Building theory can be thought of as a never-ending journey. Theory building is particularly important to disciplines that are emerging and growing. Compared to older and more established academic disciplines, logistics does not have a rich heritage of theory development. This paper aims to construct a framework that combines different research paradigms with research approaches for logistics theory building. This framework can be used for positioning studies that aim at building and articulating core logistics theories. The framework is illustrated by providing examples from logistics research adhering to different research paradigms (positivism, scientific realism and interpretivism) and using different research approaches (deduction, induction, and abduction). The paper discusses how these different research paradigms and research approaches contribute to theory building in their own way.

Introduction

Logistics has neither a unified theory (Mentzer et al., 2004) nor a rich heritage of theory development (Stock, 1997). Theory building, however, is argued to advance a discipline and profession, and is thus relatively more important to an emerging and growing discipline (Swanson, 2000). Logistics just like any other scientific discipline aims to create new, or modify existing theories (Arlbjørn and Halldórsson, 2002). Theory building can take different forms and follow different paths (Sebeok, 1983; and Nesher, 1999). As for logistics, borrowing theories from other disciplines has been advocated as a viable option for advancing the discipline (Stock, 1997; and Arlbjørn and Halldórsson, 2002). Borrowing has the advantage of learning from others and avoiding the pitfall of reinventing the wheel of building a theory.

At the same time, logistics research has often been discussed to be heavily footed in positivism and predominantly employs a deductive research approach (Mentzer and Kahn, 1995; Garver and Mentzer, 1999; Arlbjørn and Halldórsson, 2002; and Näslund, 2002). This has, however, its limitations for theory building, as the deductive derivation of hypotheses can only modify existing theories (Gioia and Pitre, 1990; and Bjereld et al., 2002). Yet, other research approaches also find their way to logistics research. The use of the inductive research approach in logistics is gaining momentum (Kovács and Spens, 2005). However, even this approach has been criticized by many, for instance Peirce (1934) stated that “[i]t never can originate any idea whatever. No more can deduction”. Despite this criticism, we argue that the deductive and the inductive research approaches are both relevant paths for advancing logistics knowledge. Kovács and Spens (2005) also discuss the use of a third, the abductive, research approach in

* Assistant Professor (Acting), Swedish School of Economics and Business Administration (Hanken), Department of Marketing, Helsinki, Finland; and the corresponding author. E-mail: kovacs@hanken.fi

** Acting Professor, Swedish School of Economics and Business Administration (Hanken), Department of Marketing, Helsinki, Finland. E-mail: karen.spens@hanken.fi

© 2007 The Icfai University Press. All Rights Reserved.
logistics research. Looking at different research paradigms and approaches, this paper thereby advocates a paradigm-based approach to theory building. In this we adhere to Gioia and Pitre (1990) who state that the grounding of theory in paradigm-appropriate assumptions helps in avoiding the common tendency of trying to force-fit functionalist/positivist theory building techniques as a universal approach. The aim of the paper is to construct a framework that combines different research paradigms with research approaches for logistics theory building. The framework can be used as a tool for positioning studies that aim at building and articulating logistics core theories. We exemplify the framework with articles using different research approaches in different research paradigms in logistics.

The paper begins with a discussion on theory building and the views of different research paradigms on theory. Thereafter, different research approaches are discussed for building theory. Building on this, a framework is presented that combines different research paradigms and research approaches for theory building in logistics. Next, this framework is discussed through examples from articles in logistics journals. A summarizing discussion of theory building in logistics concludes the paper.

Theories and Research Paradigms

Knowledge can be described as a multilevel abstraction of reality, and different layers of knowledge can be distinguished (Grønhaug, 2002). Its base consists of facts, observations, experiences and perceptions, which when recorded constitute the data. The data, when organized tabulated and presented logically and meaningfully becomes information. Information, when analyzed and processed with care can lead to inferences, generalizations and insights. Insights based on empirical observations are derived inductively, but insights can be arrived at deductively also (Ahmad, 2000). Insights can lead to formulation of concepts that become the tools for thinking, analysis and discussion. Concepts are then the basic elements for building theory (Ahmad, 2000). Figure 1 exhibits this sequence leading to theory building.

The top two boxes in Figure 1 indicate a separation between scientific theory and managerial problem solving. The ultimate goal of scientific research is to create new theories or test and/or modify existing theories (Arlbjørn and Halldórsson, 2002). Logistics literature and research have so far focused on managerial problem-solving mainly (Mentzer and Kahn, 1995). The body of knowledge for building theories exists, even concepts are fairly well developed but the step of building scientific theories is not yet accomplished.

But what is theory? The term 'theory' can mean different things, e.g., ordering-frameworks used for predicting and explaining empirical events, conceptualizations or theorizing, or even just hypotheses or explanations (Sayer, 1992). Vafidis (2002), in a review of Nordic doctoral dissertations in logistics also concludes that theories seemingly mean different things to different authors. Many of the theories referred to and used as a basis in the dissertations were not (yet) mentioned in the Dictionary of Theories (Bothamley, 2004) and even models, frameworks and concepts were labelled
Logistics Theory Building

If we adhere to the definition of theory by Sutherland (1975, as referenced in Weick, 1989) which argues that theory is “an ordered set of assertions about a generic behavior or structure assumed to hold throughout a significantly broad range of specific instances”, then models and frameworks would not qualify as theory. The same goes for references, data, variables, diagrams and hypotheses (Sutton and Staw, 1995). On the other hand, Peter and Olson (1983) contend that “scientific ideas consist of invented constructs and hypothesized relationships among them”. Similarly, Gioia and Pitre (1990) provide a loose definition of theory as it is defined as “any coherent description or explanation of observed or experienced phenomena”. They argue that this loose definition of theory is needed because different paradigms offer a wide scope of theoretical representations (Gioia and Pitre, 1990). Turning again to the issue of theory building, the authors advocate what they call a paradigm-based approach. They argue that the grounding of theory in paradigm-appropriate assumptions helps in avoiding the common tendency of trying to force-fit functionalist/positivist theory building techniques as a universal approach (Gioia and Pitre, 1990).

In this paper the paradigm-based approach is adopted, however, many different categorizations exist for research paradigms. Arlbjørn and Halldórsson (2002) distinguish between positivism, post-positivism and hermeneutics; Gioia and Pitre (1990) adopt the framework distinguishing between interpretivism, radical humanism, radical structuralism and functionalism; Hirschman (1986) contrasts the positivistic metaphysic to the humanistic one; Mentzer and Kahn (1995) distinguish between positivism and interpretivism; Solem (2003) between positivism, critical realism and interpretivism, etc. Common to all these distinctions are their two extreme ends,
constituted of positivism at one end and interpretivism at the other (Mangan et al., 2004). There is less agreement on what constitutes the ‘in-between’. While Arlbjørn and Halldórsson (2002); and Solem (2003) refer to critical realism only, Muncy and Fisk (1987) name many different approaches within scientific realism in this ‘in-between’. According to Hunt (1993), scientific realism is an umbrella term for all these different versions of realism, ranging from social realism (closest to interpretivism within scientific realism, Peter and Olson, 1983; and Sayer, 1992) to critical realism (closest to positivism; Boyd, 1984; Leplin, 1984 and 1997; and Hunt, 1990, 1991 and 1993). Other authors again call scientific realism for relativism (Muncy and Fisk, 1987).

The following discussion will start from the most common paradigm in logistics, namely positivism (Mentzer and Kahn, 1995; Arlbjørn and Halldórsson, 2002; and Näslund, 2002) and then proceed through scientific realism to interpretivism.

**Positivism**

Positivism is by far the most dominant research paradigm (Kirkeby, 1990; Alvesson and Sköldberg, 1994; and Indick, 2002), thus it is not surprising that it also dominates in logistics research (Garver and Mentzer, 1999). Modern logical positivists call themselves empiricists (Boyd, 1984) to indicate the high standards they demand of empirical research (Indick, 2002). Positivism strives to discover the true nature of reality, believing in one universal absolute truth (Peter and Olson, 1983; and Mentzer and Kahn, 1995). Research following this paradigm examines regularities and relationships that lead to generalizations and ideally universal principles (Anderson, 1983). These universal principles are not only uncovered, but can be used for normative predictions (Anderson, 1983). The universality claim is supported by a strong belief in the possibility to conduct research truly objectively and value-free (Peter and Olson, 1983; and Hirschman, 1986). Objectivity is deemed possible because of the rationality-claims of positivism that include the possibility to detach science from cultural, social, political and economic factors, and to detach the measured subject from the measurement process (Peter and Olson, 1983). Positivism can also be labelled functionalism (Gioia and Pitre, 1990).

Theories in positivism are judged by their predictive capabilities and formal elegance. Thus, the truth of a theory is judged by the truth of its predictions (Leplin, 1997). Research in a positivist paradigm is corroborated with empirical observations that are in line with its predictions, and falsified through any even minor deviating observation (Popper, 1959). Positivism in fact relies on empirical testing as the sole means of theory justification (Anderson, 1983). Any new hypothesis that is taken up and that endured in empirical testing changes the original theory and thus creates a different theory (Peter and Olson, 1983).

**Scientific Realism**

Even though scientific realism is used as an umbrella term for many different approaches (Hunt, 1993; and Muncy and Fisk, 1987) that lie ‘in-between’ positivism and
interpretivism, there are in fact some commonalities to all these approaches. Scientific realism does not, indeed, refute the ideas of truth and falsity (that would be scepticism), just replaces the notion of “absolute truth” with that of a contextualized, ‘approximate’ or “relative truth” (Boyd, 1984; and Muncy and Fisk, 1987). The questioning of the existence of an absolute truth even leads to the notion that science is seen as a process without an ultimate goal (Anderson, 1983).

Common to scientific realists, however, is their shared belief that the world exists independently of our knowledge of it (Leplin, 1984; and Sayer, 1992). Knowledge doesn’t exist without any context, in fact all our knowledge products are theory-laden (Sayer, 1992) and cannot be detached from the approach that produced them (Boyd, 1984; and Anderson Hudson and Ozanne, 1988). Scientific realists contextualize knowledge in many ways, in essence data is created and interpreted in terms of a variety of theories and theoretical commitments (Peter and Olson, 1983; and Boyd, 1984). Some social realists see theories even as the outcome of a negotiation process between scientists in a particular research community (Peter and Olson, 1983). A problematic notion could be that what counts as scientific knowledge is determined by the community that produces this knowledge (Anderson, 1983). In other terms, “a successful theory is one which is treated seriously and studied by a significant portion of a research community” (Peter and Olson, 1983, p. 112). One important notion of scientific realism is its commitment to pluralism (Solem, 2003). No theory, research approach, methodology or method is advocated as the sole path for science.

However, scientific realism should not be used as an excuse for ‘anything goes’ (Hunt, 1990). What makes an explanation, and a theory, right, is that it gives us what we need to solve a problem in some context (Leplin, 1997). Not truth, but the pragmatic value of a theory to explain and solve empirical problems should be the criterion for theories to be appraised in scientific realism (Anderson, 1983; and Halldórsson and Aastrup, 2003). Nonetheless, scientific realism follows Popperian falsificationism in many ways. The explanatory, predictive, and pragmatic success of a theory is the factor providing evidence for the existence of its associated entities (Hunt, 1991).

Interpretivism

Interpretivism is that discipline of science that is concerned with the interpretation of meaning (Sayer, 1992). The goal of theory building in the interpretive paradigm is to generate descriptions, insights and explanations of events so that the system of interpretations and meaning and the structuring and organizing processes are revealed (Gioia and Pitre, 1990). In interpretivism, the researcher and phenomenon are mutually interactive (Hirschman, 1986) and the researcher becomes part of the evolving events studied (Gioia and Pitre, 1990). Interpretivism refutes the notion of absolute truth due to refuting the possibility for truly objective ways of conducting science (Peter and Olson, 1983). In fact, seeking objectivity is even deemed undesirable in interpretivism (Hunt, 1993). Thus, interpretivism does not seek truth but variety, i.e., wants to show the many versions of subjective impressions.
As Mentzer and Kahn (1995) put it, “interpretivism portrays reality as a collective of multiple socially constructed realities”. In sociology, interpretivism is commonly criticized for its subject-ridden level advocating that sensate experiences require the presence of an actor (Bertilsson, 2004).

The interpretative researcher collects data that are relevant to the informants and aims at preserving their unique representations. Analysis begins during data collection, thereafter analysis, theory generation and further data collection go hand in hand which means that the theory building process is iterative, cyclical and nonlinear. Through the process, tentative speculations are confirmed or unconfirmed by consulting informants (Gioia and Pitre, 1990). Academics coming from a positivist background tend to claim that theories without a predictive function are pre-scientific (Cox, 1996). Interpretivists, however, have no ambition to build theories for predictions (Mentzer and Kahn, 1995). The purpose of an interpretivist theory can be descriptive or explanatory but not predictive.

**Theory Building through Different Research Approaches**

Logistics research is largely following the hypothetico-deductive research approach (Mentzer and Kahn, 1995; Arlbjørn and Halldórsson, 2002; and Näslund, 2002). Its dominance is so striking that Kovács and Spens (2005) conclude that research approaches are usually discussed in logistics research if deviating from deduction. In fact, Cox (1996) even views any non-deductive study as pre-scientific, and Mentzer and Kahn (1995) argue with the dominance of hypothetico-deductive research in logistics for disregarding other research approaches when suggesting a framework for logistics research.

In the following, we will discuss the three research approaches in the order of their usage in logistics (Kovács and Spens, 2005), deduction, induction and abduction, before presenting a framework of their application for theory building within different research paradigms.

**Deduction**

The deductive research approach follows the path from theoretical advances to their empirical testing. The process starts with an established theory or generalization, and seeks to test whether the theory applies to specific instances (Hyde, 2000), thus following the path from a general law to a specific case (Alvesson and Sköldberg, 1994; and Johnson, 1996), in other words from rule to case to result (Kirkeby, 1990; and Danemark, 2001). More specifically, deductive research starts with logical conclusions that were derived from theory and are presented in the form of hypotheses or propositions. Apart from logic, a good operationalization of the studied phenomena is required for deduction (Bjereld et al., 2002). The hypotheses or propositions are subsequently tested in an empirical setting, and general conclusions are presented based on the corroboration or falsification of the prior self-generated hypotheses/propositions (Kirkeby, 1990; and Arlbjørn and Halldórsson, 2002).
The deductive research approach has often been criticized for not being able to generate new theories (Peirce, 1931, etc.) but just modify or refine theories (Gioia and Pitre, 1990; and Bjereld et al., 2002). Nevertheless, deductive research contributes to theory building in its own way. Gioia and Pitre (1990) see the tested hypotheses or propositions along with their verifications or falsifications as revising or extending the original theory. According to Peter and Olson (1983, p. 112), "any change in a theory creates a modified product—i.e., a different theory". Thus creating new hypotheses that are logically deduced from a theory and testing them also qualifies as theory building.

Even though the deductive approach is most commonly associated with a positivist paradigm (Kirkeby, 1990; Alvesson and Sköldberg, 1994; Mentzer and Kahn, 1995; Arlbjörn and Halldórsson, 2002; and Näslund, 2002), it finds its application in other paradigms as well. Scientific realism uses the deductive research approach for refining its theories as well, only the testing is not seen as asserting its hypotheses or propositions absolute truth (Boyd, 1984; and Muncy and Fisk, 1987). This puts the predictive force of deduction into perspective, as it is questionable how the outcome of individual phenomena could be predicted based on universal facts without the question of probabilities (Bertilsson, 2004). Thus, while the deductive research approach when used in the positivist paradigm can be described as deterministic, it is only probabilistic in scientific realism. The purpose of the deductive approach can be propositional or predicative (Danemark, 2001). Propositions are related to one another with the conjunctions ‘not’, ‘and’, ‘or’, ‘if…then’, while predicative logic also examines ‘all’ and ‘no’ junctions.

Research using deductive reasoning can be purely theoretical, thus skipping the phase of empirical testing however, the deductive research approach asks for a testing phase. Different research methods can be used for this, ranging from (quantitative) methods including simulations, model building and statistical surveys (Halldórsson and Aastrup, 2003) to (qualitative) structured interviews (Hyde, 2000).

**Induction**

The inductive approach follows the path from empirical observations to theoretical advances. The process starts with a specific empirical case or a collection of observations to general law, i.e., from facts to theory (Alvesson and Sköldberg, 1994), in other words from case to result to rule (Kirkeby, 1990; and Danemark, 2001). Previous theoretical knowledge is not a necessity (Gioia and Pitre, 1990), and even if not ruled out, not systematic (Bjereld et al., 2002). Instead, empirical observations lead to emerging propositions and their generalization in a theoretical frame.

Generalization may, however, not be the purpose of all inductive research. Interpretive theory building tends to be inductive in nature (Gioia and Pitre, 1990) but does not aim at generalizations but to show subjective varieties (Hirschman, 1986). Thus the purpose of inductive research forms a continuum from subjective variety in interpretivism towards categorizations and the development of taxonomies.
to generalizations in scientific realism (Solem, 2003). Natural science research uses the inductive approach also in positivism and even adheres to the ideas of verification (Danemark, 2001). In business logistics research, however, induction (and abduction) are seen as deviating from the dominating deductive positivism (Mentzer and Kahn, 1995; and Kovács and Spens, 2005) and thus turned to when leaving the positivist paradigm. The outcome of inductive research is a theory that is tentatively accepted a priori and has been deemed as holding stand with a high probability for all possible further experiences (Anderson, 1983). Nonetheless, inductive research has also been criticized for not being able to originate radically new theories (Peirce, 1934), because once rejecting a proposition, it lacks the power of modifying action (Nesher, 1999).

Inductive research is often confused with qualitative research and vice versa. While not all qualitative research is inductive (see, e.g., structured interviews in deduction), inductive research can also encompass quantitative methods. This is the case in data mining, where researchers engage in reinterpreting data from a new perspective. The purpose of this type of inductive study is to analyze data from a different angle than the original purpose of its collection, or recontextualize and reinterpret this data. A reason for data mining can be if a previous quantitative study is non-conclusive or shows very interesting outliers. While this delimits the role of quantitative studies for the interpretivist paradigm, interpretivists claim that even statistical data has to be interpreted when analyzed, and that in fact all research would be interpretive (Gummesson, 2003).

Abduction

The abductive research approach was introduced by Peirce (1931). While some scientific realists see abduction as rooted in empiricism (Boyd, 1984), Peirce himself has been described as a scientific realist (Bertilsson, 2004). The outcome of the abductive research process is a “relative truth” (Sebeok, 1983) like in scientific realism (Boyd, 1984; and Muncy and Fisk, 1987), which can be seen in Peirce’s (1934, p. 106, § 171) following description: “Deduction proves that something must be; Induction shows that something ‘actually’ is operative; Abduction merely suggests that something ‘may be’.”

There are two ways to initiate abductive research. In the first, the researcher makes an empirical observation that deviates from a previously used theoretical framework and thus challenges the usability of this framework. This empirical observation is commonly called a “puzzling point” (Eco, 1983; Alvesson and Sköldberg, 1994; Dubois and Gadde, 2002; and Kovács and Spens, 2005). In this case, the puzzling point initializes a search for matching theories that can be used to explain the deviating observation (Kirkeby, 1990; and Dubois and Gadde, 2002).

The second way to start an abductive process is more conscious. Here the researcher applies a new theory, or a new framework, to already existing observations (Kirkeby, 1990). The novelty of the theory does not need to be universal, the claim
is that it has not been used in this stream of research (e.g., introducing chaos theory to logistics research). Borrowing theories from other disciplines thus can initiate an abductive research process. However, doing so implies a belief in the possible coexistence of theories, as in scientific realism (Anderson, 1983; and Leplin, 1997).

The aim of abductive reasoning is to understand the new phenomenon (Alvesson and Sköldberg, 1994) and to suggest new theory (Kirkeby, 1990) in the form of new hypotheses or propositions. The abductive research process closes with the application of these hypotheses/propositions in an empirical setting (Alvesson and Sköldberg, 1994). This last step can also be characterized as a deductive part of the research.

While both induction and deduction have been largely criticized for their restrictions in creating (radically) new theories (Peirce, 1934; Gioia and Pitre, 1990; and Danemark, 2001), abduction is seen as being the most creative research approach (Kirkeby, 1990) for theory building. With this creative power, abduction can introduce radically new ideas and is thus best suited for the (in Kuhn’s, 1970, terms) revolutionary phase of theory building. The abductive approach stems from a pragmatic view of science (Nesher, 1999; and Bertilsson, 2004). Hence, it is most suitable for the scientific realist paradigm that evaluates its theories in terms of their pragmatic applicability (Anderson, 1983) and usefulness (Hunt, 1991; and Leplin, 1997).

**Theory Building in Logistics Research**

The division into three research paradigms, positivism, scientific realism and interpretivism, provides a good overview of the differences to theory building in general. Turning to studies in logistics and Supply Chain Management (SCM), we can distinguish different schools and research communities along the three main paradigms or in Arbnor and Bjerke’s (1997) terms, three methodological approaches (Gammelgaard, 2004). These schools differ along their methodological, ontological and metaphysical commitments (Anderson, 1983). As for methodological commitments, the positivist paradigm largely corresponds with the analytical approach, the scientific realist paradigm with the systems approach, and the interpretivist paradigm with the actors approach (Arbnor and Bjerke, 1997; and Gammelgaard, 2004). The analytical approach in unison with positivism emphasizes the need for objectivity in research (Arbnor and Bjerke, 1997), while interpretivism specifically requires the presence of an actor (Bertilsson, 2004) and advocates subjectivism.

These different paradigms and their respective theories should not be seen as competing with each other, they rather fulfill complementary purposes (Solem, 2003). Even though, or maybe even because research in logistics is strongly footed in the positivist paradigm (Mentzer and Kahn, 1995; Garver and Mentzer, 1999; Arlbjørn and Halldórsson, 2002; and Näslund, 2002), logistics researchers have often called for complementary approaches (Seaker et al., 1993; Arlbjørn and Halldórsson, 2002; and Näslund, 2002). The different paradigms shed different light on empirical phenomena and can help to solve different (managerial and theoretical) problems.
Similarly, different research approaches contribute to theory building in different ways. Even though the deductive research approach dominates in logistics research, in order to build logistics theory, a combination of all three approaches would be needed, however, this does not mean that they should all be used in one study. Instead, the trio of abduction, deduction and induction complement each other (Sebeok, 1983; and Nesher, 1999). Meredith (1993) describes the cycle of research to go from description to explanation to testing. Different research approaches are suitable for different phases (Nesher, 1999) in this cycle. Scientific revolutions (Kuhn, 1970) can be driven through the creative power of abductive research, which introduces radically new ideas and theories (comp. Nesher, 1999). To fortify these yet rather loose theories (Lakatos, 1970; and Arlbjørn and Halldórsson, 2002), induction can be used to further develop them, expanding existing knowledge. Once these theories have been established, after the transition from loose to solid theories (Arlbjørn and Halldórsson, 2002; and Lakatos, 1970), deductive research helps to test them and further establish them. In other words, the abductive approach discovers new concepts and rules, which the inductive approach can evaluate and that are inferred in the deductive approach (Nesher, 2002). Nesher (2001) also distinguishes between the logic of discovery (abduction), the logic of consequence (deduction) and the logic of evaluation (induction). The scrutiny of falsification is needed in all phases (Popper, 1959), however, in non-positivist paradigms bearing in mind the probabilities associated with any suggested hypothesis or proposition.

Thus, the use of the three different research approaches adheres to different world views, and different underlying research paradigms, are yielding different results in

<table>
<thead>
<tr>
<th>Paradigm Research Approach</th>
<th>Interpretivism</th>
<th>Scientific Realism</th>
<th>Positivism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>from empirical observations to theoretical propositions</td>
<td>grounded qualitative non-structured quantitative</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td>variety generalization</td>
<td>descriptive/exploratory/explanatory prescriptive</td>
<td></td>
</tr>
<tr>
<td>Deductive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Not applicable</td>
<td>from theoretical hypotheses to empirical observations</td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td>semi-structured quantitative</td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td></td>
<td>probabilistic generalization deterministic</td>
<td></td>
</tr>
<tr>
<td>Abductive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Not applicable</td>
<td>to theoretical propositions to application</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Method</td>
<td></td>
<td>qualitative quantitative</td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td></td>
<td>theory suggestion descriptive/exploratory/explanatory/predictive in respective phases</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Framework for Theory-Building in Logistics
building logistics theory. While following a deductive research approach in positivism results in universal claims, the findings of deductive research in scientific realism are deemed probable but not universal. Nonetheless, Nesher’s (2002) trio of research approaches complement each other for the purposes of theory building. Figure 2 combines the presented paradigms with research approaches in a framework for logistics theory building. In doing so, representations of the typical research processes, methods and purposes are indicated for each combination of research paradigms and approaches.

For example, in the inductive research approach research processes in the interpretivist and scientific realism paradigms proceed through empirical observations to theoretical propositions. The methods used e.g., in the scientific realist paradigm can range from quantitative to qualitative, purposes vary, however the ultimate goal, that is the far end of the continuum, stresses generalization of the findings.

**Illustrating the Framework in Logistics Research**

Examples from current logistics research are used to illustrate the framework for theory building for this particular discipline. In the following, we will discuss each of the research approaches in the different research paradigms; starting with deduction and induction in positivism; deduction, induction and abduction in scientific realism, and induction in interpretivist logistics research.

**Positivism in Logistics Research**

Logistics literature often makes a link between the positivist paradigm and a ‘deductive research approach’ (Mentzer and Kahn, 1995; Garver and Mentzer, 1999; Arlbjørn and Halldórsson, 2002; and Näslund, 2002). Typically, quantitative methods are employed in this category, mainly regression analysis (Keller, 2002; Richey et al., 2002; Bhatnagar et al., 2003; and Zsidisin et al., 2003), or Structural Equation Modelling (SEM) (Autry and Daugherty, 2003; Kent and Mentzer, 2003; and Wisner, 2003).

In natural sciences, the ‘inductive research approach’ adheres to the idea of verification and can thus be used within a positivist paradigm (Danemark, 2001). However, in logistics, the inductive research approach is mainly turned to when purposefully leaving the positivist paradigm. Solem (2003) discusses inductive research in scientific realism and interpretivism only. ‘Abduction’ is also used for leaving the dominant research paradigm in logistics. Any theory-matching process implies a pluralistic belief in the coexistence of theories, which can be found in scientific realism (Anderson, 1983; and Leplin, 1997).

**Scientific Realism in Logistics Research**

Even though the ‘deductive research approach’ is often linked to positivism, it is not confined to this research paradigm. Deductive hypothesis-testing in scientific realism, however, asserts hypotheses only relative but not absolute truth (Boyd, 1984; and Muncy and Fisk, 1987). This relativizes the generalizability or universality of the findings of
such research (Bertilsson, 2004). In other words, deduction in positivism is deterministic, but the same research approach is only probabilistic in scientific realism.

This is probably most striking for the data analysis method of SEM. Most articles that use SEM in logistics research (which currently dominates the publications of the *Journal of Business Logistics*) reportedly use maximum likelihood in their confirmatory factor analysis, which is presumably a sign for a positivist background. At the same time, though, many articles using SEM in logistics test alternative models as well and/or discuss the exploratory nature of their survey. Positivists proclaiming absolute truth for one theory (Hirschman, 1986; and Gioia and Pitre, 1990) would, however, not be inclined to seek alternative models and hypotheses to their theory, this is rather a sign of scientific realism (Solem, 2003). Alternative model testing and exploratory surveys can therefore be considered as indicators for a scientific realist paradigm.

Qualitative deductive studies adhering to scientific realism can also be found in logistics. As an example, Harrison (1999) e.g., presents a very deductive, dual macro-micro model when describing different logistics systems, which is then applied in his study. According to his article, two quantitative studies precede the discussed study, which is nonetheless a qualitative one, using semi-structured interviews as its data collection technique. A predetermined set of codes is then used to categorize the transcribed quotes of these interviews. As the data analysis strictly follows prior set propositions and categories, this research is purely deductive. Harrison (1999) even sets system boundaries for the data analysis and questions the possibility of absolute generalization of his findings. This indicates that the study appertains to the scientific realist paradigm.

Qualitative data collection can also precede a quantitative data analysis in scientific realism. Moberg and Speh (2003) use structured interview guides for telephone interviews to evaluate the strength of relationships in a supply chain, but then use factor analysis to analyze this data. Zacharia and Mentzer (2004) even use their data from “in-depth” interviews to develop a structural equation model for the salience of logistics.

Inductive scientific realist research can also be found in logistics. According to Solem (2003), the purpose of inductive research ranges from manifesting subjective varieties in interpretivism to arriving at taxonomies and (relative) generalizations in scientific realism. Miemczyk and Holweg (2004) e.g., explore the effects of customization on inbound logistics in a study that uses semi-structured interviews and process mapping alongside quantitative data about inventory levels prior to developing their propositions. To be able to generalize their findings within particularly set system boundaries, Miemczyk and Holweg (2004) triangulate their data from different data collections. Hingley (2001) also uses a multi-case, multi-site approach to allow for the generalization of his findings within its industrial and market context when examining relationship management in the food industry. But while both these studies are
qualitative, there are also examples of quantitative inductive research in scientific realism. Mathematical models are deductive if a model is only applied and refined in the process, however, they are inductive if they are built from scratch e.g., in a case study (de la Fuente and Lozano, 1998).

Some authors combine two studies in one article before presenting their supposedly general conclusions. Dadzie (1998) e.g., sets survey categories deductively a priori to his study but then goes on investigating inductively emerging clusters in his data analysis. Svensson (2001) derives his propositions about disturbances in logistics flows from an inductive (and in this case, qualitative) study before evaluating these in a deductive survey. The combination of two such fundamentally different studies is only possible within scientific realism that allows for pluralistic thinking.

The theory-matching element of abduction implies pluralistic thinking. Consciously applying a new theoretical framework to investigate known empirical observations in a field can be seen as borrowing theories. According to Stock (1997), theory borrowing is common in logistics research. It even helps in avoiding the pitfall of “reinventing the wheel”, i.e., having to develop these theories again even though they are already known in other disciplines. This, however, is not the only reason abductive research pertains to scientific realism. The aim of abduction to suggest theories instead of arriving at generalizations and universal claims points at the relativistic view of this research approach on its outcome. This resembles scientific realism (Sebeok, 1983; Boyd, 1984; and Muncy and Fisk, 1987). This supports the proposition of our framework that the abductive research approach adheres to the scientific realist paradigm (Figure 2).

Examples for the abductive research approach in logistics originate from mathematical modeling but also action, and constructive research. Westwood (1999) starts out with the puzzling point of forecasting methods being insufficient and not applicable for a particular case company. He then suggests a solution from this empirical background while negotiating between theory and data from his case study. This solution is to include inter-organizational transfers in forecasting. He then develops a mathematical model to suggest his theory, and reapplies the model to the data from his case study to evaluate its use. Campbell et al. (2001) also develop a mathematical model for a city as their case study, before applying their findings to a larger geographical area and presenting conclusions on the basis of this application. Holmström et al. (1999) study process networks creating their own examples, i.e., companies are asked to implement a process network design while the implementation process is studied. They negotiate between different alternative theoretical frameworks before developing guidelines for process networks that are subsequently implemented in their prior examples before arriving at their conclusions.

Interpretivism in Logistics Research
Logistics researchers often make a link between interpretivism, inductive research, and qualitative studies. More and more inductive research is indeed published in logistics
journals (Spens and Kovács, 2006). However, Hilmola et al. (2005) found that about half of inductive case studies in the discipline use quantitative research methods. But while not all inductive research is qualitative, and does not necessarily adhere to an interpretivist paradigm, examples where this triple linkage holds stand can be found in logistics literature.

In an article by Golicic et al. (2002), the authors set out to “examine the impact of the dimensions of e-commerce on managing relationships in the supply chain” (Golicic et al., 2002, p. 852). In order to do so, they interview employees of eight companies who are responsible for activities related to the company’s supply chain. They stress the importance of on-site, in-depth interviews to seek the perceptions of the interviewees on e-commerce. Codes and categories for the collected data emerged during the transcription of interviews, and the conceptualization of main themes in the research is then purely based on the empirical data.

Another example for interpretivist studies in logistics can be found in Pålsson (2006), in which he describes the four phases he used in a participant observatory study going from a preparation phase especially focusing on the finding of gatekeepers to the empirical study, data collection through observations and interviews on site, analysis and reflection emphasising the aspect of emerging interpretations of the data, and finally, the phase of writing up the research. The study is about the implementation of Radio Frequency Identification (RFID) technology in packaging and food manufacturing companies in Sweden, apart from the technology provider. Not even the goal of the RFID implementation is given a priori but determined through interviews with the actors. Conclusions at the end of the research are presented as in comparison with existing literature in the field. Pålsson (2006, p. 6) highlights an important aspect of interpretivist studies when commenting on the resulting article being his own “interpretation of many interpretations” by the interviewees.

Conclusion
The arena of theory building research can be thought of as a never-ending journey (Swanson, 2000). Logistics has no unified theory (Mentzer et al., 2004). However, looking at different ways to theory building we can contend that not one but many possibilities exist to develop logistics theory, or indeed even theories. Theory building is a very important discipline that is emerging and growing. Theory building in itself, as important as it is, should not be taken lightly. The aim should always be to develop a good theory. Theories are judged by different criteria depending on their underlying research paradigms (Leplin, 1997). Good theory is a plausible theory, and it is judged to be more plausible and of high quality if it is “interesting rather than obvious, irrelevant or absurd, obvious in novel ways, a source of unexpected connections, high in narrative rationality, aesthetically pleasing or correspondent with presumed realities” (Weick 1989).

What makes an explanation, and a theory, right, is that it gives us what we need to solve a problem in some context (Leplin, 1997). All judgments about theories are thus
context-dependent (Sayer, 1992). Different research paradigms and research approaches contribute to theory building in their own (but very different) way.

In most fields, even natural science, many paradigms can coexist (Anderson, 1983). It is thus important to realize that different research communities coexist also in logistics. While it is important to distinguish between these schools, they cannot be evaluated as better or worse than the other. So far, no consensus in science exists as to the nature or even the very existence of a unique scientific method (Anderson, 1983), paradigm or research approach. This even suggests that it is inappropriate to seek a single best method (Anderson, 1983), paradigm or research approach for the evaluation of logistics theory. Often many theories can come to the same prediction about particularities of an observation (Leplin, 1997). Which theory is confirmed, or corroborated through a particular observation is yet to be determined (Leplin). Depending on its underlying paradigm, scientific theories can be evaluated in terms of their truth content, or in terms of their usefulness (Anderson, 1983; and Peter and Olson, 1983).

Although theory building can evolve from mainstream approaches to research, rebellious behavior has and will continue to result in new insights and theories being developed (Trim and Lee, 2004). The dominance of a research paradigm or research approach in a discipline poses strong limitations on how theory in that discipline can evolve. Meredith (1993) criticizes operations management research for skipping the descriptive phase of research and thus becoming more and more unrealistic. If management researchers are to produce new insight into complex management problems they need to be innovative and have the confidence to question what constitutes appropriate research (Trim and Lee, 2004). However, introducing radically new theories, perspectives and research approaches can be compared to launching discontinuous innovations (Peter and Olson, 1983). Theory building research often receives rough treatment from journals and reviewers and has an uncomfortable journey getting published (Swanson, 2000; and Halldórsson and Aastrup, 2003). Peter and Olson (1983) conclude that new scientific streams have to be carefully ‘marketed’ before being introduced in their fields. This paper markets the paradigm-based approach to theory building and presents the abductive approach in order to complement the research approaches that have already established their existence in the logistics literature.

References


Reference # 34J-2007-12-01-01