literature. Second, psychology literature focuses on the cognitive effects of resource scarcity on individuals' behavior. Importantly, the effects of resource scarcity are described to be inherent to the human nature and, therefore, universally relevant for human decision making. Sociology extends this assumption and investigates how individuals within a social network react to scarcity threats. Lastly, organizational management literature investigates the impact of resource scarcity on focal firms and how firms respond to scarcity threats. The interdisciplinary literature review provides important insights on how resource scarcity in supply chain management could be examined from an organizational and behavioral perspective. Next, we summarize resource scarcity in the supply chain management literature.

2.1.3. Resource Scarcity in Supply Chain Management Research

Supply chain research acknowledges resource scarcity "as a fact of life in most organizations" (Morrison 2015, p. 79). To date, resource scarcity in supply chain research has focused on the unavailability of tangible resources, such as natural resources (e.g., Bell et al. 2012, Winston 2014), labor (e.g., Morrison 2015), and physical inventory (e.g., Sterman and Dogan 2015). Further, supply chain management literature has studied resource scarcity in the context of different industries. For example, researchers emphasize the detrimental effect of resource scarcity on quality in service organizations (Oliva and Sterman 2001) and on the compliance of standards through rule violations (Martinez-Moyano et al. 2014). Morrison (2015) presents a systems view to highlight the persistent effect of personnel shortages in manufacturing firms. While front-line workers identify workarounds to address shortages, managers do not fully understand the magnitude of the shortage. Therefore, managers do not respond adequately to the scarcity creating long-term inefficiencies, deteriorating capabilities, and less effective social relationships between front-line workers and managers (Morrison 2015). However, little attention has been given to the broader meaning and effects of resource scarcity in supply chains.

Recently, supply chain research investigates two aspects of resource scarcity in more depth, natural resource scarcity and behavioral effects of resource scarcity. First, with respect to natural resource constraints, Bell, Mollenkopf and Stolze (2013) identify external, macro-level forces, including consumption, competition, and substitution, that affect natural resource availability. Other research identifies spiking commodity prices, climate change, emerging economies, and a growing world population as important drivers of natural resource scarcity (Ellram, Tate and Feitzinger 2013, Winston 2014). To respond to these challenges, firms are forced to implement long-term strategies, embrace scientific-driven solutions, and create radical innovation. Winston (2014) describes the increasing importance of creating resilient supply chains characterized by flexibility, redundancy, and effective collaborations. Bell et al. (2012) present a conceptual typology of natural resource scarcity considering the level of scarcity (available versus scarce) of the resource, the renewability (renewable versus non-renewable) and the geographic location (global versus local). The characterization of natural resource scarcities helps to identify an appropriate organizational response, such as resource employment strategies, conservation approaches, and mitigation strategies (Bell et al. 2012). Here, research emphasizes the importance of managing natural resource scarcity, but does not address the actual implications and the management of resource scarcity in supply chains. Also, the research calls for further understanding of the dynamic characteristics of resources (Bell et al. 2012).

Second, supply chain research has started looking at behavioral effects of resource scarcity on managers. Sterman and Dogan (2015) investigate managers' behavioral responses to insufficient and uncertain supply. The researchers investigate the impact of the behavioral responses on individuals' inventory management behavior through experiments. The findings suggest that

irrational behavior among participants leads to larger safety stocks (i.e., hoarding) and placing more orders than necessary (i.e., phantom ordering). Sterman and Dogan (2015) argue for more empirical research to better understand managers' behavioral responses to situations of uncertain and insufficient supply. Similarly, Rao, Rabinovich and Raju (2014) show that products with limited inventory availability (e.g., potential resource scarcity) are more likely to be purchased. The scarcity bias (termed by the authors as "scarcity heuristic") leads to an increase in product returns as consumers misjudge the true value of the product and, thus, make unintended purchases (Rao et al. 2014).

The existing supply chain management literature has taken organizational (e.g., strategies organizations can take to mitigate natural resource scarcity) and behavioral (e.g., scarcity bias can affect decision making) perspectives at both dyadic/network (e.g., buyer-supplier dyads, interfirm networks) and monadic (e.g., individual manager) levels. Further research regarding resource scarcity in supply chains is needed to better understand the inherent uncertainty surrounding scarcity issues. The following section provides an overview of the uncertainty literature.

2.2. Uncertainty and Resource Scarcity

Just as the unavailability of resources affects supply chains, uncertainty about the shortage exacerbates a firm's ability to cope with scarcity effectively. Therefore, uncertainty describes a threat to a firm's normal course of operations (Kleindorfer and Saad 2005). Uncertainty, also referred to as variability, has long been studied in the management literature (e.g., Knight 1965, Thompson 1967, Downey, Hellriegel, Slocum Jr. 1975, Milliken 1987). The focus of most studies has been on environmental uncertainty which is defined as "the predictability of conditions in the organization's environment" (Miles and Snow 1978, p. 195). Environmental uncertainty is caused by environmental dynamism, such as environmental instability, rate of change in the environment, and the unpredictability of environmental factors (Dess and Beard 1984). Regarding resource scarcity,

Cook (1977) and Oliver (1990) describe environmental uncertainty as the lack of information about resource availability in a firm's environment.

Research argues that there are different types of uncertainty, which should be studied separately as each type may uniquely affect sense-making and manager's behavior (McKelvie, Haynie and Gustavsson 2011, Flynn, Koufteros and Lu 2016). Three types of uncertainty have been discussed in the literature:

- 1. [*State uncertainty*] is the inability to assess or assign probabilities as to the likelihood of future events in the firm's environment (e.g., Knight 1965, Duncan 1972, Milliken 1987).
- [Effect uncertainty] is a lack of information about cause-effect relationships (e.g., Duncan 1972, Lawrence and Lorsch 1967, Milliken 1987).
- 3. [*Response uncertainty*] is the inability to predict accurately what the outcomes of a decision might be (Duncan 1972, Downey and Slocum 1975, Milliken 1987).

The first type of uncertainty, state uncertainty, focuses on the difficulty of predicting future events. Adapted to this research, it would indicate uncertainty regarding the future availability of resources and the likelihood of future scarcities. Milliken (1987) describes the inability to determine the future state of the environment as *state uncertainty*. In cases when no information is available about the resource state, individuals cannot assign probabilities to the occurrence of such an event (Knight 1965). Thus, classic decision making models, such as the expected utility model, are not applicable as decision alternatives cannot be weighed without knowing probabilities. As uncertainty cannot be assessed objectively, individuals interpret changes in a firm's business environment that could affect the future state of resources and potentially result in scarcity based on their perceptions (Milliken 1987, Koberg 1987). Perceptions can result in irrational decision making and, therefore, need to be taken into account (Sirmon et al. 2007, Gigerenzer and Gaissmaier 2011). Consequently, understanding perceptions about uncertain environments is critical to investigate the effect of uncertainty on managers' decision making processes. In addition, the literature distinguishes between the inability to evaluate the current "external environment of the organization" (Dickson and Weaver 1997, p. 405) as well as any future changes to the external environment. As resource scarcity can affect firms now and in the future, it is necessary to consider the time horizon when investigating perceptions about resource scarcity.

The second type of uncertainty refers to the potential impact that uncertainty has on a firm's business (i.e., effect). Milliken (1987) describes this type of uncertainty as *effect uncertainty*. Effect uncertainty reflects the lack of understanding of cause-effect relationships between a firm's environment and its business (Duncan 1972). Even if managers understand the future state of a resource, information deficits make it difficult to comprehensively assess how a certain resource state will impact a firm (Sirmon et al. 2007). Importantly, a manager who perceives a certain resource to be more important than its actual (i.e., objective) value may overestimate the effect of the scarcity threat. In order to minimize the effect of uncertainty on a firm, research emphasizes the importance of matching a firm's strategy and structure to an uncertain environment (Thompson 1967, Wong 2011). In this regard, supply chain integration is considered be an effective strategy for mitigating uncertain environmental conditions (Flynn 2016). For example, firms invest in supplier integration, cross-organizational teams and long-term relationship to ensure secure resource availability (Paulraj and Chen 2007).

The third type of uncertainty which refers to the inability to determine the most effective organizational response is *response uncertainty* (Milliken 1987). By definition, the goal of risk management is to identify and assess "the probabilities and consequences of risks" (Manuj and Mentzer 2008, p. 141). Here, understanding a decision maker's perceptions of a scarcity threat has important consequences for managing resource scarcity. First, the lack of certainty about the severity of a resource's actual and future shortage exacerbates the identification of organizational

responses to effectively avoid and mitigate resource scarcity (Carpenter and Fredrickson 2001). Second, resource management techniques that work for more predictable occurrences may prove to be ineffective in times of greater uncertainty. Therefore, it is difficult to foresee whether or not a chosen mitigation strategy will actually solve the scarcity issue (Downey, Hellriegel and Slocum 1975, Carpenter and Fredrickson 2001).

Managers deal with all three types of uncertainty simultaneously. Beyond assessing the future availability of resources, managers need to evaluate the potential impact of scarcity threats on their businesses and identify effective organizational responses to mitigate the resource scarcity. Managers' perceptions concerning the different types of uncertainty are important as well. Due to insufficient information and finite information processing capacity, managers need to interpret their environment based on their perceptions when evaluating resources, resource scarcity, and the effectiveness of organizational responses (Flynn, Koufteros and Lu 2016). Perceptions describe another source of uncertainty (Downey and Slocum 1975) due to the potential discrepancy between managers' perceptions and the environmental reality. This discrepancy influences how adequately a chosen organizational response mitigates a scarcity threat (Castrogiovanni 1991).

In summary, the challenge of resource scarcity is not only the unavailability of the resource, but also the uncertainty, and how that uncertainty affects managers. Particularly, the supply chain management literature has not considered perceptions of future resource availability. As perceptions may result from cognitive biases, the behavioral implications of insufficient and uncertain resource supply need to be considered. Further, the supply chain management literature has not sufficiently addressed how to effectively manage resource scarcity. Current scarcity mitigation approaches do not consider the impact of uncertainty on how managers respond to scarcity threats. While a few research articles have considered both resource shortages and environmental uncertainty (e.g., Castrogiovanni 1991, Koberg 1987, Nottenburg and Fedor 1983,

Dias and Magriço 2011), research has not investigated how these two constructs are interrelated. A more holistic characterization that captures the complexity of resource scarcity is required.

3. Characterization of Perceived Resource Scarcity in SCM

3.1. Perceived Resource Scarcity across the Supply Chain

In order to examine resource scarcity and uncertainty in a supply chain management context, and to distinguish scarcity from other concepts, such as supply chain disruptions, we categorize resource scarcity based on time and supply chain dimensions. Table E1-3 highlights this categorization, beginning with the differentiation of actual resource scarcity from perceived resource scarcity. Further, we distinguish both types of resource scarcity from disruptions based on state versus event properties. Each is discussed below.

We define time dimensions (current versus future) to distinguish actual resource scarcity from perceived resource scarcity. Actual resource scarcity represents a realized scarcity that can interfere with the firm's normal course of operations. In the case of future resource scarcity, the resource shortage has not yet occurred and, therefore, not yet affected the firm. Managers may expect, but do not know when, how long, and to what extent the shortage will occur. Anticipating resource shortages in the future requires perceptions which subsequently cause managers to respond to the expected unavailability despite the uncertainty concerning the resource. We describe the expected, but uncertain, resource scarcity as perceived resource scarcity. Therefore, perceived resource scarcity is defined as the anticipated unavailability of tangible and intangible resources that potentially affects a focal firm upstream, downstream, or internally and that is difficult or impossible to repair.

			Supply Chain Examples		
	Time Dimension	Characterization	Supply (SC upstream)	Internal (focal firm)	Demand (SC downstream)
Actual Resource Scarcity	Current	 Actual, realized <u>state</u> Continuous Resource insufficiency 	Limited availability of rare earth minerals	Insufficient production capacity	Insufficient transportation capacity to deliver products to customers
Perceived Resource Scarcity	Future	 Anticipated <u>state</u> Continuous Expected resource insufficiency 	Expected exhaustion of oil supply	Expected lack of skilled labor, talent	Expected shortage of logistics capacity in emerging markets due to growing demand
Disruption	Current	 Discrete <u>event</u> Unanticipated, sudden event 	Disruption of supply due to natural disaster	Disruption of service or production capacity due to weather causing power outage	Central distribution center closes down after fire

Table E1-3: Characterization of resource scarcity and disruption

Actual resource scarcity and perceived resource scarcity describe the actual and potential future unavailability, respectively, and are distinct from disruptions. As described in the supply chain risk management literature, disruptions are defined as "*unplanned* and *unanticipated* events that disrupt the normal flow of goods and materials within a supply chain" (Craighead, Blackhurst, Rungtusanatham, Handfield 2007, p. 132, emphasis added). Tang (2006) refers to disruptions as "natural and man-made disasters such as earthquakes, (...) terrorist attacks (...) or economic crises such as a currency evaluation or strikes" (p. 453). These and other disastrous events lead to demand or supply shocks which possibly result in the unavailability of resources. Importantly, unavailable resources in one location could be plentiful in another location in the supply chain, however, access to the source is disrupted. In contrast, actual and perceived resource scarcity depict current or future resource states that potentially affect a firm's normal course of operations. While a

disruption describes a discrete event that affects a firm at one point in time, the actual scarcity describes the current state of a resource and depicts the consequence that lasts generally over a longer time period (i.e., continuous).

It is also important to note that resource scarcity and disruptions affect firms in various places across the supply chain, including external and/or internal within the firm (i.e., upstream and downstream) across the supply chain. In the case of external scarcity, firms may face scarcity issues located up- and downstream within the firm's supply chain. Upstream induced scarcity is not only caused by constrained natural resources, as commonly discussed in the literature (e.g., Bell et al. 2012), but also by constraints on other tangible and intangible resources, including semi-finished goods (e.g., components) and outsourced services (e.g., warehousing). Events downstream in a firm's supply chain may similarly lead to scarcity. For instance, Yasai-Aredkani (1989) describes resource scarcity as the "rate of change of demand for industries' products and services" (p. 142) and refers to scarcity as economic change that is driven by demand-side events. After the economic crises in 2008, increasing demand for logistics services created a shortage of trucking capacity, which challenged firms to distribute their products (Badkar 2014). Lastly, firms may face shortage issues related to internal resources that cannot be easily substituted with external resources. For example, highly specialized employees represent a valuable resource that needs to be developed internally and that cannot be easily found in the market. While firms often focus on internal initiatives (e.g., Lawrence and Lorsch 1967, Sirmon et al. 2007), research should consider interorganizational consequences of resource scarcity as well.

In summary, actual resource scarcity, perceived resource scarcity, and disruptions are distinct, though related, concepts, each having differing effects on supply chains. Actual resource scarcity and disruptions immediately impact supply chains' ability to satisfy demand, while perceived resource scarcity potentially impacts future supply chains. Given there has been

substantial research focused on disruptions and risk management in the supply chain literature, the remainder of this paper will focus on perceived resource scarcity. We focus on perceived resource scarcity rather than actual resource scarcity in order to extend the focus of scarcity literature to include uncertainty. The next section discusses dimensions of perceived resource scarcity in greater depth.

3.2. Conceptualization of Perceived Resource Scarcity

As stated previously, perceived resource scarcity is defined as an issue that has the potential to affect a firm in the future, and is characterized by uncertainty regarding the state, effect and response associated with the scarcity. To understand the severity of and the lack of information about the resource scarcity, we conceptualize perceived resource scarcity as being a combination of *expected resource shortage* and *shortage uncertainty* as illustrated in Figure E1-1.



Figure E1-1: Conceptualization of perceived resource scarcity

Expected resource shortage refers to an anticipated future shortage whereby a manager must assess the expected magnitude, timing, and duration of the scarcity threat in order to mitigate the potential shortage. Expected resource shortage focuses on the availability (and thereby lack) of a resource. Expected magnitude is defined as the anticipated extent of the resource scarcity. This dimension is similarly discussed in the disruption literature as severity of disruptions (Craighead et al. 2007). A scarcity issue with a high expected magnitude, similar to a more severe disruption, leads to a "more far-reaching and financially devastating impact" (Craighead et al. 2007, p. 134). In their

crises perception model, Billings, Milburn and Schaalman (1980) describe the magnitude of a crisis as the perceived value of a possible loss. Similarly, expected magnitude reflects the perceived value that a firm may lose due to an upcoming scarcity. Expected timing describes the point in time when a scarcity is anticipated to affect a firm. Ultimately, expected timing affects the available time for managers to identify a mitigation strategy. The less time available, the higher the pressure for managers to respond to the crisis (Billings et al. 1980). Finally, expected duration is defined by the length of an expected resource scarcity. Risk management literature has studied duration in the context of disruptions (e.g., Tomlin 2006, Qi and Li 2015). While disruption length measures the duration of a discrete event, the expected duration of a scarcity issue looks at the anticipated length of a future shortage. Shortages of different lengths may require different organizational responses to mitigate the scarcity threat.

Beyond the expected impact of the shortage, the manager faces uncertainty about the estimation of the shortage, which we call shortage uncertainty. Expected resource shortage represents the anticipated impact of a scarce resource, while shortage uncertainty describes the lack of information pertaining to the anticipated impact. In other words, expected resource scarcity is the amount of a resource forecasted to be available (or unavailable), while shortage uncertainty represents the confidence (or variance) around that forecast. Shortage uncertainty related to effect uncertainty as there is a lack of information regarding what factors may cause and/or affect the state of the resource (i.e., expected resource shortage). Due to the multifaceted effects on businesses (e.g., Milliken 1987, Flynn et al. 2016), shortage uncertainty increases the difficulty of responding to expected resource shortages. Further, shortage uncertainty is also affected by magnitude, timing, and duration. Magnitude uncertainty measures the ambiguity about the extent of an upcoming shortage. Timing uncertainty describes the uncertainty about the time when the threat will affect a firm. In a study investigating the impact of positive demand shocks (i.e., a case of
downstream induced resource scarcity), Tokar et al. (2014) investigate the simultaneous impact of magnitude and timing uncertainty regarding the upcoming demand spike on inventory ordering decisions. They found that managers had more difficulty in dealing with uncertain timing than with the uncertain magnitude of demand. In addition, we incorporate uncertainty about the duration of a potential scarcity in our discussion. Coping with uncertainty regarding the duration of the scarcity could similarly challenge the manager.

Figure E1-1 highlights the potential impact of state uncertainty (e.g., expected resource shortage could impact the likelihood of a future scarcity), and effect uncertainty (e.g., uncertainty about the shortage is driven by a lack of information). It is also important to incorporate the uncertainty about selecting an effective organizational response to mitigate the scarcity issue (i.e., response uncertainty). The following section discusses the effect of expected resource shortage and shortage uncertainty on managers with respect to the organizational responses selected for scarcity mitigation.

4. The Impact of Perceived Resource Scarcity in Supply Chains

4.1. Theoretical Perspective

Most of the supply chain management literature, focused on resource management, applied the resource-based view (RBV) to examine the existence and describe the characteristics of scarce resources. According to RBV, firms must possess valuable, rare, inimitable, and nonsubstitutable (VRIN) resources to achieve a sustainable, competitive advantage (Barney 1991). These resources may be tangible or intangible resources (Wernerfelt 1984) and, thus, include human, financial, physical, technological, organizational, reputational, and relational resources (Dyer and Singh 1998, Grant 1999, Fernandez, Montes and Vazquez 2000). These VRIN characteristics are considered as "indicators of how heterogeneous and immobile a firm's resources are" (Barney 1991, p 106) and, therefore, how likely it is to obtain a sustainable competitive advantage. Barney (1991) highlights rareness as a characteristic that allows firms to "exploit opportunities or neutralize threats in a firm's environment" (p. 106). Resources may be rare, but available (e.g., expensive precious metals) whereas scarce resources are not available in quantities sufficient to meet demand. While RBV focuses on the description of resource characteristics, it does not predict potential organizational responses to perceived resource scarcity.

To facilitate understanding how firms respond to scarcity issues, two main theoretical perspectives have been used: resource dependency theory (RDT) and transaction cost economics (TCE). First, RDT is used to form a theoretical basis for investigating how firms attempt to mitigate resource scarcity. Second, TCE describes how a firm's governance structure impacts its ability to manage potential scarcity issues. Both RDT and TCE predict organizational responses to expected resource shortages and shortage uncertainty and, thus, may facilitate understanding of the impact of perceived resource scarcity in supply chains. Each theory will be described below in more detail.

4.1.1. Resource Dependence Theory (RDT)

The RDT argues that organizational success is dependent on external resources and is built upon four underlying assumptions. First, firms, seen as coalitions, build and adjust their network of relationships to maximize their own power in order to maintain access to critical resources (Pfeffer 1981, Ulrich and Barney 1984). Second, Pfeffer and Salancik (1978) emphasize the existence of internal (within the firm) and external (between firms) coalitions. Such coalitions are developed through social exchanges in order to control behavior (Ulrich and Barney 1984). Third, a firm's environment is comprised of valued resources (Pfeffer and Salancik 1978). Scarce resources are considered to be valuable in times of resource scarcity given firms compete for resource access (Aldrich 1979, Koberg 1987). Finally, firms alter their structure to gain control over resources by minimizing the dependence on other organizations or, alternatively, by maximizing the dependence

of other organizations on themselves (Pfeffer 1981). In this way, links between organizations may be described "as a set of power relations based on exchanges of resources" (Ulrich and Barney 1984, p. 472). Following RDT, firms gain access to scarce resources through some form of social coordination and relationships (Pfeffer and Salancik 1978). Such interorganizational arrangements may embody, for example, alliances, joint ventures, and mergers and acquisitions (Pfeffer and Salancik 1978, Drees and Heugens 2013). By forming alliances and joint ventures, firms seek to mitigate resource shortages, jointly, while staying legally independent (Koza and Lewin 1998).

While RDT argues that firms cooperate to increase access to resources, it is not clear if this holds true in times of perceived resource scarcity. Early research focused more on the impact of collaboration on actual resource scarcity. For example, Aiken and Hage (1968) and Molar (1978) suggest actual resource scarcity motivates firms to cooperate. Oliver (1990) argues when "resources are scarce and organizations are unable to generate needed resources, they will be more likely to establish ties with other organizations" (p. 250). However, Oliver (1990) also indicates that collaborative initiatives may be neglected in times of resource scarcity when firms fear the loss of control and autonomy.

4.1.2. Transaction Cost Economics (TCE)

TCE recognizes that governance structures are a critical way for an organization to secure resources in its environment (Rindfleisch and Heide 1997). To determine what type of governance structure is warranted, TCE analyzes the trade-off between costs of managing transactions (relationships) in the free market and managing transactions within a firm (Williamson 1998). Rindfleisch and Heide (1997) identify environmental uncertainty and human behavior as two reasons why transaction costs exist. Human behavior is characterized by bounded rationality due to limited information processing ability and opportunism (Rindfleisch and Heide 1997). Williamson (1998) acknowledges that human beings act opportunistically as continual optimizers and take

advantage of situations even if it is at the expense of others. Environmental uncertainty results in higher transaction cost as firms need to increase their communication, negotiation, and coordination (Rindfleisch and Heide 1997).

In times of perceived resource scarcity, the governance structure is not necessarily well prepared to respond to the scarcity threat. Adjusting the governance structure to a new situation takes time and describes a complex activity. Without safeguarding mechanisms, opportunistic behavior may occur in times of high shortage uncertainty (Williamson 1998). Firms are likely to perceive the cost of managing relationships will be higher than the cost of managing transactions within the firm. As such, following TCE, firms would be less likely to collaborate when faced with potential resource scarcity, and more likely to focus on a solution that could be controlled internally.

In summary, TCE and RDT predict different organizational responses to mitigate perceived scarcity threats. While resource scarcity is discussed to facilitate relationships to secure access to resources, the uncertainty about the expected shortage may lead to high transaction costs to set up the relationships. Especially in times of uncertainty, firms may respond without regard for partner firms (i.e., internal). Next, we will discuss strategies available to mitigate perceived resource scarcity.

4.2. Organizational Responses to Perceived Resource Scarcity: A Conceptual Framework

In this section, we propose a conceptual framework for understanding organizational responses to perceived resource scarcity. First, we identify potential organizational responses. Supply chain risk management literature was surveyed to summarize organizational responses that could be applied to perceived resource scarcity. Organizational responses related to resource scarcity (e.g., Bell et al. 2012, Sener 2012) and other relevant risk management strategies (e.g., Manuj and Mentzer 2008) were identified. Table E1-4 summarizes the identified organizational responses and provides a brief

description of each. We arrange the organizational response based on the mechanism *how* expected resource shortage and shortage uncertainty are mitigated. The four mechanisms are: resource employment responses; conservation responses; information visibility responses, and risk sharing responses. The former two categories follow Bell et al.'s (2012) classification of mitigation strategies applied to natural resource scarcity. Resource employment responses describe strategies that focus on changing the use of scarce resources. In contrast, conservation responses include influencing the resource availability by recovering resources for reuse (e.g., recycling) or by protecting the underlying resource base (Bell et al. 2012). The latter two categories, information visibility and risk sharing, comprise organizational responses to reduce the level of uncertainty surrounding an upcoming shortage. Information visibility seeks to increase understanding of a firm's environment to gain knowledge about the scarcity. In the TCE discussion, for example, safeguarding and monitoring are proposed to reduce uncertainty about a firm's environment (Williamson 1998). In contrast, risk sharing responses seek to distribute risk (i.e., reduce uncertainty) among supply chain partners to improve alignment and coordination.

Beyond the description of organizational responses in Table E1-4, a conceptual framework should help managers to identify an adequate organizational response based on the characteristics of perceived resource scarcity (i.e., expected resource shortage and shortage uncertainty) and its impact in supply chains (i.e., managing perceived resource scarcity internally or in collaboration with other firms). Therefore, we categorize the organizational responses along two dimensions,

Strategic I	nitiative	Definition/Description	Reference				
Resource Employment Responses							
Avoidance		 retrenchment (divestment, turnaround) divestment of specialized assets avoid business in highly uncertain 	Bell et al. (2012) Manuj and Mentzer (2008) Sener (2012)				
Logistics te	echniques	 relocate resource from rich to suffering location - logistics/geographic postponement 	Bell et al. (2012) Zinn and Bowersox (1988)				
Allocation Substitutio	'n	 ration/restrict use of scarce resources use of alternative resources adjust product/service design without using scarce resource 	Bell et al. (2012) Manuj and Mentzer (2008)				
Slack build	ing	 build up slack as "shock absorbers", e.g., inventory, production redundancies supply chain diversification, e.g., reduce a firm's exposure to certain exchange partners, use additional suppliers 	Bode et al. (2011) Chattopadhyay et al.(2001)				
Bricolage		 creation of something with resources that 	Baker and Nelson (2005)				
(Improvisa	tion)	are on hand (improvisation)					
Conservation Responses							
Resource r Sustainme approach	ecovery nt	 returns management (reverse logistics) closed-loop supply chain management (CLSC), recycling and reusing resource base protection (e.g., supplier development program) 	Bell et al. (2013) Blackburn et al. (2004) Bell, Mollenkopf and Stolze (2013) Bell et al. (2012) Krautkraemer (2005)				
approach		- improve and secure the underlying resource base	Pullman et al. (2009)				
Internal re developme Collaborat	source ent ive	 training of required talent internal innovation through R&D resource-constrained product development resource development through partnering 	Sharma and Iyer (2012)				
resource developme	ent	with other firms, suppliers, customers					
Collaborat joint ventu	ion & ires	 interorganizational relationships to ensure stable and low cost access to scarce resources 	Ulrich and Barney (1984) Pfeffer and Salancik (1978) Harrigan and Newman (1990)				
Vertical int	egration	 change of variable costs into fixed costs, merger 	Manuj and Mentzer (2008) Sener (2012)				
Collusion		 avoidance of competition through legal or illegal forms of collusion 	Aiken and Hage (1968) Pfeffer and Salancik (1978) Staw and Szwajkowski (1975)				
Off-shoring	5	 secure resources across borders 	Manuj and Mentzer (2008)				

Table E1-4: Description of potential organizational responses to perceived resource scarcity

Table E1-4 (cont'd)

Strategic Initiative	Definition/Description	Reference
Information Visibility Respo	nses	
Forecasting Internal specialization	 - improved forecasting techniques - better estimation by using big data analytics - early warning systems, simulation, tabletop - functional specialization, professional qualifications, decentralization of operating decisions, use of specialists, accountability measures (incentivize employees) 	Chichilnisky and Heal (1998) Manuj and Mentzer (2008) WEF (2014) Yasai-Ardekani (1989) Cameron and Zammuto (1983)
Operational hedging (postponement)	 opportunities to delay and adjust operating decisions over time in response to resolution of uncertainty new markets to avoid local uncertainty 	Triantis (2000) Manuj and Mentzer (2008) Sener (2012)
Financial hedging	 delay and adjust investment decisions over time to reduce uncertainty about scarcity 	Chichilnisky and Heal (1998) Manuj and Mentzer (2008)
Manufacturing Postponement	 delay use of scarce resource in manufacturing process till scarcity issue is over 	Zinn and Bowersox (1988)
Monitoring	 performance evaluation through screening control through technology, e.g. tracking; 	Manuj and Mentzer (2008) Rindfleisch and Heide (1997) Cameron and Zammuto (1983) Schreyoegg et al. (2007)
Reshoring/Insourcing	 increase control over source for resources organize transaction under unified ownership 	Williamson (1998)
Risk Sharing Responses	•	
Bridging Safeguarding	 relationship building leads to reliable and timely information exchange manage resource dependencies by enlarging a firm's influence over them (e.g., foreign board member for resource access) more communication administrative controls through more 	Bode et al. (2011) Flynn and Flynn (1999) Johnson, Sohi and Grewal (2004) Sener (2012) Beckman, Haunschild and Phillips (2004) Young-Ybarra and Wiersema (1999) Williamson (1998)
	extensive array of administrative rules and procedures - centralization of strategic decisions	Rindfleisch and Heide 1997
Contracting	 uncertainty reduction through long-term contracts (advance purchase contracts) negotiation of favorable buying terms 	Manuj and Mentzer (2008)
Outsourcing	 use of contract manufacturing and service providers domestic and international sourcing of service or products use of insurance to reduce vulnerability to price fluctuations 	Manuj and Mentzer (2008) Carlton (1979) Sener (2012) WEF 2014

'objective' and 'strategic intent', as shown in Table E1-5. Concerning the 'objective' dimension, we propose that some organizational responses focus predominantly on resolving expected resource shortages, some on predominantly reducing shortage uncertainty, and some on resolving both expected resource shortage and shortage uncertainty (i.e., perceived resource scarcity). For example, slack building of additional inventory would mainly secure access to resources, while monitoring would help to decrease shortage uncertainty. Developing a substitute resource would circumvent the perceived resource scarcity altogether, and, thus, impact both the expected resource shortage and shortage uncertainty. The second dimension, 'strategic intent', reflects whether the organizational response is directed toward solving the scarcity from an internal or external focus. Developing slackbuilding and monitoring factor markets would be examples of internally focused responses, while collaborating with a supplier to develop a substitute resource would be an example of an externally focused response.

Objective/ Resource Availability Strategic Intent Intent		Resource Availability & Uncertainty Reduction	Uncertainty Reduction
Internal Focus	 Logistics techniques Allocation Slack building Bricolage Vertical integration 	 Avoidance Substitution Internal resource development 	 Forecasting Reshoring/Insourcing Internal specialization Operational hedging Manufacturing postponement Financial hedging Monitoring
External Focus	Off-ShoringCollusion	 Collaboration & joint ventur Bridging Collaborative resource development Sustainment approach Resource recovery 	 Safeguarding Contracting Outsourcing

Table E1-5: Organizational responses categorized by objective and strategic intent

The framing of organizational responses based on objective and strategic intent helps to further understand how firms respond to perceived resource scarcity. The objective (i.e., different combinations of expected resource shortage and shortage uncertainty) may change the strategic intent (i.e., internal focus and external focus) when managing perceived resource scarcity and vice versa. The organizational response selected may not only influence the effectiveness of the response to mitigate a future scarcity, but may also affect a firm's relationships with its supply chain partners.

The proposed conceptual framework addresses four gaps in the literature. First, extant academic literature does not provide a comprehensive framework of how to mitigate perceive resource scarcity. Second, prior research has found that organizations manage resources very differently despite the similarity of resources and environmental conditions (Zott 2003, Sirmon et al. 2007). The framework allows for a comparison of organizational responses to understand why similar resources and conditions may call for different responses. Third, the theoretical discussion (i.e., RDT and TCE) revealed that perceived resource scarcity may induce distinct reactions (internal versus external), which, in turn, may affect supply chain relationships. Further research can utilize the framework to empirically test if the theoretical predictions of RDT and TCE hold in times of perceived resource scarcity. Lastly, the framework could be used to understand if perceived resource scarcity should be tackled by implementing one response only or by applying a portfolio of responses to mitigate perceived resource scarcity.

Supply chain management literature has not sufficiently discussed organizational responses to mitigate scarcity issues. We have summarized various responses in a framework along two dimensions, 'objective' and 'strategic intent'. Regarding the objective, it is important to understand which element of perceived resource scarcity (i.e., expected resource shortage and shortage uncertainty) each organizational response is likely to address. Responding to the right element of

perceived resource scarcity is crucial to mitigate scarcity threats effectively. Further, each organizational response is chosen with a strategic intent toward solving the scarcity internally (i.e., internal focus) or externally (i.e., external focus). The strategic intent may determine the impact of managing perceived resource scarcity within a firm's supply chain. On the one hand, internally focused responses may induce self-interest with potentially detrimental effects to existing relationships. On the other hand, external strategies with an emphasis on solving the scarcity threat collaboratively may be beneficial for developing stronger buyer-supplier relationships.

5. Summary

In summary, this paper introduces and discusses the concept of perceived resource scarcity, conceptualized as a combination of expected resource shortage and shortage uncertainty. We combine different disciplinary views to investigate resource scarcity in supply chains more comprehensively. Economics and organizational management literature provide important insights regarding the impact of shortages in economies and firms. While economists discuss the meaning of scarcity at a macro-economic level, organizational management literature discusses the impact of resource scarcity and environmental uncertainty on firms. To study the behavioral implications of perceived resource scarcity, we provided an overview of research conducted in sociology and psychology. Psychologists investigate the impact of shortage issues and uncertainty on the individual decision making process. In comparison, sociology literature studies the consequences of scarcity and uncertainty in social networks. Both the individual and interpersonal perspective help to better understand the impact of perceived resource scarcity in social networks.

Perceived resource scarcity is described based on four characteristics which are important in supply chain management. First, resource scarcity is caused by events that are upstream, downstream and internal to a firm and, therefore, describes a topic important across the entire

supply chain. Second, resource scarcity can affect firms over different time horizons. While a scarcity issue can affect a firm currently, a future resource scarcity may exist that while it has not occurred is expected to influence the resource availability in the future. Third, future resource scarcity is not only characterized by the expected unavailability of a resource (i.e., expected resource shortage), but also by the inherent shortage uncertainty about the magnitude, timing, and duration of the scarcity. Fourth, as expected resource shortage and shortage uncertainty may lead to different organizational responses, we investigated the combined consequences of expected resource shortages and shortage uncertainty in supply chain management.

Our conceptual framework proposes organizational responses for mitigating the different dimensions of perceived resource scarcity. We categorize potential responses based on the objective (i.e., resource availability, uncertainty reduction) and the strategic intent (i.e., internal focus versus external focus). The conceptual framework allows researchers to study how firms manage perceived resource scarcity and which combination of organizational responses is most effective to mitigate perceived scarcity threats. In addition, the framework provides a foundation to test theoretical frameworks (i.e., RDT, TCE) regarding how firms respond to perceived resource scarcity. Future research is necessary to empirically investigate the conceptualization of perceived resource scarcity and the conceptual framework.

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ESSAY 2

ORGANIZATIONAL RESPONSES TO PERCEIVED RESOURCE SCARCITY

IN BUYER-SUPPLIER RELATIONSHIPS

1. Introduction

Firms continue to be challenged by a wide variety of resource scarcities, such as labor (Badkar 2014), agricultural products (Terazono 2014), and rare earth minerals (Yap 2013). Environmental, political, and economic factors increase the likelihood of scarcity in global and interconnected supply chains (Winston 2014). Consequently, managers consider resource scarcity as a major challenge for their firms (Schoolderman and Mathlener 2011). Despite the importance of resource scarcity in supply chains, executives and researchers believe there is a lack of awareness of resource scarcity in research and practice (George, Schillebeeckx and Liak 2015), which can negatively affect the availability of a resource and, thus, a firm's performance. Therefore, it is important to understand the impact of resource scarcity from a supply chain perspective and how firms can effectively respond to scarcity threats (Winston 2014).

In global and complex supply chains, it is challenging to assess the future availability of resources (Krautkraemer 2005). Identifying which resources may be constrained in the future to develop an effective mitigation strategy in time is a critical task in supply chains. Due to a lack of information about scarcity threats, the process of identifying organizational responses relies on individuals' and organizations' perceptions regarding the future resource availability. Perceived resource scarcity (PRS) describes expectations regarding the future resource scarcity as well as the uncertainty surrounding the expected shortage. Both resource scarcity and uncertainty affect a firm's ability to develop an appropriate organizational response to the PRS. While some research indicates firms are more likely to collaborate with other firms as a means to mitigate scarcity (Oliver 1990), other research suggests responses are less likely to be collaborative (Ramirez-Sanchez and Pinkerton 2009, Nottenburg and Fedor 1983) as firms act with self-interest. The choice of mitigation strategies in collaboration with suppliers (i.e., collaborative organizational responses) and organizational responses without regard for suppliers (i.e., self-interested organizational responses)

could not only influence the effectiveness of a response, but also relationships with suppliers. Understanding the impact of PRS on buyer-supplier relationships is especially important, as relationships play an important role in achieving superior supply chain performance (Cousins, Handfield, Lawson and Peterson 2006).

Research has not investigated PRS in supply chain management. We study the phenomenon in two ways. First, we validate the importance of PRS in supply chain management by analyzing qualitative data. In an exploratory survey, purchasing managers provided information about the PRS they have experienced. We examine the different types of scarce resources that exist across various industries and that purchasing managers are focused on mitigating. This analysis helps to provide a more comprehensive understanding of PRS as a combination of expected resource shortage and shortage uncertainty. Second, purchasing managers described how their firms managed PRS. We empirically test the effect of PRS on firms' propensity to implement self-interested and collaborative organizational responses as a means to mitigate PRS. Lastly, we study how the organizational response influences the relationship with a major supplier and whether collaborative and self-interested organizational responses mitigate the PRS effectively. Also, we highlight how firms respond to the two dimensions of PRS, expected resource shortage and shortage uncertainty, differently. This provides understanding of how perceptions of resource scarcity influence the way PRS is managed in buyer-supplier relationships.

The remainder of this paper is structured as follows. First, we provide an overview of the literature on resource scarcity and its impact in supply chains. We propose PRS as a combination of expected resource shortage and shortage uncertainty to explain different organizational responses to scarcity threats. Further, hypotheses pertaining to the effects of PRS on organizational responses and buyer-supplier relationships are developed. Next, we discuss our methodological approach. Qualitative and quantitative responses from purchasing managers are analyzed to investigate PRS

and to test our proposed model. We conclude the paper with a discussion providing theoretical and managerial implications.

2. Background and Hypotheses Development

2.1. Resource Scarcity in Supply Chains

Resource scarcity is defined as the quality of a resource that is unavailable when the unavailability is difficult or even impossible to repair (Cunha et al. 2014, Buechner 2014). Research has shown that resource scarcity leads to distinct organizational responses that could potentially affect buyer-supplier relationships. Management literature identified resource scarcity as a source of conflict and organizational division (Nottenburg and Fedor 1983, Pondy 1969), but also as a factor that influences the type of relationship that exists between two firms (Aiken and Hage 1968, Pfeffer and Salancik 1978, Van de Ven and Walker 1984).

Research describes resource scarcity as a situation that leads to competitive and selfinterested organizational behavior (Ramirez-Sanchez and Pinkerton 2009). In times of resource scarcity, firms choose responses that are intended to strengthen their position without regard for their partners. Yasai-Ardekani (1989) and Koberg (1987) find that firms experiencing scarcity implement internal structural changes, for example, in administration, personnel and related to strategy, to manage the environmental threat. Castrogiovanni (1991) argues that the lack of strategic flexibility in scarce environments increases competitive pressures and conflict between organizational units. Firms that are forced to secure resources are likely to focus on their own needs and conceal, rather than share, information (Ramirez-Sanchez and Pinkerton 2009). Similarly, research on factor market rivalry discusses the competition over scarce resources within the supply chain (Ellram, Tate and Feitzinger 2013). In times of resource scarcity, firms try to gain a competitive advantage over other firms when securing access to scarce resources. This may result in self-

interested actions, such as capturing other firm's access to resources by holding-up, subverting or destroying resources (Markman, Gianiodis and Buchholtz 2009, Ellram, Tate and Feitzinger 2013). As such, resource scarcity is described as a force that facilitates competitive, firm-centered responses.

In contrast, other research has shown that resource scarcity facilitates relationship development, resulting from collaborative organizational responses (Oliver 1990, Van de Ven and Walker 1978, Aiken and Hage 1968). Oliver (1990) argues when "resources are scarce and organizations are unable to generate needed resources, they will be more likely to establish ties with other organizations" (p. 250). Legal (and even illegal) cooperation may be a way to avoid competition in scarce environments (Aiken and Hage 1968, Pfeffer and Salancik 1978). Therefore, resource scarcity motivates firms to collaborate with one another (Aiken and Hage 1968, Paulson 1976). This becomes even more important when firms are unable to generate required resources independently (Starbuck 1976). For example, a manufacturer may partner with a supplier to redesign products in order to substitute the scarce resource with more available resources.

The discussion in the literature describes different, often contradicting, organizational responses to resource scarcity (i.e., competitive, self-interested versus collaborative). Understanding organizational responses is important because of the potential impact to buyer-supplier relationships. Self-interested behavior, in times of resource scarcity, can upset long-term, trusting relationships. For example, hoarding inventory in times of scarcity threats (i.e., hoarding as a self-interested organizational response) can create conflict and negatively affect relationships (Sterman and Dogan 2015). In contrast, collaborative responses may improve the relational quality of buyer-supplier relationships (Mishra and Shah 2009, Mentzer, Min and Zacharia 2000).

2.2. Organizational Responses to Perceived Resource Scarcity

In this research, we focus on PRS conceptualized as a combination of expected resource shortage and shortage uncertainty. We define PRS as the anticipated unavailability of resources that is difficult or impossible to repair while uncertainty exists surrounding the expected resource shortage. Scarce resources can be tangible or intangible and can affect the focal firm upstream, downstream, or internally. To mitigate PRS, managers not only have to anticipate the occurrence of an expected resource shortage, but they also have to estimate the potential impact of the scarcity threat in order to develop the mitigation response. Managers' perceptions are influenced by uncertainty surrounding the expected resource shortage. For example, coffee manufacturers around the world expected a shortage of coffee beans due to drought concerns in Brazil in 2013 (Terazono 2014). The expected coffee bean shortage was seen as a threat to manufacturers' future business. Given that no reliable estimates of the drought's impact on future harvests were available, there was also uncertainty surrounding the expected resource shortage, representing shortage uncertainty. Uncertainty is generally considered as a threat to a firm's normal course of operations (Duncan 1972, Kleindorfer and Saad 2005). We argue that the contradicting organizational responses (i.e., competitive, self-interested versus collaborative) discussed previously in the literature are a result of managers responding to the different dimensions of PRS – expected resource shortage or shortage uncertainty. We propose that expected resource shortage and shortage uncertainty influence the choice of organizational responses to PRS differently.

Accordingly, we consider two different theoretical perspectives to be relevant for explaining the choice of organizational response in times of PRS. While resource dependence theory (RDT) highlights the importance of interorganizational relationships to gain control over scarce resources, transaction cost economics (TCE) emphasizes the increased costs to secure resources in uncertain environments. With regard to expected resource shortage, RDT argues that firms invest in relational

mechanisms, such as collaboration, to secure access to scarce resources (Pfeffer and Salancik 1978, Ulrich and Barney 1984). In contrast, shortage uncertainty is more likely to drive self-interested organizational responses. As discussed by TCE, firms rely on formal governance structures to mitigate uncertainty pertaining to an upcoming scarcity threat (Rindfleisch and Heide 1997). To investigate the different organizational responses, we study the effect of expected resource shortage and shortage uncertainty on firms' mitigation strategies. Given the organizational response selected can impact buyer-supplier relationships, we study PRS within the context of a firm's main supplier of the affected resource.

2.2.1. Expected Resource Shortage

Expected resource shortage refers to an anticipated future shortage, whereby purchasing managers must estimate the expected magnitude, timing, and duration of the potential shortage. Expected magnitude describes the anticipated extent of the resource scarcity and reflects the value a firm may lose due to an upcoming shortage. Expected timing describes the point in time when the resource scarcity is anticipated to affect the firm. Ultimately, expected timing determines the available time for a mitigation strategy to be identified and implemented. When less time is available, managers face greater pressure to respond to the crisis (Billings, Milburn and Schaalman 1980). Finally, expected duration is defined as the length of time the resource is anticipated to be unavailable.

According to RDT, firms that lack access to scarce resources alter their structure with the objective to gain control over resources through some form of social coordination and relationships (Pfeffer and Salancik 1978) or through vertical integration (Hillman et al. 2009, Dress and Heugens 2013). For example, firms may choose to acquire sources of supply (Webster 1992), develop joint ventures (Ellram 1992), or establish alliances and collaborations (Hillman et al. 2009). Therefore, links between organizations become a means for establishing power to gain stable and low-cost

access to scarce resources (Ulrich and Barney 1984). In times of expected resource shortage, firms become aware of their dependence on reliable resource supply. RDT research argues that the dependent (i.e., buying) firm can improve access to scarce resources by coordinating with the supplying firm(s) as self-interested responses would not lead to a secure, stable and low cost resource supply (Hillman et al. 2009). In contrast to formal transactions, collaborations enable firms to develop more alternative solutions to mitigate the expected resource shortage. Such collaborative responses are preferably chosen when firms face conditions of low uncertainty and/or low environmental complexity (Ulrich and Barney 1984, Barney and Ouchi 1983). Following the theoretical arguments of RDT, we hypothesize expected resource shortage to be less likely to lead to self-interested organizational responses, and more likely to lead to collaborative organizational responses as indicated by the following hypotheses:

H1a: Expected resource shortage is negatively related to self-interested organizational responses.

H1b: Expected resource shortage is positively related to collaborative organizational responses.

2.2.2. Shortage Uncertainty

Beyond the anticipated impact of expected resource shortage, purchasing managers face a lack of information surrounding the expected resource shortage, which we define as shortage uncertainty. Shortage uncertainty exists concerning the magnitude, timing, and duration of the expected resource shortage. Magnitude uncertainty measures the ambiguity surrounding the severity of an upcoming shortage. Timing uncertainty describes the uncertainty about the time when the threat will affect the firm. Finally, managers also face uncertainty about the duration of a potential scarcity. Due to the multifaceted effects of uncertainty when evaluating the environmental impact on supply chains (Wu and Pagell 2011, Flynn, Koufteros and Lu 2016), shortage uncertainty increases the difficulty of identifying an effective organizational response to

mitigate the PRS. Research argues that environmental uncertainty leads to organizational responses characterized by higher centralization and formality (Downey, Hellriegel and Slocum 1975). Firms facing uncertainty are less inclined to invest resources and capabilities when the outcome is ambiguous (Aragón-Correa and Sharma 2003), which would reduce the likelihood of collaboration with other firms.

Based on TCE, firms focus on efficient transactions and emphasize cost minimization to ensure stable and low cost supply (Barney and Ouchi 1983). However, managers facing shortage uncertainty are required to rely on more rigid contracts (Dahlstrom and Nygaard 1995) or to engage in self-interested behavior (Ouchi 1980, Williamson 1998). Accordingly, TCE predicts that firms "have a need for formalized governance structures" (Rindfleisch and Heide 1997, p. 48). Also, firms secure scarce resources through more centralized responses in high uncertainty and complex environments (Williamson 1981). For example, vertical integration is discussed as one potential response to increase control over other firms (Williamson 1998, Ouchi 1980, Hillman et al. 2009). Further, to avoid being impacted by self-interested responses from suppliers, firms must create safeguards and protect their business. Contracting can help to reduce uncertainty and is considered as an effective way to shield against opportunism (Manuj and Mentzer 2008). We propose that firms rely more on formal governance structures and less on informal mechanisms, such as collaboration, in times of shortage uncertainty. Also, firms choose organizational responses with less regard for the supplier in order to secure stable access to resources. We test the following hypotheses pertaining to the effect of shortage uncertainty on the firm's propensity to choose collaborative and/or self-interested organizational responses:

H2a: Shortage uncertainty is positively related to self-interested organizational responses.H2b: Shortage uncertainty is negatively related to collaborative organizational responses.

We investigate the effect of expected resource shortage and shortage uncertainty on the organizational response that is chosen to mitigate the PRS in supply chains. Here, we do not look at the specific mitigation strategy (e.g., slack building, substitution of scarce resources), but at the propensity of firms to implement collaborative and self-interested organizational responses. In our model, 'collaborative organizational responses' depict mitigation strategies that were implemented in cooperation with the major supplier. 'Self-interested organizational responses' represent mitigation strategies that benefit the focal firm only without regard for the major supplier. The constructs and the hypothesized relationships are summarized in the conceptual model in Figure E2-1.



- Company Size
 - Experience with Resource Scarcity
- Level of Responsibility

Figure E2-1: Conceptual model

2.3. Relational Satisfaction and Response Effectiveness

We test the effect of organizational responses on two performance related constructs. One construct measures the 'relational satisfaction' with the major supplier at the time when firms responded to the PRS. The second construct measures the 'response effectiveness' of the organizational response (i.e., collaborative versus self-interested response) to assess to what extent the organizational response mitigated the PRS successfully.

Research discusses the detrimental effects of self-interest and opportunism in supply chain management (Wathne and Heide 2000, Palmatier, Dant and Grewal 2007). Self-interested behavior was identified to have a negative effect on firm performance (e.g., Jap and Anderson 2003, Wathne and Heide 2000) by creating less efficient supply chains and by causing production disruptions (Morgan, Kaleka and Gooner 2007). McCarter and Northcraft (2007) describe that supply chain partners fear self-interested behaviors and, therefore, disengage from collaborations leading to failing supply chain alliances. When choosing a solution to the PRS without regard for the major supplier, the focal firm (i.e., the buying firm) is likely to see the scarcity mitigation as an independent effort. Consequently, we expect to find a negative relationship between selfinterested organizational responses and relational satisfaction with the major supplier. In addition, and, as proposed by TCE, self-interested behavior negatively affects interfirm performance as costs associated with managing the relationship in times of PRS (i.e., monitoring) are likely to increase (Heide and John 1990, Gassenheimer, Davis and Dahlstrom 1998). By choosing self-interested responses, it is more challenging to gain access to scarce resources. Therefore, we predict a negative relationship between self-interested organizational responses and response effectiveness. We put forth the following hypotheses:

H3a: A self-interested organizational response is negatively related to the satisfaction with the relationship with the major supplier.

H3b: A self-interested organizational response is negatively related to response effectiveness.

In contrast, collaboration is expected to positively influence performance and relational satisfaction (Mishra and Shah 2009). In the literature, collaboration is considered as an important force for effective supply chain management (Richey and Autry 2009). According to the RDT, collaboration is a mechanism for gaining access to scarce resources (Hillman et al. 2009). Therefore, we propose collaboration to be an effective way to achieve relational satisfaction as well as response effectiveness. We test the following hypotheses:

H4a: A collaborative organizational response is positively related to the satisfaction with the relationship with the major supplier.

H4b: A collaborative organizational response is positively related to response effectiveness.

In addition, we test potential moderating effects of social capital on the relationship between expected resource shortage and the organizational response. Social capital measures the relationship quality between the focal (buying) firm and the major supplier and refers to the "relational resource attainable by individual actors through networks of social relationships" (Tsai 2000, p. 927). Social capital is characterized by trust, information exchange, and shared vision and provides value to both firms in the relationship (Cousins, Handfield, Lawson and Petersen 2006). Autry and Griffis (2008) indicate that higher social capital motivates supply chain partners to invest more in buyer-supplier relationship. Therefore, social capital should encourage collaboration and reduce the likelihood of exhibiting self-interested behavior. Considering the important role of social capital in buyer-supplier relationships, we hypothesize that relational quality moderates a firm's organizational response to expected resource shortage toward more collaboration and less selfinterest. H5a: Social capital weakens the relationship between expected resource shortage and selfinterested organizational responses.

H5b: Social capital strengthens the relationship between expected resource shortage and collaborative organizational responses.

3. Research Design

3.1. Research Method: Critical Incident Technique

Data were collected through an online survey using the critical incident technique (CIT). Originally developed by Flanagan (1954), CIT allows analyzing and classifying human behavior based on a critical or important event of interest (Flanagan 1954, Bitner, Booms and Tetreault 1990). CIT is used as an exploratory tool, and is particularly valuable for researching topics that are not well understood (Bitner, Booms and Tetreault 1990, Butterfield et al. 2005). An incident is defined as "an observable human activity that is complete enough in itself to permit inferences and predictions to be made about the person performing the act" (Bitner et al. 1990, p.73), while a critical incident is defined as an event "that contributes to or detracts from the general aim of the activity in a significant way" (Bitner et al. 1990, p.73). Traditionally CIT has been used as an interview technique in gualitative research.

Pettigrew (1996) was among the first to use a CIT approach for survey research. In CIT, traditional survey (i.e., Likert-type scales) questions are accompanied by open-ended questions that allow elaboration (Bitner et al. 1990, Voorhees et al. 2006). Given little PRS research exists, a CIT approach was taken in order to combine exploratory, open-ended questions with, where possible, existing survey scales. Exploratory questions allow investigating the circumstances about the PRS and organizational responses. Also, open-ended questions help to understand issues that cannot be captured by measurement scales (e.g., type of scarce resource, variety of causes of PRS).

For our survey, the critical incident focuses on perceived resource scarcity issues that survey participants (i.e., purchasing managers) had experienced within the past five years and asked participants to focus on the major supplier providing the resource. To understand how firms manage PRS and to gain insights into managers' decision-making processes, the survey included various open-ended questions and contained quantitative (Likert-type scales) questions to test the conceptual model. Asking questions about the specific PRS helps to direct the participant's attention to remember their experiences at the time of the PRS (Ericsson and Simon 1980). The survey began by asking participants to describe the potential resource scarcity through a series of open-ended questions (e.g., what type of resource, how the scarcity would affect the manager's firm). Next, participants were prompted to complete a series of Likert-type questions regarding their perceptions about the PRS to gauge the expected resource shortage and shortage uncertainty. Then, respondents were asked to describe organizational responses taken to prepare for/mitigate the PRS (open-ended). In addition, Likert-type questions measured to what extent collaborative and self-interested organizational responses to mitigate the PRS where implemented by the firm. Moreover, social capital between the buying firm (i.e., the participant's firm) and the major supplier prior to the PRS was measured.

In the next step, participants were asked if the PRS became an actual resource scarcity. If it did not, respondents evaluated the satisfaction with the major supplier and then answered a series of questions capturing demographic information and control variables. If the PRS became an actual resource scarcity, participants provided details (open-ended) on how the resource scarcity actually affected the firm and if the organizational response taken were effective in mitigating the PRS. These questions were followed by a series of Likert-type measures with regard to relational satisfaction with the major supplier and response effectiveness. Again, the survey terminated after answering questions related to demographic information and control variables. We tested two

different models based on whether or not an actual scarcity occurred. In model 1, we investigate all responses without regard for the actual occurrence of the PRS. In model 2, we expand model 1 to include the impact of an actual resource scarcity and, thus, only included a subset of respondents that have experienced an actual resource scarcity and can evaluate the effectiveness of the organizational response.

3.2. Data Collection and Validation

A sample of managers with purchasing responsibility or purchasing involvement was targeted. The majority of the surveys were collected using two different research firms resulting in 135 completed and verified responses. An additional 81 surveys were completed by MBA alumni from a major U.S. university and trade association members based on 561 email invitations (response rate of 14.4%). Participants that failed to answer attention measure questions correctly (e.g., "To verify your place in the study, please enter 3 here") were not allowed to complete the survey. Five responses were eliminated due to incomplete answers and eight were eliminated due to a lack of variance in their responses and/or they represented extreme outliers. The final sample contained 203 responses.

A summary of sample demographics and industry descriptors is provided in Table E2-1. Firms in the automotive and transportation industry (14.29%) and firms in the consumer goods/beverages industry (12.81%) were most frequently represented in the sample. The different industries included in the sample provide a broad understanding of resource scarcity in various contextual environments. In addition, there is wide range of firm sizes across participants, although nearly one-third of participants worked for firms with sales of less than \$100 million. The majority of participants had between 3-10 years of work experience. Further information is summarized in Table E2-1.
Gender	Absolute	Percent of Sample
Male	117	57.64%
Female	86	42.36%
Age		
18-24	33	16.26%
25-34	69	33.99%
35-49	61	30.05%
50-64	37	18.23%
Over 65	3	1.48%
Years of Job Experience		
Less than 1 year	1	0.49%
1-2	21	10.34%
3-5	43	21.18%
6-10	62	30.54%
11-15	33	16.26%
16-20	16	7.88%
More than 20 years	27	13.30%
Industry		
Consumer Goods/Beverages	36	17.73%
Automotive and Transportation	34	16.75%
Electrical Equipment/Electronics	30	14.78%
Machinery and Industrial Equipment	19	9.36%
Pharmaceuticals/Medical supplies	18	8.87%
Oils and Gas	16	7.88%
Construction	10	4.93%
Mining and Metals	10	4.93%
Chemicals	5	2.46%
Publishing and Printing	3	1.48%
Pulp and Paper	2	0.99%
Other Industries	20	9.85%
Annual Sales 2014 (in US\$)		
Less than \$100 million	60	29.56%
Between \$100 to 250 million	30	14.78%
Between \$250 to \$500 million	25	12.32%
Between \$500 million to \$1 billion	23	11.33%
Between \$1 billion to \$10 billion	24	11.82%
Between \$10 billion to \$20 billion	11	5.42%
More than \$20 billion	30	14.78%
Sample size	203	

Table E2-1: Demographic and industry information

We took steps in the survey design phase and during the data analysis to minimize the risk of common method bias (Podsakoff, Mac-Kenzie, Jeong-Yeon and Podsakoff 2003). All sections in the survey were clearly separated from each other. Before participants could proceed, detailed instructions about the purpose and procedure of each section were provided in order to reduce the likelihood of common method bias (Podsakoff et al. 2003). In addition, we statistically investigated the sample for common method bias in two ways. First, we identified the unmeasured latent methods factor in the confirmatory factor analysis (CFA) (Podsakoff et al. 2003). In our model, the factor loading for a single common factor is 0.18 with 3.24% of the common variance explained. Further, the difference between standardized factor loadings in the model with a common latent factor and the factor loadings in the model without the common factor loading is less than 0.03 indicating no concerns with common method variance (Podsakoff et al. 2003). Second, we apply the CFA marker variable technique as discussed by Williams, Hartman and Cavazotte (2010) and Richardson et al. (2009). We included the construct, benefit administration, in the survey as a theoretically unrelated construct to the proposed model. The shared variance between the marker construct and the other substantive constructs is 0.46%. To test whether the extracted variance is significant, we investigate the change in fit between the model in which the factor loadings between the marker construct and the constructs of interest are freely estimated to the model in which they are constrained to be equal (Williamson et al. 2010). The model difference test shows that the goodness of fit of the constrained model is significantly lower (CFI reduced from 0.956 to 0.910, RMSEA increased from 0.048 to 0.061). The analysis reveals a change in fit-statistics of $\Delta \chi^2$ = 228.53, df = 79 which is significant with p < 0.001. Therefore, the factor loadings (i.e., assumed to be equal in the constrained model) associated with the marker variable were not related to the constructs of interest in our proposed model. The results indicate that common method bias is not an issue.

3.3. Construct Measurement

PRS is operationalized as expected resource shortage and shortage uncertainty. For both dimensions, we develop and test exploratory scales. Expected resource shortage items include elements of expected magnitude, duration, and timing. Shortage uncertainty items include uncertainty regarding the magnitude, duration, and timing of the expected resource shortage. With regard to organizational responses, two types of organizational responses are included: collaborative and self-interested. The measurement items for collaboration are adapted from Richey and Autry (2009). For self-interested organizational responses, we developed an exploratory scale with three measurement items. Pertaining to performance, we investigate two constructs, relational satisfaction and response effectiveness. Relational satisfaction, which examines the satisfaction with the relationship with the major supplier, includes perceptual measures adapted from Cahill et al. (2010). Response effectiveness describes the efficacy of organizational responses to mitigate PRS and is measured by an exploratory scale. In addition, social capital was included as a moderating construct in the analysis. Given social capital was shown by Whipple, Wiedmer and Boyer (2015) as a higher-order latent construct, we operationalize social capital accordingly as a construct combining structural, relational, and cognitive capital. We use measures from Ellinger, Daugherty and Keller (2000), Moberg and Speh (2003), and Carey, Lawson and Krause (2011). All items were measured based on a 7-point Likert-type scale (e.g., "1" = strongly disagree; "7" = strongly agree).

EFA is conducted to investigate the exploratory measurement scales for expected resource shortage and shortage uncertainty. Pertaining to expected resource shortage, the factor analysis suggests expected magnitude as a distinct dimension. Therefore, we conceptualize expected resource shortage as a first-order latent construct using the three items representing expected magnitude of the PRS. Cronbach's $\alpha = 0.75$ indicate high consistency between the measurement

items (Peter 1979). Regarding shortage uncertainty, factor analysis indicates that all measurement items for magnitude uncertainty, timing uncertainty, and duration uncertainty load on one construct. Therefore, we model shortage uncertainty as a first-order latent construct measured by three items. Each item represents one dimension of shortage uncertainty (i.e., magnitude, timing, duration). The reliability of Cronbach's $\alpha = 0.69$ is close to the threshold of 0.7. However, reliability levels above 0.6 are considered to be acceptable for newly developed scales (Forza 2002). Finally, we check if both expected resource shortage and shortage uncertainty depict two distinct constructs. Low and statistically insignificant covariance indicate that PRS consists of two separate constructs (cov[expected resource shortage, shortage uncertainty] = -0.102, p = 0.118). Discriminant validity is also examined using confirmatory factor analysis (CFA) for the measurement model as discussed below.

We analyze the measurement model using structural equation modeling in STATA 13 to ensure convergent validity and unidimensionality of the proposed constructs (Anderson and Gerbing 1988). In the confirmatory factor analysis, all constructs were included and correlated with each other. Any item was removed that exhibited low factor loadings on the intended latent construct or high confounding effects with other constructs. After model purification, the measurement model showed strong fit statistics ($\chi^2 = 352$, df = 288, p-value = 0.006, RMSEA = 0.048, CFI = 0.956, SRMR = 0.06). Table E2-2 summarizes the final items and the standardized factor loadings ranging from 0.54 to 0.93. The high t-values confirm statistical significance for all items with p < 0.001 indicating convergent validity (O'Leary-Kelly and Vokurka 1998). Also, all factor loadings for the confirmatory constructs show values of 0.7 or above (Nunally and Bernstein 1994). While five measurement items for the exploratory constructs have lower factor loadings, reliability levels of >0.6 suggest acceptable consistency for all exploratory constructs (Forza 2002). The

Table E2-2: Measurement model and CFA results

Construct	Measurement Items	Factor Loading	SE	t-statistic	Cronbach's Alpha	Source of Measure				
Independent Variables										
Expected R	esource Shortage [ERS]									
1	I expected the upcoming resource scarcity would negatively affect my company.	0.59	0.089	6.30		exploratory				
2	I anticipated that the resource scarcity would disrupt our operations.	0.66	0.079	8.32	0.75					
3	I anticipated that we would not be able to perform our operations as initially planned.	0.80	0.070	11.36						
Shortage U	ncertainty [SU]									
1	I was confident in how severely the resource scarcity would impact my company. (R)	0.80	0.076	10.58		exploratory, adapted from				
2	Reliable information was available about the time when the scarcity issue would affect our business. (R)	0.65	0.083	7.73	0.69	Ashill and Jobber (1999)				
3	I could accurately estimate the duration of the potential scarcity for our business. (R)	0.54	0.089	6.08						
Dependent	Variables									
Collaborati	on [COLL]									
1	My company and our major supplier worked together to manage the potential resource scarcity.	0.82	0.045	17.98		adapted from Richey and Autry				
2	My company and our major supplier shared ideas on how to prepare for the potential resource scarcity.	0.83	0.045	18.23	0.83	(2009)				
3	Partnering with our major supplier was important for finding a solution.	0.75	0.054	13.90						
Self-Interes	st [SELF]									
1	The response(s) taken to prepare for the potential resource scarcity was (were) driven by our own goals.	0.64	0.081	7.86	0.64	our le veter v				
2	We attempted to find a solution for the potential resource scarcity to avert any damage to our company.	0.87	0.077	11.26	0.04	exploratory				
3	The main goal was to secure resources for our company regardless of the relationship with our major supplier.	excluded								

Table E2-2 (cont'd)

Relational	Satisfaction [RSAT]]					
1	We are satisfied with the way we interacted with our major	0.84	0.037	22.69		
	supplier at the time of the expected resource scarcity.					
2	Differences when cooperating with our major supplier were	0.75	0.050	14.86		
	always settled smoothly at the time of the expected resource					
	scarcity.				0.88	Cahill et al. (2010)
3	The relationship with the major supplier worked well at the time	0.92	0.026	35.31		
	of the expected resource scarcity.					
4	The relationship that my company has with our major supplier is	0.70	0.058	12.07		
	something that we are committed to.					
Response E	ffectiveness [EFFC]					
1	The resource scarcity was managed effectively.	0.88	0.034	25.97		
2	Our organizational response helped to mitigate the resource	0.72	0.057	12.60	0.05	
	scarcity.				0.85	exploratory
3	Our response to the resource scarcity met our expectations.	0.86	0.038	22.69		
Moderatin	g Construct					
Social Capi	tal [SCAP]					
1	My company and the major supplier achieved goals collectively.	0.93	0.022	42.83		Ellinger et al.
	(structural)					(2000) Mohberg
2	This supplier was genuinely concerned that we succeed.	0.92	0.023	40.39	0.88	and Speh (2003)
	(relational)				0.88	Carey, Lawson
3	Both parties shared the same business values. (cognitive)	0.81	0.040	20.24		and Krause
						(2011)

Note: abbreviations for constructs in squared parenthesis, (R): reverse coded

average variances extracted (AVE) for the seven latent constructs, summarized in Table E2-3, exceed the critical value of 0.5 indicating convergent validity for all but two constructs (Hair et al. 2010, p. 709). In addition, Table E2-3 compares the AVE for each latent construct with the shared variance (i.e., squared correlations) with other constructs indicating discriminant validity for all constructs (Fornell and Larcker 1981, MacKenzie, Podsakoff and Podsakoff 2011).

Table E2-3: Discriminant validity

	ERS	SU	COLL	SELF	RSAT	EFFC	SCAP
ERS	0.480	0.003	0.003	0.380	0.000	0.000	0.021
SU		0.451	0.248	0.147	0.165	0.233	0.097
COLL			0.641	0.130	0.458	0.292	0.492
SELF				0.583	0.041	0.130	0.020
RSAT					0.651	0.479	0.577
EFFC						0.677	0.169
SCAP							0.789

AVE is on the diagonal (bold) and the squared correlations between two constructs are on the offdiagonal

We test model 1 (i.e., all respondents) and model 2 (i.e., only respondents who experienced an actual scarcity) in separate structural models to ensure goodness of fit in both models. In model 1, we test the effects of PRS and organizational responses on relational satisfaction with the major supplier. The fit indices for model 1 are $\chi^2_{(130)} = 181$, normed $\chi^2 = 1.39$, p = 0.002, CFI = 0.954, SRMR = 0.057, RMSEA = 0.047 with a sample size of 191 responses. The second model incorporates response effectiveness that allows us to investigate if a chosen organizational response was effective in mitigating the PRS. In this case, only respondents who had actually experienced the resource scarcity can assess the effectiveness of the organizational responses. The fit indices for model 2 are $\chi^2_{(167)} = 217$, normed $\chi^2 = 1.3$, p = 0.006, CFI = 0.936, SRMR = 0.068, RMSEA = 0.056 with a sample size of 102 responses.

Normed χ^2 with values <2 suggest a strong model fit (Papke-Shields, Malhotra and Grover 2002). In our case, the values for model 1 and 2 are 1.39 and 1.3, respectively. Regarding the values

for SRMR and RMSEA, Hu and Bentler (1999) suggest values of <0.08 and <0.06, respectively, for good model fits. Our models show strong fits with SRMR values <0.07 and RMSEA values <0.06 for both models. Lastly, CFI values of 0.95 and higher suggest a strong model fit (Hu and Bentler 1998). In both models, CFI values are >0.95. We can conclude that both structural models 1 and 2 have strong goodness-of-fit statistics.

4. Results

4.1. Qualitative Findings

Content analysis of open-ended questions helps to identify contextual factors (e.g., type of resource, industry) that play an important role in how purchasing managers cope with PRS. We conducted content analysis of the open-ended questions regarding the type of resources that were expected to be scarce, the reported causes of PRS, how participants learned about the PRS, and the organizational responses to the PRS. Concerning the resource type, 31 percent of the participants reported semi-finished goods, while 23 percent described raw materials that were perceived to be scarce. In addition, non-tangible resources, such as talent (14%) and services (7%), played an important role as well. Table E2-4 summarizes the identified resource categories and highlights that scarcity affects tangible and intangible resource alike. Supplier-related issues, such as insufficient capacity or a small supply pool, were mentioned most frequently as causes for PRS (33%). Social reasons (e.g., lack of skilled talent) were reported as the second most important reason for why a shortage was expected (15%). The third most common cause is related to macroeconomic circumstances, such as global resource supply (13%). Other customer related causes (e.g., growth in demand) and logistics related factors (e.g., long lead times, poor inventory management) were reported as well. Further, we analyzed how the respondents learned about the PRS. The majority of participants were made aware of the PRS from their suppliers (31%). The participants' experience

and public media/news were reported as the second and third most important sources for learning about the PRS. Only 9% of the respondents reported that their firms formally analyze the market, for example, by conducting internal research and by attending conferences, to predict upcoming scarcity threats.

63
47
28
14
22
18
8
3
203

Table E2-4: Type of resource that is expected to become scarce

Next, we investigated organizational responses to mitigate PRS in two ways. First, participants described the organizational responses in open-ended questions. We analyzed the answers to identify differences regarding the relational focus of organizational responses (i.e., collaborative, self-interested). Based on content analysis, we identified responses that were collaborative, while others were focused on self-interest. Regarding collaborative strategies, one participant reported: *"We worked in partnership with our supplier to secure Tantalum powder"* (strategic purchasing manager for raw materials). Another manager described a response with a focus on the firm's self-interest as: *"We build inventory to the greatest extent what we could manage"* (purchasing manager for fiber molded trays). Other participants reported organizational responses that have elements of collaboration and self-interest. For example, a purchasing manager for lumber stated: *"Collaborating with suppliers is important to make sure our costs are staying as low as possible and getting suppliers to honor quotes from before"*.

Second, participants were provided with a list of potential organizational responses to mitigate PRS. Table E2-5 summarizes the list and indicates how many respondents considered a particular organizational response ('very much' or 'extensively' on a 7-point Likert-type scale) as a potential mitigation strategy. From the presented list of organizational responses, 'finding an alternative to the scarce resource internally' and 'collaborating with suppliers to gain access to scarce resource' were chosen most frequently by more than 55 percent of the participants. As shown in Table E2-5, firms considered mitigation strategies that have a focus on either self-interest or collaboration. Also, the analysis reveals that managers consider more than one organizational response when dealing with PRS. In total, 77 percent of respondents considered two or more organizational responses to respond to the described PRS.

Further, we investigated whether or not, the PRS had actually affected participants' firms. As summarized in Table E2-6, 53 percent of respondents indicated the PRS actually occurred. Of the respondents that indicated the PRS had not yet affected their firms, 73 managers (77%) still expected the PRS to occur. The remaining 22 participants indicated that the PRS never materialized and, therefore, did not affect the firm's operations. We asked the 108 respondents, who were actually affected by the resource scarcity, to compare the anticipated effect to the actual impact of the scarcity incident. As summarized in Table E2-7, more than 50 percent of all respondents either over- or underestimated the effect of the scarcity incident with respect to the impact, timing, and duration of the expected resource scarcity. Therefore, in the majority of the cases the respondents' perceptions of the expected resource scarcity did not reflect the actual impact of the resource scarcity. This highlights the impact of shortage uncertainty when assessing and mitigating PRS.

Table E2-5: Organizational responses to prepare for PRS

	Organizational Response	Considered f	or PRS Mitigation
1	Working internally to find an alternative to the scarce resource (e.g., substitution with similar resource, development of alternative resource)	115	56.65%
2	Collaborating with existing supplier(s) to gain access to the scarce resource (e.g., building stronger relationships)	113	55.67%
3	Securing long-term access to the resource supply (e.g., long-term purchasing contracts, expanding the pool of suppliers)	103	50.74%
4	Monitoring the supply chain in collaboration with suppliers to reduce the uncertainty about the resource scarcity (e.g., shared forecasting tools)	98	48.28%
5	Developing better internal monitoring mechanisms to reduce uncertainty surrounding the resource scarcity (e.g., forecasting tools, performance evaluation of suppliers, adding new employees)	89	43.84%
6	Securing the availability of the resource internally (e.g., building inventory, reduce consumption)	84	41.38%
7	Minimizing the risk of experiencing the impact of the resource scarcity (e.g., hedging, insurance, pool of different suppliers)	77	37.93%
8	Gaining access to the resource by expanding my company's network (e.g., off-shoring my company's operations)	76	37.44%
9	Gaining control over the supply (e.g., M&A, vertical integration)	56	27.59%
10	Shifting responsibility of managing the scarce resource to another company (e.g., outsourcing, subcontracting)	53	26.11%
11	Recovering the scarce resource from customers (e.g., recycling, reusing)	52	25.62%
12	Avoiding use of the scarce resource to reduce uncertainty (e.g., divestment)	50	24.63%

Table E2-6: Actuality of PRS

Perceived Resource Scarcity	#
Actually occurred	108
Not occurred yet	73
Did not occur	22

Table E2-7: Comparison of perceived versus actual scarcity regarding impact, time, and length

	Impact		Т	Time		ngth	Count
Underestimated	38	35.5%	40	37.4%	46	43.0%	124
Overestimated	25	23.4%	17	15.9%	21	19.6%	63
Neither nor	44	41.1%	50	46.7%	40	37.4%	134
Total	107		107		107		

Note: one respondent did not answer to this question

4.2. Hypotheses Testing

The structural model, as depicted in Figure E2-2, illustrates all statistically significant path coefficients for model 1. H1a and H1b hypothesize a negative relationship between expected resource shortage and self-interested organizational responses, and a positive relationship between expected resource shortage and collaborative organizational responses. The results reveal a strong positive effect of expected resource shortage on self-interested responses ($\gamma = 0.463$, p < 0.001). We do not find support for H1a, as the result indicates the opposite effect than hypothesized. Although positive, no statistically significant effect was found for the effect of expected resource shortage on collaboration. Therefore, the findings do not support H1b. Thus, expected resource shortage only induces self-interested organizational responses in times of PRS.

Regarding shortage uncertainty, the results reveal a negative effect of shortage uncertainty on self-interest (γ = -0.469, p < 0.001). While the finding is statistically significant, we do not find support for H2a, as the result indicated the opposite effect than hypothesized. Also, we found a negative effect of shortage uncertainty on the propensity to collaborate (γ = -0.476, p < 0.001).



Notes:

--->: dashed arrows represent non-significant effects †: 12 of the 203 responses were excluded as the relationship was discontinued and relational satisfaction was not evaluated.

Figure E2-2: Final results for model 1

This result provides support for H2b. In summary, shortage uncertainty about an upcoming scarcity affects both self-interest and collaboration negatively.

Hypotheses H3a and H4a examine the effect of self-interested responses and collaborative responses on relational satisfaction with the major supplier. Concerning self-interest, no significant effect was found on relational satisfaction, providing no support for H3a. In contrast, collaborative responses have a positive effect on relational satisfaction ($\beta = 0.684$, p < 0.001), supporting H4a. In addition, the findings in model 1 reveal significant effects of two control variables, 'prior experience with resource scarcity' and 'company size'. Experience in managing resource scarcity increases the propensity to choose self-interested responses ($\beta = 0.155$, p < 0.083). Firm size, however, has a positive effect on collaboration. Managers in larger firms are more likely to choose to collaborate with the major supplier in an effort to mitigate the PRS ($\beta = 0.127$, p < 0.098).

The remaining hypotheses were evaluated using model 2 in order to investigate the impact of actual shortages. Figure E2-3 illustrates all statistically significant path coefficients. Model 2 is consistent with model 1 on the previously tested hypotheses. However, the positive effect size between expected resource shortage and self-interested responses and the negative effect size between shortage uncertainty and collaborative responses are even larger. It is important to note that neither control variable (i.e., scarcity experience and company size) is significant in model 2. With respect to H3b, taking a self-interested response when managing PRS has no direct significant effect on the effectiveness of the organizational response. Consequently, H3b is not supported. In contrast, H4b is supported (β = 0.389, p = 0.002), whereby responding to PRS through collaboration with the major supplier helps to mitigate the resource scarcity more effectively.

To test for the moderating effect of social capital, we adopted the estimation technique as proposed by Marsh, Wen and Hau (2004) and further investigated by Steinmetz, Davidov and



Notes:

--->: dashed arrows represent non-significant effects

[†]: 6 of the 108 responses were excluded as the relationship was discontinued and relational satisfaction was not measured.

Figure E2-3: Final results for model 2

Schmidt (2011). We follow the unconstrained approach for modeling moderation for latent construct models (Marsh et al. 2004). First, the moderating effect was modeled as the product of the centered measurement items. Second, the means of the latent first-order effect variables were fixed to zero (i.e., social capital and expected resource shortage) and the means of the latent product variable (i.e., social capital x expected resource shortage) equals the covariance of the two latent constructs (Marsh et al. 2004). Because of the increased model complexity and limited sample size, we only test the moderating effect of social capital between expected resource shortage and the organizational response and exclude relational satisfaction and response effectiveness from the model.

Pertaining to H5a and H5b, the analysis reveals a significant moderating effect of social capital on the relationship between expected resource shortage and self-interested organizational responses (β = -0.279, p < 0.001). Therefore, social capital in buyer-supplier relationships weakens the positive relationship between expected resource shortage and self-interested responses. The moderating effect is illustrated in Figure E2-4. The results support H5a. Regarding the moderating effect of social capital on the relationship between expected resource shortage and collaboration, we find a significant interaction effect between expected resource shortage and social capital on collaboration (β = -0.178, p = 0.033). The main effect of expected resource shortage on collaboration remains insignificant (β = 0.068, p = 0.371). In contrast, we find that social capital has a strong main effect on the propensity to collaborate with the major supplier in times of PRS (β = 0.78, p < 0.001). Therefore, social capital alone increases the propensity to choose collaborative responses. Regarding the moderating effect of social capital in buyer-supplier relationships with low social capital, expected resource shortage leads to a higher propensity to choose collaborative organizational responses. If social capital is high, expected resource shortage leads to a lower propensity to choose collaborative organizational responses. The moderating effect is illustrated in such as the propensity to choose collaborative organizational responses.

Figure E2-5. We do not find support for H5b, as the result reveals the opposite effect than hypothesized. We summarize our findings in this section in Table E2-8.



Figure E2-4: Moderating effect of social capital on the relationship between expected resource shortage and self-interest



Figure E2-5: Moderating effect of social capital on the relationship between expected resource shortage and collaboration

	Model	Independent Variable	\rightarrow	Dependent Variable	Finding
H1a	1	Expected Resource Shortage	-	Self-Interest	not supported (significant, but opposite effect)
H1b	1	Expected Resource Shortage	+	Collaboration	not supported
H2a	1	Shortage Uncertainty	+	Self-Interest	not supported (significant, but opposite effect)
H2b	1	Shortage Uncertainty	-	Collaboration	supported
H3a	1	Self-Interest	-	Relational Satisfaction	not supported
H3b	2	Self-Interest	-	Response Effectiveness	not supported
H4a	1	Collaboration	+	Relational Satisfaction	supported
H4b	2	Collaboration	+	Response Effectiveness	supported
H5a	1	Social Capital x Expected Resource Shortage	-	Self-Interest	supported
H5b	1	Social Capital x Expected Resource Shortage	+	Collaboration	not supported (significant, but opposite effect)

Table E2-8: Summary hypotheses testing

4.3. Post-hoc Tests

We further investigate the contradicting effects of expected resource shortage and shortage uncertainty on the organizational responses and test a mediated model as post-hoc analysis. Mediation analysis helps to understand the underlying mechanisms between the different constructs in our model (Mathieu, DeShon and Bergh 2008). We investigate the mediators (i.e., selfinterested and collaborative organizational responses) in two separate, simple mediation models. After identifying the direct effects from path analysis (MacKinnon and Dwyer 1993), we investigate the mediated (indirect) effects. As summarized in Table E2-9, the direct effect of shortage uncertainty on relational satisfaction is insignificant (γ = -0.016, p = 0.894). However, the analysis confirms a negative indirect effect (β = -0.388, p < 0.001) of shortage uncertainty on relational satisfaction mediated by collaboration. In order to claim mediation, the direct effects of the independent construct on the mediator and the direct effect of the mediator on the dependent variable need to be significant (MacKinnon et al. 2002). The requirements are fulfilled as we identify a direct effect of shortage uncertainty on collaboration (γ = -0.476, p < 0.001) and a direct effect of collaboration on relational satisfaction (β = 0.684, p < 0.001). Also, the Monte Carlo Method for assessing mediation confirmed the statistical significance of the mediation effect (LCI = -0.61, UCI = -0.21) (Selig and Preacher 2008, MacKinnon, Lockwood and Williams 2004) Therefore, collaboration mediates the negative impact of shortage uncertainty on relational satisfaction. Pertaining to expected resource shortage, no mediating effects of collaborative or self-interested organizational responses were identified.

Further, we examine in two-group comparisons if situational factors change our findings. Respondents who have actually experienced the consequences of a scarcity show a higher propensity for choosing self-interested organizational responses ($\beta_{occurred} = 0.67$, $\beta_{not occurred} = 0.24$, $\chi^2 = 5.237$, p < 0.023).

Also, we test whether individual characteristics (i.e., demographic factors) of participants change our presented findings. First, we investigate the effect of the control variable 'scarcity experience' that was shown to have a positive effect on self-interested organizational responses in model 1. By conducting two-group comparisons, we analyze differences between the models for participants with high experience in managing scarcity issues (i.e., > 2 incidents) and for participants with less experience (i.e., <= 2 incidents). Results suggest that the effect of the expected resource shortage on self-interested organizational responses is higher among participants with more

NULL MODEL										
Direct Effects (no mediation)	Std. Coeff.		Unstd. Coeff.	Std. Err	Z	р				
COLL> RSAT	0.716	***	0.685	0.047	15.170	0.000				
SELF> RSAT	0.370	***	0.676	0.193	3.510	0.000				
SU> RSAT	-0.017		-0.297	0.084	-0.200	0.842				
SU> RSAT	-0.382	***	-0.467	0.083	-4.570	0.000				
MEDIATED MODEL										
Indirect Effects	Std. Coeff.		Unstd. Coeff.	Std. Err	z	р				
SIZE (CV)> RSAT	0.103	*	0.056	0.032	1.760	0.078				
ERS> COLL> RSAT	0.105		0.185	0.171	1.080	0.280				
SU> COLL> RSAT	-0.388	***	-0.476	0.140	-3.410	0.001				
Direct Effect (with mediator)										
ERS> SELF	0.463	***	0.579	0.144	4.010	0.000				
SU> SELF	-0.469	***	-0.411	0.099	-4.160	0.000				
RS EXPER> SELF	0.155	*	0.037	0.021	1.730	0.083				
ERS> COLL	0.063		0.115	0.158	0.730	0.467				
SU> COLL	-0.476	***	-0.603	0.136	-4.430	0.000				
SIZE (CV)> COLL	0.127	*	0.071	0.043	1.650	0.098				
SELF> RSAT	0.134		0.188	0.232	0.810	0.420				
COLL> RSAT	0.684	***	0.662	0.091	7.260	0.000				
ERS> RSAT	-0.130		-0.228	0.188	-1.210	0.226				
SU> RSAT	-0.016		-0.019	0.143	-0.130	0.894				
Total Effects										
ERS> SELF	0.463	***	0.579	0.144	4.010	0.000				
SU> SELF	-0.469	***	-0.411	0.099	-4.160	0.000				
RS EXPER (CV)> SELF	0.155	*	0.037	0.021	1.730	0.083				
ERS> COLL	0.063		0.115	0.158	0.730	0.467				
SU> COLL	-0.476	***	-0.603	0.136	-4.430	0.000				
SIZE (CV)> COLL	0.127	*	0.071	0.043	1.650	0.098				
SELF> RSAT	0.134		0.188	0.232	0.810	0.420				
COLL> RSAT	0.684	***	0.662	0.091	7.260	0.000				
ERS> RSAT	-0.024		-0.043	0.152	-0.280	0.778				
SU> RSAT	-0.404	***	-0.495	0.129	-3.850	0.000				

Table E2-9: Mediation results – model 1

Stat. significance: * p<0.1, **p<.05, ***p<.01, Abbr.: SIZE: Size of company, RS EXPER: Experience with resource scarcity, CV: Control Variable

scarcity experience ($\beta_{low} = 0.39$, $\beta_{high} = 0.601$, $\Delta \chi^2 = 5.237$, p < 0.02). Here, we find that facing expected resource shortage leads to self-intended responses when the manager had a lot of experience with previous scarcity issues. Second, the level of 'responsibility' was found to have a

moderating effect on the relationship between shortage uncertainty and self-interested organizational responses (β = 0.58, p < 0.001). As job responsibility increases, managers are more likely to choose self-interested mitigation strategies. The main effect of shortage uncertainty on self-interested response remains negative (β = -0.471, p < 0.001).

5. Discussion and Conclusion

In this study, we investigate PRS as a combination of expected resource shortage and shortage uncertainty and its impact in buyer-supplier relationships. Qualitative findings show that perceived resource scarcity is associated with a large variety of tangible and intangible resources. Also, it is important to study PRS across the entire supply chain as it is caused by upstream and downstream incidences in a firm's supply chain. Further, the lack of formal analysis to learn about upcoming scarcity threats in the market leads to shortage uncertainty and increases the difficulty to estimate the impact of PRS. Content analysis revealed that purchasing managers learn about PRS from other firms in the supply chain, public media or through experiencing actual shortages. Only in a few cases, firms analyze the business environment to identify potential scarcity threats in the market leads to shortage duration of PRS. Understanding the uncertainty surrounding the expected resource shortage depicts an important challenge as perceptions influence the choice of organizational responses to mitigate the scarcity threat.

We develop and test latent measurement constructs for PRS as a combination of expected resource shortage and shortage uncertainty. EFA revealed that expected resource shortage is characterized by the magnitude of an expected resource shortage. Purchasing managers are most concerned about the potential impact on the firms' operations. In contrast, shortage uncertainty is measured by items describing the uncertainty about the magnitude, timing, and duration of the expected resource shortage. Here, shortage uncertainty is equally driven by the lack of information

about the magnitude, timing, and duration of the expected resource shortage. Consequently, purchasing managers are ambiguous about a PRS independent from what causes the shortage uncertainty. CFA verified discriminant validity between both expected resource shortage and shortage uncertainty indicating the importance of studying PRS as two separate constructs.

Importantly, expected resource shortage and shortage uncertainty influence what organizational response firms choose to mitigate PRS. Results suggest opposite effects of expected resource shortage and shortage uncertainty on the propensity to choose self-interested organizational responses in times of PRS. On the one hand, expected resource shortage facilitates organizational responses that focus on self-interest. When resources become unavailable, firms are more concerned about their own performance than solving the crisis with regard for the major supplier. In contrast, shortage uncertainty creates a lower propensity to choose self-interested organizational responses. Moreover, purchasing managers were also less inclined to respond collaboratively with the major supplier to mitigate the PRS. The findings suggest that firms are hesitant to implement any organizational response in times of high shortage uncertainty. The hesitance may indicate uncertainty avoidance as described by behavioral theory (Camerer and Weber 1992). As purchasing managers are unwilling to act when facing shortage uncertainty, firms may not be sufficiently prepared for an upcoming resource scarcity with potentially detrimental effects on firms if the PRS actually occurs. This is especially important as complex supply chains are inherently uncertain and expected resource scarcities are difficult to anticipate. To avoid detrimental effects of PRS, firms need to increase awareness for uncertain scarcity threats and gather information about upcoming shortages. By reducing shortage uncertainty, firms lower the risk of being insufficiently prepared for expected resource shortages.

Further, our findings suggest different organizational responses to PRS than predicted by organizational theories such as RDT and TCE. Pertaining to expected resource shortage, the results

do not confirm the formation of coalitions to secure stable and low-cost resource access as predicted by RDT (Ulrich and Barney 1994). Other factors may influence the decision what organizational response is chosen to mitigate the anticipated shortage. For example, firms' responses may be driven by purchasing managers' behavioral reactions to PRS. Behavioral literature has described cognitive biases in times of expected resource shortage that lead to a more competitive orientation (Roux, Goldsmith and Bonezzi 2015). Similarly, we have identified the choice of self-interested organizational responses when respondents anticipated the unavailability of resources. Regarding shortage uncertainty, behavioral research discussed risk averse and irrational decision making in times of uncertainty (Camerer and Weber 1992, Gneezy, List and Wu 2006). Accordingly, we have seen negative effects of shortage uncertainty on both collaborative and self-interested organizational responses. In conclusion, behavioral responses to different dimensions of PRS (i.e., expected resource shortage, shortage uncertainty) may influence managers' decisions making process and, consequently, explain our findings regarding firms' organizational responses to PRS.

Concerning the impact of PRS and the organizational responses on buyer-supplier relationships, we do not find direct effects of expected resource shortage or shortage uncertainty on relational satisfaction. Against our predictions, the inclination to choose self-interested organizational responses does not affect relational satisfaction. Here, a self-interested response without regard for the major supplier may describe an internal decision within the (buying) firm without consequences on how the purchasing manager perceives the relationship with the major supplier. Potentially, the relationship with the major supplier remains unaffected as long as the major supplier does not learn about the self-interested responses and acts accordingly. Future research should investigate the long-term consequences of self-interested responses in buyersupplier relationships.

In contrast, the propensity to collaborate with the major supplier is positively related to the level of satisfaction with the major supplier in times of PRS. In addition, we find that collaboration and relational satisfaction are key drivers for effectively mitigating PRS. The importance of collaboration is reinforced by identifying a strong relationship between collaborative responses and response effectiveness. Collaborative approaches to mitigate PRS are perceived to be more effective. Also, collaborative responses act as a mediator between shortage uncertainty and relational satisfaction and mitigate the negative indirect effect of shortage uncertainty on relational satisfaction. Therefore, firms without a focus on collaborative problem solving may experience the negative effects of shortage uncertainty directly. However, firms need to actively engage in collaborative strategies. PRS alone does not induce collaborative responses as neither expected resource shortage nor shortage uncertainty has a positive effect on collaboration. Firms must recognize the importance of and engage in collaborative responses to mitigate PRS. This finding emphasizes the importance of preparing for PRS and the awareness for effective organizational responses.

In addition, we study the importance of social capital in buyer-supplier relationships in times of PRS. Social capital has a positive main effect on choosing collaborative responses with the major supplier. While the direct effect of expected resource shortage on collaboration is insignificant, the moderation analysis provides further insights. The findings indicate that in relationships with low social capital expected resource shortage results in a higher propensity to collaborate, while in relationships with high social capital expected resource shortage leads to a lower propensity to collaborate with the major supplier. However, the interaction effect is much weaker and superposed by the main effect of social capital on collaborative responses. Furthermore, social capital weakens the inclination to respond to expected resource shortages with self-interest. Consequently, social capital describes an important moderator to facilitate

collaborative and less self-interested organizational responses and, considering the mediating effect of collaboration, to increase response effectiveness and relational satisfaction.

Lastly, we investigated the effect of various control variables in the model. First, purchasing managers in larger firms indicated a higher propensity to solve PRS in collaboration with the major supplier. Smaller firms may feel more threatened by PRS leading to more self-interested organizational responses while larger firms have more opportunities (e.g., more resources) to implement collaborative initiatives to mitigate the PRS. Also, the large fraction of smaller firms in our sample (30% with sales less than \$100 million) may explain why the results did not reveal positive effects of either expected resource shortage or shortage uncertainty on collaborative organizational responses. Second, we studied the effect of individual characteristics such as experience with previous resource scarcity and the level of responsibility for managing a scarcity threat. Both experience and responsibility increase the propensity to select self-interested organizational responses to mitigate the PRS. Managers may have experienced the importance of focusing on their firms' interests rather than considering the relationship with the major supplier. High responsibility could increase the feeling of being accountable for solving the PRS. To avoid any blame, purchasing managers exhibit a higher interest in the welfare of their own firm rather than considering the needs of the major supplier.

In summary, this is the first study that empirically investigates PRS and organizational responses to mitigate PRS in buyer-supplier relationships. The findings provide insights on how different dimensions of PRS (i.e., expected resource shortage and shortage uncertainty) influence firms' responses to mitigate PRS. The contradicting and unexpected effects of expected resource shortage and shortage uncertainty call for further research. Other organizational and behavioral frameworks may be helpful to explain some of the unexpected findings, such as the unwillingness to respond to PRS in times of high shortage uncertainty. In addition, collaborative organizational

responses seem to be the main driver for relational satisfaction and response effectiveness. While self-interested organizational responses were shown to have no impact, future research may consider long-term ramifications of self-interest in buyer-supplier relationships. Acting without regard for the major supplier may negatively affect buyer-supplier relationships in the long-term while solving the PRS in the short-term. REFERENCES

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ESSAY 3

MANAGING EXPECTED RESOURCE SHORTAGES IN SUPPLY CHAINS:

AN EXPERIMENTAL STUDY

1. Introduction

"Resource scarcity captures our mind and changes how we think" Mullainathan and Shafir (2013)

In global supply chains, resource scarcity describes a common threat for firms. Predicting the future availability of resources becomes more difficult as the resource state is influenced by economic and social changes. The lack of information about future resource scarcity increases the difficulty to effectively manage resource availability. Due to scarcity concerns, firms invest in organizational responses to stabilize the resource supply. For example, Delta Airlines acquired a refinery for \$150 million in Pennsylvania in 2011 in order to gain control over the supply of kerosene and to reduce procurement costs (Postrel 2012). With today's lower oil prices, questions arise if the long-term investment in upstream capacity proves to be a profitable decision. In another example, Mars Inc. invested in collaborations with cocoa farmers in the Ivory Coast to provide training as a response to anticipated long-term shortage of cocoa beans (Wexler 2016). Considering the lack of information about the future resource availability in both examples, managers are challenged to identify adequate organizational responses to mitigate scarcity threats. What drives decision makers to choose certain mitigation strategies especially when the effectiveness is not assured?

Resource scarcity has been studied by different disciplines (e.g., economics, organizational management, sociology, psychology) with a focus on either organizational or behavioral implications of scarcity. Various *organizational responses* can be taken to protect against expected resource shortages. For example, Bell et al. (2012) conceptualizes three main organizational responses for managing natural resource scarcities, which include resource employment strategies, conservation approaches, and mitigation strategies. To secure access to scarce resources, research advocates organizational responses that focus on relational mechanisms (Pfeffer and Salancik
1978), whereby collaboration can enable a firm to secure stable and low-cost access to scarce resources (Ulrich and Barney 1984). However, not all organizational responses are collaborative (e.g., vertical integration). The organizational response selected may have long-term implications to a firm's relationships with its supply chain partners. Responses that emphasize solving the scarcity collaboratively may result in stronger buyer-supplier relationships, while less collaborative approaches may harm existing relationships. Supply chain research has not examined the impact of organizational responses to scarcity threats on buyer-supplier relationships.

Research in supply chain management that discusses organizational responses (i.e., strategies selected) to specific issues (e.g., risks, environmental changes) does not typically incorporate behavioral responses toward others in supply chains. However, organizational responses are selected by managers, who are affected by behavioral responses. Research examining managers' *behavioral responses* has shown that irrational decision-making can lead to costly and ineffective organizational responses.

With respect to expected resource shortage, when managers perceive resources to be scarce, scarcity bias occurs, which can lead to irrational decision-making (Mittone and Savadori 2009). Scarcity bias is a cognitive mechanism that influences how managers cope with scarcity threats (Mittone and Savadori 2009, Simon, Houghton and Aquino 1999) and affects how managers behave toward others, such as social motives (Pronin 2006, Shah et al. 2012). Social motive illustrates the extent to which managers value the welfare of others in comparison to their own welfare (Messick and McClintock 1968, Liebrand 1984). Behavioral responses are reflected in managers' social motives, which, in the case of buyer-supplier relationships, can affect how managers behave toward their suppliers affecting the likelihood that managers select collaborative responses for resolving the expected resource shortage. While situational cues (e.g., contractual obligations, influence of supervisor) may override the impact of social motives (Dehue, McClintock

and Liebrand 1993), behavioral effects, due to social motives, should be considered (Van Lange 2000, Smeesters et al. 2003). To date, supply chain research has not investigated how social motives affect organizational responses and buyer-supplier relationships.

This study follows an interdisciplinary approach and combines organizational and behavioral responses to expected resource shortage in buyer-supplier relationships. We use scenario-based experiments to investigate the effect of expected resource shortage on managers' social motives and the propensity to solve the expected resource shortage in a more (or less) collaborative manner with the major supplier. Further, we investigate to what extent social motives influence the propensity to collaborate in times of expected resource shortages. Our study contributes to the purchasing and supply chain management literature in several ways. First, this research examines the behavioral effects of expected resource shortage on managers' social motives. Second, we study how the expected resource shortage and social motives affect a manager's propensity to choose collaborative organizational responses to mitigate the expected resource shortage. Third, we discuss the effect of uncertainty surrounding the anticipated scarcity on the behavioral and organizational responses to scarcity threats. Similar to the expected resource shortage, uncertainty was shown to be another factor that influences the decision making process (Flynn, Koufteros and Lu 2016). Lastly, we investigate the impact of relational capital between in buyer-supplier relationships on the organizational response to the expected resource shortage.

The remainder of this paper is structured as follows. We provide an overview of the literature on expected resource shortage and develop hypotheses regarding the effects of expected resource shortage on organizational and behavioral responses. Further, we discuss our scenario-based experiments to investigate managers' responses to scarcity threats with regard to the social motive toward the major supplier and the inclination to collaborate with the major supplier to

mitigate the scarcity threat. We conclude our study with a discussion of findings as well as theoretical and managerial implications.

2. Background and Hypotheses Development

2.1. Expected Resource Shortage

Expected resource shortage (ERS) describes an anticipated resource scarcity and is characterized as the "quality of something that is unavailable, insufficient or not plentiful" (Cunha et al. 2014, p. 202). Further, ERS describes a situation (i.e., insufficiency of resources) that is difficult or even impossible to repair (Buechner 2014). To date, resource scarcity in supply chain management research has focused on the unavailability of tangible resources, such as natural resources (e.g., Bell et al. 2012, Winston 2014), labor (e.g., Morrison 2015), and physical inventory (e.g., Sterman and Dogan 2015). However, ERS can also affect various tangible and intangible resources (George, Schillebeeckx and Liak 2015), such as transportation capacity and knowledge/capabilities. ERS reflects the value a firm may lose due to an upcoming shortage and is discussed as a factor creating long-term inefficiencies, deteriorating capabilities, and less effective social relationships between employees within a firm (Morrison 2015). Also, research has identified ERS as a source of division and conflict in organizations (Pondy 1969, Staw and Szwajkowski 1975).

Considering the negative effects of ERS on businesses, firms are challenged to find adequate *organizational responses* (Morrison 2015, Bell et al. 2012). Some research highlights the importance of generating internal efficiencies to mitigate resource scarcity (Starbuck and Hedberg 1977, Whetten 1980). Other research emphasizes that firms are interdependent in their resource environments (e.g., factor markets) and, as such, cannot focus solely on internal strategies (Capron and Chatain 2008). For instance, Winston (2014) discusses the increasing importance of implementing long-term solutions and creating resilient supply chains. In this research, we focus on

the importance of collaboration as a means for managing resource scarcity through, for example, closed-loop supply chains (Blackburn et al. 2004, Bell et al. 2013), joint ventures (Ulrich and Barney 1984) and relationship building (Bode et al. 2011).

When assessing ERS, managers need to estimate the availability (or lack) of resources in complex and dynamic supply chains (George, Schillebeeckx and Liak 2015). Constantly changing information about the current and future availability of a resource can affect how managers attempt to secure resource supply (Eisend 2008). As accurate information about upcoming scarcity threats is not always available, managers must assess and manage a potential shortage based on their perceptions. Therefore, it is important to understand managers' behavioral responses to ERS (Kraaijbrink et al. 2010). As managers rely on their perceptions and are challenged by bounded rationality, they may not act rationally (Zwane 2012, Gigerenzer and Gaissmaier 2011). In times of ERS "a scarcity mind-set emerges" (Shah, Shafir and Mullainathan 2015, p. 402) that influences managers' decision making process. In particular, when resources are perceived to be scarce, a cognitive bias, called scarcity bias, can occur. The theory of scarcity bias predicts that "the subjective value of a good increases due to the mere fact that it is scarce" (Mittone and Savadori 2009, p. 453). Importantly, Mittone and Savadori (2009) demonstrate that the scarcity bias exists for any kind of resource, independent from the true (i.e., objective) availability or the strategic importance of that resource. Further, Mullainathan and Shafir (2013) assert that the scarcity bias is not simply a product of irrational behavior, but a systematic bias, which occurs in times of ERS. Instead of responding to objective information about the state of a scarce resource, managers make decisions based on subjective, potentially irrational cues (Shah et al. 2012, Mittone and Savadori 2009).

Research has shown that the scarcity bias results in managers making poor quality decisions as they attempt to mitigate the ERS (Zwane 2012). The theory of scarcity bias suggests that ERS

leads not only to a higher valuation of scarce resources, but also to an increased willingness to pay for scarce resources (Lynn 1989, Lynn 1992, Shah et al. 2012). As part of the scarcity bias, managers direct their attention to the scarce resource even to the point of neglecting other, potentially more important challenges than mitigating the ERS (Mullainathan and Shafir 2013). Managers focus on immediate scarcity threats rather than preparing for long-term challenges (Shah et al. 2012). Consequently, the scarcity bias results in less comprehensive decision-making (Simon et al. 1999) and can lead to diminishing performance (Bozzolo and Brock 1992, Shah et al. 2012). Considering the broad implications of the scarcity bias on decision makers, we study the effect of the behavioral responses to ERS on the organizational response to mitigate the scarcity threat. Next, we discuss behavioral and organizational responses to ERS relevant in supply chains.

2.2. Behavioral Response: Social Motive

Social motives, also referred to as social value orientation by Murphy, Ackermann and Handgraaf (2011), describe the "quantity of how much a DM [decision maker] is willing to sacrifice in order to make another DM better off (or perhaps worse off)" (p. 772, square bracket added). Management literature traditionally argues that self-interest is the most important, and potentially the only relevant, motivator for behavior (Gerbasi and Prentice 2013). However, recent studies in social psychology have shown that certain observed behaviors cannot be explained by profit maximization (i.e., self-interest) only (Cropanzano, Goldman and Folger 2005, Murphy and Ackermann 2014). Rather, fairness and reciprocity can motivate behavior, reflecting an interest not only in the self, but also in others (Camerer and Thaler 1995, Gerbasi and Prentice 2013). In supply chain research, Autry, Skinner and Lamb (2008) discuss a similar behavior in the context of interorganizational citizenship behavior, defined as "behavioral tactics, generally enacted by boundary personnel, that are discretionary, not directly or explicitly included in formal agreements" (p. 54).

Social motives can be represented by benevolence, which is defined as "the degree to which one party is genuinely interested in the other's well-being and seeks joint gain." (Doney and Cannon 1997, p. 36). Conceptually, benevolence describes the notion of helping behaviors (George and Jones 1997). For example, the buying firm may support a supplier by providing financial resources or knowledge so that the supplier can acquire expertise, knowledge or machines to eliminate the ERS. This investment may or may not result in actual returns to the buying firm. Therefore, we study two forms of benevolence: altruistic and mutualistic benevolence (Lee et al. 2004). *Altruistic benevolence* refers to helping behavior that enhances the partner's well-being without an expectation of future gain for the own firm (Jarvenpaa, Knoll, and Leidner 1998). *Mutualistic benevolence* refers to helping behavior motivated by an expectation of mutual gain in the relationship (Doney and Cannon 1997, Johnson et al. 1996). In this sense, mutualism brings in elements of self-interest because the helping behavior is done due to the belief that reciprocity will occur. Both altruistic and mutualistic benevolence describe a behavior that develops beyond the scope of formal contracts in buyer-supplier relationships (Lee et al. 2004).

Considering the behavioral effects of the scarcity bias on decision making processes, we investigate how ERS influences the managers' social motives toward the major supplier. In behavioral experiments that investigate the effect of resource scarcity on managers' behaviors, Roux, Goldsmith and Bonezzi (2015) find that scarcity activates "a more general competitive orientation, which then affects subsequent decision making (...) that are not explicitly linked to the resource that was described as scarce" (p. 13). Darley and Batson (1973) highlight that managers are less likely to exhibit helpful behaviors under time restrictions (i.e., scarcity of time). When the ERS only lasts for a limited amount of time, managers show more competitive behaviors (Grossman and Mendoza 2003). Staw and Swajkowski (1975) find that managers in resource scarce environments are not only more competitive, but are also more likely to commit illegal acts. Due to

the higher cognitive load, managers, in times of ERS, tend to focus on simplified and short-term solutions rather than on innovative, complex solutions (Laughlin and Brady 1978). When choosing more simplified solutions, managers avoid interaction with others (Booth 1984) and, therefore, are less inclined to show consideration for others. As such ERS prompts managers to behave in a less benevolent manner. Thus, we put forth the following hypothesis:

H1a: In times of high expected resource shortage, managers exhibit lower mutual benevolence toward the major supplier.

H1b: In times of high expected resource shortage, managers exhibit lower altruistic benevolence toward the major supplier.

2.3. Organizational Response: Collaboration

As supported by resource dependency theory (RDT), interfirm collaboration has been considered a key force for successful supply chain management (Richey and Autry 2009). Based on the resource-based view, firms must possess valuable, rare, inimitable, and non-substitutable (VRIN) resources to achieve a sustainable, competitive advantage (Barney 1991). These resources may be tangible or intangible (Wernerfelt 1984) and, thus, include human, financial, physical, technological, organizational, reputational, and relational resources (Dyer and Singh 1998, Fernandez, Montes and Vazquez 2000). Through collaboration, firms form relationships to generate value that they cannot create on their own (Fawcett, Magnan and Williams 2004) making the resource inimitable and non-substitutable. Barney (1991) highlights rareness as a characteristic that allows firms to "exploit opportunities or neutralize threats in a firm's environment" (p. 106). Resources that are expected to be scarce are "rare" in the sense that they represent resources that are not available in quantities sufficient to meet demand. Collaboration is a mechanism for gaining access to scarce resources (Hillman et al. 2009).

Research by Aiken and Hage (1968) and Molar (1978) suggest that resource scarcity motivates firms to cooperate. When firms lack access to scarce resources they may realize their

dependence on reliable resource supply and attempt to gain access to scarce resources through some form of social coordination and relationships (Pfeffer and Salancik 1978). For example, firms may choose to develop joint ventures (Ellram 1992) or establish alliances and collaborations (Hillman et al. 2009). Oliver (1990) argues when "resources are scarce and organizations are unable to generate needed resources, they will be more likely to establish ties with other organizations" (p. 250). In this way, collaboration helps to share expertise and to access each other's knowledge (Spekman et al. 1998) in order to mitigate the ERS more effectively. Therefore, when resource shortages are expected, managers choose to collaborate with suppliers to secure scarce resources (Ulrich and Barney 1986). We hypothesize a positive relationship between ERS and collaboration with the supplier as the organizational response to solve the ERS, leading to the following hypothesis:

H1c: In times of expected resource shortage, managers choose a high degree of collaboration as the organizational response to mitigate the scarcity threat.

2.4. Social Motive as a Mediating Factor

Roch and Samuelson (1997) illustrated that, in times of resource scarcity, managers choose different organizational responses, based on their social motives. Specifically, self-interested managers (i.e., managers who have less benevolent social motives) would secure more resources than managers with less self-interest (Roch and Samuelson 1997). Social motives have been found to be consistent predictors of cooperative behavior (De Dreu and Van Lange 1995, Smeesters et al. 2003). Considering the impact of behavioral responses on decision making processes (Van Lange 2000, Smeesters et al. 2003), we investigate the effect of social motives when managing ERS. Not only ERS itself, but also the impact of ERS on social motives, may influence the strategic choices in buyer-supplier relationships. Therefore, we investigate how social motives in times of ERS influence

(i.e., mediate) the degree of collaboration chosen to mitigate the anticipated shortage. We put forth the following two hypotheses:

H2a: Altruistic benevolence mediates the relationship between expected resource shortage and the degree of collaboration.

H2b: Mutualistic benevolence mediates the relationship between expected resource shortage and the degree of collaboration.

2.5. Impact of Shortage Uncertainty as a Moderating Factor

Shortage uncertainty describes the ambiguity pertaining to the anticipated impact of ERS. For example, it may be expected that a resource will have a future shortage (e.g., drought conditions affecting a corn crop leads to ERS), but it is unclear how much the resource availability will be affected (e.g., future corn crop affected by drought, but uncertainty concerning the quality and volume of corn yield leads to shortage uncertainty). Shortage uncertainty may involve uncertainty about the potential severity of the shortage, uncertainty about the effect of the scarcity threat on the firm's business, and/or uncertainty about the choice of effective organizational responses (Milliken 1987, Daft and Macintosh 1981). It is important to investigate shortage uncertainty as research suggests that uncertainty leads to less effective decision-making (Von Neumann and Morgenstern 1944, Gneezy et al. 2006, Simonsohn 2009).

In uncertain and dynamic market environments, firms are forced to constantly adjust governance structures (Williamson 1985, Williamson 1998) to prepare for upcoming, potential scarcity threats. Managers that face shortage uncertainty are required to rely on more rigid contracts (Dahlstrom and Nygaard 1995) or to engage in self-interested behavior (Ouchi 1980, Rindfleisch and Heide 1997). Managers do not know how the partner firm will act in uncertain environments. For example, a partner firm may increase prices when future resource shortages are expected. Due to the uncertainty, managers become more risk averse when faced with high uncertainty (Camerer and Weber 1992), which may decrease the likelihood that managers' behave benevolently. Therefore, ambiguity about the ERS may lead to a lower propensity to exhibit benevolence toward the major supplier.

In high uncertainty environments, transaction cost economics (TCE) predict that firms secure uncertain resource supply through centralized and formal governance structures (Williamson 1985, Rindfleisch and Heide 1997). Firms must create safeguards and protect their business from self-interested behaviors. Contracting can help to reduce shortage uncertainty and is considered as an effective way to shield against opportunism (Manuj and Mentzer 2008). Therefore, firms rely on formal contracts rather than relying on informal mechanisms, such as collaboration. As such, we propose that shortage uncertainty will decrease the effect of managers' social motives in times of ERS on the degree of collaboration. As such, we test the following hypotheses:

H3a: The mediation effect of mutualistic benevolence between expected resource shortage and the degree of collaboration increases when shortage uncertainty is low.

H3b: The mediation effect of altruistic benevolence between expected resource shortage and the degree of collaboration increases when shortage uncertainty is low.

2.6. Impact of Relational Capital as a Moderating Factor

Relational capital is an important interorganizational resource that can lead to improved relationship outcomes (Cousins, Handfield, Lawson and Peterson 2006). Relational capital in supply chains is defined as "the configuration and social structure of the group through which resources are accessed." (Cousins et al. 2006, p. 853), and is characterized by interpersonal interactions and trust in buyer-supplier relationships (Gilliland and Bello 2002, Cousins et al. 2006). Social connections are deemed to be important for achieving superior performance and to enhance supplier relationships (Cousins et al. 2006), and, therefore, may influence managers' social motives and/or their decision to respond to the ERS by collaborating (or not) with the supplier. Kale et al. (2000) argue that relational capital can help to limit self-interested behavior and facilitate learning. Relational capital motivates supply chain partners to share more information and solve problems

jointly (Zajac and Olsen 1993). We argue that relational capital has a positive impact on benevolent behavioral responses and collaborative organizational responses to ERS and propose the following hypotheses:

H4a: Relational capital is positively related to altruistic benevolence.

H4b: Relational capital is positively related to mutualistic benevolence.

H4c: Relational capital is positively related to collaboration.

Figure E3-1 visualizes the proposed model and summarizes the hypothesized relationships. First, we hypothesize that ERS influences managers' social motives and the inclination to choose collaboration with the major supplier as an organizational response. Second, we propose that managers' behavioral response (i.e., social motive) influences the organizational response (i.e., collaboration) to ERS. Lastly, we account for potential moderating effects of shortage uncertainty and relational capital when managing ERS.



3. Method

3.1. Experimental Vignettes

Behavioral experiments are widely used in business research to investigate managers' behavior in controlled environments (Katok 2011). The goal is to understand the influence of situational variables on decision-making by manipulating controlled treatments (Bendoly, Donohue and Schultz 2006). One approach used in behavioral experiments is the experimental vignette methodology (EVM) using scenario-based vignettes. A scenario-based vignette is defined as "a short, carefully constructed description of a person, object, or situation, representing a systematic combination of characteristics" (Atzmüller and Steiner 2010, p. 128). As these scenario-based vignettes represent real-world situations, EVM experiments are less likely to be criticized, in comparison to other behavioral experimental approaches, for low external validity. EVM is especially useful when relationships between the constructs of interest cannot be easily examined empirically (Finch 1987). The realism of vignettes also helps to examine the change of social motives in times of ERS. As studying managers' behavior (i.e., social motives) in real business environments in times of ERS is difficult, vignettes allow us to manipulate characteristics of ERS, shortage uncertainty and other situational factors and to causally investigate the effect of ERS on behavioral and organizational responses (Bendoly and Eckerd 2013).

Scenario-based vignettes have been used to study buyer-supplier environments (Pruitt and Lewis 1975, Bendoly, Donohue and Schultz 2006) and how managers make decisions regarding, for example, order quantities and inventory levels (Eckerd et al. 2013, Tokar et al. 2013). Vignettes are applicable for studying managers' intentions, attitude and behaviors (Aguinis and Bradley 2014), and can be used to explore cause-effect relationships (Aguinis and Vandenberg 2014). We create vignettes that represent different ERS scenarios in order to investigate the conceptual model and hypotheses.

We follow the approach as suggested by Rungtusanatham et al. (2011) to develop the vignettes for our different scenarios. Our vignettes describe situations in which a buyer/purchasing manager is facing an ERS. In the pre-design stage, we collected information from real-world cases reported in the public media (i.e., newspaper articles) and from prior research. The realism in the scenarios enables participants to immerse themselves in the described situation in order to respond as if it is a real-world business situation (Shephard and Zacharakis 1999). Additional information, such as figures and charts, are used in the vignettes to increase the level of immersion for each participant (Hughes and Huby 2002). The vignettes were presented to 12 MBA students to determine if any aspects of the scenarios did not appear realistic. The scenarios were improved based on the MBA students' feedback.

3.2. Context of Investigation & Experimental Design

The basic premise of the experiment is that participants assume the role of a strategic purchasing manager, working for a company that produces catalytic converters. The participant is responsible for managing a critical raw material, palladium, used in the manufacturing process. The scenario specifically emphasizes the criticality of the resource for which there are no short-term substitutes available in the market. Further, providing sufficient supply at the lowest possible cost is stated as the most important performance measure for the manager. Immediately after introducing the scenario, the participant receives information about the expected availability and the level of shortage uncertainty for palladium (see appendices A-C for scenario descriptions and for scenario 1 and scenario 4 as examples).

A between-participants research design was employed with a $2 \times 2 \times 2$ independent factorial design. The independent variables are ERS (low or high), shortage uncertainty (low or high) and relational capital (low or high). The baseline scenario, with low levels of ERS and low shortage uncertainty, depicts the situation where no threat to supply is expected. The factorial design was

created through eight different scenarios. In order to visualize the first two independent variables, ERS and shortage uncertainty, fictitious demand-supply charts were provided (see appendix D). The charts show forecasts from various experts who are internal and external to the company. Scenarios with high ERS levels depict a large gap between supply and demand. In addition, the level of shortage uncertainty is illustrated by the level of agreement/disagreement between the different forecasts. In the high shortage uncertainty scenarios, the forecasts from the different experts are contradictory. At the end of each screen, the participants had to confirm that they studied the scenario information carefully. To model relational capital, participants also received information about the nature of the relationship between their company and the major supplier for palladium. The relationship was described as either "transactional (non-strategic)" or "strategic". To clarify the meaning of transactional versus strategic, the buyer-supplier relationship was described by the level of relational capital based on the degree of interaction, agreement, trust, and concern about each other's success (as shown in appendix E).

Following each scenario description, the participants were asked to describe their thoughts about the presented scenario. The opportunity to describe thoughts allows participants to engage in the scenario and to reflect on the presented information. Also, researchers can check if important information was understood. Next, manipulation checks were conducted to ensure the scenarios created the desired effect on participants. Participants were asked to indicate the level of agreement to statements such as "*The supply of palladium is insufficient*" for measuring the level of ERS and "*I am not exactly sure how much supply of palladium will be available in the future*" for measuring the level of shortage uncertainty. Also, realism checks were conducted to ensure that the scenarios were perceived to be "believable" (Wason, Polonsky and Hyman 2002, p. 53). Participants were asked to indicate the level of agreement with the following statements: (1) "*The scenario of this study is realistic.*" and (2) "*I took my assigned role* (Strategic Purchasing Manager)

seriously as I was responding to the questions." For both measurement items, scores averaged 4.1 and 4.55, respectively, on a 5-point Likert-type scale (anchored with "5" at "strongly agree"). Therefore, respondents found the described scenario believable and were engaged in the scenario. Finally, the participants were asked a series of questions representing dependent and control variables. The dependent variables were the level of benevolence (managers' social motives) and the degree of collaboration (mitigation strategy taken). Various control variables, such as age, gender, job experience, and level of education, were included. We also asked whether or not participants had experience in a purchasing/procurement position, with managing palladium, and/or dealing with prior resource scarcity issues, as other control considerations.

A survey research company was used to recruit experiment participants. As we were seeking to understand managerial decision-making, we required participants to have at least three years of work experience. Further, we did not require a specific job role (e.g., purchasing) to show the general validity of the behavioral responses to the scarcity bias independent from job experience. To ensure a quality sample, we used various control measures. First, participants that failed to answer attention measure questions correctly (e.g., "To verify your place in the study, please enter 3 here") were not allowed to complete the experiment. Also, we collected data that calculated how long respondents spent on each screen as well as on the overall experimental survey. Thirty-five respondents were eliminated because they spent less than ten seconds on a particular screen or less than 500 seconds on the survey. Three additional respondents were eliminated due to a lack of variance in their responses and/or they represented extreme outliers based on univariate outlier analysis. The final sample contained 358 responses.

Table E3-1 summarizes the demographic information of the respondents. The average age range of the participants was 35-49. The majority of the participants were female (68%). The two most frequently reported job roles were operations (22%) and sales (9%). Each participant was

randomly assigned to one of the eight scenarios, which was presented using Qualtrics. Table E3-2 summarizes the distribution of participants to the different scenarios. Cell sizes ranged between 39 and 51 respondents.

		Percent of
Gender	Absolute	sample
Male	114	31.8%
Female	244	68.2%
Age		
18-24	9	2.5%
25-34	109	30.4%
35-49	137	38.3%
50-64	99	27.7%
Over 65	4	1.1%
Job role		
Operations	148	41.3%
Sales	34	9.5%
Administration	27	7.5%
Customer Service	20	5.6%
Project Management	19	5.3%
Accounting	17	4.7%
Finance	15	4.2%
IT Management	14	3.9%
Purchasing	14	3.9%
Marketing	11	3.1%
Human Resources	9	2.5%
SC Analysis	7	2.0%
Logistics	4	1.1%
Other	19	5.3%
Sample size	358	

Table E3-1: Demographic information

Table E3-2: Summary of scenarios

#	Scenario (see Appendix D)	Expected Resource Shortage	Shortage Uncertainty	Σ		Relational Capital	Responses
1	Scopario 1	low(1)	low(1)	70		low (-1)	39
2				78		high (1)	39
3	Sconario 2	high (1)	low(1)	94		low (-1)	51
4	Scenario 2	nigh (1)	10w (-1)	94		high (1)	43
5	Scenario 2	low (-1)	high (1)	90		low (-1)	45
6	Scenario 5	10w (-1)	iligii (1)	30		high (1)	45
7	Sconario A	high (1)	high (1)	06		low (-1)	48
8	Scenario 4	iligii (1)	iligii (1)	90		high (1)	48
					Σ	low (-1)	183
					Σ	high (1)	175
							358

3.3. Construct Measurement & Verification

The experiment combines constructs that have been tested before in previous research as well as exploratory constructs not previously tested. ERS and shortage uncertainty were developed and tested as part of this research. Both constructs were measured with three items as shown in Table E3-3. The items for ERS were adapted from Roux et al. (2015), and only two items were retained due to a low factor loading of the third item. Three items representing shortage uncertainty were created and all were retained. Relational capital refers to the relationship quality between the focal firm (buyer) and the main supplier in the experiment. Measurement items were adapted from Doney and Cannon (1997), Ellinger, Daugherty and Keller (2000), and Moberg and Speh (2003) to address interorganizational interaction. Collaboration examines the extent to which the respondent chose to work collaboratively with the major supplier to solve the shortage issue and is measured by combing different collaboration scales used by Richey and Autry (2009), Sinkovics and Roath (2004), Lee and Choi (2003). All previously described items used 7-item Likert-type scales (e.g., "1" = strongly disagree, "7" = strongly agree).

Table E3-3: Constructs and measurement items

Construct	Measurement Items	Factor Loading	Observed Reliability	Source of Measure
	Constructs for Manipulation Checks			
Expected F	Resource Shortage (ERS)			
1	The supply of palladium is insufficient.	0.886		exploratory, adapted from
2	Epsilon Inc. will not have enough palladium in the future.	0.890	0.87	Roux et al. (2015)
3	We need to secure the supply of palladium.	excluded		
Shortage L	Incertainty (SU)			
1	I am not exactly sure how much supply of palladium will be available in the future.	0.785		
2	I am very uncertain about the future supply of palladium in the market.	0.783	0.73	exploratory
3	There is a high level of discrepancy among the major supplier, Epsilon's operations group, and industry analysts.	0.674		
Relational	Capital (RC)			
1	There is a high level of interaction between Epsilon Inc. and the main supplier.	0.900		adapted from
2	Epsilon Inc. can rely on the main supplier.	0.936	0.94	Cousins et al. (2006),
3	This supplier can be trusted at all times.	0.915		Gilliland and Bello (2002)
	Dependent Variables			
Collaborat	ion (COLL)			
1	Epsilon Inc. should closely partner with the major supplier to find a solution to	0.827		adapted from Richey, Jr.
	any potential problem related to the palladium supply.			and Autry (2009).
2	Epsilon Inc. and the major supplier must share ideas on how to secure the	0.834	0.77	Sinkovics and Roath
	future palladium supply.		0.77	(2004), Lee and Choi
3	It is important to involve the major supplier in changes related to the procurement of palladium.	0.792		(2003)

Table E3-4: Measurement of bipolar scales

Construct	Measurement Items	Factor	Observed	Source of Moscure	
Construct	Low level <	High level	Loading	Reliability	Source of Measure
Mutualistic	Benevolence (MB)				
1	I would volunteer our resources for our main supplier in order to improve Epsilon's position in the market.	I would volunteer our resources for our main supplier in order to improve Epsilon's relationship with the supplier.	0.670		
2	I would go out of my way to help our main supplier with business related issues if I sense that our business at Epsilon Inc. is threatened.	I would go out of my way to help our main supplier with business-related issues if I sense that Epsilon's relationship with the supplier is in danger.	0.673	0.74	adapted from Skinner et al. (2009) (1,2);
3	I would provide support to our main supplier in one or more ways because a long-term relationship would be economically beneficial for Epsilon Inc.	I would provide support to our main supplier in one or more ways because a long-term relationship would be economically beneficial for both parties.	0.742		Lee, Sirgy, Brown and Bird (2004) (3,4)
4	I would help our main supplier to improve Epsilon's business.	l would help our main supplier because of mutual gains.	0.710		
Altruistic B	enevolence (AB)				
1	I am concerned about our major supplier's welfare only because we depend on the supplier.	l am concerned about our major supplier's welfare because, I truly care about the supplier.	0.757		
2	Concerning the supply of palladium, I would help this supplier beyond the call of duty; however, I would expect something in return for Epsilon Inc.	Concerning the supply of palladium, I would help this supplier beyond the call of duty, and would not expect anything in return.	0.642	0.70	adapted from Lee, Sirgy, Brown and Bird (2004)
3	I would help this supplier in difficult times not because I am expected to, but because I see an opportunity for Epsilon's business.	I would help this supplier in difficult times not because I am expected to, but because I just want to help.	0.802		

With regard to social motives, we created bipolar, seven-point scales to capture participants' degree of benevolence, where higher levels represent high benevolence and lower levels represent low benevolence. As shown in Figure E3-4, an item would have the following endpoints *"I would help our main supplier because of mutual gains."* and *"I would help our main supplier because of mutual gains."* and *"I would help our main supplier because of mutual gains."* and *"I would help our main supplier to improve Epsilon's business."* where the former statement represents high mutualistic benevolence, and the latter represents low benevolence. This strategy was selected to avoid response bias by asking direct questions on self-interest. Three items for contrasting low and high altruistic benevolence were adapted from Lee, Sirgy, Brown and Bird (2004). The contrast between low and high mutualistic benevolence is measured by four items adapted from Lee et al. (2004) as well as Skinner et al. (2009). Further scale statistics, such as means and standard deviation, are summarized in Table E3-5.

		М	SD	2	3	4	5	6
1	ERS	4.48	1.64	0.424**	-0.213**	-0.105*	-0.106*	-0.022
2	SU	4.50	1.41		-0.177**	-0.191**	-0.092*	0.007
3	RC	4.42	1.72			0.401**	0.190**	0.383**
4	AB	3.00	1.29				0.468**	0.209**
5	MB	4.27	1.42					0.266**
6	COLL	5.90	0.89					

Table E3-5: Scale statistics and correlations

Notes:

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

M = Mean, SD = Standard Deviation

Principal component analysis (PCA) was conducted to test unidimensionality of each construct. Items for the manipulation checks (i.e., expected resource shortage, shortage uncertainty, relational capital) and dependent items (i.e., collaboration, altruistic benevolence, mutualistic benevolence) were analyzed separately. Table E3-3 and Table E3-4 summarize the final items and factor loadings for all constructs. For all but three items, the factor loadings are above 0.7

and significant (p < 0.01) (Nunnally and Bernstein 1994). Also, the average variance extracted (AVE) exceeds the critical value of 0.5 indicating convergent validity for all but two constructs (Hair et al. 2010, p. 709). Further, reliability is demonstrated for all constructs as Cronbach's Alpha are all >0.7 where values >0.8 represent good values, and values >0.7 represent acceptable reliability (Hair et al. 2010). Finally, discriminant validity was tested by comparing the AVE for each construct to the squared correlations (squared Spearman correlation) between two constructs. As illustrated in Table E3-6, all AVE values exceed the corresponding squared correlations indicating discriminant validity (Fornell and Larcker 1981).

Table E3-6: Discriminant validity

	ERS	SU	RC	AB	MB	COLL
ERS	0.788	0.180	0.045	0.011	0.011	0.001
SU		0.561	0.031	0.036	0.008	0.000
RC			0.835	0.161	0.036	0.147
AB				0.543	0.219	0.044
MB					0.489	0.071
COLL						0.669

Notes: AVE is on the diagonal (bold) and the squared correlations between two constructs are on the off-diagonal

3.4. Manipulation Check

Manipulation checks are essential to test the correspondence between the manipulated factors and the dependent variables of interest (Rungtusanatham et al. 2011) and were conducted for all three manipulated factors (i.e., ERS, shortage uncertainty and relational capital). After ensuring unidimensionality, composite scores¹ were used to conduct a series of ANOVAs. A comparison of means revealed that participants recognized the manipulated levels of ERS (F(1,356) = 146.65, p < 0.01; M_{low} = -0.578 and M_{high} = 0.502), shortage uncertainty (F(1,356) = 99.91, p < 0.01;

¹ For higher construct validity, we used regression-weighted composite scores. It is important to note that regression-weighted composite-scores are standardized ($\mu = 0, \sigma = 1$).

 $M_{low} = -0.491$ and $M_{high} = 0.443$) and relational capital (F(1,356) = 463.96, p < 0.01; $M_{low} = -0.731$ and $M_{high} = 0.766$). Results of the manipulation checks are summarized in Table E3-7. Also, R²-values indicate that the majority of variance is explained by the manipulated factors (ERS: R² = 0.39, shortage uncertainty: R² = 0.286, relational capital: R² = 0.579).

Factor	Levels	Mean	Std. Dev.	Significance	Partial η^2	Observed Power
FRS	Low	-0.578	0.952	n<0.001	0 332	1 000
LNJ	High	0.502	0.732	p<0.001	0.552	1.000
SU	Low	-0.491	0.973	n<0.001	0 245	1 000
	High	0.443	0.791	p \$0.001	0.245	1.000
RC	Low	-0.731	0.774	n<0.001	0 572	1 000
	High	0.766	0.508	ρ<0.001	0.575	1.000

Table E3-7: Manipulation checks

4. Results

For hypothesis 1 and hypothesis 2, ANOVAs were used to assess the three dependent variables in separate models. Cell means for the dependent variables (i.e., degree of collaboration, mutualistic benevolence, and altruistic benevolence) as a function of ERS and shortage uncertainty are presented in Table E3-8. Furthermore, the MANOVA results for the between-subjects effects, including levels of significance, values for partial η^2 , and the observed power, are summarized in Table E3-9. The full factorial design helps to understand the idiosyncratic effects of each treatment variable and to identify potential interaction effects.

Dependent	Shortage Treatment	Uncert Treatr	Marginal	
Variable		Low SU	High SU	Means
COLL	Low ERS	0.059	0.150	0.107
	High ERS	-0.160	-0.031	-0.095
	Marginal Means	-0.061	0.056	
MB	Low ERS	0.151	0.122	0.136
	High ERS	-0.164	-0.077	-0.120
	Marginal Means	-0.021	0.193	
AB	Low ERS	0.238	-0.137	0.038
	High ERS	-0.125	0.041	-0.041
	Marginal Means	0.040	-0.046	

Table E3-8: Cell means for three dependent variables

Note: All means are calculated based on the standardized composite scores.

Table E3-9: Test of between-subjects effects

Source	DV	F	Sig.	Partial η ²	Observed Power
ERS	COLL	3.282	0.071	0.009	0.439
	MB	5.796	0.017	0.016	0.670
	AB	0.525	0.469	0.002	0.112
SU	COLL	0.776	0.379	0.002	0.142
	MB	0.020	0.886	0.000	0.052
	AB	1.171	0.280	0.003	0.190
RC	COLL	32.965	0.000	0.087	1.000
	MB	12.840	0.000	0.036	0.947
	AB	37.165	0.000	0.097	1.000
ERS x SU	COLL	0.056	0.813	0.000	0.056
	MB	0.288	0.592	0.001	0.083
	AB	7.070	0.008	0.020	0.755

Hypotheses H1a and H1b propose a relationship between ERS and the social motive of a manager to behave benevolently toward the relationship and the major supplier. With regard to H1a, the comparison of cell means in Table E3-8 indicates less mutualistic benevolence ($M_{low ERS} = 0.136 > M_{high ERS} = -0.12$). The ERS manipulation has a significant effect on mutualistic benevolence

(F(1, 168) = 5.796, p < 0.017, partial η^2 = 0.02). Therefore, the results provide support for H1a. For altruistic benevolence, the mean comparison does not provide significant differences for situations with low versus high ERS (M_{low ERS} = 0.038 > M_{high ERS} = -0.041, F(1,168) = 0.525, p = 0.469). Accordingly, we do not find support for H1b.

Regarding the relationship between ERS and collaborative organizational response, the ANOVA results reveal a significant main effect of ERS on collaboration ($M_{low ERS} = 0.107 > M_{high ERS} = -0.095$, F(1,168) = 3.282, p = 0.071). Therefore, managers are less inclined to collaborate with the major supplier in times of high ERS. We do not find support for H1c, as the results reveal the opposite effect than hypothesized.

To test H2a and H2b, we employ Hayes' (2013) PROCESS macro (model 4) with both social motive variables tested in one model. First, to test for mediation, we investigate the significance of the direct effect of the mediators on the dependent variable, collaboration, and the direct effect of ERS on the mediators (MacKinnon et al. 2002). In contrast to the ANOVA results, the direct effect of ERS on collaboration is insignificant in the mediated model (direct effect = -0.140, t = -1.378, p = 0.169). The direct effect of ERS on mutualistic benevolence (γ = -0.255, t = -2.428, p = 0.016) and the direct effect of mutualistic benevolence on collaboration (β = 0.196, t = 3.390, p < 0.001) are identified to be significant. Further, the results reveal that mutualistic benevolence significantly mediates the effect of ERS on collaboration (indirect effect = -0.051, LCI = -0.110, UCI = -0.017) providing support for H2a. In contrast, the mediating effect of altruistic benevolence was not found to be significant (indirect effect = -0.012, LCI = -0.046, UCI = 0.012). Thus, the mediation test does not support H2b. Taking the direct and indirect effects together, the total effect of ERS on

collaboration becomes significant (total effect = -0.202, p = 0.056). Overall, the model reveals that the effect of ERS on collaboration is mediated through the manager's social motive.²

Next, we test H3a and H3b and apply Hayes' (2013) PROCESS macro model 8 with both mediators tested simultaneously. We summarize the regression results in Table E3-10. The results show that shortage uncertainty does not have main effects on mutualistic benevolence (main effect = 0.029, t = 0.271, p = 0.786), altruistic benevolence (main effect = -0.105, t = -0.997, p = 0.319), and collaboration (main effect = 0.120, t = 1.187, p = 0.236). Further, we investigated the mediation effect for both social motives moderated by shortage uncertainty. The indirect effect of ERS on collaboration mediated by mutualistic benevolence is robust to the moderating effect of shortage uncertainty (low shortage uncertainty: indirect effect = -0.061, LCI = -0.14, UCI = -0.012, high shortage uncertainty: indirect effect = -0.038, LCI = -0.115, UCI = -0.001). A comparison of indirect effects of ERS on collaboration in low versus high shortage uncertainty conditions did not reveal significant differences (moderated mediation index = 0.022, LCI = -0.036, UCI = 0.098). Thus, the moderated mediation test does not provide support for H3a.

Further, the regression results reveal that the main effects of ERS (β = -0.093, t = -0.882, p = 0.379) and shortage uncertainty (β = -0.105, t = -0.997, p = 0.319) on altruistic benevolence are insignificant, while the interaction effect between ERS and shortage uncertainty on altruistic benevolence was found to be significant (β = 0.539, t = 2.563, p = 0.011). Participants exhibit more altruistic behavior when ERS and shortage uncertainty are either both low or both high. In contrast, when ERS and shortage uncertainty are disparate (i.e., one high when the other is low), participants are less likely to exhibit altruistic benevolence. These findings are highlighted in Figure E3-2.

² We have tested the robustness of the mediation effect with alternative dependent measures that describe resource allocation to either the own firm (self-interest), the major supplier (altruistic benevolence) or to the relationship (mutualistic benevolence). The mediated models confirm the negative indirect effect of ERS on collaboration mediated by mutualistic benevolence. Also, confirming the results using allocation decisions instead of perceptual measures indicates that common method bias is not a problem.

Model 1				Path Coefficient	S.E.	t	р	LLCI	ULCI
ERS	\rightarrow	MB	**	-0.257	0.106	-2.434	0.015	-0.431	-0.083
SU	\rightarrow	MB		0.029	0.106	0.271	0.786	-0.146	0.203
ERS x SU	\rightarrow	MB		0.116	0.211	0.550	0.583	-0.232	0.464
ERS	\rightarrow	AB		-0.093	0.105	-0.882	0.379	-0.266	0.081
SU	\rightarrow	AB		-0.105	0.105	-0.997	0.319	-0.278	0.069
ERS x SU	\rightarrow	AB	**	0.539	0.210	2.563	0.011	0.192	0.886
ERS	\rightarrow	COLL		-0.136	0.102	-1.329	0.185	-0.304	0.033
SU	\rightarrow	COLL		0.120	0.102	1.187	0.236	-0.047	0.288
ERS x SU	\rightarrow	COLL		-0.070	0.205	-0.341	0.734	-0.407	0.268
MB	\rightarrow	COLL	***	0.192	0.058	3.319	0.001	0.097	0.288
AB	\rightarrow	COLL	***	0.157	0.058	2.689	0.008	0.061	0.253
Moderated Mediation									
direct effe	cts								
SU: low ERS	\rightarrow	COLL		-0.101	0.148	-0.683	0.495	-0.344	0.143
SU: high ERS	\rightarrow	COLL		-0.171	0.141	-1.207	0.228	-0.404	0.063
indirect efj	fects	(mediat	or: MB)					
SU: low ERS	\rightarrow	COLL	**	-0.061	0.038†			-0.140	-0.012
SU: high ERS	\rightarrow	COLL	**	-0.038	0.032†			-0.115	-0.001
indirect efj	fects	(mediat	or: AB)						
SU: low ERS	\rightarrow	COLL	**	-0.057	0.033†			-0.128	-0.016
SU: high ERS	\rightarrow	COLL		0.028	0.026†			-0.004	0.080
Model Summary				F	р	R ²			
Outcome: MB				2.089	0.101	0.017			
Outcome: AB				2.608	0.051	0.022			
Total Effect Model				7.791	< 0.001	0.101			

Table E3-10: Moderating effect of shortage uncertainty in mediation model

+bootstrapped SE

Stat. significance: * p<0.1, **p<0.05, ***p<0.01

Regarding altruistic benevolence as a mediator, the conditional effect of ERS on collaboration is significantly more negative in low shortage uncertainty conditions (indirect effect = -0.057, LCI = -0.128, UCI = -0.016). However, in high shortage uncertainty conditions, the indirect effect becomes insignificant. Therefore, altruistic benevolence is moderated by shortage uncertainty, indicating that the negative indirect effect on collaboration is only relevant when shortage uncertainty is low

(moderated mediation index = 0.084, LCI = 0.023, UCI = 0.185). The moderated mediation test provides support for H3b.



Figure E3-2: Visualization of interaction effect between expected resource shortage and shortage uncertainty

Next, we examine the moderating effect of relational capital. The results are summarized in Table E3-11. Again, we employ Hayes' (2013) PROCESS macro model 8 with both mediators tested simultaneously. Relational capital does not moderate the indirect effects of ERS on collaboration for the mediating variables mutualistic benevolence (moderated mediation index = -0.008, LCI = -0.078, UCI = 0.056) and altruistic benevolence (moderated mediation index = -0.005, LCI = -0.049, UCI = 0.019). However, the analysis reveals significant main effects of relational capital on all mediating variables and the dependent variable: mutualistic benevolence (main effect = 0.372, t = 3.58, p < 0.001), altruistic benevolence (main effect = 0.622, t = 6.165, p < 0.001), collaboration (main effect = 0.465, t = 4.480, p < 0.001). Therefore, the results provide support for H4a, H4b and H4c. The findings for all hypotheses are summarized in Table E3-12.

Model 2				Path Coefficient	S.E.	t	р	LLCI	ULCI
ERS	\rightarrow	MB	**	-0.248	0.104	-2.393	0.017	-0.419	-0.077
RC	\rightarrow	MB	***	0.372	0.104	3.588	0.001	0.201	0.543
ERS x RC	\rightarrow	MB		-0.042	0.207	-0.201	0.841	-0.384	0.300
ERS	\rightarrow	AB		-0.066	0.101	-0.655	0.513	-0.232	0.100
RC	\rightarrow	AB	***	0.622	0.101	6.165	0.001	0.455	0.788
ERS x RC	\rightarrow	AB		-0.059	0.202	-0.290	0.772	-0.391	0.274
ERS	\rightarrow	COLL		-0.139	0.099	-1.398	0.163	-0.303	0.025
RC	\rightarrow	COLL	***	0.465	0.104	4.480	0.001	0.294	0.636
ERS x RC	\rightarrow	COLL		-0.003	0.197	-0.016	0.988	-0.328	0.322
MB	\rightarrow	COLL	***	0.184	0.057	3.261	0.001	0.091	0.277
AB	\rightarrow	COLL		0.083	0.058	1.427	0.154	-0.013	0.179
Moderated Mediation									
direct effe	cts								
RC: low ERS	\rightarrow	COLL		-0.137	0.139	-0.992	0.322	-0.366	0.091
RC: high ERS	\rightarrow	COLL		-0.141	0.141	-0.993	0.321	-0.374	0.093
indirect efj	fects	(mediat	or: MB)					
RC: low ERS	\rightarrow	COLL	**	-0.042	0.031†			-0.104	-0.003
RC: high ERS	\rightarrow	COLL	**	-0.050	0.033+			-0.116	-0.009
indirect efj	fects	(mediat	or: AB)						
RC: low ERS	\rightarrow	COLL		-0.003	0.012†			-0.033	0.010
RC: high ERS	\rightarrow	COLL		-0.008	0.016†			-0.052	0.006
Model Summary				F	р	R ²			
Outcome: MB				6.316	<0.001	0.051			
Outcome: AB				12.873	<0.001	0.098			
Total Effect Model				12.110	<0.001	0.147			

Table E3-11: Moderating effect of relational capital in mediation model

+bootstrapped SE

Stat. significance: * p<0.1, **p<0.05, ***p<0.01

Lastly, we tested the effect of control variables (i.e., covariates) using MANOVA and found two significant results. Participants with a higher level of education are less likely to collaborate to mitigate ERS (F = 2.593, p < 0.10). Managers with more years of job experience show a higher propensity to collaborate to mitigate ERS (F = 6.831, p < 0.01).

Table E3-12: Summa	ry of	hypotheses	testing
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	Independent Variable	Mediator	Dependent Variable	Finding
H1a	Expected Resource Shortage		Mutualistic Benevolence	Supported
H1b	Expected Resource Shortage		Altruistic Benevolence	Not Supported
H1c	Expected Resource Shortage		Collaboration	Not Supported (significant opposite effect)
H2a	Expected Resource Shortage	Mutualistic Benevolence	Collaboration	Supported
H2b	Expected Resource Shortage	Altruistic Benevolence	Collaboration	Not Supported
H3a	Expected Resource Shortage x Shortage Uncertainty	Mutualistic Benevolence	Collaboration	Not Supported (robust to moderation)
H3b	Expected Resource Shortage x Shortage Uncertainty	Altruistic Benevolence	Collaboration	Supported
H4a	Relational Capital		Mutualistic Benevolence	Supported
H4b	Relational Capital		Altruistic Benevolence	Supported
H4c	Relational Capital		Collaboration	Supported

5. Discussion

This research investigates the behavioral (i.e., social motive) and organizational (i.e., collaboration) responses to ERS. We focus our analysis on the distinct behavioral reactions of managers in times of anticipated resource scarcity, described in the behavioral literature as scarcity bias. We show how ERS influences social motives, which, in turn, affects the degree of collaboration with the major supplier. Furthermore, managers are challenged to mitigate ERS due to uncertain and limited information about an upcoming scarcity threat. We highlight the combined effect of ERS and shortage uncertainty on how managers respond to ERS. Lastly, we investigate how relational capital between the buyers and suppliers affects behavioral and organizational responses to ERS. Our experimental findings reveal several important insights.

First, the analysis suggests that ERS influences behavioral responses (i.e., social motives) toward less mutualistic benevolent behavior and the organizational responses toward less collaboration with the major supplier, respectively. Therefore, managers exhibit more self-interested behavior that translates into more competitive organizational responses when resources are anticipated to be scarce. These findings confirm the theoretical predictions of the scarcity bias. When resources become scarce, managers focus on their firms' needs and seem to neglect the importance of solving the scarcity threat collaboratively with the major supplier. Therefore, our findings contradict organizational responses as predicted by RDT. While RDT emphasizes the importance of securing scarce resources through collaborative actions, manager's decision making process is influenced by the scarcity bias leading to more self-interested behavior and responses.

Second, we investigate the effect of uncertainty surrounding the ERS. The findings indicate no main effects between shortage uncertainty and behavioral and organizational responses to ERS, respectively. However, shortage uncertainty becomes important when considering in interaction with ERS. The interaction effect between ERS and shortage uncertainty influence managers' altruistic behavior toward the main supplier. Managers exhibit high levels of altruistic benevolence when both ERS and shortage uncertainty were either both low or both high. Therefore, altruistic benevolence occurs when the environmental threat is not existent (low shortage/low uncertainty) or most complex (high/high). On the one hand, when the scarcity threat is low, managers seem to be willing to act in the interest of the supplier without expecting any return, and, on the other hand, in the most complex situation (high ERS and high shortage uncertainty), it may be more effective to invest in the supplier directly. Here, supporting the supplier altruistically may depict a long-term investment that enables the supplier to stabilize access to critical resources.

Concerning managers' behavioral response, it is noteworthy that ERS affects mutualistic and altruistic benevolence differently. While a direct relationship was found between ERS and

mutualistic benevolence that is robust to different levels of shortage uncertainty, altruistic benevolence is only affected (negatively) by ERS when shortage uncertainty is low. Therefore, in times high shortage uncertainty, managers are more inclined to act benevolently toward the major supplier (i.e., altruistically), rather than acting benevolently toward the relationship (i.e., mutualistically). These findings highlight the importance of analyzing ERS and shortage uncertainty in combination and the multifaceted effects of ERS on managers' behavioral responses.

Third, this study investigates the mediating effects of the behavioral response to ERS on the organizational response in times of ERS. Our study reveals that managers' less mutualistic benevolent behavior, which occurs as a result of ERS, leads to less collaboration with the major supplier. Here, behavioral responses due to the scarcity bias influence the organizational response on how the ERS is mitigated. Importantly, the degree of collaboration with the major supplier in times of ERS is mediated by mutualistic benevolence. Therefore, collaboration is not a "natural" response to the ERS, but a result of managers' behavioral reaction to ERS. As the direct effect of ERS on collaboration becomes insignificant, the mediated model helps to explain the negative effect of ERS on collaboration as identified in H1c. Although collaboration might be most effective, the change in social motives may prevent managers to collaborate with the major supplier resulting in potentially costly and ineffective organizational responses to ERS. Further, managing scarcity threats without regard for the major supplier may have detrimental effects in buyer-supplier relationships.

Regarding altruistic behavior, the negative mediating effect between ERS and collaboration was only found for participants who were facing low shortage uncertainty. Therefore, the inclination to collaborate with the major supplier was negatively affected when managers were certain about the anticipated shortage. Again, the direct effect of ERS on the organizational response becomes insignificant when we incorporate the mediating effect of altruistic behavior.

Also, investigating the altruistic benevolence in the moderated mediation model explains why no mediation effect was found in the simple mediation model (i.e., why H2b was not supported). Overall, the mediation analysis helps to understand why firms apply strategies against normative strategies as predicted by organizational theories such as RDT. Our findings confirm the importance of considering both behavioral and organizational theories simultaneously to understand firms' responses in times of scarcity threats.

Fourth, our findings confirm the positive effect of relational capital in buyer-supplier relationships on behavioral and organizational responses independent from the effect of ERS. We observe a higher propensity to collaborate and more benevolent behavior in relationships with high relational capital. At the same time, relational capital does not change the effect of ERS on the behavioral response and organizational response. Even in buyer-supplier relationships with high levels of trust and interaction, the effect of ERS and shortage uncertainty on decision making processes is not eliminated. Independent of the relational capital in buyer-supplier relationships, managers exhibit a high level of self-interest when anticipating a resource shortage. Considering the effects of the scarcity bias and the focus on self-interest, ERS depicts a threat to strategic buyer-supplier relationships. The ERS may jeopardize long-term investments in relational capital leading to potentially less effective collaborations.

Lastly, our results highlight that prior job experience positively influences the propensity to collaborate in times of ERS. Over time, managers may have learned the importance of mitigating external threats, such as ERS, collaboratively with suppliers. Interestingly, however, job experience did not affect a manager's social motives. Over time, managers may be become more reliant on their suppliers and consider collaboration as the best strategy for mitigating ERS even if managers, themselves, are not socially motivated to act benevolently. Future research could examine how effective this is as research has shown collaboration is not always the best strategy (Villena, Revilla

and Choi 2011). On the other hand, this finding highlights that a manager's social motive is robust to job experience. Therefore, the scarcity bias describes a consistent and systematic effect that cannot be easily eliminated through more job experience.

6. Contributions and Conclusions

This research provides various theoretical and managerial contributions. With regard to supply chain management research, we combine behavioral and organizational theories to investigate the effect of ERS in buyer-supplier relationships. While RDT emphasizes the importance of social mechanisms to secure scarce resources, this study investigates if the normative strategies are actually chosen to solve scarcity threat. We describe the effect of behavioral responses on organizational responses and identify behaviors that are predicted by behavioral decision theory (i.e., scarcity bias). This research emphasizes the importance of combining behavioral and organizational research streams to better describe and understand phenomena in the supply chain management. Only by combining behavioral and organizational responses in the regression analysis, we were able investigate the interaction of different constructs. For instance, while simple mean comparison suggested a relationship between ERS and degree of collaboration, mediation analysis revealed no direct effects. Instead, behavioral responses to an anticipated scarcity mediate the relationship between ERS and the degree of collaboration. By investigating the mediated model, we gain understanding on how behavioral responses drive organizational responses to ERS. Also, comparing organizational and behavioral theories helps to understand why certain firms, as indicated by the initial industry examples, respond to ERS differently.

From a managerial perspective, this research highlights the importance of behavioral responses to scarcity threats. Even if certain organizational responses, such as collaboration, are considered to be effective to mitigate ERS, managers' rational decision making might be influenced

by cognitive biases. Initiatives to increase awareness for managers' behavior in complex and uncertain business situations, such as professional training, could be helpful to respond to scarcity threats more effectively. Also, formal assessment strategies for identifying ERS may reduce the dependence on managers' subjective evaluation. This research emphasizes the importance of managing ERS as the behavioral effects are robust to organizational factors such as relational capital. Even in buyer-supplier relationships with high relational capital, ERS was shown to affect managers' decision making toward more self-interested behavior despite the higher level of trust and interaction with the major supplier.

While this experimental study is one of the first studies to investigate the effect of ERS in buyer-supplier relationships. We believe that this research provides various future research opportunities. First, our experiment focuses on one organizational response (i.e., collaboration) to mitigate ERS. Future research may investigate how managers would react to ERS if other organizational responses are available, such as collusion or M&A. Second, the vignettes in this experiment only comprise one type of resource. Validating our findings by studying other tangible and intangible resources could help to generalize our findings to describe ERS as a holistic phenomenon relevant in different supply chains. Third, our experiment focuses on the decision making process of managers acting as purchasing managers. While we examined social motives as the value orientation toward the major supplier, social motives are likely to depend on behaviors and attitudes of the supplier as well. Therefore, studying social motives and behavioral reactions to ERS in dyads (i.e., buyer-supplier relationships) could lead to important insights into the behavioral dynamics in buyer-supplier relationships.

APPENDICES

Appendix A: Description of Scenario

You work for Epsilon Inc.

Epsilon Inc. is a large US manufacturer for catalytic converters (picture 1) and sells catalytic converters to various customers in the chemical, pharmaceutical, heavy equipment, and automotive industry. Epsilon's customers are located all over the world, but mainly in the U.S. and Western Europe. While Epsilon Inc. is well known for its outstanding and reliable product quality, the market for catalytic converters is very competitive.

Palladium, a precious metal, is the most critical resource for producing catalytic converters (picture 2). Major deposits of palladium were found in South Africa, Russia, and North America. Over 50% of the global supply of palladium is used to manufacture catalytic converters. Global demand increased steadily from 100 tons in 1990 to nearly 250 tons in 2014.

Securing the supply of palladium is an important strategic goal for Epsilon Inc.!







Picture 2: Palladium

Figure E3-A1: Screen 1

You are the Strategic Purchasing Manager for Epsilon Inc.

Your responsibilities include managing the supply, ensuring sufficient inventory, and managing relationships with suppliers of palladium.

Upper management frequently reminds you that palladium is critical for the future of Epsilon Inc. and it encourages you to watch and manage the supply closely. Your performance evaluation, including an annual bonus, is based on how well you manage palladium.

Figure E3-A2: Screen 2
Appendix B: Scenario 1 – low Expected Resource Shortage and low Shortage Uncertainty

As part of a monthly routine, you are reviewing the current sourcing strategy for palladium and potential strategic initiatives to ensure the availability of palladium for Epsilon Inc. in the future. For your analysis, you review historic and forecasted demand and supply data for palladium:

1. Demand Data

- Demand data reflect the amount of palladium required to meet the production goals for each month.
- As production levels are determined long-term, demand estimates are very reliable.

2. Supply Data

- Supply data reflect the expected amount of palladium available for delivery to Epsilon Inc. in each month.
- Because supply estimates can vary, you review supply forecasts from three different sources: (1) from the operations group, (2) from your major supplier, and (3) from market analysts. You form your opinion based on all sources of information.
- The three sources suggest that the forecasted **supply is expected to be sufficient** to satisfy the estimated production.
- There is a high level of agreement among the different sources of information. You feel confident about the future supply of palladium in the market.

The chart on the next screen was prepared by your data analysts to visualize the information.

Figure E3-A3: Screen 3 for scenario 1

Appendix C: Scenario 4 – high Expected Resource Shortage and high Shortage Uncertainty

As part of a monthly routine, you are reviewing the current sourcing strategy for palladium and potential strategic initiatives to ensure the availability of palladium for Epsilon Inc. in the future. For your analysis, you review historic and forecasted demand and supply data for palladium:

1. Demand Data

- Demand data reflect the amount of palladium required to meet the production goals for each month.
- As production levels are determined long-term, demand estimates are very reliable.

2. Supply Data

- Supply data reflect the expected amount of palladium available for delivery to Epsilon Inc. in each month.
- Because supply estimates can vary, you review supply forecasts from three different sources: (1) from the operations group, (2) from your major supplier, and (3) from market analysts. You form your opinion based on all sources of information.
- The three sources suggest that there will be a **significant shortage of supply** within the next few months.
- There is a considerable discrepancy among the different sources of information. Due to the different predictions about the future supply of palladium, you are very uncertain about the future supply of palladium in the market.

The chart on the next screen was prepared by your data analysts to visualize the information.

Figure E3-A4: Screen 3 for scenario 4





Figure E3-A5: Scenario 1 - low expected resource shortage, low shortage uncertainty



Figure E3-A6: Scenario 2 - high expected resource shortage, low shortage uncertainty



Figure E3-A7: Scenario 3 - low expected resource shortage, high shortage uncertainty



Figure E3-A8: Scenario 4 - high expected resource shortage, high shortage uncertainty

Appendix E: Manipulation of Relational Capital

Epsilon Inc. buys palladium from one major supplier. With this supplier, Epsilon Inc. developed a transactional (non-strategic) relationship over the last 3 years. The relationship can be characterized in the following way:

- You <u>do not interact</u> much with the main supplier. Beyond order-related data, no further information is shared.
- You <u>do not know</u> much about the main supplier's long-term strategy for the relationship with Epsilon Inc.
- You <u>do not trust</u> the main supplier to act in Epsilon Inc.'s interest in times of any problems related to the supply of palladium.
- You <u>do not feel</u> that the supplier is genuinely concerned about the success of Epsilon Inc.

Figure E3-A9: Manipulation for low relational capital

Epsilon Inc. buys palladium from one major supplier. With this supplier, Epsilon Inc. developed a close and trustful relationship over the last 15 years. This strategic relationship can be characterized in the following way:

- You <u>interact</u> with the main supplier on a frequent basis and share ideas and information regularly.
- You <u>agree</u> with the main supplier on what is best for the long-term relationship.
- You <u>trust</u> the main supplier to act in Epsilon Inc.'s interest in times of any supply related problems.
- You <u>feel</u> that the supplier is genuinely concerned about the success of Epsilon Inc.



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