

**TITLE: Development of agile supply chains within SMEs**

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**SUMMARY:** Changes in worldwide competition and the traditional marketplace have resulted in SMEs facing unprecedented levels of challenge. Larger organisations have traditionally made use of their financial power to enforce supply chain compliance, but their small stature eliminates this possibility for SMEs. New methods of supply chain development in terms of agility provide a viable option to assist SMEs in this new environment. Various frameworks have been proffered to assist in the development of supply chain agility, yet they tend to concentrate on the prospect from a strategic rather than an operational perspective. Underpinned by these supporting frameworks, this paper provides a practical model through which agile supply chains can be developed by SMEs for their long-term growth and competitiveness.

**WORD COUNT:** 1920

## Key Terms

- Agile – the ability of organisations to adapt to change and uncertainty at short notice.
- Supply chains – factors interlinking activities such as purchasing, manufacture, warehousing, distribution, customers and end users.
- SMEs- Small and Medium Sized Enterprises.

## Introduction

In turbulent times, standardised means of operation falter, requiring new methods to be devised and adopted. From a historical manufacturing perspective, mass production implemented various lean as well as output-controlled methodologies to align itself with market needs and surpass competitors (Peaucelle, 2000; Lucio, 2013).

The turbulent business environment has impacted most organisations, yet SMEs and their restricted means have possibly felt the challenge more than most (Ahmad et al., 2012), with the financial tests faced (Löfving et al., 2013) being compounded by legislature, market volatility, supply chain relationships and national economic failures (Bhamra and Dani 2011). Furthermore, the increase in world-wide competition and the now everyday use of on-line shopping has brought competition to SMEs that had hitherto not existed, making them more vulnerable to market fluctuations than their larger counterparts (Vargo and Seville, 2011). Despite such knowledge, only limited research has been conducted in this field, the majority of which are not necessarily applicable to SMEs (Herbane, 2010).

The importance of SMEs is recognised throughout the world (Peters and Waterman, 2012), alongside the relevance of supply chains and the growing adoption of agility (Gligor and Holcomb, 2012). The agility concept has been widely researched over the past 20 years. The rich literature of the subject provides the required setting for undertaking this research study. Possibly the most common overview descriptor for agility was advocated by authors such as Nagel and Dove (1991) and Pan and Nagi (2013) who suggested it to be the ability for an organisation to respond to changing and unpredictable environments.

The growing interest in agility within supply chains indicates its potential to assist organisations in achieving their required levels of efficiency as well as flexibility and responsiveness. Work by authors such as Sharifi & Zhang (1999), Ismail *et al.*, (2006) and Sharifi *et al.*, (2013) aligned this potential to the need of SMEs, providing strategic overviews for the possible means of implementation. However as an emerging methodology for setting organisational strategy and direction, it has not been developed well - Vázquez-Bustelo *et al.*, (2007) argued that there is a lack of tools available to assist in agile supply chain development and implementation. Zhang (2011) and Ismail *et al.* (2011) have also highlighted the fact that there is no satisfactory answer to the question as to how agility can be built into organisations, and particularly across supply chains.

With this knowledge gap in mind, this research considers the strategic perspectives aligned to SMEs and agile supply chains, and presents a model with which SMEs can practically move forward in the application of this concept. In practice, the research focuses on how SMEs should and can engage in product innovation/development in accordance with the circumstances in their business environment, and consequently successfully and sustainably deliver their products to markets and customers around the world, with the supply chain as the unit of analysis.

Two key objectives pursued in this work are 1) To theoretically and empirically explore the idea of agile supply chains in the context of SMEs. This will involve the exploration and extension of agile supply chain frameworks for SMEs to examine their benefits or otherwise, and to ultimately test this through case studies; 2) to develop a practical model for agility and agile supply chains such that an approach can be devised to assist SMEs in adopting agile supply chains.

## **Framework Overview**

Whilst a thorough literature review was conducted, the key framework models underpinning this work were identified as:

- The Agility Road Map (Ismail et al., 2006)
- The framework for agile supply chains (Ismail and Sharifi, 2006)
- The Strategic Agility Framework (Ismail et al., 2011)
- The extended Ansoff matrix (Sharifi et al., 2006; Sharifi et al., 2013)

In reviewing and adopting these strategic framework models that align SMEs and agile supply chains, it was established that implementation would require knowledge of the present state of operation for an SME, the identification of the features of product components, and the identification of potential supply chain partners. The approach devised here creates a thorough understanding of the true status of an SME's functioning, followed by utilisation of this knowledge base to identify a path or roadmap to implementation of the solutions. The developed framework consists of three key elements in the identification of the present state of operation for an SME, which are:

1. A spreadsheet based model providing analysis of the present state of factors affecting a supply chain within an SME. The data for this model is fulfilled via questionnaire interview, and considers the key areas of:
  - Market risk
  - Suppliers in the supply chain
  - Relationship with suppliers
  - Suppliers and the future
  - Vulnerabilities
  - The environment

- The product
  - Economic factors
2. The supporting tool of Conjoint Analysis identifies product component features required by customers and users, through a ranking system to ascertain desirable feature combinations to manufacture and meet market requirements. The statistical data for this is intended to be captured during the previously highlighted questionnaire data collection model.
  3. The identification of potential suppliers comes through the use of the supporting tool namely Repertory Grid Analysis. Based upon *personal construct theory* (Kelly, 1955, 1970), the tool provides a quantitative perspective to qualitative data (Eisenhardt, 1989), effectively considering the views relating to potential supply chain partners and identifying the best suited. Whilst there is limited evidence of the use of Repertory Grid Analysis in agile supply chain development, Goffin *et al.*, (2012) advocate its use to encourage case study interviewees to consider and evaluate supplier performance, hence its application herein. The statistical data for this is captured during the previously highlighted questionnaire interview. The key areas considered within the Repertory Grid Analysis are:
    - Cost
    - Time
    - Effort
    - Company capabilities
    - Ability / capability to deliver
    - Quality
    - Performance
    - Innovation
    - Flexibility
    - Service
    - The need to outsource
    - Consideration as to whether or not a supplier exists
    - Consideration as to whether or not a specialist supplier is required in the agile supply chain
    - The amount of time/input required
    - Supplier interest / commitment
    - Supplier capability
    - Supplier strength

Having identified the operating state of an SME, desirable product component features and potential suppliers with whom to build an agile supply chain were considered. Various implementation methodologies exist to assist in this area but they are effectively deemed to be unsuitable for use in SMEs – a point noted by various authors (Zhang and Sharifi, 2000; Vázquez-Bustelo *et al.*, 2007; Zhang, 2011)

who consider the lack of suitable implementation tools to be the challenge facing the final stage of the agility development process

Subsequently, the final stage of this work makes use of an accompanying roadmap tool developed to assist a proactive SME in the implementation of its agile supply chain. For simplicity this tool utilises the IDEF0 framework and presently operates in a generalised (non-tailored) form, in principle for use in any SME.

An overview of the model process is illustrated in Figure 1

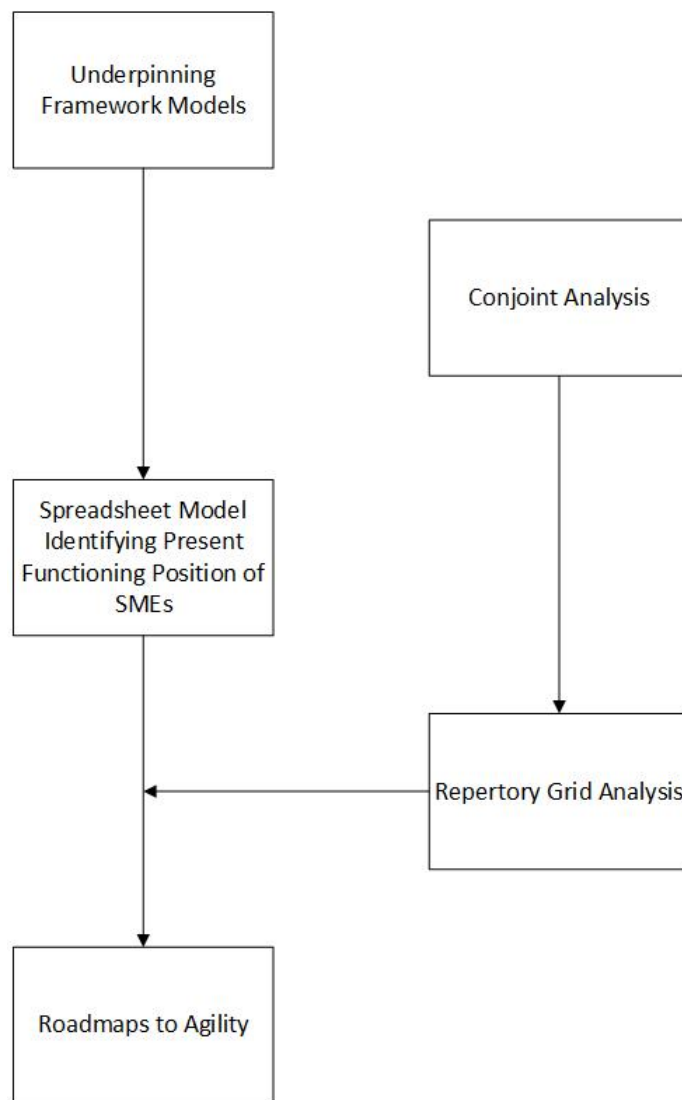


Figure 1 – Model Overview (Authors)

## **Data Collection**

Data was collected through detailed SME case studies, in line with Yin (1989) and McCutcheon and Meredith (1993) who argued that case studies ought to be the primary method used to undertake detailed investigations and have been utilised in the Operations Management field for some time (McCutcheon and Meredith, 1993; Meredith, 1998; Voss et al., 2002; Eisenhardt and Graebner, 2007). Furthermore, Eisenhardt and Graebner (2007) support this line as they highlight that multiple cases allow for wider examination of the topic.

The research utilised case studies with two main purposes. Firstly, to examine the theoretical projections on SME perceptions of the agility concept in their supply chain, focussing on new product development. The second objective was to put the proposed tool set for implementation of firm's strategies for new product development within their supply chain to test for validation and possible generalisation.

Data was collected through case study method from a sample of SMEs in UK. Organisational size varied from under 10 to 200 employees, with annual turnover varying from one hundred thousand to over one hundred million pounds. Organisations in the sample were predominantly owner managed, enabling accurate, high quality data to be secured whilst working within the ethical limits of the project. The data collection method incorporated a questionnaire-interview at each organisation that was recorded for subsequent transcription. This data collection method was adopted due to it providing both qualitative and quantitative data for subsequent analysis. Data outcomes from the model were presented to the relevant SMEs for consideration and any subsequent feedback.

## **Findings**

The key model for this research identifies the present state of factors affecting the supply chain within an SME. Outputs are unique to each SME organisation and cannot be compared to those of another. These key outputs can be utilised in line with a roadmap to implementation to assist the SME in the development of its agile supply chain.

Feedback from each participating organisation has proved to be positive in identifying an accurate position and identification of its present operating state. Whilst complete implementation of the model outputs has been limited, there is evidence to suggest that the outputs are beneficial with one organisation in the testing model illustrating significant improvement in its product range and the efficiency with which the organisation develops. Arguably, some level of adjustment is required for the roadmap process to assist implementation relative to the individual needs of the SME in question, but early results remain positive.

Overall findings fall into two categories. The first supports the effective use of the model within SMEs. The second is possibly of broader interest from a macro perspective. Historically, published works have suggested that larger organisations are better suited to dealing with econometric and supply chain changes in turbulent

times, and from an immediate financial standpoint the research outputs suggest this to be the case. However, the outputs indicate that smaller SMEs are better aligned to agility and agile supply chains, leading to the subsequent long-term postulation of them being better suited to the turbulent markets of the future.

## Conclusion

Based upon existing theories and framework models within the agile supply chain literature, this work extends the discourse of Agile Supply Chains in the SME domain, supported by development of a practical model to address the gap in the subject knowledge. This is pursued through a process comprising strategic and operational appraisal of the firm, profiling the firm's product and supply chain aspects, and a complementary road map for implementation of a systematic approach to agility. Early outputs indicate its value to small SMEs in particular.

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