

# **Pathways to develop a lean organization: configurations of lean practices for different business strategies**

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## **Abstract**

This paper identifies pathways to develop a lean organization. Previous research identified complementarity between supplier related, customer related, just-in-time, total productive maintenance, and human resource management bundles. This research identifies strategy related configurations of these bundles linked to substantive operational performance. Data on operational performance and lean bundles were gathered from 44 manufacturers using multiple respondent self-assessments and analysed using Qualitative Comparative Analysis. Three different pathways to substantive operational performance were identified. Our findings provide focus to both research and practice as they suggest that lean bundles are not consistently linked to each other nor equally important for different organizations.

**Keywords:** Lean bundles; Operational performance; Qualitative comparative analysis

## **Introduction**

To develop a lean organization, it is important to focus on the most important lean bundles for that organization. This focus is ill addressed in the literature. Most research studies the link between lean bundles as well as their link with operational performance (like McKone, Schroeder and Cua, 2001; Rahman and Bullock, 2005; Fotopoulos and Psomas, 2009; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012; Danese and Bortolotti, 2014). Some incorporate generic contingencies like country or age (like McKone, Schroeder and Cua, 1999; Cua, McKone and Schroeder, 2001; Dal Pont, Furlan and Vinelli, 2008; Furlan, Dal Pont and Vinelli, 2011; Furlan, Vinelli and Dal Pont, 2011; Alsmadi, Almani and Jerisat, 2012; Bortolotti, Boscari and Danese, 2015). And a few take market conditions like demand variability into account (like Sakakibara et al., 1997; Ketokivi and Schroeder, 2004; Bortolotti, Danese and Romano, 2013). This paper sets out to explore strategy related configurations of lean bundles that are linked to substantive operational performance.

From its introduction onwards, the lean philosophy of increasing customer value and decreasing waste through just-in-time production and respect-for-employees (Sugimori et al., 1977) has been important for organizations trying to improve their organizational

processes (Naylor, Naim and Berry, 1999; Shah and Ward, 2003; Liker and Morgan, 2006; Radnor and Walley, 2008; de Souza, 2009). Lean however constitutes a diversity of bundles regarding total productive maintenance (TPM), just-in-time (JIT), human resource management (HRM), suppliers and customers (Shah and Ward, 2003, 2007). This diversity of bundles adds to the challenge of developing a lean organization (Hines, 2010; Mann, 2014).

It is shown that not all lean bundles are equally important for every organization (Sakakibara *et al.*, 1997; Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Brown, Squire and Blackmon, 2007; Ward, McCreery and Anand, 2007). For example, a customer link might be more important for organizations striving for customer intimacy while TPM might be more important for organizations striving for operational excellence (Treacy and Wiersema, 1996; Ward, McCreery and Anand, 2007). Rather than equally important it might be that lean bundles are best performed in configurations (Ward, Bickford and Keong Leong, 1996; Cua, McKone and Schroeder, 2001). Configurations are “multidimensional constellation[s] of conceptually distinct characteristics that commonly occur together” (Meyer, Tsui and Hinings, 1993, p. 1175). Related concepts are typologies (Miles *et al.*, 1978), gestalts (Miller, 1981), types (Mintzberg, 1990) or forms (Short, Payne and Ketchen, 2008). A configurational approach identifies dominant types of observable characteristics of behaviour which appear to lead to a particular performance.

Given the configurational approach, it is proposed that configurations of lean bundles can be developed depending on how an organization strives to distinguish itself (Filippini, Forza and Vinelli, 1996; Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007; Galeazzo and Furlan, 2018). Only one study explored configurations of lean bundles in relation to performance (Galeazzo and Furlan, 2018). Using data from 78 informants from 19 manufacturing medium and large firms, they found configurations of lean bundles that were linked to successful financial performance; JIT combined with total quality management *or with* TPM and HRM. However, their study focusses on internal related lean bundles only, neglecting bundles regarding the supply chain (supplier and customer related) and their study linked lean bundles to financial rather than operational performance. This study tries to add to this literature as it aims to *explore strategy related configurations of lean bundles that are linked to substantive operational performance*.

An overview of business strategies and related configurations of lean bundles is followed by an explanation why and how we used Qualitative Comparative Analysis (Ragin, 2008) to analyse our data and come to different pathways to develop a lean organization.

### **Configurations of lean bundles**

To explore strategy related configurations of lean bundles that are linked to substantive operational performance, we identify different business strategies which we link to different lean bundles to conceptualize configurations that are linked to operational performance.

#### *Business strategies*

Brown, Squire and Blackmon (2007) showed that world-class plants link lean operations to business strategy. Many approaches to business strategy have been taken (like Miles *et al.*, 1978; Porter, 1985). Treacy and Wiersema (1996) distinguish three basic ones; product leadership, operational excellence and customer intimacy. In line with these, Ward, McCreery and Anand (2007) identified three types; broad-based competitors,

differentiators and price leaders. As Treacy and Wiersema (1996) focus specifically on customer value (Zacharias, Nijssen and Stock, 2016) and as they show considerable overlap with the types of Ward, McCreery and Anand (2007) we will continue with these.

First, according to Treacy and Wiersema (1996) product leadership aims to excel on product quality, innovation and brand marketing. The focus is on design and development of a variety of good products, produced in low volume, with high margins and a quick time-to-market (Ward, McCreery and Anand, 2007). Second, operational excellence is about an outstanding production process with superior operations and execution. The focus is on efficiency and streamlined operations and supply chain management as the organization tries to offer a reasonable quality for a very low price (Ward, McCreery and Anand, 2007). Third, customer intimacy aims to excel in customer focus and customer service. The focus is on delivering customer specific products and services on time and above customer expectations as the organization adapts products and services for the benefit of individual or almost individual customers (Ward, McCreery and Anand, 2007).

According to Treacy and Wiersema (1996), organizations should strive to meet the threshold of all three strategies but at the same time excel at one of them. Research (Sakakibara *et al.*, 1997; Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007) has shown that proper alignment of business strategy strengthens the connection between lean bundles and operational performance. So lean bundles can help to meet strategic aims and market demands on an operational level.

#### *Lean practices and lean bundles*

Shah and Ward (2003, 2007) identified lean bundles from ten lean practices. Their practices are widely used in the literature because of their comprehensive view; they include people, process and technology aspects as well as supplier, internal and customer aspects. Following others, we grouped these lean practices into five internally consistent lean bundles. The supplier related bundle consists of supplier feedback, JIT delivery and developing suppliers (Shah and Ward, 2007). The customer related and HRM bundles each consist of one lean practice (Shah and Ward, 2007). Deviating from Shah and Ward, we split the internally related group into TPM consisting of controlled processes and productive maintenance, and JIT consisting of pull, flow and low setup (McKone, Schroeder and Cua, 1999, 2001; Cua, McKone and Schroeder, 2001). Like the ten lean practices, these five lean bundles are widely used in the literature (Mackelprang and Nair, 2010).

#### *Configurations of lean bundles*

The lean bundles can be conceptualized in the following configurations. First, to achieve product leadership short delivery times are paramount. To this end, the most important bundle seems JIT as this mainly helps to reduce product lead time (Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012). Prerequisites for JIT appear to be the bundles TPM for a steady production process (Swink, Narasimhan and Kim, 2005) and supplier related for steady deliveries (Panizzolo, 1998; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012). Bundles of lesser importance, though not irrelevant, seem customer related (Furlan, Dal Pont and Vinelli, 2011) and HRM (Furlan, Vinelli and Dal Pont, 2011). There appear to be no bundles counterproductive for this configuration.

Second, to achieve operational excellence low variety and high volume is produced for low margins. To this end, a steady marketing mix combined with a stable production

line seem most important. This is achieved by the bundle TPM (McKone, Schroeder and Cua, 1999, 2001). Bundles of lesser importance seem JIT (Danese, Romano and Bortolotti, 2012) and supplier related (Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012) as the high volume permits production to be done in small batches rather than single pieces. Some even find JIT (Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007) and supplier related (Ward, McCreery and Anand, 2007) to be counterproductive for this strategy. The customer related and HRM bundles (Ward, McCreery and Anand, 2007) might be too expensive for this configuration as the low variety permits steady designs and production. Though for these two bundles too, some researchers find otherwise (Ketokivi and Schroeder, 2004).

And third, to achieve customer intimacy direct contact with customers is most important making customer related the most important bundle (Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Ward, McCreery and Anand, 2007). Furthermore, because of the complexity in production, the bundles HRM (Swink, Narasimhan and Kim, 2005) and JIT (Swink, Narasimhan and Kim, 2005) seem to be required as well. TPM might be of lesser importance as unicity of the products does not require very high levels of productive maintenance or process control (Swink, Narasimhan and Kim, 2005). The supplier related bundle might be least important in this configuration as lead time oftentimes is not an order winner in this strategy (Furlan, Dal Pont and Vinelli, 2011). These configurations are also given in Figure 1.

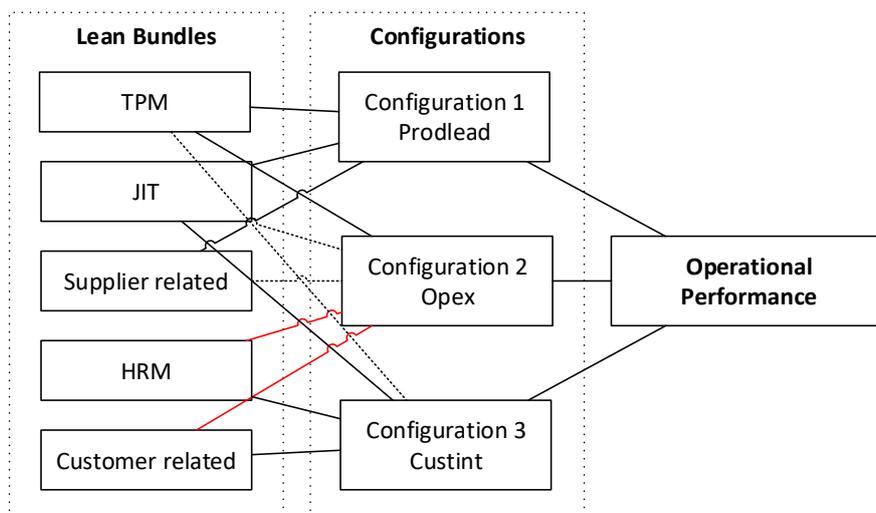


Figure 1, Configurations of Lean Bundles for Operational Performance

Note: black lines show a strong link, dotted lines a weak link and red lines an inverse link

## Methodology

To analyse the identified configurations of lean bundles that are linked to substantive operational performance, we first explain why we used multiple respondent self-assessments to gather data on operational performance and lean bundles before we explain why and how we used Qualitative Comparative Analysis (Ragin, 2008) to analyse this data and come to different pathways to develop a lean organization.

### Data gathering

Data was gathered from 44 Dutch manufacturing SMEs through the network of the research group World Class Performance/Lean of the HAN University of Applied Sciences in The Netherlands. Multiple respondents (6 on average, over 250 in total) from

different levels (executives till team leaders) and functions (Sales till Expedition) filled in a questionnaire on their operational performance (costs, quality, delivery speed, delivery dependability, product flexibility and volume flexibility) (White, 1996; Slack, Chambers and Johnston, 2010) and lean practices (See Shah and Ward (2007) for details). The lean practices were grouped in five bundles to enable data analysis with QCA; supplier related (supplier feedback, JIT delivery and developing suppliers), customer related, HRM, TPM (controlled processes and productive maintenance) and JIT (pull, flow and low setup).

#### *Data quality*

To estimate construct validity, an exploratory factor analysis (EFA with varimax) and a confirmatory factor analysis (CFA with direct oblimin) were performed for operational performance and lean practices respectively and given in **Fout! Verwijzingsbron niet gevonden.** and

Table 2. KMO's were >0.5 and Bartlett's tests of sphericity were both <0.001 hence all were significant. All meet the excellent threshold of >.7 while costs, JIT delivery, developing suppliers, pull and productive maintenance meet the very good threshold of >.6. Also following judgemental criteria (Wieland et al., 2017) and considering the content of the deflecting items (content validity) we decided to keep all items to maintain coverage of the identified groups.

*Table 1, Exploratory Factor Analysis of operational performance*

<b>Bundle</b>	<b>Indicator</b>	<b>Factor loading</b>	<b>Average performance</b>
1	Delivery speed	.928	6.0
	Delivery dependability	.947	6.4
2	Costs	.688	5.1
	Quality	.795	6.9
3	Product flexibility	.827	7.0
	Volume flexibility	.782	6.6

*Table 2, Confirmatory Factor Analysis of lean practices*

<b>Bundle</b>	<b>Practices</b>	<b>Average factor loading</b>	<b>Average performance</b>
Supplier related	Supplier feedback	.714	3.5
	JIT delivery	.663	2.5
	Developing suppliers	.647	2.3
Customer related	Involved customers	.760	3.2
HRM	Involved employees	.764	2.7
TPM	Controlled processes	.729	2.0
	Productive maintenance	.684	2.6
JIT	Pull	.689	3.1
	Flow	.833	3.1
	Low setup	.822	2.6

#### *Data analysis*

Data were analysed with QCA (Ragin, 2008; Schneider and Wagemann, 2012) in fsQCA 3.0 (Ragin, Drass and Davey, 2017). QCA is a technique which allows a systematic comparison of cases. Rather than statistics, it uses Boolean logic to find configurations of conditions for a certain outcome (Fiss, 2007). To do a QCA, several steps must be performed.

In preparation, both bundles of operational performance and lean practices were calibrated as shown in Table 3. Operational performance was measured on a nine-point scale with 1-3 being lower, 4-6 equal and 7-9 better than competition. Therefore, 6.5 was chosen as the threshold for cases outperforming competition. As there were no cases above 8 nor below 5 these acted as full and non-membership thresholds respectively. Lean practices were calibrated based on groups identified in our own dataset. As lean bundles for most cases were below 4 and above 2 these acted as full- and non-membership values respectively.

Next, the actual QCA was performed. Necessary or sufficient conditions were identified, a truth table was made with each row representing each possible configuration, and for each outcome consistency and coverage were calculated. To improve confidence in the identified configurations, two robustness tests were performed. These tested whether the findings were the same for different cross over points; one based on groups identified using the average per lean bundle and one based on the industry average from three studies (Alsmadi, Almani and Jerisat, 2012; Hofer, Eroglu and Rossiter Hofer, 2012; Bortolotti, Boscarri and Danese, 2015).

*Table 3, Calibration of outcome and conditions*

Lean practice	Threshold full-membership (0.95)	Crossover point (0.51)			Threshold non-membership (0.05)
		Groups in data	Data average	Industry average	
Operational performance	8	6.5	6.4	NA	5
Supplier related	4	3.2	2.8	3.5	2
TPM	4	3.0	2.3	3.5	2
JIT	4	3.4	2.9	3.4	2
HRM	4	3.2	2.6	3.6	2
Customer related	4	2.6	3.2	3.8	2

## Results

To find which configurations of bundles of lean practices were linked to increased operational performance for different business strategies, we first performed the QCA-test for necessity but found no bundles that were necessary for each configuration. We then performed the truth table algorithm to identify which bundles of lean practices were sufficient for cases to outperform competitors. Results are given in Table 4 and show that there are three configurations of lean bundles with substantive operational performance. First, JIT combined with supplier related and TPM. Second, TPM combined with supplier related but with absence of HRM and customer related. And third customer related and HRM combined with supplier related and JIT. These configurations of lean bundles show considerable overlap with the configurations identified from the literature.

Table 4, Configurations of lean bundles sufficient for substantial operational performance

Configuration	1	2	3
Supplier related	●	●	●
TPM	●	●	
JIT	●		●
HRM		⊗	●
Customer related		⊗	●
Raw coverage	.393	.600	.461
Consistency	.888	.889	.870

Note: Black circles denote the presence of the lean bundle and crossed-out circles denote the absence of the lean bundle. Blank spaces denote irrelevant lean bundles meaning that neither presence nor absence was linked to the outcome.

## Discussion

The aim of this paper was to explore strategy related configurations of lean bundles that are linked to substantive operational performance. This section will elaborate on our results and their theoretical and practical contributions.

### *Pathways to develop a lean organization*

Our results confirm earlier work on configurations of lean bundles linked to operational performance (Filippini, Forza and Vinelli, 1996; Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007; Galeazzo and Furlan, 2018) while we specify these configurations into three specific pathways to develop a lean organization. It appears that for product leadership, JIT is the most important bundle (Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012) while the TPM (Swink, Narasimhan and Kim, 2005) and supplier related bundles (Panizzolo, 1998; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012) are required as well. Like others, we too find that the customer related (Furlan, Dal Pont and Vinelli, 2011) and HRM bundles (Furlan, Vinelli and Dal Pont, 2011) are not required for this configuration.

Regarding operational excellence there is less agreement. We too find that the TPM (McKone, Schroeder and Cua, 1999, 2001) and supplier related bundles (Ketokivi and Schroeder, 2004; Swink, Narasimhan and Kim, 2005; Romano, Danese and Bortolotti, 2010; Danese, Romano and Bortolotti, 2012) are important for this configuration. However this contradicts findings of others (Ward, McCreery and Anand, 2007) regarding supplier related. Furthermore, we too find that JIT is *not* important for this configuration (Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007) contradicting those that find it is (Danese, Romano and Bortolotti, 2012). This might be due to lower variety and higher volumes hence less setups, pull and flow. Contradicting findings of others (Ketokivi and Schroeder, 2004), our results show that HRM and customer related are not required for this configuration (Ward, McCreery and Anand, 2007) as these might be too expensive.

Regarding customer intimacy, we mostly confirm earlier findings. The customer related bundle was most important (Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Ward, McCreery and Anand, 2007) while HRM (Swink, Narasimhan and Kim, 2005) and JIT (Swink, Narasimhan and Kim, 2005) were required as well. However, contradicting others (Swink, Narasimhan and Kim, 2005) our results show that TPM was not required

for this configuration. This might be because unicity of the products does not require very high levels of productive maintenance or process control. Finally, contradicting others (Furlan, Dal Pont and Vinelli, 2011) our results indicate that supplier related was important for this configuration. This might be due to the increasing importance of lead time. In sum our findings refine our understanding of configurations of lean bundles for substantive operational performance.

#### *Contributions and future research*

This paper confirms that not all lean bundles are equally important for every organization (Sakakibara *et al.*, 1997; Ketokivi and Schroeder, 2004; Brown, Squire and Blackmon, 2007) while it specifies a previously identified direction for analysis (Filippini, Forza and Vinelli, 1996; Panizzolo, 1998; Cua, McKone and Schroeder, 2001; Swink, Narasimhan and Kim, 2005; Ward, McCreery and Anand, 2007). Managers trying to develop a lean organization can use these findings to focus their efforts depending on their external environment and related business strategy. Future research could take the same approach to elaborate and refine our findings using different samples from different industries or cultures as well as samples with different combinations of lean bundles.

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