Understanding the application of Actor-Network Theory in the process of accounting change.

Abstract

Actor-Network Theory (ANT) has been used as a lens by a number of researchers to guide their inquiry (see, for example, Ezzamel, 1994; Robson, 1991; Lowe, 2004; Becker, Jagalla, and Skærbæk, 2013). The purpose of this paper is to provide an appraisal of the use of ANT in the accounting literature. We examine articles which consider how ANT is used as a framework in a management accounting change context. In doing so, we provide some clarity in guiding the endeavors of future researchers' who may want to use ANT as their theoretical foundation.

Our analysis of the ANT studies shows several themes. For example, the potential for accounting to be an effective mechanism for achieving long-distance control and the power of accounting to be used as a rationale for institutional or system change. However, our investigation revealed a range of limitations in the accounting research application of ANT from which we can deduce lessons for future research. For example, there has been a tendency for some studies to overemphasize the human/social element and to downplay the role of nonhuman actors in the network.

Key Words

Actor-Network Theory, Latour, Actors, Networks

Understanding the application of Actor-Network Theory in the process of accounting change.

1. Introduction

> [Researchers] of accounting may wish to build on the studies of the use and modification of ... accounting systems, paying attention to the interconnections between the technology and social factors, examining the networks of use, elaboration and modification of accounting (Preston, Cooper and Combs, 1992, p. 590).

If accounting is a social construction, then it is important to investigate accounting in local settings, to uncover the nature of that practice (Lowe, 2004). Actor-Network Theory (hereafter referred to as "ANT") enables researchers to explore inter-connections between accountants, inscriptions and the technology they use and how accounting intercedes local actions. ANT has been widely employed during the past twenty years in a variety of situations and contexts in accounting. For example, Jones and Dugdale (2002) explored the rise of activity-based costing across the period 1984 to 1992. Robson (1991) explored the genesis of accounting standard setting in the UK. However, it should be noted that some researchers (Mclean and Hassard, 2004; Collins and Yearly, 1992) have been critical of the application of ANT by researchers in the management and social sciences. Given the increasing adoption of ANT and criticisms of its use in other disciplines, the major aim of this study is to appraise the use of ANT in the management accounting literature. Using the results of our appraisal, this research also seeks to identify key lessons for future ANT research so as to enhance the value of investigations using this theoretical framework.

ANT has been used by accounting researchers to provide insights into the organic nature of change (see for example: Ezzamel, 1994; Lowe, 2001c; Jones and Dugdale, 2002). ANT specifically examines how networks are developed and maintained and the interacting role of the various actors (human and non-human) within these changing accounting processes. This paper examines the influence of ANT on accounting research. ANT was originally developed by Bruno Latour, Michael Callon and John Law in the mid to late 1970's as a means to understand the social construction of science[1]. Essentially, it is an analytical framework, a "tool box" (Law, 2007) used to study the roles of humans and non-humans in the structuring

[1] It should be noted that his colleague at the Centre de sociologie de l'Innovation at the Ecole nationale supérieure des mines in Paris, Michael Callon, and the British sociologist John Law were also early influences on the development of this theory (Vidmar-McEwen, 2008).

of networks between people, their ideas and technology for the purpose of creating new knowledge (Latour, 2005; Callon, 1986; Law, 1986). ANT can be more technically described as a material-semiotic method, mapping relations that are simultaneously material (between things) and semiotic (between concepts). Everything in the social and natural worlds does not exist separately, but is being constantly generated by relationships between actors in networks (Law, 2007). It is through a series of complex interactions between humans and non-humans and the ways in which they interlock within networks of construction and reconstruction which allow the production of accepted facts or knowledge (McNamara, Baxter & Chua, 2004, p. 57). As Latour (2005) himself stated:

> What I want to do is to redefine the notion of social by going back to its original meaning and making it able to trace connections again. Then it will be possible to resume the traditional goal of the social science but with tools better adjusted to the task (Latour, 2005, p. 1).

ANT has since been influential in a wide range of disciplines[2] from economics (see, for example, Bledin and Shewmake, 2004) to geography (see, for example, Rutherford and Holmes, 2008). Organizational studies have used this framework to examine phenomena such as knowledge management (Hull, 1999), communities of practice (Fox, 2000) and economic markets (as in Callon and Muniesa, 2005). Accounting researchers have used it as a lens to explain accounting change in an organizational context (see, for example, Lowe, 2001a, 2001b, 2001c), the implementation of information technology (for example Quattrone and Hopper, 2006; Bloomfield and Vurdubakis, 1994), and accounting as practice (Robson, 1992, 1991).

Justesen and Mouritsen (2011) observed that previous work in the accounting literature has utilized ANT as conceptualised in Latour's "Science in Action" (1987). They noted that actor-network theory has changed over time and new directions for accounting research may be found in an analysis that includes contemporary development of Latour's theoretical framework. Therefore this paper builds on Justesen and Mouritsen (2011) by providing an examination of the previous ANT literature in accounting viewed through the lens of Latour's

[2] The popularity and influence of ANT around the world may well be a product of the appeal and quality of its attributes (for example, the inclusion of broad networks in an attempt to explain transformation in society) but also a willingness by the co-founders to publish their findings widely including in various languages. These attributes combined with a willingness to conduct diverse field studies around the world (especially the U.S.) all have served to increase the legitimacy of ANT as a plausible conceptual framework for studying diverse phenomena (Law, 2002).

more recent works, notably "Reassembling the Social" (2005). Using the outcomes from this analysis, our paper identifies key lessons for guiding future ANT related studies. .

This paper contributes to the literature in four ways. First, it identifies accounting articles that use ANT as their theoretical foundation and conducts an appraisal of the method applied through a discussion of the contribution and limitations of these articles. Second, the paper contributes by analyzing the application of ANT in accounting research through the various critiques on ANT such as those identified by McLean and Hassard (2004) and Collins and Yearly (1992). Third, we discuss the use of Callon's four step process as a conceptual framework in the literature. Finally, using the insights provided within this analysis, guidance is given regarding issues to consider for future accounting inquiry based on ANT.

This paper is structured as follows. The following section gives a description of actor-network theory and includes some studies in the accounting literature that have utilized case studies. The next section provides an exploration of the methodological approaches in the accounting literature to date informed by some critiques of the methodology highlighted by authors such as McLean and Hassard (2004) and Latour (2005) himself. In doing so, it is hoped that this will provide clarity on a range of issues/concerns with the application thus far of ANT in accounting research. The final part of the paper seeks to inform future researchers by drawing on some lessons identified from the issues/concerns identified in the previous section.

2. An overview of Actor Network Theory[3]

Given this study seeks to appraise the methodological application of ANT, it is important that we commence with a detailed overview of this theory. ANT, as proposed by Callon (1986), Law (1986) and Latour (1987), is a social theory which originated in the field of science and technology. Accounting is used by differing stakeholders to support the decision-making process. ANT explains how, over time, networks of actors are built to support claims to specific knowledge by those who use accounting numbers and reports in an effort to persuade and influence (Mouritsen, Larsen and Bukh, 2001). This specific knowledge is referred to as a 'claim' (Latour 1987) because it may or may not be accepted by others outside the network

[3]Some researchers such as McLean and Hassard (2004) and even Latour (1999) himself had argued that ANT is not a theory of the social, subject or nature but a "very crude method to learn from the actors without imposing on them an a priori definition of their world building capacities" (Latour, 1999: 20). More recently, Latour (2005) acknowledged ANT as a theoretical framework (Latour, 2005).

as a ‘fact’ (Gendron and Barret, 2004; Miller, 1991) Using this framework, actors considered within the network may be human or non-human (such as technology or animals) which act, or make a difference within the network (Lowe, 2001a, 2001b). These networks change in an ongoing process of making and remaking (Pipin and Czarniawska, 2010; Callon, 1986).

ANT is ontologically relativist (Lee and Hassard, 1999). This means that it has a view that “the empirical would not be a passive collection of ‘raw materials’ silently awaiting for the researcher’s gift of intelligibility, form and voice” (p. 399). Society is not deemed to exist out there as some sort of scaffold (Law, 1992) or with a precise domain and properties (Latour, 2005). There is no overarching context in which actors can be framed or embedded, for instance there are no organizations or levels of management. The theory does not deny the existence of such societal structures; rather it argues that society is made up of associations between actors who are defined by their place within the network and their relationship with other actors (Justesen & Mouritsen, 2011; pp. 174-175). Society is made up of associations between actors who are defined by their place within the network and their relationship with other actors. This assumption enables the researcher to ignore divisions within society that may be considered to be foundational and explore how the networks grow and what material practices are brought to bear (Law, 2007). Organizations are seen as a number of networks of heterogeneous actors in more or less stable associations (Law, 1991). However, ANT recognizes external actors can be influences on the organization and allows for the network/s to expand beyond the “boundary” of the organization (Pipin and Czarniawska, 2010; Arnaboldi and Lapsley, 2009; Lee and Hassard, 1999). Quattrone (2004) points out that when one discusses change, it implies that there is something “out there” that requires changing, the antithesis of ANT ontological underpinnings. To uncover movements towards changing accounting practices implies a norm, an accounting that is already accepted. This previous “reality” is in essence another construction, another network of humans and non-humans that can be made into something else (p. 236). ANT will assist in uncovering the test of wills, the controversies between what is perceived to be “reality” and the movement towards a differing way of doing things, promoted by a different network. In other words, it helps the researcher to understand the forces behind and the process of organizational change.

All elements of the networks need to play their part at the appropriate time for the networks to remain stable, they need to cooperate (Law, 2007), since the elements depend on each other, regardless of whether they are human or non-human. To understand how these

networks are built, it is important that no assumptions are made by the researcher regarding the positions or beliefs of the actors within the network, including how the actor defines and associates with other actors, (Latour, 1987, 2005; Callon, 1986). Since an actor can be human, technology or animal, to maintain generalized symmetry, it is important to use the same vocabulary and repertoire for all actors (see especially Callon, 1986). The accounting function is a result of a range of activities that are performed by people and technology, which measures and calculates phenomena. Accounting solutions can be influenced by the kinds of technology available which are available and, in this way, computing can control the human actors (Gendron and Barrett, 2004). Researchers using ANT pay attention to all 'actants[4]' within the network.

According to Callon (1986) a network is built through a four step process: problematization, interessement, enrolment and mobilization. During the first phase, problematization, the primary actor attempts to identify the problem, what is the knowledge claim that is required, and what actors are required within the network. As the primary actor works to build the network, negotiations will take place with other actors regarding the roles they may play within the network. This is interessement. The primary actor will need to convince others that they will achieve their own goals when they join the network. Ezzamel (1994) discovered two opposing networks, built by actors to combat the each other in an effort to achieve their goal regarding budgetary changes. Building the network may involve some compromise from both sides. Negotiation leads to enrolment, actors accept the roles they have been given and enroll in the network. Mobilization then occurs as others external to the network (allies) move to support it. This process is not unproblematic. Controversy may unenroll the actors or remove the support of the external allies. Gendron and Barrett (2002) discovered that professional accounting bodies in North America were unable to enroll external actors to ensure the success of their web based assurance product. The principle actor may then attempt to revisit the building process, or the network simply falls apart. This process of transformation of the network is termed "translation".

If the actor-network is successful the knowledge claim is accepted as fact by those outside, controversies regarding its 'truth' are settled and it becomes 'fact' (Latour, 1987). In time, the 'fact' can be separated from the network that built it and it becomes a "black-box".

[4] Actants may be specific actors or a group of actors with a common role in the network, a network within a network.

Because of this separation, knowledge regarding how the 'fact' was built, and the networks that built it, becomes unknown and it is difficult to question the validity of the fact, by re-opening the black-box and recreating the network (Latour, 2005). Robson (1991) considered the "black-boxing" of accounting standards as they moved towards acceptance and the network which built them "disappeared". This black-boxing can be problematic, because accounting facts are then accepted as "truth". As Savaranamuthu (2004) noted, this gives the numbers greater power to influence and weakens the ability to acknowledge other needs such as the environment and society.

ANT can be used to examine how networks are built to produce accounting facts (Latour, 2005), such as financial statements or the accounting information that will be produced from new systems. The next section discusses the use of ANT in accounting research,

3. ANT and Accounting Research

The increasing use of ANT in the literature (Justesen and Mouritsen, 2011) shows a willingness on behalf of accounting researchers to use ANT (Callon, 1986; Law, 1986; Latour, 1987) in their investigations. ANT has been highly influential in studies of the discursive processes of accounting change across the past 20 years. Indeed, ANT has been applied to a variety of accounting issues and settings. The most common application is to the study of changes in management accounting practices such as the introduction of new costing systems within public sector organizations, especially, hospitals (see, for example, Lowe, 2001a, 2001b, 2001c; Preston, Cooper and Coombs, 1992). These studies have used as their case setting a specific organization (or section of an organization). However, this theory has also been applied to wider controversies in the accounting world that transcend a specific institutional setting. For example, analysis of the study of the genesis of accounting standard setting in the UK (Robson, 1991), the dominance of quantification in accounting (Robson, 1992), the embedding of activity-based costing in practice (Jones and Dugdale, 2002) and the development of intellectual capital statements (Mouritsen, Larsen and Bukh, 2001) to name just a few.

There are several themes in the literature as they pertain to ANT. Specifically, the potential for accounting to be an effective mechanism for achieving long-distance control (e.g.

Quattrone and Hopper, 2005; Mouritsen, Larsen and Bukh, 2001; Robson, 1992); the power of accounting to be used as a rationale for institutional or system change (e.g., Preston, Cooper and Coombs, 1992); the capacity of the accounting profession to adapt in ways that maintain both its legitimacy and relative levels of autonomy (e.g., Jones and Dugdale, 2002; Robson, 1991) and the inter-connectedness of a wide range of actors, human and nonhuman, in facilitating accounting reforms (e.g. Cuganesan and Lee, 2006).

In essence, it would seem that ANT is suitable as a theoretical framework within the accounting area where a group of actors, human and non-human, are seeking to collectively establish a "truth" which is yet to be widely accepted through the exploitation of accounting as a tool. ANT provides a framework for studying and understanding the fabrication of a specific phenomenon through a process of "debate, dialogue and struggle" (Mouritsen et al., 2001, p. 736). As noted by Lowe (2001b), "It is only after all these resources: the computer software; the accountants; the IT people; the computers, have been successfully brought to bear that controversies are settled and black boxes are produced" (p. 330).

In the next section, will now examine what insights have been provided by ANT within accounting studies to date. We consider those studies that have applied ANT to controversies/phenomena in the accounting world that transcend a specific institutional setting. In the second section, we will evaluate those studies that focus on a specific organizational setting (or section of an organization). The basis of this separation is that ANT has been criticized (see McLean and Hassard, 2004) for emphasizing the micro over the macro. Yet, a reading of the accounting literature suggests that a number of researchers have employed ANT to study accounting phenomena across both specific organizations and broad institutional settings. A discussion regarding the roles of macro and micro actors in accounting networks is included in the next section.

4. Accounting Research using ANT

Justesen and Mouritsen (2011) considered a selection of papers from the literature to explore how Latour's conceptual toolbox has been utilized by accounting researchers to investigate accounting within its context. They argued that ANT provides new and interesting ways to view accounting, its inscriptions and calculations because ANT considers accounting

technologies as central to the sociological explanation of accounting and accountants activities. ANT is argued to provide another understanding because of the originality of its view of the context, and Justesen and Mouritsen (2011) provided a comparison between ANT's approach and other theoretical frameworks such as contingency and institutional theory. They found it interesting to note that the research to date is informed from Latour's earlier work, concluding their paper with a discussion of future possibilities of utilizing the more the recent writings of Latour when using ANT.

Building on the above study, we will now examine the accounting research papers in light of five critical notes on the production of actor-network accounts. These critical notes are: problems of the inclusion and exclusion of actors; treatment of humans and non-humans; nature of privileging and status; the handling of agency and the structure of society; and, the process of heterogeneous engineering, power and politics. Given that these appraisals of ANT have been identified in several studies originating from the non-accounting literature (see, for example McLean and Hassard, 2004; Collins and Yearley, 1992) they provide a sound starting point to assess related accounting research.

4.1. Issues of Inclusion and Exclusion

This criticism (see, for example, Bloomfield and Vurdubakis, 1999; Miller, 1997; Strathern, 1996) relates to the decision about which actors to include and to exclude in ANT studies. An analysis of many accounting studies to date using ANT suggests that the process of identification of actors to be included or excluded in the process is not elucidated in any detail. The result is that this process may, perhaps unjustly, appear to be somewhat arbitrary. In many cases there is little discussion of the basis on which actors were included or excluded or even specific identification of who the key actors appear to be.

An example of this would be Robson (1991). This paper made a major contribution by introducing the accounting literature to Latour’s work. His analysis of the origins of the standard setting program in the UK in the 1960s did not explain how actors were included or excluded in the network described. Similarly, Preston, Cooper and Coombs (1992) in their fascinating account of reforms to the hospital budgeting systems of the British National Health Service provided little insight into their processes of actor identification other than to say “we mapped networks of resource, support and use, both historically and across conventional boundaries, in order to examine the multiplicity of people involved in the

fabrication process" (p. 567). While the authors made a major contribution to the accounting literature through their account of fabrication and how interests may shift through this process, their conclusions are understandably limited by the difficulty in identifying and studying the numerous actors involved, "we can reasonably argue that many skeptics are won over" (p. 575) and "Despite all the elaborate fabrications, in this case management budgeting does not become an established fact" (p. 589).

A related issue from Preston, Cooper and Coombs (1992) is that their analysis is based on published materials from a previous time:

> Our outline of the production of management budgeting covers a fairly distinct episode, and is for the most part restricted to debates, statements and specific initiatives within the NHS. The analysis begins with the publication of the Griffiths Report in 1983 which proposed the initiative, and ends with the publication of a Department of Health and Social Security (DHSS) Health Notice in November 1986 (DHSS HN(86) 34) (p. 564)

In such circumstances, how can one be confident that all actors and all influences have been considered when analysis is necessarily restricted to known and published sources?

Despite the tendency for studies in accounting to provide a cursory explanation of the actor selection process, there are some notable exceptions. For example, Briers and Chua (2001) directly identified in detail who the actors were in their case analysis of the implementation of activity based costing by the manufacturing strategic business unit of a large Australian mining company. They even demarcated between so-called cosmopolitan and local actors. Similarly, Lowe noted in his study of the application of a casemix accounting system in a large regional New Zealand health provider (2001b):

> A critical aspect of the research process involved the imperative to follow the actors and identify the extent of the networks built up … The researcher tried to carry this off by "making the list" of actors, however long and heterogeneous (p. 346).

The above analysis points to key application issues with ANT, namely, that the boundaries of the project are rarely given and knowable. It is thus left to the discretion of the researcher to select the paths he/she wishes to follow (including which actors) and to choose those that will be ignored. As an example of this dilemma in the accounting literature, Chua (1995) chose a specific date as the cut-off point for her hospital case study because this represented the point where a first run of the costing model had occurred while acknowledging that "…at this

point, the results produced were still regarded as preliminary" (p. 118). The implication of this limitation is that it is possible (without casting any aspersions on the studies referred to above) that the investigator may not succeed in comprehending the network and may thus produce "…an incomplete or misleading research story" (Lowe, 2001b, p. 346).

The above discussion also raises the question of how one selects objects, machines or artifacts to be included in the network. Bloomfield and Vurdubakis (1999, p. 7) suggested that while the researcher must attempt to remain impartial and to consider all possible actors, ultimately the process of selecting appropriate actors to study is dependent on suppositions about what actors exist and their relative positions within possible networks. As Preston, Cooper and Coombs (1992) pointed out; there are numerous heterogeneous actors that affect accounting choices. Lowe (2001b) considered it important to reflect upon all who may be involved. Also it should be noted that networks continue to evolve and translate as some actors join and others leave. ANT, because it requires the researcher to begin without preconceived notions of roles, responsibilities and boundaries, allows him or her to include actors within the study without any predetermined criteria, such as employment within an organization.

It follows from the above dialogue that future accounting studies applying ANT need to ensure that the boundaries are explicitly defined and justified and the actors identified and justified. However, it must be conceded that as one cannot follow actors everywhere (Latour, 2005), he/she ultimately engages in a "practice of ordering, sorting and selection" (McLean and Hassard, 2004, p. 500).

4.2. *Treatment of Humans and Non-Humans*

Perhaps the most controversial aspect of Latour's framework is the "symmetrical treatment of such seemingly dichotomous factors as humans and non-humans, society and nature, and the social and the technical" (McLean and Hassard, 2004, p. 502). Collins and Yearley (1992) were especially critical of this aspect of ANT and cited as an example, Callon's (1986) use of ANT to study scallop farming in France where the scallops are treated as equal actors with the fishermen and scientists:

> Would not complete symmetry require an account from the point of view of the scallops? Would it be sensible to think of scallops enrolling the scallop researchers so as to give themselves a better home and to protect their species from the ravages of the fishermen? (Collins and Yearley, 1992, p. 313).

The point of this sarcastic observation is that Callon (1986) is viewed as providing a predominantly human-focused account of the scallop fishing case and that this can be a flaw with many ANT-inspired studies. All non-human actors require a spokesman, a human, to speak on their behalf. This introduces questions regarding the ability of that spokesman (frequently the researcher) to interpret the interests of the non-human actor (Collins and Yearly, 1992). How can a researcher with a lack of expertise discuss the non-human in a meaningful way? Collins and Yearly suggest that Callon should be an expert on scallops before he can do so in his work on scallops and Latour should obtain technical knowledge before he can discuss door openers (Latour and Johnson, 1988). In response to Collins and Yearly it should be noted that accounting researchers will frequently have an understanding of the systems which are the subject of their investigations and may have the expertise to speak for them within the investigation.

Callon requires the researcher to agnosticism in order to produce accounts that ensure relevant actors are represented within the study, concentrating on their impact within the network (Mclean and Hassard, 2004).

As Lowe (2001b) cautioned:

> A balance must be struck between the attention that is given to social interaction and behaviour (what we might call people's interests) and the part played by machines and systems to effect and channel the social (p. 341).

Proponents of ANT such as Lee and Brown (1994) counter this perceived weakness by contending that ANT is centered on the way in which actors, machines etc. rely on spokespersons and "how the delegation of authority to speak on behalf of others is both an epistemological and political process" (McLean and Hassard, 2004, p. 503). Researchers follow the actors through their work, they do not wish to replace the actors themselves, rather describe how those actors cope with controversies and alternatives (McLean and Hassard, 2004).

Callon (1986), in his work on scallops, indicated that the goal of the researcher is *methodological* symmetry, recommending that researchers acknowledge the uncertainties of the natural, technical and social world as actors deal with the building of knowledge. Researchers should allow the actors to explain their world and the identities that make up their networks, describing their relationships with both the natural and the social world. The

researcher can then identify those relationships, choices and negotiations and then describe both "the technical and the social aspects of the problem studied" (p. 4) using the same vocabulary chosen by the researcher. It is the use of the vocabulary, the same words for both the human and the non-human that produces the methodological symmetry required (Callon, 1986, p.4).

As noted previously the process of "accounting" utilizes technology to calculate, measure and control numerical information. It is arguably ANT's acknowledgement of the non-human that allows the researcher to include technology as a part of the accounting network. This enables a more thorough understanding of the varying forces which facilitate change in it. Highly dependent on technology, networks may not survive because that same technology is resistant to enrolment in the network. It may not exist; be too expensive or too hard to use.

4.3. Privileging and Status Issue

Critics of ANT (see, for example, Collins and Yearley, 1992) suggested that on occasions ANT seems to provide objects, machines etc. with a higher status in terms of their relation to humans than may be warranted given the reality of the situation. Callon and Latour (1992) agreed that they had granted "to nature and to artifacts the same ontological status that realists and technical determinists are used to granting to them" (p. 347). Latour (2005) stated that he was not interested in status issues but rather the roles that given actors within the network play:

> "If action is limited a priori to what 'intentional', meaningful' humans do it is hard to see how a hammer… could act. They might exist in the domain of 'material', 'causal' relations but not in the 'reflexive' 'symbolic' domain of social relations. By contrast, if we stick to our decision to start from the controversies about actors and agencies then *any thing* that does modify a state of affairs by making a difference is an actor" (Latour, 2005, p 70, emphasis in the original)

and

> "This of course does not mean that these participants 'determine' the action, that baskets 'cause' the fetching of provisions or what hammers 'impose' the hitting of the nail… ANT is not the empty claim that objects do things 'instead' of human actors: it simply says that no science of the social can ever begin if the question of who and what participates in the action is not first of all thoroughly explored" Latour, 2005; p 71-72)

Put another way, ANT traces the actors, both human and non-human within the network, without considering who or what they are in order to understand what is happening. Not surprisingly, this symmetry of status has been contested. For example, Pels (1995) argued for weaker asymmetries that enable one to maintain some of the crucial features of modernity such as political, social or cultural distinctions. A counter argument is that these differences should be understood as effects or outcomes rather than as an accepted order of things (McLean and Hassard, 2004).

While the temptation for researchers is to highlight humans and their actions, society as it is today cannot exist without the non-human – all the technology, buildings, texts we use daily – and therefore the latter cannot be ignored. As Law (1992) succinctly stated: "If these materials were to disappear then so too would what we sometimes call the social order" (p. 3). Faithfulness to symmetry is arguably a central tenant to ANT and any possible departure from this requires a strong rationale but it is important to understand the concept of symmetry as conceived by Latour. In recent times, Latour (2005) has attempted to directly address the symmetry debate in ANT:

> ANT is not, I repeat is not, the establishment of some absurd 'symmetry between humans and non-humans'. To be symmetric, for us, simply means *not* to impose a priori some spurious *asymmetry* among human intentional action and a material world of causal relations. There are divisions one should never try to bypass, to go beyond, to try to overcome dialectically. They should rather be ignored and left to their own devices, like a once formidable castle now in ruins (p. 76) [emphasis in the original].

And

> This is the reason why I have abandoned most of the geometrical metaphor about the principle of symmetry when I realized that readers concluded from it that nature and society had to be 'maintained together' so as to study 'symmetrically', 'objects' *and* subjects, 'non-humans' *and* 'humans'. But what I had in mind was not *and*, but *neither*: a joint *dissolution of both collectors*. The last thing I wanted was to give nature and society a new lease on life through symmetry (p. 76) [emphasis in the original].

Latour (2005) cautions against endeavoring to create a picture that does not reflect the realities of nature by concentrating so heavily on non-humans that the study no longer reflects reality. It is due consideration and recognition of the non-human and human actors in networks and their inter-connectedness that he appears to be seeking in future ANT-inspired research.

In the accounting literature, there seems to have been divergent emphases on the role of machines and other non-human actors. Many of the accounting studies to date using ANT appear to have emphasized the social over the machine in studying networks. Mouritsen, Larsen and Bukh (2001) in examining so-called Intellectual Capital Statements focused heavily on managers' manipulation of these statements for their personal gain: "…knowledge and power are related and the interest in knowledge derives from managers' interest in controlling organizational arrangements" (p. 759) and "the intellectual capital statement allows managers to ask such questions [as whether organizational activities are sensible or on the correct track etc.] about the resource base of the firm" (p. 759). It follows from the above discussion that future accounting research using actor-network theory needs to be careful not to devalue the non-human elements relative to the human.

An example of a study that granted a high status to machines was Lowe (2001b):

> The researcher examined reports; on nursing wards; the biochemistry laboratory and radiology as part of a research process designed to unravel the workings of these systems. Some of this meant *going beyond the reports by building spreadsheet models* of the costing and patient data in order to understand how the data were being manipulated to produce the inscriptions of patient costs (p. 343).

Similarly, Robson (1992) with his focus on accounting inscriptions as "writing, recording, drawing, tabulating" (p. 689) placed the non-human factor at the forefront. Cuganesan and Lee (2006) also stressed the technological aspects of a procurement network. Conversely, studies such as Ezzamel (1994) had a sociological emphasis.

Given the seemingly contrasting emphases evident in the accounting literature, a key consideration is whether we can assume a priori that the human drives the non-human to build society as it is today (Law, 1992, p. 3)? Law (1992) argued that "to say that there is no fundamental difference between people and objects is an analytical stance" (p. 4), not an ethical or moral stance. People are influenced and shaped by their interaction with the non-human; their social world shaped by a heterogeneous network of tools and other materials. Latour (2005) provided an example of how the introduction of the television remote control fundamentally altered the viewing habits of consumers. Suddenly, they were far more likely to change channels than previously and advertisers and television networks had to change the way they scheduled programs and advertisements. An inanimate object drastically changed everything in the television world and its presence and impact could not be ignored. It

follows that ANT should not grant privilege to either the human or the non-human, it requires an open mind and that no assumptions be made by the researcher regarding who or what is the driver, analyzing the network as it exists. By admitting the non-human to the network as an actor, the researcher is able to expose the effect that each actor has on another, without making preconceived assumptions as to their relationship.

Modern accounting is heavily reliant on the availability of technology, especially in the form of computer hardware and software. Jones and Dugdale (2002) noted the importance of available software solutions when management made decisions in regard to activity based software. Lowe (2001b) stressed the role of non-human actors: "What ANT offers is a different view of social reality in which nonhuman actants are of particular significance" (p. 344). Chua's (1995) study of a hospital case mix system does not mention how difficult it was to collect the data the system required for its reports, nor the possible costs of such a system, and how that may have affected possible controversies. It seems reasonable to assume that the availability, cost and comprehensibility of computer reporting processes are important aspects of the decision making processes within the organizational context. Therefore they should be included in research in this area.

4.4. Agency and structure of the social

This criticism relates to the claim that ANT emphasizes the micro over the macro and therefore does not consider the "broader social issues that influence the local" (McLean & Hassard, 2004, p. 507). Habers and Koenis (1996) commented that ANT focuses excessively on the input of non-human items to social processes. Similarly, Reed (1995) argued that ANT tends to:

> concentrate on how things get done, to the virtual exclusion of the various ways in which institutionalized structures shape and modify the process of social interaction and the socio-material practices through which it is accomplished (p. 332, as cited in McLean and Hassard, 2004, p. 508).

Latour (1991, p. 118) countered this criticism by contending that the 'macro-structure' of society is made up of the same basic connections as the 'micro-structure', and thus can be examined in much the same way (Latour, 1991, p, 118):

> It's not that there are a macro-sociology and a micro-sociology, but that there are two different ways of envisaging the macro-micro relationship: the first one builds a series of Russian Matryoshka dolls – the small is being enclosed, the big is enclosing; and the second deploys connections – the small is being unconnected, the big one is to be attached (Latour, 2005, p. 180).

Latour (2005) also contended that the 'macro-structure' is a larger network that can be connected to the actor in the same way as other networks and actors. He explained that this is why the term "actor-network" is hyphenated, actors are not only actors as individuals, but also represent the larger networks behind them.

Law (1992) also refused to make any distinction between the macro and the micro-social. If the wider networks of the macro-social are unproblematic at any time, they are perceived to be much simpler by actors outside that network. It is not obvious to those outside the network of the macro-social who or what constitutes that network, nor is it relevant at that time to the actor. Whilst in the longer term the larger network may be made visible by degeneration[5], its stability renders it invisible.

Certainly in much of the accounting research to date there has been a heavy focus on the activities *within* an organization (see, for example, Ezzamel, 1994). How does the organization exist and how can the researcher conceptualize it if, according to Latour (2005), society does not exist "out there"? The organization cannot exist, according to Latour's concept of the social separate to the actors within it. The organization can be seen as a heterogeneous actor-network, like any other, formed over time through problematization, interessement, enrolment and mobilization. For many actors within that organization, its existence is unproblematic, represented by spokespersons at a higher management level, its stability rendering the network invisible as such to the actors.

However, researchers have also often sought to contextualize the exogenous environment, when the wider network of the macro-social is perceived to be failing and, therefore, visible[6]. For example, Preston, Cooper and Coombs (1992) in their case study of potential accounting reforms to the British National Health System (NHS) stated.

> There are a number of discursive conditions out of which emerged the possibility of management budgeting. Two sets of discourses seem to have been particularly significant. Firstly, beginning in the 1970s, and intensified after the election of the Thatcher government in 1979, influential diagnoses of the relative underperformance of the British economy were associated with a

[5] This term was used by Law (2003) to describe how networks are not always stable, and over time can fall apart, the separate elements, previously taken for granted, becoming separate and visible to the observer. Law uses the example of a television – if it is in working order one sees simply a television. If it ceases to work one becomes aware of television repair men, circuits, spare parts and aerials; all of which make up a working television.

[6] See previous footnote.

> concern about the level of state expenditures and doubts about the feasibility and/or desirability of satisfying the demands for welfare (including health and education) through public funding … The NHS was increasingly characterized as being a major contributor to this growing burden despite its "sacred cow" status. Secondly, there has been considerable debate, almost throughout the history of the NHS, about mechanisms to "improve efficiency" through reorganizations and changed managerial practices (p. 568).

Briers and Chua (2001) focused on a range of actors in their study of a manufacturing strategic business unit including so-called cosmopolitan actors which they defined as "global actors in the sense that they are adept at penetrating spatial and cultural boundaries" (p. 241). In placing a heavy emphasis on these global actors in their analysis, Briers and Chua (2001) not only extended the use of ANT within the accounting field but they considered the influence of the external environment to a much greater extent than had been achieved before.

As a final example, Jones and Dugdale (2002) went to considerable lengths to portray the dynamic international environment that resulted in the rising popularity of activity-based costing. They documented the Harvard list of allies that supported the new technology and the various companies globally (John Deere and Hewlett-Packard in the US, Siemens in Germany and Ericsson in Sweden to name a few) that helped champion its use. However, one needs to recognize that given the subject matter of Jones and Dugdale (2002) it would have been difficult if not impossible to have ignored the diverse forces contributing to the activity based accounting "bandwagon" (p. 121).

Overall, it would seem that due consideration of the exogenous environment and how it impacts on accounting controversies at an institutional level has been prevalent in some, but not all, studies to date. The lesson from this is that future researchers need to ensure that they appropriately contextualize their case studies so that the reader is in a better position to fully appreciate the overarching influences and countervailing forces behind the actions and processes being studied in a specific organizational situation.

4.5. Heterogeneous Engineering, Power and the Political Issue

A final criticism put forward by McLean and Hassard (2004) was that ANT neglects to evaluate the political and moral issues behind the technologies studied. Sturman (2006) highlighted that ANT does not address social issues including gender and race. The theory

does not take into account the society that exists separately to the individual. It is the assumption of a separate 'society', that enables the researcher to divide that society into strata such as 'gender' and 'race' according to previously established criteria, and then place members of society into one, or more, groupings, for instance an 'indigenous, female accountant': "[A]ctors are *made to fit* into a group – often more than one" (Latour, 2005, p 28, emphasis in the original). In other words, Latour (2005) is saying that actors or groups of actors can be pigeon-holed by the researcher:

> Not that they are wrong since its perfectly true that older social relations have been packaged in such a way as to seem to provide a ready explanation for many puzzling subjects. But the time has come to have a much closer look at the type of aggregates thus assembled and at the ways they are connected to one another. (Latour, 2005, p. 22)

Using ANT as a framework, networks which form the social are only present as interaction takes place between actors. Put another way, it is the actors who form their own groups of heterogeneous elements, rather than the researcher. This approach contrasts with social scientists who place individuals into homogenous groupings based on some common characteristics as mentioned above. If there is no interaction, then there is no network in existence and no social context (Latour, 2005). It follows that this theory seeks to understand how or why these groups are formed and not to explore issues such as gender or race.

This absence of focus on homogeneity, helps explain why researchers such as Winner (1993, p. 370) stated, "they [ANT researchers] have little to say about the deep-seated political biases that can underlie the spectrum of choices that surface for relevant actors". Fujimura (1992) put this assertion simply by posing that is important to endeavor to find the answer to such key questions as:

> How and why some perspectives are more persuasive than others in the construction of truths? How and why some actors go along with the will of others? And how and why some resist being enrolled? (as cited in McLean & Hassard, 2004, p. 512).

In answer to these questions, the researcher should consider why actors enroll in networks. According to ANT, actors will become enrolled in the network because they perceive that their interests align with others within it, handing over the power to the principal actor to act, control and co-ordinate the actions of the network so that all may achieve their goals (Latour, 1987). Some actors may not join a network, or may not remain in one which they have initially joined, refusing to allow the principal actor to control affairs. This resistance to

cooperate, when explored by the researcher, can lead to an understanding of the issues of power and morality. Actors, in explaining their behavior and resistance to the researcher, may voice concerns that indicate their problems in these areas.

> Power, like society is the final result of a process and not a reservoir, a stock or a capital that will automatically provide an explanation. Power and domination have to be produced made up, composed. Asymmetries [such as hierarchies and inequalities] exist, yes, but where do they come from and what are they made out of? (Latour, 2005, p. 64).

While the accounting literature employing an ANT perspective does not appear to have pre-supposed any strata of the social world when conducting field studies, actors themselves may actually apply those strata when discussing their networks and the roles they play within them. For example, Chua (1995), in discussing the attitudes of two costing experts towards a proposed new case mix system for a hospital made the following observation:

> As they saw it, present allocative mechanisms were overly influenced by interest group politics and in need of a rational, scientific basis. At the very least, a more objective formula would help identify when, how and whose politics influenced particular outcomes (p. 122).

An observation of this type would seem to be an attempt to answer the key question put forward by Fujimura (1992) of: Why some actors go along with the will of others? In this case study, the experts were keen to champion the new system and other actors supported it, because they viewed it as a mechanism to overcome politically influenced costing that did not reflect reality as they saw it.

Preston, Cooper and Coombes (1992) in their critical interpretation of attempts made to introduce a radical new responsibility accounting system to the British National Health Service, were highly cognizant of political processes and engineering behind this set of events:

> … we have been able to more clearly see the nature of scepticism to systems of financial calculation and an articulation by the sceptics of the possible effects of such systems on the mode of operation of the hospital. Rather than reflecting an organizational reality, these sceptics recognize that organizations may themselves be transformed by accounting systems (p. 589).

and

> Despite all the elaborate fabrications, in this case management budgeting does not become an established fact. Networks are not fully set in place, doctors are not fully convinced of the arguments, managers are faced with alternative demands on their time and resources, information systems do not necessarily connect to the proposed designs of the systems. Thus our account of the

> fabrication of management budgeting is also an illustration of the problems of fabrication and the difficulty of making budgeting systems appear as unexceptional facts of organizational life. (p. 589)

Indeed, the central tenant of their study is to examine "the *struggle* to fabricate an adequate budgeting technology" (p. 563) implying the significance of recognizing the agendas behind the decisions and rhetoric of specific actors and in doing so they sought to examine why some actors were able to exert their influence more effectively than others.

Ezzamel combined ANT with Foucault's Power/Knowledge (1980) to study the building of a network to resist accounting change in a university. Two networks of actors were in evidence in this study, those that attempted to push through redundancies that were perceive to be unfair others who built a network which successfully produced a report to counteract the arguments first put forward. This study is an example of how Foucault's work can be combined with actor-network theory to explain why actors join networks in an effort to obtain their own goals.

In sum, much of the accounting research appears to have been quite focused on examining the agendas, the perspectives and the power plays behind the behaviors and the language of actors. While there does not seem to have been a focus on moral perspectives or on social groupings like gender or race, it would seem overall that the criticism that ANT neglects to evaluate the political issues behind the technologies studied is not prevalent within this body of literature.

The next section will discuss the use of Callon's (1986) conceptual framework in ANT studies in the literature.

5. Callon's four step process

As previously explained in section 2 of this paper, Callon (1986) developed a conceptual framework to explain the development of an actor-network. The four steps (sometimes referred to as the 'four moments of translation'] of 'problematization', 'interessement', 'enrolment' and 'mobilization' where used in his analysis of an attempt by scientists to build a network of miscellaneous actors. The network was designed to increase the understanding of the nature of scallops and improve fishing outcomes in St Brieuc Bay. According to

Callon, these steps, or moments, constitute the different phases of a general process, during which the identity of actors, the possibility of interaction and a process of negotiation is undertaken to enrol the actors into an actor-network (Callon, 1986; p. 203).

Problematization refers to actors' efforts to convince others to subscribe to their own view by showing they have the 'correct' solution (Ezzamel, 1994). That is, they work towards imposing their definition of a problem on others (Carrington & Johed, 2007). Enrolment is the creation of a network of alliances, to build up agreement among the differing actors concerning their interests and how they can align those interests with the Primary Actor (Alcouffe, et al., 2008). Interessement corresponds to the strengthening of links between these various interests and in what form those links will take (Lowe, 1997). Finally, mobilization refers to the monitoring of the interests so that they remain stable (Mouritsen, et al., 2001). This process is common to many instances where accounting changes in an effort to solve a problem and can be used as a construct to understand the linkages between accounting and its social context (Robson, 1991).

Ezzamel's (1994) study of budgetary tension in a university setting called upon the four step process as a means of explaining how the heterogeneous actors were gathered to resist attempts by senior management to make some accounting academics redundant. He utilized the steps to emphasize the resistance and power/knowledge relationships in the case study:

> The process of translation shows how the opposition (AVS) group problematized the issues, established themselves as the focal point of resistance and effectively enrolled and mobilized allies. The strategy of enrolling allies was rooted in the power-based technical knowledge of the AVS group and, in part, in ethical values. Mobilization was also vested in the will and power of those opposed to the change to close ranks and resist (p.237)

In another study, Skærbæk (2009) explored how the National Audit Office of Denmark changed their identities to 'modernizers' and, at the same time, lay claim to be 'independent auditors'. The audit office assisted in the implementation of a new accounting system for the Danish Defence Forces and therefore could be classed as modernizers, while also fulfilling their role of auditor for the same system. Skærbæk used Callon's four step process as an important component of his analysis:

> In operationalising actor-network theory for this study, the four moments of translation constitute the core of the framework to examine the ways in which the performance-accountability project is made feasible and how the [Auditing]Office manoeuvres during the execution of the project (p. 975)

This ability to utilise the conceptual framework has enabled other researchers to compare and contrast in-depth case studies. For instance Alcouffe, et al. (2008) investigated the fate of two costing systems in France. They were able to understand the importance of allies and network building to the promulgation of ABC, and the failure of take up of the Georges Perrin method. The authors took the view that "accounting innovations diffuse because they translate the changing and transitory interests of various groups of actors who are looking to maintain their position and influence within organizations and society" (p. 2). Their findings indicate it was the allies brought in to support ABC against the George Perrin method, rather than the possible technical superiority of the ABC programme itself, that brought about the general acceptance of ABC.

In another example of cross case analysis, Becker, Jagalla and Skærbæk (2013) utilised this conceptual framework to analyse two similar cases. Their research was situated in two German states as Accrual Output-Based Budgeting was implemented. The use of the conceptual framework enabled the authors to compare and contrast the formation of the different actor-networks and the effect of the different moments on the Public Sector Accountants' identities. For instance, in their section on enrolment and mobilization, the accountants in Hesse

> To summarise, regarding enrolment and mobilisation, the cases of Hesse and Hamburg differ in certain dimensions. Certain elements of Hesse's initially sophisticated AOBB concept (e.g. Balanced Scorecards, transfer prices, and detailed variance analyses) were unsuccessful as interessement devices. Thus, they were no longer demanded as mandatory in order to continue with the implementation of AOBB as the reforming actors realised that their initial intentions might have overly strained the organisation. Hamburg had to invest into additional interessement devices to ensure enrolment, yet the consequent training and supplementary staffing was put in to place as an addition to the original setup. Regarding the mobilisation factors as active supporters and sceptics of the reform as well considering the number of defectors, Hesse and Hamburg were rather similar (p. 9-10)

ANT is a theoretical framework used to understand how networks of homogeneous actors, both human and non-human are built to produce new knowledge. The use of Callon's four step process can be seen in the literature to enable the documentation of this process in a way that enables the comparison of different networks. These networks may be built to achieve the opposing outcomes or the same outcome. The conceptual framework may enable greater

understanding not only that actor-networks are different, but may provide a deeper insight into why this is so.

The next section will outline how the above analysis in section can be used to inform further studies using ANT and, possibly, Callon's (1986) four step process in future research.

6. Lessons for Future Research using ANT

Now that we have provided an appraisal of the use of ANT in the accounting literature, we will identify key lessons for future research based on our analysis of previous studies. First, as noted in Section 4.3 there has been a tendency for some studies to overemphasize the human/social element and to downplay the role of non-human actors in the network. It follows that due weight needs to be given to all actors and the inter-connectedness of each within networks needs to be recognized. The issue of symmetry has long been debated in the literature and is discussed in some detail in Section 4.3. It is essential for the researcher to keep an open mind. Neither people nor technology should be given a privileged status in accounting research. Our society has developed over time as we have reacted to the availability of technology and accounting processes are not different. It is important for the researcher to concede that networks may fail because the technology, on which the networks depend, is not utilized or available. Both technology and people play their parts in the network and should be treated impartially.

Second, our discussion in Section 4.1 highlights there has also been a lack of detail provided in some studies about how actors were selected for the study or the basis on which they were omitted from it. Similarly, the rationale for the selection of commencement and finishing dates of case studies is often inadequate. Ultimately the process of selecting appropriate actors to study is dependent on suppositions about what actors exist and their relative positions within possible networks. Clearly, future studies need to elucidate on this actor selection process and the rationale for the time period chosen.

Third, adequate consideration of the exogenous environment is necessary. Too often in prior research the researcher appears fixated on the particular organization or grouping within the organization that he/she is studying. The external environment is largely ignored. This contrast with the philosophy of ANT which seeks to focus on the network rather than limit

itself to an organization (Latour, 2005).The ANT researcher must hold no preconceived notion of roles, responsibilities and boundaries. Including in a study and reporting on the involvement of network participants who may be external to an organization such as consultants or government departments or who may not be at a senior managerial level can provide richer insights into the how the accounting network develops. The researcher must attempt to remain impartial and to consider all possible actors. Choices in some studies appear to have been quite arbitrary, sometimes based on time, budgetary or accessibility restraints. It should also be recognized that networks that are built can be influenced by taken-for-granted macro actors. Today's business environment is dynamic and diverse forces can be brought to bear that will affect the network under investigation. Studies should explain the extent and boundaries of the network and why they have been chosen.

Fourth, a detailed description of the external environment that is influencing the development of the network is also important. Future researchers need to ensure that they appropriately contextualize their case studies so that the reader is in a better position to fully appreciate the overarching influences and countervailing forces behind the actions and processes being studied in a specific situation.

Fifth, Section 4.2. emphasizes that accounting processes and networks in today's organizations are built around a combination of people and technology. It would not be possible to collect, collate and distribute large amounts of data without the use of computers and associated software. It follows that it is not possible for the researcher to ignore the impact that technology has on the production of accounting information and so this element of the network should not be under-played and under-reported in the write-up of case studies.

Finally, the use of Callon's (1986) four step process has operationalized in in-depth case studies in the accounting literature (examples include Ezzamel, 1994; Skærbæk, 2009) and cross case analysis (Alcouffe, et al., 2008; Becker, et al., 2013). The use of this conceptual framework has been shown to enable cross case analysis, leading to a greater understanding of how the human and non-human elements come together (or not) to build the actor-network to produce the required knowledge object.

7. Conclusion

ANT can play an important role as a framework of understanding of the importance of change and understanding the organic nature of this adjustment process within organizations. It is specifically helpful in providing insights into how networks are developed, maintained and altered to achieve the goals of those who join the network. In the accounting context, by understanding how transformation takes place it is possible to see how accounting networks are translated by actors with a view to producing new information. It enables researchers to understand the dynamics of this alteration and which actors, both human and non-human (accountants, technology and others), play a significant role in the change process.

This study sought to provide an appraisal of the applications of ANT in the management accounting change literature. It has sought to enable researchers to understand the how changing accounting practices take place in an organizational context. Our analysis highlights the contribution of ANT's concepts of translation, intermediaries and mediators, and generalized symmetry amongst others which have been employed by accounting researchers. These concepts have been employed to explain a variety of accounting phenomena such as networks developed to: advocate new accounting systems (e.g., Lowe, 2001a, 2001b, 2001c); promote a novel approach to accounting (e.g., Jones & Dugdale, 2002); and, increase control (e.g., Ahrens & Mollona, 2007; Robson, 1992).

Our findings show that while the subject matter studied has been rather diverse, some common themes emerge that show how changing accounting practices can be used including: the potential for accounting to be an effective mechanism for achieving long-distance control (e.g. Mouritsen, Larsen and Bukh, 2001; Robson, 1992); the power of accounting to be used as a rationale for institutional or system change (e.g., Preston, Cooper and Coombs, 1992); the capacity of the accounting profession to adapt in ways that maintain both its legitimacy and relative levels of autonomy (e.g., Jones and Dugdale, 2002; Robson, 1991) and the inter-connectedness of a wide range of actors, human and nonhuman, in facilitating accounting reforms (e.g. Cuganesan and Lee, 2006).

This study evaluates the accounting research to date in light of critical arguments identified in the literature: problems of the inclusion and exclusion of actors; treatment of humans and non-humans; nature of privileging and status; the handling of agency and the structure of

society; and, the process of heterogeneous engineering, notable in relation to concepts of power, ordering and distribution. This analysis was further informed by recent work by Latour (2005) and a recent analysis of the ANT research in accounting by Justesen and Mouritsen (2011). Our investigation revealed a range of limitations in the accounting research using ANT from which we can deduce lessons for future studies in the discipline.

The present study contributes to the literature in four ways. First, it provides a review of management accounting literature which uses ANT to investigate management accounting change. Second, it analyses the application of ANT in management accounting change research through five critical notes on ANT, utilizing Latour's more recent work, especially "Reassembling the Social" (2005). To our knowledge this has not been attempted before in the accounting area. Third, using the lessons from our critique we provide some recommendations for designing future accounting studies based on more recent developments in this theoretical framework. Finally we have considered the use of Callon's (1986) four step process in the analysis and comparison of in-depth case studies.

There are two limitations of the present study that need to be recognized. First, the number of studies utilizing ANT has grown remarkably and we have not included all in our review. However, it should be recognized that we attempted to cover all those that have been commonly cited. Second, some of the controversies in the ANT literature generally such as the symmetry of humans and nonhumans issue are yet to be resolved.

Turning to avenues for future research, ANT has much potential to be used in a wider variety of studies in accounting. Much of the research to date has been studies of management accounting change. The use of this framework for enhancing understanding of change in financial reporting, auditing and management information systems is far less prevalent. Moreover, some studies such as Preston, Cooper and Coombes (1992) and Ezzamel (1980) observed tensions as actors built different networks. How these tensions are played out and how individual actors react to these tensions is an interesting area for further study.

References

Ahrens T, Mollona M. Organisational control as cultural practice—A shop floor ethnography of a Sheffield steel mill. Accounting, Organizations and Society 2007; 32 (4-5): 305-31.

Alcouffe S, Berland N, Levant Y. Actor-networks and the diffusion of management accounting innovations: A comparative study. Management Accounting Research 2008; 19 (1): 1-17

Arnaboldi M and Lapsley I. Asset Management in Cities: Polyphony in action. Accounting, Auditing & Accountability Journal 2009; 23(3), 392 - 419.

Baxter J, Chua WF. Alternative Management Accounting Research: Whence and Whither. Accounting, Organizations and Society 2003; 28: (2-3): 97-126.

Becker SD, Jagalla T, Skærbæk P. The Translation of Accrual Accounting and Budgeting and the Reconfiguration of Public Sector Accountants' Identities. Critical Perspectives on Accounting 2013; In Press.

Bledin J, Shewmake S. Research programs, model-building and actor-network-theory: Reassessing the case of the Leontief Paradox. The Journal of Economic Methodology 2004; 11 (4): 455-76.

Bloomfield B, Vurdubakis T. Boundary Disputes: Negotiating the boundary between the technical and the social in the development of IT systems. Information, Technology and People 1994; 7 (1): 9-24.

Bloomfield B, Vurdubakis T. The outer limits: monsters, actor networks and the writing of displacement. Organization 1999; 6 (4): 625–48.

Briers M, Chua WF. The role of actor-networks and boundary objects in management accounting change: a field study of an implementation of activity-based costing. Accounting, Organizations and Society 2001; 26 (3): 237- 69.

Brown LD. Influential Accounting Articles, Individuals, Ph.D. Granting Institutions and Faculties: A Citation Analysis. Accounting, Organizations and Society1996; 21 (7-8): 723-54.

Bukh PN, Jensen IK. Intellectual capital statements in the Danish utility sector: materialisation and enactment. Journal of Human Resource Costing and Accounting 2008; 12 (3): 148-78.

Callon M. Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay. In: Law J, editor. Power, Action, and Belief: A New Sociology of Knowledge? London: Routledge; 1986. p. 196-223.

Callon M, Latour B. Don't throw the baby out with the bath school. In Pickering A, editor. Science as Practice and Culture. Chicago, IL: University of Chicago Press; 1992. p. 343-368.

Callon M, Muniesa F. Economic markets as calculative collective devices. Organization Studies 2005; 26 (8): 1229-50.

Carrington, T, Johed, G. The Construction of Top Management as a Good Steward: A study of Swedish annual general meetings. Accounting, Auditing & Accountability Journal 2007; 20(5):p. 702-708.

Chua WF. Experts, networks and inscriptions in the fabrication of accounting images: A story of the representation of three public hospitals. Accounting, Organizations and Society 1995; 20 (2-3): p. 11-145.

Chua WF. Translating Social Theory: A critical commentary. Critical Perspectives on Accounting 2004; 15 (2): 255-60.

Collins H, Yearley S. Epistemological chicken. In Pickering A, editor. Science, Practice and Culture. Chicago, IL: University of Chicago Press; 1992. P. 301-326.

Cooper DJ, Robson K. Accounting, Professions and Regulation: Locating the Sites of Professionalization. Accounting, Organizations and Society 2006; 31 (4-5): 415-44.
Cuganesan S. Calculating customer intimacy: accounting numbers in a sales and marketing department. Accounting, Auditing & Accountability Journal 2008; 21 (1): 78-103
Cuganesan S, Lee R. Intra-organisational influences in procurement networks controls: The impacts of information technology. Management Accounting Research 2006; 17 (2): 141-70.
Emsley D. Different interpretations of a "fixed" concept: Examining Juran's cost of quality from an actor-network perspective. Accounting, Auditing & Accountability Journal 2008; 21 (3): 375-97.
Ezzamel M. Organizational change and accounting: understanding the budgeting system in its organizational context. Organization Studies 1994; 15 (2): 213-40.
Foucault, M, Power/Knowledge: Selected interviews and other writings. Gordon C, editor. Brighton, Harvester 1980.
Fox S. Communities of practice. Journal of Management Studies 2000; 37: 6: 863-67.
Fujimura J. Crafting science: standardized packages, boundary objects and translation. In Pickering A. editor. Science, Practice and Culture; Chicago, IL: University of Chicago Press 1992. p. 168-211.
Gendron Y, Barrett M. Professionalization in Action: Accountants' Attempt at Building a Network of Support for the WebTrust Seal of Assurance. Contemporary Accounting Research 2004; 21 (3): 563-602.
Habers H, Koenis S. The political eggs of the chicken debate. European Association for the Study of Science and Technology Review 1996; 15 (1): 9-15.
Hopper T, Major M. Extending Institutional Analysis through Theoretical Triangulation: Regulation and Activity-Based Costing in Portuguese Telecommunications. European Accounting Review 2007; 16 (1): 59-97.
Hopwood AG. Whither accounting research? The Accounting Review 2007; 82 (5):1365-74.
Hull R. Actor network and conduct: the discipline and practices for knowledge management. Organization 1999; 6 (3): 405-28.
Hyvönen T, Järvinen J, Pellinen J. A virtual integration: The management control system in a multinational enterprise. Management Accounting Research 2008; 19 (1): 45-61.
Jones C, Dugdale D. The ABC bandwagon and the juggernaut of modernity. Accounting, Organizations and Society 2002; 27 (1-2): 121-63.
Justesen L, Mouritsen J. Effects of actor-network theory in accounting research. Accounting, Auditing and Accountability Journal 2011; 24(2): 161-193.
Latour B. Science in Action: How to Follow Scientists and Engineers through Society. Cambridge, Mass: Harvard University Press; 1987.
Latour B. The Pasteurization of France. Cambridge, Mass: Harvard University Press; 1988.
Latour B. Technology is society made more durable. In Law J editor. A Sociology of Monsters: Essays on Power, Technology and Domination, London: Routledge; 1991. p. 103-31.
Latour B. Reassembling the Social: An Introduction to Actor Network Theory. Oxford: Oxford University Press; 2005.
Latour B, Johnson J. Mixing Humans and Non-humans: Sociology of a Door-opener. Social Problems 1988; 35: 298-310
Latour B, Woolgar S. Laboratory Life: The Construction of Scientific Facts. Princeton, NJ: Princeton University Press; 1986.
Law J. On Methods of Long-Distance Control: Vessels, Navigation and the Portuguese Route to India. In Law J, editor. Power, Action and Belief: A New Sociology of Knowledge? London: Routledge; 1986. p. 234-63.

Law J. Introduction: Monsters, machines and sociotechnical relations. In LawJ, editor. Sociology of Monsters: Essays on power, technology and domination. London: Routledge; 1991. p. 1-25.
Law J. Notes on the Theory of the Actor Network: Ordering, strategy and heterogeneity. 1992 available at http://www.lancs.ac.uk/fass/centres /css/ant/ant.htm #int
Law J. Actor Network Theory and the Material Semiotics. 2007 available at http://www.heterogeneties.net/publications/Law2007ANTandMaterialSemiotics.pdf.
Lee N, Brown S. Otherness and the actor-network: the undiscovered continent. American Behavioural Scientist 1994; 37 (6): 772–90.
Lee N, Hassard J. Organization Unbound: Actor-network theory, research strategy and institutional flexibility. Organization 1999; 6 (3): 391-404.
Lounsbury M. Institutional Rationality and Practice Variation: New directions in the institutional analysis of practice**.** Accounting, Organizations and Society 2008; 33 (4-5):349-61
Lowe A. Accounting Information Systems as Knowledge-Objects: Some effects of objectualization. Management Accounting Research 2001a; 12 (1): 75-100.
Lowe A. After ANT: An illustrative discussion of the implications for qualitative accounting case research. Accounting, Auditing and Accountability Journal 2001b; 14 (3): 327-51.
Lowe A. Casemix Accounting Systems and Medical Coding: Organisational actors balanced on "leaky black boxes". Journal of Organizational Change Management 2001c; 14 (1): 79-100.
Lowe A. Postsocial Relations: Toward a performative view of accounting knowledge. Accounting, Auditing & Accountability Journal 2004; 17 (4): 604-08.
Lowe A, Koh B. Inscribing the Organization: Representations in dispute between accounting and production. Critical Perspectives on Accounting 2007; 18 (8): 952-74.
McLean C, Hassard J. Symmetrical Absence/Symmetrical Absurdity: Critical notes on the production of actor-network accounts". Journal of Management Studies 2004; 41 (3): 493-519.
McNamara C, Baxter J, Chua WF. Making and managing organisational knowledge(s). Management Accounting Research 2004; 15 (1): 53-76.
McRae T. A Citation Analysis of the Accounting Information Network. Journal of Accounting Research 1974; 12 (1): 80-92.
Miller P. Accounting Innovation beyond the Enterprise: Problematizing investment decisions and programming economic growth in the UK in the 1960s. Accounting, Organizations and Society 1991; 16 (8): 733-62.
Miller P. The multiplying machine. Accounting, Organizations and Society 1997; 22 (3-4): 355-64.
Mouritsen J, Larsen HT, Bukh PND. Intellectual Capital and the 'Capable Firm': Narrating, visualising and numbering for managing knowledge. Accounting, Organizations and Society 2001; 26 (7-8): 735-62.
Pels D. The politics of symmetry. Social Studies of Science 1995; 26 (2): 277–304.
Pipan T, Czarniawska B. How to Construct an Actor-Network: Management accounting from idea to practice. Critical Perspectives in Accounting 2010; 21(3): 243-51.
Preston AM, Cooper DJ, Coombs RW. Fabricating Budgets: A study of the production of management budgeting in the National Health Service. Accounting, Organizations and Society 1992; 17 (6): 561-93.
Quattrone P. Commenting on a Commentary? Making methodological choices in accounting. Critical Perspectives on Accounting 2004; 15 (2): 232-47.

Quattrone P. Books to be Practiced: Memory, the power of the visual, and the success of accounting. Accounting, Auditing & Accountability Journal 2009; 34 (1): 85-118.
Quatrrone P, Hopper T. What is IT? SAP, Accounting, and Visibility in a Multicultural Organisation. Information and Organization 2006; 16: 212-50.
Reed M. The Action/Structure Debate in Organizational Analysis. Paper prepared for the Conference on Structuration Theory and Organizations, Paris, France 1995.
Robson K. On the Arenas of Accounting Change: The process of translation", Accounting, Organizations and Society 1991; 16 (5-6): 547-70.
Robson K. Accounting Numbers as "Inscription": Action at a distance and the development of accounting. Accounting, Organizations and Society 1992;17 (7): 685-708.
Rutherford T, Holmes J. The Flea on the Tail of the Dog: Power in global production networks and the restructuring of Canadian automotive clusters. Journal of Economic Geography 2008; 8 (4):519-44.
Skærbæk, P. Public Sector Auditor Identities in Making Efficiency Auditable: The National Audit Office of Denmark as an independent auditor. Accounting, Organizations and Society 2009; 34, 971-987.
Strathern M. Cutting the Network. Journal of the Royal Anthropological Institute 1996; (2): 517–35.
Sturman S. On Black-boxing Gender: Some Social Questions for Bruno Latour. Social Epistemology 2006; 20 (2): 181-84.
Vidmar-McEwen, H. Anthropologists Biographies: Bruno Latour. 2008. Available at http://www.indiana.edu/~wanthro/theory_pages/Latour.htm
Winner L. Upon Opening the Black Box and Finding It Empty: Social constructivism and the philosophy of technology. Science, Technology and Human Values 1993; 18 (3): 362–78.