Can lean and agile organisations within the UK automotive supply chain be distinguished based upon contextual factors?

Qamar, Amir; Hall, Mark

DOI:
10.1108/SCM-05-2017-0185

Can Lean and Agile Organisations within the UK Automotive Supply Chain Be Distinguished Based upon Contextual Factors?

Purpose:

The purpose of this paper was to: (1) Robustly distinguish whether firms were implementing lean or agile production in the automotive supply chain; and (2) by drawing on contingency theory as our theoretical lens, independently determine whether lean and agile firms could be distinguished based upon contextual factors.

Design/methodology/approach:

Primary quantitative data from 140 firms in the West Midlands (UK) automotive industry were obtained via a constructed survey. Analysis incorporated the use of logistic regressions in order to calculate the probability of lean and agile organisations belonging to different groups amongst the contextual factors investigated.

Findings:

We found that lean and agile firms co-exist in the automotive supply chain and that lean firms were found to be at higher tiers of the supply chain while agile firms were found to be at lower tiers.

Originality/value:

The originality of this study lies within the novel methodological attempt used to distinguish lean and agile production, based upon the contextual factors investigated. We not only theoretically approve the importance of contingency theory, but contest the 'received wisdom' within Supply Chain Management. These are: (1) That automotive supply chains will comprise of organisations that predominantly adopt lean production methods; and (2) That in supply chains comprising of both lean and agile organisations, the firms closer to the customer will adopt more flexible (agile) practices, while those who operate upstream will adopt more efficient (lean) practices. Our findings have implications for theory and practice, as lean and agile firms can be found in the automotive supply chain without any relationship to the physical value adding process. In order to speculate as to why our findings contest existing views, Resource-Dependence-Theory, and more specifically, a power perspective, was invoked. We provide readers with a new way of thinking concerning complicated supply chains and urge that the discipline of Supply Chain Management adopt a 'fourth' supply chain model depicting a new lean and agile supply chain configuration.

Key Words: Lean, Agile, Contextual Factors, Automotive, Contingency Theory.

1.0 Introduction

'Received wisdom' suggests that automotive supply chains are predominantly lean in nature. That same 'wisdom' also suggests that where lean and agile firms coexist in a supply chain, the agile firms will be located downstream, close to the customer, while the lean firms will be located further upstream (Mason-Jones *et al*., 2000). In this paper, we seek to overturn, or at least challenge, these assertions. Although scarce, previous literature (Yusuf & Adeleye, 2002; Shah & Ward, 2003; Narasimhan *et al*., 2006; Reichhart & Holweg, 2007; Gunasekaran *et al*., 2008; Hallgren & Olhager, 2009; Purvis *et al*., 2014) has incorporated the use of performance measures when distinguishing lean and agile simultaneously within a singular study. However, inconsistencies amongst the lean and agile literature have resulted in authors placing greater emphasis on the role of contextual factors (Godinho Filho *et al*., 2016). Contingency Theory (CT) suggests that firms align their performance priorities with their contextual factors. Therefore, it is reasonable to question whether or not lean and agile production concepts have a relationship with contextual factors, namely firm age, firm size and positional tier within the supply chain (SC), especially the automotive supply chain (ASC). The ASC has been considered an underdeveloped area with regard to contextual factors (Marodin *et al*., 2016). Shah & Ward (2003) and Bayo-Moriones *et al*. (2010) have previously advocated that for the successful implementation of any manufacturing practice, contextual factors need to be considered, as such characteristics may act as a driving force behind the production strategy employed. On the contrary, contextual factors may also act as a barrier when firms seek to implement certain strategies, such as lean production (Marodin & Saurin, 2015; Marodin *et al*., 2017a). With this in mind, it should be possible to determine the manufacturing strategy pursued by a firm by looking at its contextual attributes. However, there is a sense of ambiguity within the literature concerning lean and agile production. There is a scarcity in studies solely focussing on lean and agile production relative to contextual factors, especially supply chain (SC) positional tier (Jasti & Kodali, 2015; Marodin *et al.*, 2016; Tortorella *et al*., 2017a, 2017b). This highlights the research gap that this study seeks to fill. With this in mind, the objectives of this study were to: (1) Robustly distinguish whether firms were implementing lean or agile production; (2) Independently determine if lean and agile firms can be distinguished based upon contextual factors. Thus, the main research question for this study was presented as:

RQ. Can lean and agile organisations within the automotive supply chain be distinguished based upon contextual factors?

2.0 Theoretical Foundation

Being conscious of Chicksand *et al*.'s (2012) and Walker *et al*.'s (2015) concern that only approximately one third of studies within the realms of SCM and Operations Management

(OM) incorporate the use of a theoretical tradition to ground their research, the main over-arching theory which grounded this research was Contingency Theory (CT). CT has been advocated as a major theoretical lens through which to view organisations (Sousa & Voss, 2008). CT advocates that no theory, and in turn method, is applicable in every circumstance (Lawrence & Lorsch, 1967). In essence, this approach suggests that there is no single best way to design an organisation and that organisations may need to match their priorities in line with factors that are contingent in the environment. Sousa & Voss (2008) also asserted that the context in which a firm is based may play a role in the relationship between practice and performance, and that researchers should not focus solely on analysing management practices, but must also investigate the context in which firms are positioned. As a result, CT and contextual factors are becoming more popular within the domain of SCM (Demeter & Matusz, 2011; Huo *et al*., 2014; Kembro *et al*., 2014; Tortorella *et al*., 2015; Marodin *et al.*, 2016; Marodin *et al.*, 2017a, 2017b; Tortorella *et al*., 2017a, 2017b). Given this, we incorporated three contextual factors when seeking to distinguish between lean and agile production, namely firm size, firm age and positional tier within the SC. Furthermore, we limited our selection of the sample to just the automotive industry within the West Midlands (UK), as industry and country contexts have both been indicated as factors which can impact the results of research (Demeter & Matusz, 2011; Marodin *et al*., 2016). In addition, the West Midlands automotive industry has experienced significant reshoring, thus it is an interesting industry to examine (Qamar, 2016).

3.0 Distinguishing Lean and Agile Production

Lean production is a concept which ensures high levels of efficiency via the elimination of all non-value adding activities (waste) and the effective flow of goods, thus improving productivity and quality levels (Tortorella & Fettermann, 2017). By contrast, agile production emphasises the ability to respond quickly to sudden changes in the market environment as effectively as possible (Narasimhan *et al.*, 2006; Gunasekaran *et al*., 2008). Flexibility and speed have been continually associated with agile production (Purvis *et al*., 2014), whereas cost and efficiency are repeatedly associated with lean production (Narasimhan *et al.*, 2006; Gunasekaran *et al*., 2008). However, in order to distinguish between lean and agile production, Da Silveira & Slack (2001) suggested that differences in manufacturing strategies can be explained via the examination of organisations' resources and capabilities. With this in mind, we looked to explore the existing literature that has advocated key Tools, Practices, Routines and Concepts (TPRCs) (i.e. resources and capabilities) associated with each manufacturing paradigm (see Table 1). Initially, we identified previous studies (Soriano-Meier & Forrester, 2002; Vazquez-Bustelo & Avella, 2006) that have outlined a scorecard to assess the levels of lean or agile production. Building on this, we next conducted key word searches that included the terms ‘lean’ or ‘agile’ relative to ‘tool’ or ‘practice’ or ‘routine’ or ‘concept’. We limited our search between the years 1990-2014. Our intention was not to list every single TPRC associated with each production strategy, but to focus on identifying TPRCs that have repeatedly been associated with lean and agile production in prior research. Chronologically, as the agile production concept was introduced after the lean production concept, it was no surprise that there were fewer agile TPRC citations in the 1990’s, when compared with lean TPRCs. In total, our search identified twenty-two TPRCs related to lean and agile production. Table 1 illustrates some of the key studies that have repeatedly associated the TPRCs with lean, agile or leagile production. Importantly, certain TPRCs (‘j-o’ in Table 1) were associated with both lean and agile production, hence we refer to them as ‘hybrid’. These overlapping TPRCs can explain the confusion between each of the approaches within the existing literature. Although there are similarities amongst the remaining TPRCs, they clearly highlight different strengths between the two production strategies, complementing Skinner’s (1969) assertion that no strategy can compete on all measures of performance.

Table 1: Lean, Agile and ‘Hybrid’ Tools, Practices, Routines & Concepts (TPRCs)

Practices	Lean	Agile
a) Elimination of Waste	White *et al.* (1999); Sanchez & Perez (2001); Soriano-Meier & Forrester (2002); Hopp & Spearman (2004); Rawabdeh (2005); Malmbrandt & Ahlström (2013); Kull *et al.* (2014).	- - - - -
b) Continuous Improvement	Flynn *et al.* (1999); White *et al.* (1999); Sanchez & Perez (2001); Soriano-Meier & Forrester (2002); Taj & Morosan (2011); Clark *et al.* (2013); Malmbrandt & Ahlström (2013); Sundar *et al.* (2014); Belekoukias *et al.* (2014).	- - - - - - -
c) 5S	Womack & Jones (1996); Bamber & Dale (2000); Feld (2000); Sweeny (2003); Lee-Mortimer (2006); Abdulmalek & Rajgopal (2007).	- - - -
d) Zero Defects	Emiliani (1998); Murman *et al.* (2002); Soriano-Meier & Forrester (2002); Hopp & Spearman (2004); Sahoo *et al.* (2008); Malmbrandt & Ahlström (2013).	- - - - -
e) Production Smoothing	Womack *et al.* (1990); Abdulmalek *et al.* (2006); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Saurin *et al.* (2011).	- - - -
f) Line Balancing	Schroer (2004); Lee-Mortimer (2006); Malmbrandt & Ahlström (2013); Sundar *et al.* (2014).	- - -
g) Value Stream Mapping	Womack & Jones (1996); Murman *et al.* (2002); Hopp & Spearman (2004); Lee-Mortimer (2006); Malmbrandt & Ahlström (2013); Sundar *et al.* (2014); Belekoukias *et al.* (2014).	- - - - -

h)	Total Productive Maintenance	Feld (2000); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Taj & Morosan (2011); Sezen *et al.* (2012); Belekoukias *et al*. (2014).	- - - -
i)	Cellular Manufacturing	Shah & Ward (2003); Lee-Mortimer (2006); Abdulmalek & Rajgopal (2007); Kull *et al.* (2014); Sundar *et al.* (2014).	- - - -
j)	**Just-in-Time**	Boyer (1996); Gunasekaran (1999); Sanchez & Perez (2001); Soriano-Meier & Forrester (2002); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Taj & Morosan (2011); Kull *et al.* (2014); Belekoukias *et al*. (2014).	Takahashi & Nakamura (2000); Sharifi & Zhang (2001); Jin-Hai *et al.* (2003); Vazquez-Bustelo & Avella (2006); Shah & Ward (2007); Inman *et al.*(2011);
k)	**Kanban**	Flynn *et al*. (1999); White *et al*. (1999); Schroer (2004); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Rahman *et al*. (2013); Sundar *et al*. (2014); Belekoukias *et al*. (2014).	Takahashi & Nakamura (2000); McCullen & Towill (2001); Sharifi & Zhang (2001); Vazquez-Bustelo & Avella (2006)
l)	**Multifunctional Teams/Machines**	Koufteros *et al*. (1998); Sanchez & Perez (2001); Soriano-Meier & Forrester (2002); Bhasin (2011); Saurin *et al.* (2011); Malmbrandt & Ahlström (2013).	Gunasekaran (1998); Sharp *et al.* (1999); Yusuf *et al.* (1999); Maskell (2001); Vazquez-Bustelo & Avella (2006); Erande & Verma (2008).
m)	**Total Quality Management**	Boyer (1996); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Taj & Morosan (2011); Belekoukias et al. (2014).	Sharifi & Zhang (2001); Jin-Hai *et al.* (2003); Vazquez-Bustelo & Avella (2006).
n)	**Employee Empowerment**	Boyer (1996); Achanga *et al.* (2006); Vidal (2007); Rose *et al*. (2011); Taj & Morosan (2011).	Gunasekaran (1998); Sharp *et al.* (1999); Yusuf *et al.* (1999); Crocitto & Youssef (2003); Vazquez-Bustelo & Avella (2006).
o)	**Setup Reduction (SMED)**	Womack *et al*. (1990); Bamber & Dale (2000); Feld (2000); Lee-Mortimer (2006); Abdulmalek & Rajgopal (2007); Shah & Ward (2007); Saurin *et al.* (2011); Sundar *et al* (2014); Kull *et al.* (2014); Belekoukias *et al*. (2014).	Iravani *et al*. (2004); Ismail *et al*. (2006); Erande & Verma (2008); Matt (2010); Abraham *et al*. (2012).
p)	Virtual Enterprise	- - - - - -	Gunasekaran (1998:1999); Sharp *et al.* (1999); Yusuf *et al.* (1999); Maskell (2001); Sharifi & Zhang (2001); Dowlatshahi & Cao (2006); Vazquez-Bustelo & Avella (2006); Tseng & Lin (2011).
q)	Core Competence Management	- - - -	Yusuf *et al.* (1999); Sharp *et al.* (1999); Maskell (2001); Jin-Hai *et al.* (2003); Erande & Verma (2008); Tseng & Lin (2011).
r)	Knowledge Driven Enterprise	- - - -	Yusuf *et al.* (1999); Maskell (2001); Ismail *et al.* (2006); Vazquez-Bustelo & Avella (2006); Erande & Verma (2008).
s)	Reconfiguration	- - - - -	Yusuf *et al.* (1999); Maskell (2001); Vazquez-Bustelo & Avella (2006); Erande & Verma (2008); Tseng & Lin (2011); Vinodh & Kuttalingam (2011).
t)	Rapid Prototyping	- -	Gunasekaran (1998:1999); Sharp *et al.* (1999); Yusuf *et al.* (1999); Onuh

	- -	& Hon (2001); Vinodh & Kuttalingam (2011).
u) Concurrent Engineering	- - - - -	Gunasekaran (1998); Sharp *et al.* (1999); Sharifi & Zhang (2001); Jin-Hai *et al.* (2003); Vinodh & Kuttalingam (2011); Tseng & Lin (2011).
v) IT Driven Enterprise	- - - - -	Gunasekaran (1998:1999); Sharp *et al.* (1999); McCullen & Towill (2001); Coronado (2003); Dowlatshahi & Cao (2006); Vazquez-Bustelo & Avella (2006).

4.0 Literature Review

4.1 Manufacturing Age

Shah & Ward (2003) asserted that the age of the firm may play a pivotal role in the strategy employed, as older firms may be more resistant to change. This view is complementary to organisational sociology, which proposes that the age of the firm is inversely related to the rate of innovations (Stinchombe, 1965). This view is also in line with the thinking behind evolutionary economics (Nelson & Winter, 1982), as organisational routines (such as manufacturing practices) have been identified as a source of inertia (Hannan & Freeman, 1984). Although Osterman (1994) did not associate firm age with the adoption of 'newer' practices, Shah & Ward (2003) and Haddach *et al.* (2016) did find certain lean TPRCs to be affiliated with age. More specifically, older organisations have been associated with higher levels of lean implementation (Marodin *et al*., 2015). Although Tortorella *et al*. (2015) presented mixed findings, they did go on to find that older manufacturing plants found it more difficult to adapt their organisational culture in a way that favoured certain dimensions of lean production (openness, participation, teamwork transparency). As there are mixed findings within the literature, we used the resistance to change idea to conceptualise our hypotheses. For instance, chronologically, the agile concept was introduced after the lean concept, and by applying the notion of resistance to change, it may be suggested that 'older' organisations are more likely to implement lean practices (due to inertia brought about by their organisational routines), whereas 'younger' organisations may be more likely to implement agile practices. Thus, the following two hypotheses were developed:

H_{Aa}. Lean firms are more likely to be older in age when compared with agile firms.

H_{Ab}. Agile firms are more likely to be younger in age when compared with lean firms.

4.2 Firm Size

Sousa & Voss' (2008) review of CT in OM highlighted that the literature deems firm size to be an important contextual factor. The importance of firm size can even be traced back to Child & Mansfield (1972), who suggested that procedures and administrative tasks tend to be more complex in larger firms. Sousa & Voss (2008) illustrated inconsistencies within their review. For instance, studies that purely focused on quality management (Ahire & Golhar, 1996) found little to no evidence of firm size effects. However, studies investigating the application of lean production did find firm size to account for some effects (Shah & Ward, 2003). Furthermore, previous findings have asserted that larger firms are more likely to adopt lean practices (Narasimhan *et al*., 2006; Bonavia & Marin, 2006; Bhasin, 2012; Marodin *et al*., 2016), and that smaller firms are more likely to adopt agile practices (Cohen & Klepper, 1992). More recently, Marodin *et al.* (2017a, 2017b) emphasised that larger companies are more likely to successfully implement lean practices. The positive association between lean production and large firms stems from the notion that large firms possess greater availability of capital and technological resources (Shah & Ward, 2003; Dora *et al*., 2013), thus they have greater bargaining power than small firms. Bhasin (2012) also found that larger organisations were more likely to successfully adopt lean as an ideology as opposed to just a set of practices. This was supported by Godinho Filho *et al*. (2016), who suggested that small organisations lacked an understanding to what it means to be lean. Tortorella *et al*. (2017a) found that larger firms were more likely to implement 15 lean supply chain practices as opposed to smaller firms, findings that were also confirmed by Susilawati *et al*. (2015) and Tortorella *et al*. (2017b). Netland (2016) suggested that small and large sized organisations may require different lean implementation approaches. However, Furlan *et al*. (2011) found no correlation between firm size and the implementation of lean production within organisations in Europe, Asia and North America. Lucato *et al*. (2014) also found little evidence to suggest that there was a relationship between the extent to which lean was being implemented within organisations and the size of a firm. Belekoukias *et al*.'s (2014) findings also went on to demonstrate that certain lean TPRCs were associated with small organisations as opposed to large organisations. Although there are mixed findings concerning firm size and lean production (Negrao *et al*., 2017), as the literature generally associates lean and agile production with large and small organisations respectively, the following two hypotheses were developed:

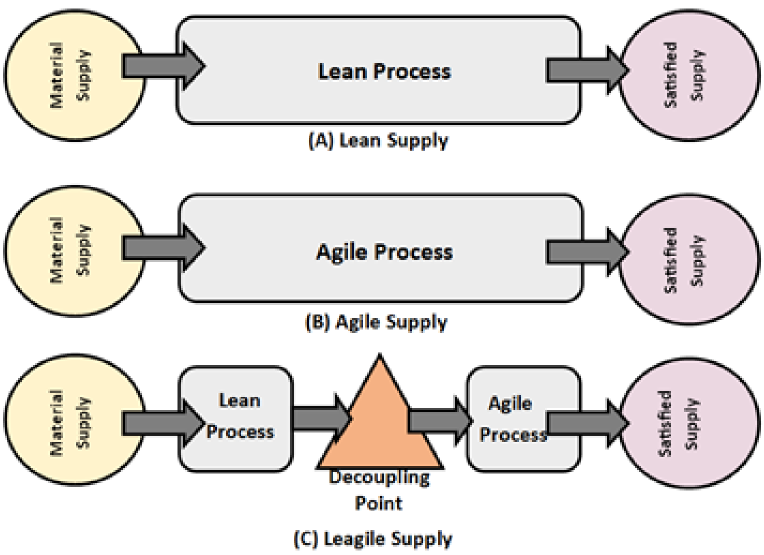
H_{MSa}. Lean firms are more likely to be larger in size when compared with agile firms.

H_{MSb}. Agile firms are more likely to be smaller in size when compared with lean firms.

4.3 Supply Chain Positional Tier

Mason-Jones *et al*. (2000) suggested that SCs, generally speaking, can either be lean, agile or 'leagile' (Drake *et al*., 2013), as depicted in Figure 1. The latter (leagile) SC, also referred to as the hybrid SC (Huang *et al*., 2002), is a combination of both paradigms encompassing a total SC strategy which involves a decoupling point. The lean approach is best suited when a market is highly predictable with strong foundations of supply certainty. In contrast, the agile approach is more suitable for turbulent SCs (Drake *et al*., 2013), where customer requirements often change, resulting in unpredictability and the need for innovative products of shorter life-cycles (Cox & Chicksand, 2005). Naylor *et al*. (1999) noted that a lean strategy is not a suitable strategy for all SCs, as SCs have unique demand and supply characteristics that require different ways of working operationally, both internally and externally. Often, it is necessary to implement the 'leagile' approach as there are decoupling points within particular SCs that require a lean approach at one point and an agile approach at another. Essentially, the decoupling point refers to the point in a SC at which order-driven and forecast-driven orders meet (Hoekstra & Romme, 1992). Mason-Jones *et al*. (2000) suggested that when operating within a 'leagile' SC, lean manufacturing systems are located at the lower levels of the SC and operate upstream, enabling a level schedule in output. In contrast, agile systems are generally located at the top or higher levels of the 'leagile' SC and operate downstream from the decoupling point, ensuring there is an agile response capable of delivering to unpredictable market demand. More recently, Vinodh & Aravindraj (2013) acknowledged that the 'leagile' SC paradigm has been gaining importance within the fields of lean and agile production and that it requires further development.

Figure 1 – Lean, Agile and 'Leagile' SCs



Source: Adapted from Mason-Jones *et al*. (2000).

Although the literature asserts that Automotive Supply Chains (ASCs) are lean, there are contingencies in the ASC that may influence the degree to which a firm is lean as opposed to agile. For example, Original Equipment Manufacturers (OEMs) are undoubtedly key players within the ASC, as they control the design, quantity required and the costs of components (Hallavo, 2015). Furthermore, OEMs will typically encourage, or even require, their closest suppliers to also implement lean production, as this will enable them to achieve their desired operational performance (Morris *et al*., 2004). For instance, Marodin *et al*. (2016) suggested that Toyota and Honda developed a collaborative lean relationship with their closest suppliers. Furthermore, first-tier suppliers produce goods that are of more added value relative to firms positioned lower down the ASC, who have to devise a manufacturing strategy that emphasises speed and a broader range of products, i.e. one that is more flexible (Doran, 2004; Boonsthonsatit & Jungthawan, 2015). With this in mind, one may argue that firms positioned lower down the ASC are more agile than lean. Considering this in conjunction with Mason-Jones *et al.*'s (2000) assertions that if a SC, such as the ASC, does encompass both lean and agile systems (i.e. 'leagile'), are lean firms operating upstream and agile firms operating downstream? There is limited literature that has explored the agile concept relative to different tiers of a SC. Although recently, authors have started to acknowledge the importance of lean production relative to different tiers within a SC (Marodin *et al*., 2017a). However, lean literature concerning positional tier (Sezen *et al*., 2012; Garza-Reyes *et al*., 2015; Tortorella *et al*., 2017a, 2017b) has also presented mixed views, signalling the need for clarification in this area. For instance, Marodin *et al*. (2016) found that firms situated in the top tiers of an ASC, closer to the end customer, were more likely to be adopting lean practices relative to those firms located in the lower tiers of an ASC, which supports the findings of Boonsthonsatit & Jungthawan (2015). Tortorella *et al*. (2017a) sided with this, as findings from their study revealed firms positioned closer to the customer implemented lean practices to a greater extent when compared with firms positioned lower down the ASC. On the contrary, Sezen *at al*. (2012) did not find any difference between the degree to which lean production was being adopted between first and second tier suppliers. Meanwhile, Tortorella *et al*. (2017b) found that firms positioned lower down the SC, more specifically third and fourth tier suppliers, were implementing lean practices to a greater degree compared to firms positioned at the top of the SC. Tortorella *et al*. (2017b) argued this anomaly may have occurred because firms positioned lower down the Brazilian ASC are often owned by an oligopoly and they therefore had a degree of bargaining power to influence and drive several aspects of their respective SC. Panizzolo *et al*. (2012) suggested that examination of lean production in developing economy countries should be approached differently than in developed countries, as socio-economic variables may influence managerial decisions in a different way. In summary, within the ASC, the literature generally sides with lean production being more associated with firms closer to the end customer, whereas firms positioned lower down the ASC are said to be competing on flexibility, hence, they are agile. Thus, although Mason-Jones *et al*. (2000) suggested that 'leagile' SCs consist of lean and agile firms at the top and lower tiers of the SC respectively, in association with the discussion presented in this section, we conceptualised the following hypotheses:

***H_{PTa}*. Lean firms are more likely to be positioned at the top tiers of a SC when compared with agile firms.**

***H_{PTb}*. Agile firms are more likely to be positioned at the lower tiers of a SC when compared with lean firms.**

5.0 Methodology

5.1 Sampling

In total, 1,710 manufacturing firms were identified as the population operating within the West Midlands (UK) ASC. We contacted approximately 25% of firms within the original population. In total, 450 Managing Directors and Operational Directors were contacted via emails and LinkedIn, asking for their participation in completing a survey questionnaire. A total of 140 surveys were completed revealing a response rate of 31%. All data were obtained within a 6-month period in 2014.

5.2 Distinguishing Lean & Agile Firms

In order to distinguish lean, agile and 'hybrid' firms through the use of the constructed survey, we asked participants to state which manufacturing strategy (lean, agile, hybrid) was being implemented to the greatest extent within their organisation. In total, 77 firms asserted that they were implementing a lean strategy, 63 firms stated they were adopting an agile strategy, and no firm reported as following a 'hybrid' strategy. However, to improve the rigour when distinguishing between lean and agile firms, we also asked participants to state the extent to which the twenty-two TPRCs from Table 1 were being implemented within their organisation on a Likert scale ranging from 1 (zero levels) to 5 (high levels). The mean values were calculated between each of these three bundled TPRCs groups (lean, agile, hybrid) and depending on which group scored the highest, firms were distinguished as being lean, agile and 'hybrid'. No firm scored the highest within the 'hybrid' group, hence, our investigation was focused to just lean and agile. In total, 74 and 66 firms were identified as pursuing lean and agile production respectively, which was 97% consistent with the original responses. As the technique by which lean and agile firms were distinguished involved a scorecard consisting of Likert-scale questions, it is important to test the reliability of these constructs, as Hair *et al.*

(1998, p.118) stated that "any summated scale should be analysed for reliability to ensure its appropriateness before proceeding to an assessment of its validity". With this in mind, our investigation employed Cronbach's alpha to test the internal consistency reliability amongst the TPRCs investigated. Cronbach's alpha is widely used in the social sciences when determining levels of inter-reliability amongst a range of items. Vogt (1999) suggested that values greater than 0.70 suggest that the sub-items are measuring the same construct. The results are presented in Table 2. All the TPRCs that were ascribed to lean production acquired a Cronbach's alpha score of 0.72. However, with the exclusion of TPRCs associated with both lean and agile production, the Cronbach's alpha score increased to 0.82. On the other hand, all the TPRCs associated with agile production acquired a Cronbach's alpha score of 0.70, and with the exclusion of TPRCs affiliated with both (i.e. the leagile ones) this Cronbach's alpha score increased to 0.92. Although the Cronbach's alpha score for the hybrid strategy was also above the threshold criteria, as no firm scored highest within the hybrid strategy, the inclusion of leagile was omitted from this study. As both lean and agile manufacturing TPRCs were identified as scoring well above the 0.70 threshold, it is viable to assert that the named TPRCs were indeed internally consistent and reliable.

Table 2: Reliability of TPRCs Associated with Lean and Agile production

Manufacturing Strategy	Number of Items	Cronbach's Alpha
Lean	15	0.72
Lean excluding hybrid TPRCs	8	0.82
Hybrid	7	0.73
Agile	13	0.70
Agile excluding hybrid TPRCs	7	0.92

In addition, in order to test the validity of using two factors (lean and agile), as opposed to three factors (lean, agile, leagile), this study made use of confirmatory factor analysis (CFA). Kaiser (1960) suggested that the number of factors should depend on the number of factors with eigenvalues greater than one. Results from the CFA revealed that the three factors (lean, agile and hybrid) had eigenvalues greater than one, however, the third factor's (hybrid) eigenvalue was marginally over the value of 1. Considering that the two factor solution accounted for 69% of the variance, as opposed to 75% with the three factor solution, it was deemed appropriate to exclude the examination of a third factor. In summary, we propose that the ASC can be 'hybrid/leagile' in nature because it consists of lean and agile firm; however, the individual, constituent firms within the ASC can be distinguished as being either lean or agile.

5.3 Non-Respondent Bias

Initially, 42 organisations returned the survey within the first two months, 64 organisations returned the survey after a reminder email during months 2-4, and finally a further 34 firms returned the survey after a second reminder within months 4-6. In order to test for non-respondent bias, using Armstrong & Overton's (1977) technique, late respondents were considered as a surrogate for non-respondents. With this in mind, the first 30 surveys received were compared to the last 30 received surveys. T-tests were conducted using firm sales and strategy employed, however, the results indicated that there were no significant differences between the responses. As there were no significant differences between both groups, organisations were deemed to be representative of the West Midlands automotive industry, suggesting no significant non-respondent bias.

6.0 Analysis

Analysis with regard to contextual factors involved the use of logistic regressions in SPSS. Researchers (White *et al.*, 1999; Moayed & Shell, 2009) incorporate the use of logistic regressions when predicting the probability/odds ratio of categorical placement or category membership concerning a dependent variable based upon multiple independent variables. Logistic regressions are used to measure the relationship between the dependent variable, which is categorical in nature, with one or more independent variables. This relationship is measured via estimating the probability by using a logistic function. The independent variables in this study were lean/agile and coded as 1 or 0 respectively. The dependent variables were firm age, firm size, and positional tier, and the parameters concerning each of the dependent variables are outlined within the upcoming sections.

6.1 Firm Age

Based on Shah and Ward's (2003) suggestions, firms were grouped into three age categories, namely: firms operating for less than 10 years; firms operating between 10 and 20 years; and firms operating over 20 years. For convenience, these age categories were coded as 'young', 'established' and 'mature' respectively. Models 1a and 2a utilise young firms as the reference category, whereas Models 3a and 4a use mature firms as the reference category.

Table 3: Firm Age Regression Results

Model 1a (Ref category is young & agile is base)						Model 2a (Ref category is young & lean is base)				
Firm Size	L/A	B	Sig	Exp (B)		Firm Size	L/A	B	Sig	Exp (B)
Established	L (1)	.047	.931	1.048		**Established**	A (1)	-.047	.931	.954
	A (0)	.	.	.			L (0)	.	.	.
Mature	L (1)	.627	.173	1.872		**Mature**	A (1)	-.627	.173	.534
	A (0)	.	.	.			L (0)	.	.	.
Model 3a (Ref category is mature & lean is base)						**Model 4a** (Ref category is mature & agile is base)				
Firm Size	**L/A**	**B**	**Sig**	**Exp (B)**		**Firm Size**	**L/A**	**B**	**Sig**	**Exp (B)**
Young	A (1)	.627	.173	1.872		**Young**	L (1)	-.627	.173	.534
	L (0)	.	.	.			A (0)	.	.	.
Established	A (1)	.580	.171	1.786		**Established**	L (1)	-.580	.171	.560
	L(0)	.	.	.			A (0)	.	.	.

Results from Model 1a suggest that when comparing lean firms against agile firms, lean firms were (1.048-1=.048) 4.8% and (1.872-1=.872) 87.2% more likely to be established and mature respectively, relative to being young. On the other hand, results from Model 2a suggest that agile firms in comparison with lean firms were (1-.954=.046) 4.6% and (1-.534=.466) 46.6% less likely to be established and mature respectively, relative to being young. Results from Model 3a found that when comparing agile firms against lean firms, agile firms were (1.872-1=.872) 87.2% and (1.786-1=.786) 78.6% more likely to be young and established respectively, relative to being mature. However, Model 4a revealed that lean firms, when compared to agile firms, were (1-.534=.466) 46.6% and (1-.560=.440) 44% less likely to be young and established respectively, relative to being mature. Although the results from each of the models do imply that lean firms were more likely to be older and more established and agile firms were more likely to be younger in age, these findings were not of significance Therefore, hypotheses $\boldsymbol{H_{Aa}}$ and $\boldsymbol{H_{Ab}}$ were both **rejected**.

6.2 Firm Size

Next, using a technique previously deployed by Bhasin (2012), organisations were categorised as small when employing equal to or less than 50 employees, medium when employing greater than 50 but equal to or less than 250 employees, and as large when employing more than 250 employees. The results concerning firm size and manufacturing strategy are reported in Table 4.

Table 4: Firm Size

	Lean		Agile		Total	
	Number of firms	% of firms	Number of firms	% of firms	Number of firms	% of firms
Small	27	37%	22	33%	49	35%
Medium	32	43%	34	52%	66	47%
Large	15	20%	10	15%	25	18%
Total	74	100%	66	100%	140	100%

Results from Table 4 portray fairly consistent proportions between the size of the firm and manufacturing strategy employed. Although there are a greater number of lean firms that were large in comparison with agile firms, there are also a larger number and proportion of firms that were small and lean in comparison with agile and small firms. In order to statistically test whether there was a significant relationship between manufacturing strategy and firm size, once again logistic regressions were conducted, the results of which are presented in Table 5. Models 1b and 2b involve small firms as the reference category, whereas Models 3b and 4b use large firms as the reference category.

Table 5: Firm Size Regression Results

Model 1b Ref category is small & lean is base.						**Model 2b** Ref category is small & agile is base.				
Firm Size	**L/A**	**B**	**Sig**	**Exp (B)**		**Firm Size**	**L/A**	**B**	**Sig**	**Exp (B)**
Medium	A (1)	.265	.483	1.304		**Medium**	L (1)	-.265	.483	.767
	L (0)	.	.	.			A (0)	.	.	.
Large	A (1)	-.201	.688	.818		**Large**	L (1)	.201	.688	1.222
	L (0)	.	.	.			A (0)	.	.	.
Model 3b Ref category is large & lean is base.						**Model 4b** Ref category is large & agile is base.				
Firm Size	**L/A**	**B**	**Sig**	**Exp (B)**		**Firm Size**	**L/A**	**B**	**Sig**	**Exp (B)**
Small	A (1)	.201	.688	1.222		**Small**	L (1)	-.201	.688	.818
	L (0)	.	.	.			A (0)	.	.	.
Medium	A (1)	.466	.328	1.594		**Medium**	L (1)	-.466	.328	.627
	L (0)	.	.	.			A (0)	.	.	.

When comparing agile firms against lean firms, Model 1b shows agile firms to be (1.304-1=.304) 30.4% more likely and (1-.818=.182) 18.2% less likely to be medium and large respectively, relative to being small. Model 2b shows that lean firms, in comparison to agile firms, were (1-.767=.230) 23% less likely and (1.222-1=.222) 22.2% more likely to be medium and large respectively, relative to being small. Model 3b shows that agile firms, in comparison to lean firms, were (1.222-1=.222) 22.2% and (1.594-1=.594) 59.4% more likely to be small and medium respectively, relative to being large. Finally, Model 4b shows that lean firms, in comparison to agile firms, were (1-.818=.182) 18.2% and (1-.627=.370) 37% less likely to be small and medium sized respectively, relative to being large. Results from all four models in Table 5 demonstrated a positive association between lean manufacturing and large organisations, and a positive association between agile firms and small organisations. However, as the P values are not less than 0.05 in either of the regressions, these statements were not of significance. Thus, hypotheses $\boldsymbol{H_{MSa}}$ and $\boldsymbol{H_{MSb}}$ were both **rejected**.

6.3 Positional Tier

Table 6 reports on the number of lean and agile firms at varying levels of the ASC. Out of the possible 140 firms, 16 (11%) firms were Original Equipment Manufacturers (OEMs), 36 (26%) firms were 1st tier suppliers, 32 (23%) firms were 2nd tier suppliers, 33 (24%) firms were 3rd tier suppliers and 23 (16%) firms were 4th and 5th tier suppliers within the ASC. With the exception of OEMs and 4th & 5th tier suppliers, there seemed to be a fairly consistent total number of firms who were 1st, 2nd and 3rd tier suppliers within the ASC. Table 6 suggests that the majority of lean organisations seem to be positioned at the higher (top) end of the ASC, as 16% and 34.5% of lean organisations are OEMs and 1st tier suppliers respectively, but further down the SC, the percentage of lean organisations decreases. On the contrary, the majority of agile organisations appear to be positioned at the lower end of the ASC with 27% and 29% of agile organisations classified as 4th & 5th and 3rd tier automotive organisations respectively. A cumulative 21% of agile firms within this study were OEMs & 1st tier suppliers, which is notably less than the cumulative 50.5% of lean organisations who were OEMs and 1st tier suppliers.

Table 6: Lean and Agile Systems within the ASC

Positional Tier	**Lean**		**Agile**		**Total**	
	Number of firms	% of firms	Number of firms	% of firms	Number of firms	% of firms
OEM	12	16%	4	6%	16	11%
1st	26	34.5%	10	15%	36	26%
2nd	17	23%	15	23%	32	23%
3rd	14	18.5%	19	29%	33	24%
4th & 5th	6	8%	18	27%	23	16%
Total	74	100%	66	100%	140	100%

Next, in order to statistically test if lean and agile firms were positioned at different levels of the SC, we incorporated the use of multinomial logistic regressions (Table 7). Automotive tiers within the SC were categorised into three levels, namely; top, middle, bottom. The top of the SC consisted of OEMs and 1st tier suppliers, the middle of the SC consisted of 2nd tier suppliers, and the bottom of the SC consisted of 3rd and 4th & 5th tier suppliers. Models 1c and 2c involve middle firms as the reference category, whereas Models 3c and 4c used top firms as the reference category.

Table 7 – Positional Tier Regression Results

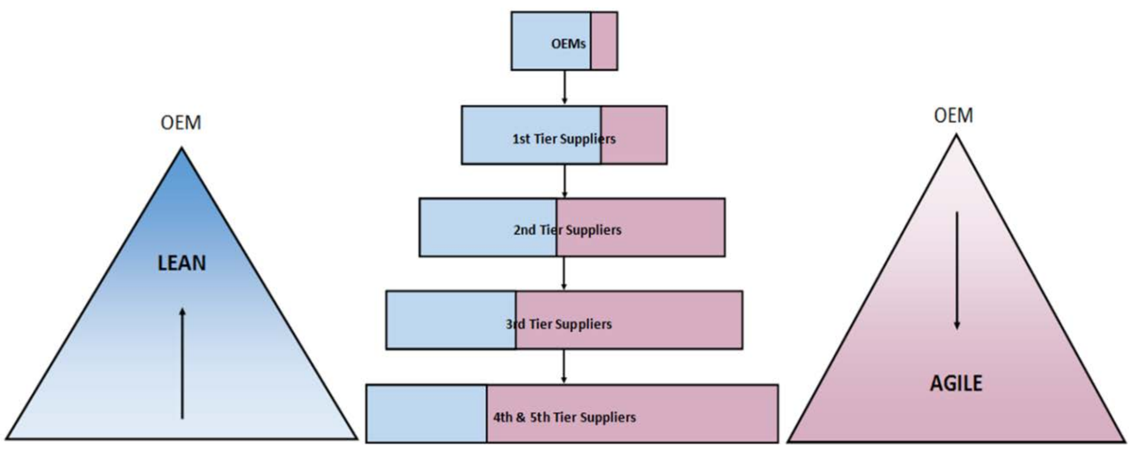
Model 1c Ref category is middle & lean is base.						**Model 2c** Ref category is middle & agile is base.				
SC Position	**L/A**	**B**	**Sig**	**Exp (B)**		**SC Position**	**L/A**	**B**	**Sig**	**Exp (B)**
Top	A (1)	-1.025	.010	.359		Top	L (1)	1.025	.010	2.787
	L (0)	.	.	.			A (0)	.	.	.
Bottom	A (1)	1.003	.061	2.727		Bottom	L (1)	-1.003	.061	.367
	L (0)	.	.	.			A (0)	.	.	.
Model 3c Ref category is top & lean is base						**Model 4c** Ref category is top & agile is base.				
SC Position	**L/A**	**B**	**Sig**	**Exp (B)**		**SC Position**	**L/A**	**B**	**Sig**	**Exp (B)**
Middle	A (1)	1.025	.010	2.787		Middle	L (1)	-1.025	.010	.359
	L (0)	.	.	.			A (0)	.	.	.
Bottom	A (1)	2.028	.000	7.600		Bottom	L (1)	-2.028	.000	.132
	L (0)	.	.	.			A (0)	.	.	.

When comparing agile firms to lean firms, results from Model 1c suggest that agile firms were (1-0.359=.640) 64% less likely and (2.727-1= 1.727) 172.7% more likely to be positioned at the top and bottom of the SC respectively, relative to the middle of the SC. Model 2c shows that lean firms, in comparison with agile firms, were (2.787-1= 1.787) 178.7% more likely and (1-0.367= 0.63) 63% less likely to be positioned at the top and bottom of the SC respectively, relative to the middle of the SC. The P value was less than 0.05 for only two of these findings, therefore lean firms were significantly more likely to be positioned at the top of the SC relative to the middle of the SC, and agile firms were significantly less likely to be positioned at the top of the SC, relative to the middle of the SC. Although results portrayed agile firms as being more likely to be positioned at the bottom of the SC, this cannot be reported as being of significance as the P value (0.061) was above the 0.05 threshold. In order to investigate whether lean and agile firms are distinguishable based upon the positional tier to which they belong in the SC, this study conducted two more regressions (Models 3c & 4c). Model 3c shows that agile firms, in comparison to lean firms, were (7.600-1=6.60) 660% more likely to be positioned at the bottom of the SC relative to the top of the SC. Model 4c shows that lean, in comparison to agile firms, were (1-0.132= 0.868) 86.8% less likely to be positioned at the bottom of the SC relative to the top of the SC. Furthermore, the P value is less than 0.05 for both of these findings. With this in mind, lean firms were significantly less likely to be positioned at the middle and bottom of the SC relative to the top of the SC, and agile firms were significantly more likely to be positioned at the middle and bottom of the SC relative to the top of the SC. Based upon the findings presented in Table 7, hypotheses $\boldsymbol{H_{PTa}}$ and $\boldsymbol{H_{PTb}}$ were **accepted**.

7.0 Discussion

The main contribution of this study is the finding that Contingency Theory (i.e. contextual factors) can play a part in differentiating between lean and agile organisations, especially the positional tier. However, results obtained in this study refuted some of the misconceptions concerning lean and agile production relative to contextual factors (Hines *et al*., 2004; Marodin *et al*., 2016; Tortorella *et al*., 2017a). For instance, although lean firms were expected to be larger and older in age when compared with agile firms, the results concerning these contextual factors were not of significance. Therefore, lean and agile firms could not be differentiated based upon firm size or firm age. Thus, our findings side with Furlan *et al*. (2011) and Lucato *et al*. (2014). However, positional tier was an important and significant factor that could distinguish lean and agile organisations. With this in mind, it is important to extend the discussion (Sezen *et al*., 2012; Garza-Reyes *et al*., 2015; Marodin *et al*., 2016; Marodin *et al*., 2017a, 2017b; Tortorella *et al*., 2017a, 2017b) concerning the role of positional tier within the ASC. Figure 2, which we have called the Lean Agile Automotive Supply Chain (LAASC) Model, is a simple visual aid to show where lean and agile firms were positioned within the ASC. Triangles are used to represent the size of the ASC, for example, the limited number of OEMs at the top and a vast number of 3rd and 4th & 5th tier suppliers at the base. The shading of the two triangles is of great importance. Looking at the lean triangle and agile triangle, there is an inverse relationship between the shading concerning each of the triangles. This reflects a high concentration of lean and agile firms operating downstream and upstream within the ASC respectively.

Figure 2 – The Lean and Agile Automotive Supply Chain (LAASC) Model



Although findings concerning positional tier share similarities with recent lean studies (Marodin *et al*., 2016; Tortorella *et al*., 2017a), findings from this study are in direct contradiction to traditional thinking behind lean, agile and 'leagile' SCs. For instance, Mason-Jones *et al*. (2000) suggested that when operating within a 'leagile' SC, a decoupling point occurs where lean and agile activities meet. Firms within SCs were our unit of analysis. It is these organisations that provide the components and parts to construct the finished vehicle and which, together, form the value chain. In other words, the physical value chain is made up of firms carrying out production activities in order to produce the final product. Given this, our conception of the decoupling point is the point at which the majority of firms switch from predominantly employing TPRCs associated with lean production to TPRCs associated with agile production. In our analysis, this occurred at the third tier and beyond. 'Leagile' SC literature suggests that lean firms are located at the lower levels of a SC and operate upstream, enabling a level schedule in output. In contrast, agile firms are located at the top or higher levels of the respective 'leagile' SC, and operate downstream from the decoupling point, ensuring there is an agile response capable of delivering to an unpredictable marketplace. However, findings from this study suggest that when operating within a complex SC, lean firms were found to be operating downstream, whereas agile firms were found to be operating upstream. Therefore, by taking the LAASC Model into account, it may be argued that firms implementing lean TPRCs, who compete on costs and efficiency levels, are more likely to be located at the top of the SC. In contrast, firms implementing agile TPRCs, who compete on flexibility and speed, are more likely to be located at the lower end of the SC. Although this directly contests Mason-Jones *et al*. (2000) as well as received wisdom, these varying competitive priorities within different tiers of the ASC are in line with assertions made by Doran (2004) and Boonsthonsatit & Jungthawan (2015). Furthermore, Marodin *et al*. (2016) and Tortorella *et al*. (2017a) also found firms to be leaner at the top tiers of an ASC and although their research did not look into the concept of agility, their findings did reveal firms positioned at the lower levels of the ASC to be less lean. In contrast, results contest findings by Tortorella *et al.* (2017b). However, as mentioned previously, Tortorella *et al*. (2017b) suggested their findings may have been an anomaly as the Brazilian ASC encompasses firms of oligopoly status lower down the ASC, which is why Panizzolo *et al.* (2012) suggested that SCs in developed and developing countries should be treated separately in this regard.

In terms of generalisability, we propose that the LAASC Model is applicable when the final product is complex, requiring thousands of components. However, in terms of SCs producing simpler final goods, which only require few components, the LAASC Model may not be applicable and Mason-Jones *et al*.'s (2000) description of lean, agile and 'leagile' SCs may be more appropriate. In order to provide a speculative insight into why lean and agile firms were found at different levels of the ASC, we turn to the literature surrounding CT and Resource-Dependence Theory (RDT). RDT has become one of the most useful theoretical stances within organisational theory and strategic management (Hillman *et al.*, 2009). Within RDT, the firm is viewed as an open system that is reliant on multiple contingencies within the external environment (Pfeffer & Salancik, 1978). To understand the behaviour within an organisation, it is necessary to understand the context of that behaviour. Literature surrounding RDT has power at its heart (Touboulic *et al.*, 2014) where an organisation's success can be attributed to power maximisation (Ulrich & Barney, 1984). In essence, one organisation's ability to exercise power over another will play a part in its success, where levels of dependency are crucial. Singh *et al.* (2011) stressed that RDT has only been scarcely explored and needs further development. Cox *et al.* (2001) stated that there are fundamental weaknesses concerning descriptive approaches to SCs within business management, as authors tend to exclude examining the importance and complexity of power. Cox (2001) asserted that there are four general buyer and supplier positions concerning power, namely; buyer dominance, interdependence, independence and supplier dominance. During times of buyer dominance, buyers will generally be able to achieve all they desire operationally and commercially at the expense of their suppliers (Cox *et al.*, 2004). Considering our LAASC Model suggested that lean firms were generally found to be operating at the top tiers of the ASC, we can say that as there are few buyers and many suppliers, agile firms, who are the suppliers to lean buyers, are in a position of high buyer dependency. Therefore, when OEMs or even first-tier suppliers require changes, as they are in a positon of buyer dominance, they can acquire the benefits operationally at the expense of their suppliers, which is a concern within the automotive industry also identified by Singh *et al.* (2005). This may explain why firms operating at the top levels of the ASC are seen to be implementing the TPRCs associated with cost reduction, higher efficiency and quality levels (lean), whereas firms positioned lower down the ASC were found to be implementing TPRCs associated with gaining advantage in terms of speed and flexibility (agile). Thus, the results imply that OEMs and first-tier suppliers are prioritising cost and quality performance and require firms at the lower levels of the ASC to be able to accommodate changes in design at great speed, supporting Marodin *et al.'s* (2017a) assertions. Although Turner (2005) suggested that European automotive industries may be 'leagile' as opposed to lean, due to the positional tier to which lean and agile firms were predominantly operating, our findings support Doran (2004) and Boonsthonsatit & Jungthawan (2015) assertions. In essence, firms positioned at the top tiers (downstream) of the ASC produce goods of higher added value relative to firms positioned lower down (upstream) in the ASC, who are more flexible in nature. Crute *et al.* (2003) also asserted that firms find it extremely difficult to implement lean systems when in a position of low negotiation power, which goes hand-in-hand with the discussion presented in this section.

8.0 Contributions

Several contributions are made. First, by examining the relevant TPRCs we identified a holistic mode by which lean and agile firms could be distinguished. Second, our results contribute towards clarifying the general misunderstandings related to the contingent nature of lean and agile production (Hines *et al*., 2004; Tortorella *et al*. 2017a). As lean and agile firms can be determined in the automotive supply chain without any relationship to the physical value adding process our results have theoretical implications. For instance, the idea that lean can be implemented as 'best practice' within all companies is refuted, as contingent variables, such as positional tier, can be an influential and significant factor. Although Marodin *et al*. (2016) found that lean production was not only being implemented in large-volume and low-variety companies, such as OEMs and first-tier suppliers, our results did not convey the same argument. For instance, firms positioned lower down the ASC, were generally found to be implementing TPRCs associated with flexibility (agile) as opposed to efficiency (lean). Firm size and firm age did not portray levels of significance; however, they did illustrate signs of bearing a relationship between lean and agile production. Third, the use of logistic regressions when calculating the probability of lean and agile firms belonging to different contextual groups can arguably hold more meaning and relevance when compared to previous studies. Fourth, we developed the LAASC Model that directly refutes Mason-Jones *et al*.'s (2000) existing views which, we feel, suggests that the field of SCM requires a new way of thinking concerning lean and agile firms within complicated SCs. Fifth, we contribute to the scarce literature that involves the use of both lean and agile paradigms simultaneously within a singular study. Finally, for practitioners, not only do we present a method that can assist them in determining whether their firms are lean or agile, but we also demonstrate which strategy is being employed to the greatest extent within different tiers of the ASC. For instance, managers can use the results in this study to see that firms positioned at the top tiers of the ASC are generally implementing a lean strategy, whereas firms positioned at the lower tiers of the ASC are generally implementing an agile strategy.

9.0 Conclusion

There is limited research examining lean and agile production relative to the role of contextual factors, especially supply chain positional tier (Jasti & Kodali, 2015; Marodin *et al*., 2016; Tortorella *et al*., 2017a, 2017b). Furthermore, there are inconsistent results presented in the literature Negrao *et al*. (2017). With this in mind, first we looked to rigorously distinguish between lean (cost effective and highly efficient) and agile (speed responsive and highly flexible) firms based upon the core TPRCs employed within their organisations. Next, employing Contingency Theory, the main aim of this study was to determine if the identified lean and agile organisations could be distinguished based upon contextual factors. We did not find a significant relationship between lean and agile production relative to firm size and firm age. Thus, our findings contest certain studies (Shah & Ward, 2003; Marodin *et al*., 2015; Haddach *et al*., 2016; Tortorella *et al*., 2017a, 2017b) and side with others (Furlan *et al*., 2011; Lucato *et al*., 2014). In terms of firm size, our findings may have been jeopardised by a large number of SMEs in the sample; therefore, it is crucial for future studies to gain a greater insight in determining if there may be a linkage between each of the manufacturing paradigms under investigation with relation to firm size. However, an interesting phenomenon is revealed concerning the positional tier to which firms belong within an ASC. Our positional tier findings support some of the literature (Doran, 2004; Boonsthonsatit & Jungthawan, 2015; Tortorella *et al*., 2017a) as lean organisations were primarily found to be positioned at the higher tiers of the ASC, and in contrast, agile firms were chiefly found at the lower levels of the ASC. Therefore, we proposed the Lean Agile Automotive Supply Chain (LAASC) Model as a starting point in moving towards a new way of theoretical thinking. Importantly, this finding is in direct opposition to discussions surrounding the decoupling point within the 'leagile' SC literature. We utilised Contingency Theory and Resource Dependence Theory, and more specifically, we invoked a power perspective to better understand why firms may be positioned in this way. We believe this paper is of theoretical importance to the fields of OM and SCM, with a particular focus on lean and agile literature. In summary, not only does this paper conceptualise a mode in which lean and agile firms can be differentiated, but our discussion also provides a new way of conceptualising a 'leagile' SC, and urges that the discipline of SCM may require a 'fourth' lean and agile SC model.

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