An Investigation into Agile Supply Chain Networks: A Proposal for a Research Framework Based on Pragmatic Inquiry into Workarounds

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Research
ABSTRACT

Supply Chain Networks are increasingly being required to increase their Agility particularly to the unexpected. Yet there is a lack of theoretical clarity on what this means and what the underlying mechanisms are. This is in part associated with a reliance on positivistic theory that deals with linear predictable events but not with the unpredictability of the complex context, which these networks are working within. In contrast, this paper builds upon complexity theory and outlines a theoretical and conceptual framework for studying the issue of agility in Supply Chain Networks. Pragmatic theory building is used as a guiding philosophy, based on Lynham’s theory building process. A small illustrative case study of workarounds is used to show how this philosophy and process could be used to Study SCN.

Keywords: Supply Chain Networks, Agility, Pragmatic Inquiry

INTRODUCTION

There are growing trends in the socio-economic landscape brought about by impending energy costs, the introduction of fast evolving ICT driving the expansion of corporate and social networks, natural disasters, potential regional balance of power shifts and on-going global economic down turns. These are disrupting the once established slow changing practices associated with global and regional supply chain dynamics.

To this end a number of articles have addressed the issue of agility in order to bring to light those characteristics that define such a network [15]. Thus far however, studies have reported on rather speculative, generalist broad model approaches largely bordering on a positivist (philosophical) outlook that hinders pluralism [22]. A recent survey of the literature by Burgess, Singh and Korologu [6] points out that as the supply chain literature grew, it adopted the same positivist biases as the management and economics literature.

We believe however, that studies into the nature of Supply Chain Network (SCN or network) agility are best served by a pragmatic approach since the very nature of unstable environments increases their complexity to the point of becoming poorly definable in positivist terms. That is, setting aside the guiding principles of reductionist type approaches based on seemingly ill-suited epistemologies for developing theories based on complex social systems [22, 23, 24, 29].

The context of a SCN can be viewed as a highly networked complex social system (systemic) where the relationships between the entities that are part of the system give it meaning (epistemic). However, within this complex system, relationships are dynamic and subject to structural redefinition embracing the ontology of multiple realities (i.e. qualitative, but more specifically pragmatic) [22]. Once this notion of complexity and variability is accepted, one can begin to perceive the limitation of a positivist approach to inquiry in terms of theory building. In other words, when one moves beyond the reach of positivism but still intends to remain within the boundaries of rational inquiry, attention should turn to underlying philosophies of inquiry that at least lend support to the socio-political [12, 31] context of the discourse at hand that is, “experiential conditions” [26, 29].

This paper forms a position statement in terms of the approach used to reach a definition of agility within the context of a SCN. It begins by placing the notion of agility in SCNs within the pragmatic paradigm. It does this for at least two reasons. Firstly because a SCN it is
situated in a complex socio-political system where structural and dynamic changes can occur rapidly and in a stochastic fashion rather than through planning. Secondly, because inquiries into complex socio-political systems are not well served, indeed can be severely limited, by a positivist approach [22, 23, 24]. The second part of the paper outlines a practical pragmatic approach to an investigation into a definition of agility within the context of a SCN.

It is envisaged that this approach into SCN agility would follow the process as outlined by Lynham [25]. In practical terms this entails the forming of an initial view regarding the approach to the definition of agility, the identification and definition of the determinants of agility, the nature of the interaction (model) of the determinant of agility, the use of the model to analyse agility within various settings, and finally measuring the effects of various levels of agility on organisations.

**PRAGMATIC INQUIRY**

Pragmatism according to James [16] is borne out through a complex interconnection of pluralistic beliefs, experiences and the ‘cash-value’ of experiences (p.88-100). Put in another way: “True ideas are those that we can assimilate, validate, corroborate and verify. False ideas are those that we cannot. That is, the practical difference it makes to us to have true ideas; that, therefore, is the meaning of truth, for it is all that truth is known as,” (p.88). So the identity, the true self of a “thing” (whether concrete or abstract) in all its multidimensional richness is not considered to be an innate property that spontaneously reveals the absolute truth about the “thing” but rather, what the “thing” is, is made true by events, circumstances, perceptions, historical significance, cultural values and actions [2]. In short, the truth is reached through a process of verification, validation and the unique perceptual significance found in events. Put simply, pragmatism is the set of beliefs that says the truth is not an idea but something that happens to make ideas true.

To inquire pragmatically is to begin with an engagement with ideas [19]. A pragmatist is not concerned with abstract philosophical inquiry as such, but with the notions that reality is born out through the mutation of social experience. This mutation takes place as actors engage ideas to assess their usefulness. As Metcalfe [26] notes it’s more about ‘what works well’ and ‘conjectures’ that make sense, rather than an abstract set of laws determining the existence of a concrete, pre-determined, reductionist reality [2]. Metcalfe [26] outlines a series of principles that determine the meaning of a pragmatic inquiry. Below these concepts are related to the idea of an agile network:

1. The community, in this case SCN professionals, draw from different experiences in order to determine physical events. That is, the current state on agile SCNs is based in part, on a series of past decisions that go back through previous learning experiences. In order to comprehend the current state, previous decision-making events need to be carefully scrutinised.

2. A dialectic of possible truths is required to shape a consensus. Pragmatism requires an engagement with a variety of ideas in order to synthesise [19] a set of ideas that revolve around clear ordered concepts. An agile SCN is pragmatic because it adapts as the people in it weigh up and adopt alternative concepts to keep it active and moving. A key argument here is that **practical problems and rationality**, is a key driver for agility. The supply chain moves and adapts to match current and anticipated future events, and market fluctuations that in turn create the agile network.
3. Whatever concepts are used to create a ‘solution’, require that they be transformed into a hypothesis or statement of truth that can be effectively verified. The agile SCN does not run on hopes and dreams; it runs on verifiable algorithms, concepts and ideas that are built on what works well. Discovering these core concepts and systemic and epistemic relationships will help us uncover how agility works.

4. Try out the concepts/solutions and learn from the experience. An agile SCN is a learning network. It draws on the pragmatic notion of what works well; derived from practical ‘trying’ and learning that comes from implementing hypothesis to see if they work well or not. This step can also be thought of as a learning stage where the key elements of pragmatism come together. As James [16] said, ‘the truth is something that happens to ideas.’

5. Having acted, the pragmatist learns about what works well by reflecting on how these ideas came together. This where the ideas and hypotheses are carefully examined for their usefulness.

In summary, a pragmatic inquiry is one where the historical concepts of the subject of investigation are examined for their usefulness through the lens of multiple realities (as opposed to a singular truth – thus likening it more to a subset constructionist epistemologies related to practical outcomes [5] rather than positivist ones), tested, reflected on and thought of as useful or not useful. The key elements of pragmatic inquiry are the identification of these concepts, the testing of them and sorting into meaningful groups for further analysis.

We propose linking pragmatism to agility by studying the patterns of work of agile SCN based on three broad assumptions. Firstly, that agile SCN are pragmatic in orientation. That is, they develop over a period of years through the engagement of pragmatic assumptions (shown above). Secondly, they do so in a systemic interconnected fashion. The epistemological base they embrace includes a type of communication (a systems thinking mindset [18]) that draws on the connections between the wholes rather than a focus on the analytical parts. Lastly, the epistemology is divergent, drawing on the connections and core concepts that make agility work.

**PRAGMATISM AND THEORY BUILDING**

In line with the pragmatic inquiry tradition the proposed research can be classified as exploratory with the intent of building a theory [11], supported by an appropriate model, and eventually tested in a physical environment. This premise fits well given the scant knowledge about what an agile system is, its determinants (factors), and how those factors interact (model) to facilitate agility. Rational inquiry is able to handle an initially combined inductive and deductive approach eventually leading to model building [28]. This is quite relevant as agility is not well defined and begins with a broad and ill-defined theme to be nurtured and expanded into firm theoretical concepts.

It is important at this stage however, to take a step back and seriously consider how the gap between theoretical schemes (theory) and empiricism can be credibly bridged. We regard this as an important requirement that should not to be compromised since any derived tool-set, to be of practical use, should possess a high level of reliability in terms of both internal and external validity. To this end we turn to the notion of “concepts” as proposed in Blumer [3] and used by many others since [4, 13]. Blumer [3] argued that concepts (for the want of a
better word) are the means of establishing a link between empirical instances and their theoretical proposal. However, the simplicity of the statement belies a hidden complexity. The relationship between concepts and the empirical world can be deceptively difficult, hard to define and, at times, impossibly vague. Since (as previously stated) the scope of our investigation lies in a complex socio-political domain, the notion of concepts, in this case “agility”, at best allows only for a tenuous identification; current literature certainly does not clearly and unequivocally define agility as a class (attributes, boundaries, benchmarks, etc.). This vagueness is quite problematic as it hinders our ability to move forward with confidence and formulate adequate methods of inquiry for the research at hand.

If we accept the premise that “agility” as a concept in SCNs lacks precise reference, with attempts at its definition yielding disparate opinions and ill-defined (if any) tool-sets [15], then there is a need to step back and rethink a different approach to its investigation. As suggested by Bowen [4] concepts such as “agility” can be used as “sensitising instruments” for the task at hand, providing at the very least a starting point with a sense of direction. The notion of concepts as sensitising instruments reflects the pragmatist philosophy needed in order to move forward in ill-defined problem domains such as these allowing for the concept (in our case agility) to develop and improve over the course of the research in order to capture the nature of the phenomenon to which it relates (sociology research methods; Bryman, Liao, Lewis-Beck).

Drawing from Faulkner [13] we expect the investigation to rely on both the exploration and exploitation of concepts. Although the investigation is based on pragmatism, its very nature allows for a plurality of methods working in sync, including the utilisation, refining, deepening and extension of existing concepts (exploitation) and the discovery and development of new concepts (exploration).

In this study the substantive (empirical) area of inquiry are SCNs, whereas the formal (conceptual) area of inquiry is agility. As Glaser and Strauss [14] observed, most studies generating substantive theory will ultimately generate and improve formal theory.

To this end Lynham’s [25] general method of applied theory building is deemed the most appropriate due to its flexibility in terms of allowing the generation of theories from multiple paradigms and the inclusion of inductive and deductive logic. Further, the method makes the process explicit, and if desired applicable to practice allowing to evolve through both empiricism and reflection. Drawing attention to Figure 1 we note the plurality of the method in terms of paradigm diversity and logic approach.

As seen in Figure 1, the conceptual framework is derived during the conceptual phase as a result of the initial investigation. This is followed by the operationalization of the concept into a model applicable in practice. Once the operationalization phase is completed the model is either confirmed or disconfirmed from the point of view of whether the model can help inform practice. That is, has the model been correctly defined and derived from the research agenda (have we built what we intended to build). The application phase determines whether the theory does in fact work in practice, and helps bring about understanding and subsequently improvements. During this phase the theory should be under constant review for possible improvements. Ongoing is the phase refinement and improvement, where theory and model are continuously reviewed and improved upon over time as long as it remains serviceable.
The flexibility of the method in terms of a pragmatic approach lies in the overall inherent concept of continuous refinement and development, including both inductive and deductive approaches and the freedom allowed to the researcher (intuition, creativity, and curiosity) [25]. In the conceptual development phase, whose outcome is the conceptual framework, the approach allows for a wide scope of inquiry methods ranging from archival searches, suitability of alternative theories, ethnographic studies, literature reviews, etc. In this phase the theory begins to take shape and its fundamental elements are identified together with relationships and limitations. At this stage Lynham’s method [25] becomes useful in another way; that is, as taxonomy of relevant theories, models and practical applications of the concept under investigation. This is helpful because deductions about how theories relate to each other and how they contribute to different components of the theory building process can be made. Further, the classification helps in identifying gaps in the literature. So, on the one hand the classification will help build an historical overview on agility and also act as a guide for future research.

In a practical sense a suitable way forward for this type of investigation is the mixed method approach as it allows both exploratory and confirmatory activities within the same study [32, 7]. Of the six proposed mixed methods [8] the ‘sequential exploratory mixed method’ is proposed for the study. In particular see Figure 2 (b), which best represents the method adopted.

Figure 1: Lynham’s General Method of Theory Building [25]
As shown, data is collected using a suitable qualitative instrument such as focus groups, interviews, observation, etc. This is followed by a qualitative analysis of the data which includes methods such as coding, hermeneutical analysis, induction, typology, etc. The interesting part in the mixed method approach occurs at this juncture; if the qualitative analysis has been carried out rigorously then its use to inform the quantitative phase of the analysis brings about a higher quality instrument for data collection. This in turn can avoid instrument redesign. This is followed by the quantitative analysis phase and then the interpretation of the results.

**Conceptual Development Phase**
A number of steps are proposed in order to identify relevant factors and models that explain agility, frame an appropriate model, and eventually validate it. In the first instance a thorough review of the literature needs to be conducted, seeking out those attributes that have so far been identified as determinants of agility, and analysing proposed models. While the review should primarily consider the field of research at hand, extending the search into adjoining fields, e.g. the management literature, may yield useful insights into a broader view of agility thus considering the inclusion of other (new) determinants and perhaps the validation of other models. It is not unusual during the review process to find conflicting information. In these instances further analysis needs to be carried out to uncover the reasons behind sometime favourable and/or unfavourable reporting. If the differences cannot be reasonably resolved the particular findings are ignored.

The second stage of the study consists of building a model to determine how the candidate determinants so far identified might interact leading to a conceptual view of agility. In order
to do this determinants and models identified during the literature review are considered. Of crucial importance at this stage is the identification of contextual information. Usually factors and subsequent models are tested within a narrow context (this could be due to a number of legitimate reasons) and it’s unusual to find a ubiquitous set of factors and/or models, see for example TAM [10]. In any case the end result from the second stage should be a set of candidate determinants whose interaction leads to a hypothetical theory which can conceptually be viewed in the form of a model.

**Operationalisation Phase**

The third stage of the study consists of presenting the candidate determinants and their interactions in the form of a model to a number of experts for critical review. A number of methods exist in order to collect data from experts. Open ended interviews are quite common for collecting data in qualitative research as opinions about unforeseen issues are difficult to otherwise collect [9, 21]. In any case the colloquialism (chattiness) realized in this type of interview yields rich and extensive data [17]. It is envisaged that during this stage a number of both public and private organisations will be surveyed using open ended interviews. From the interviews factors that influence agility will be identified, including current and future initiatives and their likelihood to affect agility. The design of open ended interview questions and questionnaires should be naturally grouped around themes identified in the literature. It is proposed that the participants be selected using purposeful random sampling [30] in order to select information rich cases. The interviews will be recorded for transcription and prepared for data analysis. The ensuing qualitative data analysis will be inductive in nature [3, 8] in order to establish a comprehensive set of themes. NVivo is a suitable tool for analysing qualitative data as it is helpful in managing the data and emerging themes, it can also represent the data graphically providing an excellent visual aid. The emerging themes are then interpreted and linked to determinants identified in the previously formulated conceptual model. Finally based on the findings a number of propositions will be developed which can be tested (quantitatively) in a pilot study.

Validity and reliability are of a concern especially in the qualitative stage of a mixed research study. To begin we assume that validity and reliability is implied in those factors adopted from previous research and therefore tested in previous studies. To uphold validity and reliability in the interview process steps such as pilot interviews, reflective listening and interview transcription (validation) can be used to ensure accuracy.

**Confirmation or Disconfirmation Phase**

The fourth and final stage involves the testing of the propositions or hypothesis defined during the qualitative analysis. This stage involves the design of a questionnaire (instrument) suitable for large surveys administered to a sample population. As in the qualitative survey the target population will have to be identified albeit on a much greater scale. An appropriate way forward would be to use cluster sampling procedures where corporation of similar characteristics would be grouped together. Random sampling procedures (simple random sampling) can then be used within the clusters to target the survey recipients [8]. A fast, inexpensive and flexible method for delivering questionnaires is through the internet [28] this is also quite handy if the target population happens to be global. Once the surveys have been completed the quantitative analysis can follow. A number of techniques are available to derive meaning from the analysed data [28]. To provide an example of pragmatic theory building the following case study of determining ‘agility’ in a supply chain is offered. To structure the discussion we follow a qualitative theory building case study that results in a
model as per Lynham’s theory building. Case studies can be a useful mean to identify detailed, complete, self-contained examples, pertinent and in support of the discussion.

**CASE STUDY**

Several years ago a company called ‘Utilcom’ developed a network infrastructure for delivering freight across the northern parts of the country. However, after many years of operation, the supply chain had become slow and inefficient. In order to overcome the problem, management decided to reorganise its processes and use an information system to introduce a number of improvements to regain lost efficiency. When it became apparent that the information system had not delivered the results a research team was called in. It was soon realised that although it looked as if the information system was being used as planned, in reality workarounds had been devised. The research team was asked to come up with an explanation for the reasons why this may be the case. The research team decided that an approach using pragmatic inquiry would deliver a strong plausible explanation (theory), since the problem was situated in a complex socio-political system.

**Conceptual Development**

According to Lynham [25], the conceptual development phase should lead to a guiding framework, or a set of concepts used to make sense of the research issue. The research team began with a model that offered an explanation of the phenomenon at hand. As Lynham notes, this initial explanation is used to guide the researcher, and complements the ‘sensitising concepts’ phase mentioned earlier. Metcalfe [26] points towards the idea that in pragmatic inquiry the research team begins with a conjecture – a rough thumbnail sketch – of what the problem may be. This explanation drives exploration into the problem and effectively leads to conclusions and empirical measurements as to what the likely ‘causes’ may be. The conjecture for this case was based on variants of decision making theory and for expediency was called ‘adaptive behaviour’. Borrowed from psychology, adaptive behaviour was argued to explain problem solving in situations where a change comes along into a person’s life, usually personal, that forces individuals to adapt and change as the context of their environment shifts.

As the concept of adaptive behaviour was applied it promoted the understanding of the behaviour of the people interviewed. For example, people where deliberately creating workarounds and changing work processes in order to cope. It was at this phase during the conceptualisation stages that the team drew on the dialectic suggested by Metcalfe. Reasons for ‘adaptive behaviour’ were explored from a positive and negative aspect simultaneously. If workarounds were being created it was reasoned that the system was not adequately meeting the needs of workers. On the other hand if workers were using the systems, management would believe that workers would be more productive. This would enable the proposition of a flexible interpretation that could explain the complex phenomena noticed from both the workers and management perspective. This flexible interpretation led to the formulation of a concept that allowed for the exploration of the problem in more depth.

**Operationalisation Phase**

Due to the complexity of the case a method that explained adaptive behaviour couldn’t easily be found. This was also the case because behaviour can fluctuate depending on circumstances and different contextual stimuli [20]. To this end two propositions were developed to guide the exploration of the problem from earlier conjectures:
(1) – How is the system facilitating fluctuating adaptive behaviour?
(2) - How is the system not facilitating fluctuating adaptive behaviour?

To observe these propositions a broad study of the organisation over a long period was conducted, previously reported in Houghton and Metcalfe [19]. After several rounds of interviews it was revealed that workarounds could often explain the behaviour of workers in the same way they could explain the behaviour of management. That is, if managers believed the system was effective it was equally reflected as ineffective by worker actions in that they didn’t use it. Managers that were interviewed saw the system as useful and productive, except when workarounds emerged and workers saw their own workaround as being efficient regardless. This presented the research team with a paradox. To explore this the concept of ‘adaptive behaviour’ was used to explain how managers adapted their interpretation and behaviour of the problem to fit their own perceptions as did the workers. The problem was that both sets of managers and workers delivered different versions of reality yet would agree that the system was the single point of their problems! As noted earlier, different experiences are drawn upon to give people better explanations. Adaptive behaviour (for the research team) meant that actors were systematically modifying actions and beliefs to suit acceptable truths. The challenge was to get both parties to an acceptable ‘synthesis’ where they could agree on a model where the ‘truth’ was a shared concept.

**Confirmation and Disconformation**

Lynham [25] describes this phase as the building of a ‘trustworthy’ theory than can be used with confidence to inform better action and practice. Given the pragmatic nature of this study the aim at this phase should nojust be explanatory. As Lynham notes it should create a theory that can be used to explain, predict, inform and even guide practices (as in the case of PSMs [27]). The theory had to have ‘practical consequences’ if it was to be pragmatic. Ackoff [1] first used the concept of ‘dissolving problems’ based on his own interpretation of Hegelian synthesis as part of his research. To help test the assertions that ‘adaptive behaviour’, as it was constructed, explained and informed the problem context, a model of practice that would dissolve the current tensions was facilitated. This of course depended on the research team’s ability to have the opportunity to do so. After the initial investigation Utilcom decided to look at each worker individually and see what their work patterns were like. The purpose of this was to create a platform for worker/system integration to see if the fluctuating patterns could be normalised through a synthesis of worldviews.

It was eventually discovered by the organisation over a period of time, that if people could be shown how the system made their lives easier, thus adjusting their concepts of what worked well, they would engage and begin to use the system. This worked for the consultant but left the research team with difficult set of explanations. It confirmed that by moving the two parties together towards a central concept their behaviour would become similar and a new agreement on new ideas could be reached. On the other hand, it showed that the adaptive behaviour concept was based on two streams. Firstly, that the workers had their own set of concepts that may have been ill-informed. Secondly, that those concepts were the basis for their ‘adaptive behaviour’. That is, they changed as they related to the perception of circumstances as they saw it. When they began to move their concepts of the situation and management worked with them to help them, a new concept emerged and both sets of behaviour changed. This gave the research team a preliminary working model of worker adaptive behaviour in complex environments as shown in Figure 3 below:
This crystallised for the research team the veracity of the concept to explain complex realities. What was disconfirmed was the ability of the concept to explain a singular reality. That is, at first it was conjectured that the concept would explain worker behaviour in relation to the system. It actually emerged as a useful concept to explain the relationship of workers with other workers in synchronous hierarchies. The concept helped the research team to make sense of the interactions and eventually helped to frame a meaningful conclusion. This can be summarised as the following ‘theory’: In order to tame multi-directional adaptive behaviour, a core set of beliefs and concepts is required. This was to some extent a re-iteration of Ackoff [1]. However, by having this explanation the research team was able to take action and structure the problem differently.

**Continuous Refinement and Development**

The research team also proposed a working concept that could be further tested in a more robust analysis. Although it hasn’t as yet happened, future research will develop this concept and place it in other cases or perhaps some empirical model to refine it. During the phases of the theory building several working ideas of the concepts were formulated and refined. Movement from inductive to deductive reasoning and back again several times was noted. The result was a framework that could be developed continuously.

**CONCLUSION**

The study, in the initial stages at least, follows a pragmatic epistemology in order to exploit the pluralistic nature of the topic at hand. Indeed, one might conjecture that in codifying a methodology of inquiry based of pragmatic principles we are weakening the principles on which the inquiry is based on since we are assisting convergence, moving towards consensus. However, in broad terms, this methodology should identify a richer set of factors that determine the agility of a SCN, specifically in turbulent environments. Further, the interaction of the factors believed to lead to agility can then be presented as a model and subsequently tested for validity. Pragmatism re-enters the discussion however if a view of continuous refinement and development is adopted, although this is not addressed in the proposed research design. In terms of the overall purpose, the identification and consensus about what constitute agility and what agility actually is, is particularly important if we are to measure its impacts as there is need of a firm platform from which to do this. As demonstrated, in the case example, the iterative process of theory building can lead to more
practical and useful insights about agility. For example, the different levels of agility revealed through the case above were the result of thinking about the problem through the philosophical lens of pragmatism. A lot more work would be needed to flesh these out. It is our intention that the effects of agility, once determined, on firm performance can be studied and effectively quantified.

REFERENCES


