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Exploring the importance of cultural collectivism on the efficacy of lean practices: Taking an organisational and national perspective

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Title:
Exploring the importance of cultural collectivism on the efficacy of lean practices: Taking an organisational and national perspective

Abstract:

Purpose: The purpose of this study is to assess the influence of cultural collectivism on the efficacy of lean practices. Furthermore, this study assesses whether or not potential cultural disadvantages related to the level of individualism at the national level can be compensated for at the organisational culture level.

Design/methodology/approach: Hofstede's cultural dimension of individualism is used to test whether practicing a collectivistic culture at the organisational level can fully compensate for the potential disadvantages of being geographically situated in an individualistic culture when practicing lean.

Findings: Results suggest that cultural collectivism at the national and organisational level have a significant impact on the efficacy of lean practices. Furthermore, the negative impact of being situated in an individualistic country cannot be fully compensated for through practicing a collectivistic organisational culture when practicing lean.

Originality/value: This study represents a comprehensive attempt to simultaneously assess the collectivism cultural components of lean practices at the national as well as at the organisational level.

Keywords:
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1. Introduction[1]

Competitive pressures have resulted in organisations designing global manufacturing networks with the added complexity of managing operations across international boundaries. One key challenge in the age of transnational manufacturing (Ferdows, 1997) is to examine and understand the impact of culture, as recent research has shown its influence on the results of implementing various practices (Pagell *et al.*, 2005; Flynn and Saladin, 2006; Power *et al.,* 2010; Wiengarten *et al.*, 2011).

Recent findings indicate that manufacturing plants implementing manufacturing practices and programs such as TQM, six-sigma or lean are experiencing differences in their performance outcomes (Wiengarten *et al.*, 2011). Researchers have identified that the success of these manufacturing practices are dependent on various contextual and environmental factors (Power *et al.*, 2010). Recently, it has been argued that culture plays a crucial role for the success of various management practices (Kull and Wacker, 2010; Power *et al.,* 2010). Culture is a multi-dimensional construct that has been studied at different levels – i.e. individual, organisational or national. Accordingly, when studying the impact of culture on the spread of best practices across national boundaries it is critical to consider at least two levels: national and organisational culture (Naor *et al.,* 2010). National culture can be defined as the culture that the members of a society share which shapes their overall behaviour (Hofstede, 1980). Organisational culture can be defined as the collective programming of the employees' mind that distinguishes members of one organisation from others (Hofstede *et al.,* 1990; Hofstede, 1998).

Various studies have identified that certain characteristics of national culture have an impact on the efficacy of various manufacturing practices. There is considerable empirical support to indicate that the success of selected practices such as quality management depends

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to a certain extent on its national cultural environment (Kull and Wacker, 2010; Power *et al.*, 2011; Wiengarten *et al.*, 2011). In the context of lean manufacturing, although this practice has been considered contextually and culturally independent (Womack *et al.,* 1990), this view has been recently questioned and challenged in various studies that have identified various contextual factors affecting the efficacy of lean practices (Shah and Ward, 2003). Hines *et al.* (2004) argued that lean has evolved from merely a shop floor practice to an organisational-wide managerial philosophy. Lean in itself is based on collectivistic principles such as the ability to work in teams. In collectivistic environments people are integrated into strong, cohesive groups. This collectivistic mind-set is based on cultural characteristics and in strong contrast to individualistic cultures. The collectivistic-individualistic paradigm shifts across nations and companies. However, lean practices such as total production maintenance (TPM), which are team based, might be more effective in a collectivistic environment. The cultural dimension (i.e., collectivism) and the manufacturing practices (i.e., lean) might form a symbiotic entity that leads to performance improvement (i.e., Power et al., 2010; Wiengarten et al., 2013).

Various models of national and organisational culture have been developed that operationalise culture across multiple dimensions (Hofstede et al., 1990; Schwartz, 1994; Hofstede, 1998; Trompenaars et al., 1998; House, et al., 2002). From the different dimensions considered (e.g., power distance, individualism, masculinity, uncertainty avoidance, etc.), we focus on the cultural trait of collectivism/individualism because the success of many lean practices such as kanban, small batch sizes (i.e. one piece flow), pull scheduling, multipurpose layout, and total preventive maintenance (TPM) are inherently based on a group oriented working culture (Ohno, 1988; Rother, 2009).

Providing evidence that cultural collectivism on the national level is an important contingency factor when implementing and practicing lean would add to our understanding

of manufacturing strategy. However, from a managerial perspective this might not be sufficient. Proving that corporate culture can be practiced to counteract these potentially negative cultural influences would be of greater importance. Indeed, some authors have suggested that organisational culture may act and safeguard against less favourable and 'negative' national influences (Naor *et al.*, 2010).

Building on the work of Naor *et al.* (2010), we consider two levels of culture (national and organisational) and drawing on the results of Power *et al*. (2010), we focus our analysis on the effect of the cultural dimension of collectivism and its impact on the success of lean practices. In particular, we propose that an organisational culture characterised by collectivism compensates for the potential negative effects of an individualistic national culture. Accordingly, the objective of this paper is to analyse the role of a collectivistic culture for the success of lean practices within the context of national and organisational culture. More specifically, we aim to answer the following research questions:

(1) Does collectivism at the national and organisational culture has a positive impact on the efficacy of lean practices? And if so,

(2) Can organisational collectivism offset the potential negative impact of an individualistic national culture on the efficacy of lean practices?

Providing answers to these questions would not only highlight the importance of national and organisational culture in terms of collectivism for the success of lean practices but also indicate whether or not organisational cultural characteristics can compensate for the less favourable outcomes that are a consequence of a national culture.

2. Literature review

The term 'lean' manufacturing[2] is used to refer to a production system pioneered by Toyota – also known as the Toyota Production System (TPS) (Womack *et al.,* 1990). Lean manufacturing can be described as a multi-dimensional approach to manufacturing that includes a wide range of management practices such as, just-in-time (JIT), quality systems, work team, cellular manufacturing, supplier collaboration and TPM. These practices are synergistically integrated to create a continuous, streamlined and high-quality system to reduce or eliminate waste and take a customer-centric perspective (Shah and Ward, 2003). The reduction or elimination of waste is a core principle of lean. From the lean viewpoint, waste refers to overproduction, waiting time, inventory, defective goods or any other factor that can disrupt the even flow of goods along the transformation process (Cusumano, 1994).

Hines *et al.* (2004) argue that lean exists at two organisational levels: the strategic and operational level. The strategic dimension emphasises lean thinking, in terms of the philosophical customer-centric perspective of lean. It can be deployed across an organisation and is not restricted to the shop-floor. On the other hand, at the operational level there are the lean tools that enable the execution of the lean philosophy linked to the strategic level. Lean thinking encourages a mutual and combined effort between employees to execute tasks and permanently improve processes and quality, which will be reflected ultimately in products that consume less inputs (Womack *et al.,* 1990). Lean is also regarded as a key integration and coordination mechanism of internal and supply chain wide manufacturing activities, using typically manufacturing cells and a collaborative approach to supply chain management (Helper, 1991; Helper and Sako, 1998; Jayaram *et al.,* 2008).

2.1 Lean Practices and Operational Performance

[2] In the following we use the terms lean manufacturing and lean practices interchangeably.

Companies have reacted to increased competition through implementing various managerial and manufacturing practices such as TQM, six sigma, business process reengineering (BPR), etc. Many firms have adopted lean practices in order to gain a competitive boost thereby enabling them to meet the increasing opportunities and demands of global markets and competition (Mackelprang and Nair, 2010). The basic premise about lean practices is that it provides firms with the ability to reduce costs through eliminating non-value adding activities (Shah and Ward, 2003).

Some studies have identified a positive relationship between implementing lean practices and performance improvements (e.g., Sakakibara *et al.,* 1997; Fawcett and Myers, 2001; Ward and Zhou, 2006). Fullerton *et al.* (2003), for example, examine the impact of lean on financial performance through a survey of US manufacturing firms. They identify that firms implementing higher degrees of JIT manufacturing practices outperform competitors who do not use such practices. However, the general outcome of linking lean to performance has been mixed. Recently, Mackelprang and Nair (2010) carry out a meta-analytic investigation on the relationship between various lean practices and performance. They identify that the general outcome of previous research in terms of studying the lean practice – performance relationship has been ambiguous (e.g., Rinehart *et al.,* 1994; Flynn *et al.,* 1995). Dean and Snell (1996), for example, could not identify any significant relationship between lean and performance. Swink *et al.* (2005) investigate the impact of various manufacturing practices on cost efficiency, flexibility and market-based performance. They identify that JIT flow does not improve a firm's cost efficiency. However, it does contribute to process flexibility and partially to new product flexibility. Pay (2008) highlights that less than five per cent of companies that implemented lean programs achieved their anticipated results.

Some researchers argue that such mixed results might be explained by the fact that previous research has neglected the introduction of contextual and interacting factors

(Mackelprang and Nair, 2010). Recent studies have investigated and confirmed the contextual influence of various factors such as firm size (Lawrence and Hottenstein, 1995; White *et al.,* 1999), industry type (Lawrence and Hottenstein, 1995), human resource management practices (Fawcett and Myers, 2001; Challis *et al.,* 2005), strategy (Swink *et al.,* 2005; Jayaram *et al.,* 2008) and technology on the efficacy of lean manufacturing (Ward and Zhou, 2006). Previous research has assessed the impact of various contextual factors (i.e., unionisation, age and size of the plant) on the success of implementing lean manufacturing practice bundles (Hines *et al.,* 2004). They identify that lean manufacturing (i.e. lean bundles) significantly improves operational performance. However, the magnitude varies depending on the organisational context (i.e. plant size, unionisation and plant age) (Shah and Ward, 2003).

In summary, the literature provides support for challenging the universal applicability proposition of lean (Womack *et al.,* 1990). Some studies evidently identified a central role of contextual factors for the success of lean. The remaining sections will review the potential contextual and moderating role of culture.

2.2 Cultural Components in Lean

In our study we address the impact of culture in terms of collectivism on lean practices on two levels of culture: national and organisational. Culture can be regarded as the collective programming of the mind, which distinguishes the members of one group from those of another (Hofstede, 1980).

Traditionally, lean manufacturing was viewed to be contextually and culturally independent, evidenced by the successful implementation of lean practices in the Western world (Holweg, 2007). According to Womack et al. (1990, p. 9), "*we believe that the fundamental ideas of lean production are universal – applicable anywhere by anyone – and*

that many non-Japanese companies have already learnt this". Womack *et al.* (1990) highlight the transferability of lean into non-automotive and non-Japanese settings (Hines *et al.,* 2004). However, some observers have questioned this transferability. According to Hines *et al.* (2004), the failure to consider contingencies in the adoption of lean manufacturing has been revisited by its original proponents (Jones and Womack, 2002). Hines et al. (2004) argued that because of cultural differences, Western manufacturers that tried to emulate lean practices had difficulties in achieving significant performance benefits and productivity gains that are comparable to Japanese manufacturers (Holweg and Pil, 2001).

When viewing lean as more than just a bundle of practices, but rather a philosophical mind-set that executes its vision through practices, the lean approach clearly has some cultural elements attached to it (Bhasin and Burcher, 2006; Shook, 2010). Like Hines *et al.* (2004), Bhasin and Burcher (2006) also divide lean into two building blocks: technical and cultural characteristics/requirements. They argue that implementing lean in a non-Japanese environment requires certain adjustments to the organisational culture in order to make it successful. This would not only suggest a cultural component at the national level but also at the organisational level (Challis *et al.,* 2005; Wong and Cheah, 2011).

In summary, lean has been operationalized and defined from both a practices perspective that includes tools such as kanban, equipment layout and batch size reduction and from a philosophical perspective that includes elements that emphasizes the softer side of lean including taking a long-term perspective and a focus on collaboration. In this paper we are implicitly dealing with both perspectives of lean: lean in terms of lean practices and lean in terms of a collectivistic organizational culture. The concept of a collectivistic organizational culture includes elements that might align with the philosophical element of lean.

3. Hypotheses Development

3.1 Collectivism and Lean Practices at the National Level

Various models of national culture have been developed that operationalise culture across multiple dimensions (Schwartz, 1994; Trompenaars *et al.,* 1998, 2000; House, *et al.,* 2002). One of the most widely used concepts of national culture was developed by Hofstede (1980). Initially, Hofstede conceptualises various cultures according to the distinct dimensions of power distance, individualism, masculinity and uncertainty avoidance (Hofstede, 1980). Through further development of his model Hofstede added two additional dimensions in the form of long-term versus short-term orientation and indulgence versus restraint. Although widely used, Hofstede's work has been criticised for its lack of generalisability, the assumption of homogeneity in each of the studied cultures and that the data was solely collected from a single corporation with multiple subsidiaries (Smith, 1992; Sivakumar and Nakata, 2001; McSweeney, 2002; Rarick and Nickerson, 2008). While it is recognised that there are limitations to using Hofstede's classification, we use his classification of national culture because of its confirmed validity and its widespread usage in the operations management literature (Merritt, 2000; Magnusson *et al.,* 2008; Power *et al.,* 2010; Wiengarten *et al.,* 2011).

Considering the practices and programs under the umbrella term of lean manufacturing, it can be argued that the lean approach may be contingent upon the cultural traits of the continuum between individualism and collectivism (Hines *et al.,* 2004; Bhasin and Burcher, 2006). Individualism can be defined as the extent to which humans in a country prefer to act as individuals or groups (Hofstede, 1993). While some humans prefer a loosely knit social framework where individuals take care of themselves and their families (low collectivism), others prefer to have tightly knit social frameworks in which they expect families, or others within the group, to look after them, in exchange for loyalty (high collectivism) (Ramamoorthy *et al.,* 2007).

A number of studies have explored the importance of culture for quality management practices (e.g. Kull and Wacker, 2010; Wiengarten *et al.,* 2011). Kull and Wacker (2010) identify that on average quality management (i.e., TQM, ISO 9000, SPC and six sigma) are more successful (in terms of product quality performance) in companies situated in Asian countries than in non-Asian countries. Similarly, in terms of other management practices, Wiengarten *et al.* (2011) explore the impact of various characteristics of national culture on the success of quality management practices (i.e., TQM, ISO 9000, SPC and Six Sigma). They identify that quality management practices have a stronger positive effect on operational performance when plants are situated in countries characterised by high collectivism (Wiengarten *et al.,* 2011). Similarly, Rungtusanatham *et al.* (2005) study the universal applicability of TQM practices across multiple countries. While not explicitly looking at differences in performance outcomes, they identify differences in the level of adoption of TQM practices across nations. The quality management practices investigated either originated or were very similar to the lean philosophy (Shah and Ward, 2003). Consequently, lean may also be exposed to selected cultural traits.

The success of many lean practices such as kanban, batch size reduction (i.e. one piece flow), pull scheduling, multipurpose layout, and TPM are inherently based on a group oriented working culture (Ohno, 1988; Rother, 2009). Rother (2009) highlights that in terms of learning, lean practices expose employees to a group-oriented learning process because production systems are too complex to be understood and managed by individuals. Bhasin and Burcher (2006) propose that companies implementing lean practices need to adjust their culture in order to improve the chances of lean being successful. They highlight that lean practices require a culture of decision-making starting at the lowest organisational level, implying a group-based approach to problem solving.

This relationship between lean practices and a group-oriented working culture is also reflected in the cultural characteristics of Japanese society. Based on the Hofstede scores, the national culture of Japan is characterised by a relatively low level of individualism (i.e., IDV = 46). This indicates an emphasis on a group-oriented society, which as argued previously, may also be an important contextual factor for the efficacy of various lean practices. Accordingly, lean practices as originated in Japan might not be as effective in individualistic cultures.

The specific lean practices that we include in this paper are equipment layout (i.e. extent of use of cellular manufacturing), kanban (i.e., extent of use of the concept of kanban), batch sizes (i.e., extent to which the plant utilises or works towards using small lots in production), order release into manufacturing (i.e., extent of existence of a pull production system), and maintenance and housekeeping (see Appendix A for the questionnaire items). A process/equipment layout that is following a cellular manufacturing relies on a multi-skilled workforce that works in cells that group together similar machines to produce families of parts. Furthermore, to make a kanban system work to control inventory levels the workforce is also required to work as a team, to communicate and to collaborate between different departments (e.g., production and distribution). Similar arguments can be made for introducing a pull production system and to reduce batch sizes. Likewise, total productive maintenance, an approach to equipment maintenance, is also based on the knowledge and pro-activeness of the workforce (involving everyone) to care about the production facilities (i.e., machines). We propose that these lean practices are more effective in collectivistic cultures as compared to individualistic cultures. Subsequently, we propose the following hypothesis.

H1: The impact of lean practices on operational performance is stronger in plants situated in nations with a collectivistic culture.

3.2 Cultural Collectivism and Lean Practices at the Organisational Level

We highlighted that previous research has identified that national culture can have a significant impact on operations and its performance (e.g., Nakata and Sivakumar, 1996; Pagell *et al.,* 2005). However, research has also shown that organisational culture can affect operations in various forms (Bates *et al.,* 1995). Differences in organisational culture are mainly expressed through differences at the level of practices while the core of organisational culture is conceptualised through its values (Hofstede *et al.,* 1990).

A recent study by Naor *et al.* (2010) analyses the impact of national and organisational culture on manufacturing performance. At the organisational level they identify that some traits of organisational culture (i.e., power distance, future orientation, and performance orientation) between Eastern and Western countries differ significantly. Furthermore, in comparing the importance of national and organisational culture they identify that organisational culture has a significantly stronger impact on manufacturing performance compared to national culture (Naor *et al.,* 2010).

We make a similar argument to national culture with respect to organizational culture. Lean practices such as cellular manufacturing, TPM, kanbans, pull production systems and the likes requires a knowledgeable workforce that collectively understands the importance of lean and practices it. These practices require a collectivistic mind-set with a long-term perspective. This includes the training and educating of the workforce about the challenges and benefits of these lean practices. Consequently, we argue that in general, at the organisational level, a favourable organisational culture increases the efficacy of lean practices. In other words, practicing a collectivistic, group oriented working culture result in more effective and efficient lean practices. Accordingly, we posit the following hypothesis:

H2: The impact of lean practices on operational performance is stronger in plants practicing high levels of collectivistic organisational culture.

3.3 Organisational/National Collectivistic Culture and Lean Manufacturing

The relationships between national and organisational culture have been explored by way of the convergence and divergence hypotheses (Child and Keiser, 1979; Nelson and Gopalan, 2003; Rungtusanatham *et al.,* 2005; Naor *et al.,* 2010). Proponents of the convergence hypothesis claim that organisations can mitigate the impact of national culture through their industrialised practices (Von Glinow *et al.,* 2002). On the other hand, the divergence hypothesis proposes a more dominant role of national culture (Ralston *et al.,* 1997). It proposes that social norms embedded in the national culture dictate the way people behave and relate to each other (Child and Keiser, 1979).

Several empirical studies suggest that national culture might not dictate or dominate an individual's behaviour, providing support for the convergence hypothesis (e.g., Dastmalchian *et al.,* 2000). In other words, workers' behaviour may not be constrained by their cultural belief system. This would imply that management could change workers' behaviour through implementing and enforcing their own organisational culture (Ogbonna and Harris, 2000; Naor *et al.,* 2010). Similarly, Wiengarten *et al.* (2011) suggest that in order to overcome the negative impact of national culture on the success of manufacturing practices (i.e., quality practices in a national individualistic cultural environment), plants must work to create a collective culture within their organisational boundaries.

However, Naor *et al.* (2010) highlight that the interplay between organisational and national culture may result in tensions, potentially harming performance. Best practices, such as those that come under the title of lean manufacturing may be implemented globally, which may provoke local cultural conflicts, if they conflict with national cultural values (Naor *et al.,*

2010). Since previous research suggests that organisational culture might dominate differences in national culture, an organisational culture geared towards group orientation may overcome less favourable individualistic conditions at the national level (Naor *et al.,* 2010). Subsequently, we propose that a collectivistic orientated organisational culture can counterbalance individualistic national cultural characteristics.

H3: Plants situated in nations with a less favourable individualistic culture can overcome these negative influences through practicing high levels of collectivistic organisational culture.

Our research model is depicted in Figure 1. Hypothesis one posits a moderating effect of collectivism at the country level, which suggests that in plants located in countries with a collectivistic culture, the impact of lean practices is higher. Similarly, hypothesis two formulates that organisational collectivism enhances the impact of lean practices on performance. Finally, hypothesis 3 posits that the negative effects of an individualistic national culture on performance can be compensated for by having a collectivistic organisational culture.

Insert Figure 1 Here
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4. Research Method

4.1 Sample

To test our proposed hypotheses we utilised survey data that was collected through the Microscope Benchmarking Instrument. The database of the plants to be contacted was provided by governmental SME agencies in each country. Subsequently, the sample is not likely to be random. The survey effort was managed by the London Business School in association with IBM United Kingdom. The data was collected by trained facilitators who visited each of the plants site. The facilitator spent time in consultation with the site

manufacturing management team to reflectively respond to each practice and performance variable.

Sample demographics are listed in Table 1. Specifically, number of employees, national culture and industry are listed to provide an overview over the collected data. The sample consists of 932 plants situated in Australia (IDV = 90), Belgium (IDV = 75), Italy (IDV = 76), Republic of Ireland (IDV = 70), United Kingdom (IDV = 89) and the United States (IDV = 91). The utilized survey items are listed in Appendix A. The questionnaire was divided into specific sections such as introduction (i.e., business profile), plant and equipment, organization and culture, and performance related sections (i.e., manufacturing cycle times, quality, and business measurement). The survey starts with an introduction section with general information on how to fill out the survey. Furthermore, before each section a comprehensive description of the meaning of each item is given. For example, the maintenance item is described as follows: *"Emphasis should be on actual events, not intentions and written procedures. Total absence of breakdowns is not expected, but maintenance should be a planned activity to minimise disruptions. Is the cause of equipment downtime recorded and a structure in place to reduce lost time due to maintenance activity? How often are problems not solved at the first attempt? What practical steps have been taken to enable operators to perform routine maintenance tasks, without recourse to specialist personnel?"*. The additional information helps the respondents to gain additional information to fill out the questionnaire correctly.

Insert Table 1 Here

4.2 Measures

The lean paradigm has evolved over time as has its conceptualisation and measurement. However, some "core" elements have been identified, which seem to continue to be

implemented over time (Shah and Ward, 2003). The following lean practices are considered in our study: equipment layout (i.e. extent of use of cellular manufacturing), kanban (i.e., extent of use of the concept of kanban), batch sizes (i.e., extent to which the plant utilises or works towards using small lots in production), order release into manufacturing (i.e., extent of existence of a pull production system), and maintenance and housekeeping (i.e., extent of proper maintenance of machinery and overall plant facilities). We focus on these lean practices because they can be viewed as the traditional Toyota Production System (TPS) tools (Schonberger, 2007). Focusing on these practices will help to establish a refined examination of the cultural elements in lean. All items are measured on a 5-point Likert scale with higher usage of lean practices being reflected in higher scores.

National collectivism culture is measured through the IDV culture scores provided by Hofstede (see Table 1). This enables us to categorise the selected countries in the sample and make meaningful comparisons with the collectivistic orientated Japanese culture.

For organisational culture we follow the approach by Naor *et al.* (2010), adopting items that measure collectivism (i.e., institutional collectivism) at the organisational level (Roth *et al.,* 2007). We selected items to reflect Hostede's national collectivisms at the organizational level-organizational collectivism. We selected items related to the level of practice of plant wide shared vision, mission and goals, employee involvement and employee training and education (Mintzberg and Waters, 1985; Geletkanycz, 1997; Samson and Terziovski, 1999; Collier et al., 2004; Naor *et al.,* 2010). Organisational collectivism is also measured on a 5-point Likert scale.

According to Shah and Ward (2003), the construct validity of whether operational performance is unidimensional in a conceptual sense is a separate question. We measure operational performance through a unidimensional variable utilising the following items:

product reliability in service, defects, customer delivery commitments met, customer satisfaction and productivity (Shah and Ward, 2003).

In addition, we also include plant size and industry type as a control variable. As previously noted size and industry seem to have a significant impact on the success of lean practices (Shah and Ward, 2003). Therefore, in order to increase the generalisability of our results we control for size and industry. Consistent with previous research we use the number of employees as a proxy for firm size (Ketokivi and Schroeder, 2004; Power *et al.,* 2010).

4.3 Assessment of Validity and Reliability

To assess the measurement properties of the data we conducted confirmatory factor analysis (CFA). The CFA model included five items measuring lean practices, four items measuring organisational culture, and six items measuring operational performance (see Table 2). Findings regarding the absolute and incremental fit indices indicate that the data fits our proposed model relatively well (e.g. NFI = .95; NNFI = .95; CFI = .97; IFI = .97; RFI = .93). They all exceeded their commonly proposed cut-off value of .9 (Bollen, 1989; Gerbing and Anderson, 1992).

Table 2 provides measurement values for the mean, standard deviation, factor loading, t-value, standard error, R^2 and Cronbach alpha (α). The several iterative and continuous development and design stages of this well-established survey instruments assured content validity.

Insert Table 2 Here

Table 2 indicates that convergent validity (the degree to which items measure their underlying construct) was acceptable. Furthermore, the items load significantly and unidimensionally on the proposed latent variables. The Cronbach alpha results, in Table 2, confirm reliability, with the alpha scores being in the commonly accepted range above .70 (Nunnally, 1978). Subsequently, construct validity was confirmed through establishing

content validity, reliability, and convergent and discriminant validity (Narasimhan and Schoenherr, 2011).

Insert Table 3 Here

We assessed the presence of common method bias through CFA and the Harman's single-factor test (McFarlin and Sweeney, 1992; Boyer and Hult, 2005). Based on this test common method bias would be present if a single factor would emerge that accounts for all or most of the items (Podsakoff and Organ, 1986). Results indicate that the single factor model resulted in a χ^2 above the corresponding value for the confirmed measurement model (1007.74 vs. 296.97). This suggests that common methods bias is not a serious concern in this dataset.

Additionally, we analysed non-response bias through testing the significant differences in the responses of early and late returned questionnaires (Pearl and Fairley, 1985; Lambert and Harrington, 1990). Six of the items used in the analysis were randomly selected, and chi-square tests were performed on the initial and last set of twenty responses. The significance values for the selected items were well above the .01 level. This indicates that there was no statistically significant difference in the estimate between early and late respondents, that is, no evidence of bias for non-response (Armstrong and Overton, 1977).

5. Analysis and Results

To test the three hypotheses we conducted regression analysis. In the first step (sig. F change = .269) we entered the two control variables plant size and industry into the model (R^2 adj. = .001, F = 1.317, p = .269). In the second step (sig. F change = .000) we entered the independent variable lean practices and the moderators national and organisational culture (R^2 adj. = .051, F = 8.165, p = .000). In the third step (sig. F change = .001) we entered the two two-way interaction terms calculated through multiplying lean practices with organisational collectivism culture and lean practices with national collectivism culture (R^2

adj. = .083, F = 10.534, p = .000). Finally, in the fourth step (sig. F change = .789) we entered the three-way interaction term through multiplying lean practices with collectivism culture at the organisational and national levels (R^2 adj. = .081, F = 9.343, p = .269).

Before carrying out the OLS regression (ordinary least square) analysis the data characteristics were tested in terms of linearity and multicollinearity (Kennedy, 1999). We confirmed linearity through plotting standardized residuals against the standardized predicted values. Furthermore, the variance inflation factors (VIFs) were calculated and are listed in Table 4. Results indicate that VIFs are all well below 2, which is less than the commonly applied threshold.

Hypothesis one posited that the impact of lean practices on operational performance will be stronger in plants that are situated in nations with a collectivistic culture. The results in Table 4 indicate that lean practices (B = .229, p < .001) and national culture (B = -.104, p < .05) yielded a significant regression weight on operational performance. Moreover, our results indicate that the 2-way interaction term between lean practices and national collectivistic culture was significant (B = -.149, p < .005).

Insert Table 4 Here

Having identified the significant interaction term we calculated the simple slopes (Aiken and West, 1991) of the regression of lean practices on operational performance at low (one SD below the mean) and high levels (one SD above the mean) of IDV (Preacher *et al.,* 2006). As illustrated in Figure 2, lean practices are more strongly associated with operational performance when individualism is low (B = 4.54, p < .01), than when individualism is high (B = 2.31, p < .01). In other words lean practices have a stronger positive impact on a plant's performance when collectivism is high. As such, these results confirm our first hypothesis: Lean practices have a stronger impact on operations performance in plants that are situated in

nations characterised by lower levels of IDV (i.e. collectivistic nations) when compared to plants situated in nations with an individualistic orientation.

Insert Figure 2 Here

Hypothesis two posits that the impact of lean practices on operations performance is higher in plants that are practicing a group oriented working culture compared to plants practicing an individualistic working culture. Similar to the previous hypothesis we calculated the interaction term through multiplying lean practices with the moderator organisational culture.

Table 4 indicates that in contrast to national culture, organisational culture does not significantly affect operational performance (B = .089, p = .119). We also added this 2-way interaction term into the same regression model in the third step. The results in Table 4 indicate that the 2-way interaction term between lean practices and organisational culture was significant (B = .124, $p < .05$).

Again, we calculated the simple slopes (Aiken and West, 1991) of the regression of lean practices on operational performance at low (one SD below the mean) and high levels (one SD above the mean) of organisational collectivistic culture (Preacher *et al.,* 2006). As illustrated in Figure 3, lean practices are more strongly associated with operational performance when organisational collectivism is high (B = 2.28, $p < .01$), than when organisational collectivism is low (B = 2.34, $p < .01$). In other words, lean practices have a stronger positive impact on a plant's performance when plants practice a high level of collectivism. Thus, we also find support for our second hypothesis: lean practices indeed have a stronger impact on operations performance in plants practicing high levels of collectivism when compared to plants practicing an individualistic organisational culture.

Insert Figure 3 Here

Finally, hypothesis three posits that through practicing a collectivistic-oriented organisational culture plants can overcome a less favourable national individualistic culture. To test this hypothesis we added the previously calculated 2-way interaction terms between national culture (i.e., IDV) and lean practices and organisational culture (i.e., collectivism) and lean practices. In addition, we calculated the 3-way interaction term through multiplying lean practices with national and organisational culture.

The results are listed in Table 4 and indicate that adding the three-way interaction term was not significant (B = .023, p = .454). Furthermore, adding the interaction term did not significantly add to the variance explained in operational performance. Subsequently, this result does not support our third hypothesis. A collectivistic organisational culture cannot overcome national cultural disadvantages in terms of individualism.

6. Discussion

This study investigates the interplay of national and organisational culture in terms of the individualism-collectivism trait and its impact on the efficacy of lean practices. In the operations management literature there has been considerable debate as to what extent the success of best practices in general, and lean practices in particular, are dependent on the cultural environment. Through utilising a large multi-country dataset we explored the relationships between various lean practices, national culture, organisational culture and operational performance.

At the country level, our results confirm hypothesis one indicating that collectivism at the country level moderates the impact of lean practices on operational performance. Lean practices have a stronger impact on operations performance in plants that are situated in relatively collectivistic nations, as opposed to plants situated in nations with an individualistic orientation. Similarly, at the plant level, our results also confirm hypothesis two indicating

that an organisational collectivistic culture moderates the impact of lean practices on operational performance. Lean practices have a stronger impact on operations performance in plants practicing high levels of collectivism as opposed to plants practicing an individualistic organisational culture. However, our results do not provide support for hypothesis three. While a collectivistic organisational culture is essential for the success of lean, it cannot fully compensate for the disadvantages that plants are exposed to when practicing lean in countries characterised by an individualistic culture.

These results have both important theoretical contributions and implications for management. From a theoretical perspective our results provide additional evidence supporting the significance of culture in international operations management research (Power *et al.,* 2010; Wiengarten *et al.,* 2011). While at the country level the importance of national culture for the efficacy of management practices in the operations environment is well recognised, the importance of organisational culture has been explored to a lesser extent. At the national culture level our results confirm the findings by various authors suggesting that selected national cultural traits impact on the efficacy of manufacturing practices such as quality practices (Kull and Wacker, 2010; Power *et al.,* 2010; Wiengarten *et al.* 2011). However, a gap in the literature had existed with regard to the impact of national culture on lean practices. While our research can only be viewed as a starting point to fill this gap, we have clearly identified that lean inherits a cultural component at the national and organisational level. In looking at the individualism/collectivism dimension of culture our results indicate that the efficacy of lean can vary across countries and cultures. Our results contradict the previous findings of Naor *et al.* (2010). The development of a supporting organisational culture for lean cannot fully overcome and compensate for disadvantages due to national cultural differences. As such, these results provide partial support for the divergence hypothesis, which proposes a dominant role for national culture (Ralston *et al.,*

1997). Even though we have identified the significance of culture at the national and organisational level, we cannot confirm that organisational culture in the form of collectivism can fully overcome individualistic national cultural traits.

By considering and analysing culture at two levels of analyses (i.e. national and organisational culture) our results have various managerial implications. As expected we can confirm that a supportive collectivistic organisational culture contributes to the efficacy of lean practices. Regardless of location, plant managers implementing and practicing lean need to keep in mind the philosophical dimension of lean. A collectivistic organisational culture that supports group work, employee involvement and training leads to better performance results through lean.

At the same time, managers also need to be aware that when implementing and practicing lean manufacturing at various plants and locations, they are likely to reap greater benefits from lean practices when the plant is situated in a country with low levels of individualism at the national level. The disadvantages experienced at the national level cannot be fully compensated for at the organisational level. As a result, managers need to be aware of cultural issues at least at the national and organisational level. It is apparent that performance disadvantages can arise due to choices and decisions made regarding the plants' location. While organisational culture can certainly be used to counterbalance some of these differences, they cannot fully compensate for an individualistic national culture. This leaves management with a constrained but nevertheless important organisational cultural tool to make lean a success regardless of location. Nonetheless, managers need to be aware of potential performance disadvantages when implementing and practicing lean in plants situated in individualistic countries. Therefore, when evaluating the implementation of lean manufacturing, managers need to consider that plants situated in individualistic countries will achieve lower performance improvements.

7. Conclusions

Our research adds to the on-going and increasing debate on the role of culture in the successful adoption of best operations practice (Power *et al.,* 2010). Consistent with prior research, our findings suggest that standardised manufacturing and production tools such as lean still carry cultural elements with them that need to be considered and managed during implementation (Wiengarten *et al.,* 2011). Moreover, our research provides clear evidence that culture at the national and organisational level in terms of individualism and collectivism has a significant impact on the operational success of lean practices.

There are limitations that need to be taken into consideration when interpreting these results. Firstly, the plants in our sample are mainly small- or medium-sized plants. Although we have introduced plant size as a control variable, the results could differ in larger plants. Secondly, we followed the approach of various previous studies and conceptualised operational performance through a single dimension. However, it might be interesting to test whether the importance of national and organisational culture varies between the various dimensions of operational performance. Thirdly, we solely assessed whether or not organisational collectivist culture can compensate for a national individualistic culture. How other dimensions of culture interact (such as long term orientation and distance to power) may also be of importance. Finally, we only sampled plants situated in Western industrialised countries. Using a similar controlled sample from plants situated in Asian industrialised countries might provide additional insights and results. Furthermore, additional limitations have to be highlighted in terms of the data utilised. Sampling is not random, with some organisations volunteering to participate. The end result is a large sample of plants situated in a limited number of similar manufacturing industries that was not randomly selected. As

such, our results are validated for relatively large firms and we cannot generalise our results to small medium sized companies.

Apart from these limitations this paper makes a number of contributions from a practical and theoretical perspective. In answering the formerly stated two research questions as to whether or not selected characteristics of national and organisational culture affect the efficacy of lean practices and whether or not organisational culture can offset the potential negative impact of national culture on the efficacy of lean practices we contribute to the increasing body of knowledge in international operations management research. This study provides evidence that national culture is an important contingency factor that needs to be considered when implementing and practicing lean. Many studies have already confirmed this important finding. However, from a managerial perspective this might not be sufficient. This study went beyond this finding by exploring whether or not organisational culture can counterbalance these negative influences. Our results indicate that, from a lean perspective, national culture is the dominant force and its potential disadvantages cannot be fully counterbalanced by organisational culture.

APPENDIX A

Questionnaire items

Plant and equipment questionnaire					
Lean Practices	1	2	3	4	5
Equipment layout	Functional layout (traditional equipment grouped in like types)		Some cellular layout incorporating CNC or specialized equipment		Multi-purpose layout with in-process control, mostly CNC or specialized equipment
Kanban	High work in progress, no specified location		Pull production with some kanban implementation		Demonstrated reduction in kanban sizes, continuous improvement
Batch sizes	Large batch sizes with WIP		Moving towards smaller, balanced batch sizes		Batch size of one for conceptually 'one piece'
Order release into manufacturing	Once a month based on plan		Weekly, based on orders		Daily, pull scheduling
Maintenance	Crisis maintenance		Preventive maintenance corrective action		Total preventive maintenance, maintenance

			teams		scheduling, synchronized with production, performed by operators
Organisation and culture questionnaire					
Organizational Collectivistic culture	1	2	3	4	5
Shared vision, mission and goals	Insufficient direction, no shared plan or vision statement, employees do not understand goals		Management, commitment to shared vision, written mission statement, some employee involvement		Total employee involvement, published improvement plan, individuals and departments have vision matching company's
Employee involvement	Little or none		Quality teams, suggestion programme, corrective action teams, 25-50% employees involvement in teams		More than 50% involved in teams, open access to management empowered individuals throughout the business
Training and education	Ad hoc, no plan		Some skills, and development plans for all employees		More than 5% of each employee's time devoted to training
Performance	1	2	3	4	5
Product reliability in service	Unit failure rate more than 2%, frequent recalls, make-goods and returns		Unit failure rates between 0.1% and 1%		Unit failure rates less than 0.01%
Defects	More than 10,000 parts per million (more than 1% defect)		Less than 1,000 parts per million (less than 0.1% defect)		Less than 100 parts per million (less than 0.01% defect)
Customer delivery commitments met	Less than 80% per month		More than 95% per week every week		More than 95% per day every day
Customer satisfaction	Some customer complaints, often needing escalation to resolve		Few complaints; handled as a priority, customer satisfaction tracked		Delighted customers whose expectations are often exceeded
Productivity	Decreasing		Moderate improvement		Consistently improving, significant gains

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Table 1. Sample demographics

Number of Employees	*n*	Industry	*n*	Country	IDV Score
Less than 5	32	Automotive & Aerospace	174	Australia	90
5 – 20	337	Chemical & Pharmaceutical	263	Belgium	75
21-50	313	Electrical/ Electronic	56	Italy	76
More than 50	250	Food	183	Republic of Ireland	70
		Mechanical	441	United Kingdom	89
		Utility	483	United States	91
		Textile goods	219		
		Others	57		
Total	932				

Table 2. Measurement characteristics

Construct/ Variable	Mean	S.D.	Loading	*t*-value	Std. error	R^2
Lean Practices (α = .718)	3.36	.73				
Equipment layout			.58	14.40	.046	.44
Kanban			.51	12.41	.045	.35
Batch sizes			.44	10.04	.050	.22
Order release into manufacturing			.45	10.78	.044	.26
Maintenance			.49	12.42	.044	.34
Organizational Collectivistic Culture (α = .709)	2.76	.85				
Shared vision, mission and goals			.71	20.17	.033	.61
Employee involvement			.75	21.27	.038	.67
Training and education			.64	15.42	.036	.39
Performance (α =.745)	3.00	1.17				
Product reliability in service			.51	11.53	.042	.32
Defects			.50	11.06	.049	.30
Customer delivery commitments met			.60	14.98	.048	.46
Customer satisfaction			.62	15.01	.031	.47
Productivity			.59	13.67	.032	.42

Table 3. Correlation of constructs

	Lean Practices	National Culture	Organizational Group Culture	Performance	Industry	Plant Size
Lean Practices	1					
National Culture (i.e., IDV)	-.078*	1				
Organizational Collectivistic culture	.348**	-.131**	1			
Performance	.210**	-.087**	.263**	1		
Industry	.052	-.081*	.041	-.047	1	
Plant Size	.059	.016	.059	-.072*	-.138**	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

Table 4. OLS regression results

Variables	Beta coefficient	t-value	Significance	VIF
Control Variables:				
Industry	-.066	-1.741	.082	1.012
Plant size	-.006	-.154	.878	1.061
Independent Variables & Moderator:				
Lean Practices	.229	5.435	.000	1.256
Organizational Collectivistic culture	.089	1.810	.119	1.139
National Culture (i.e., IDV)	-.104	-2.565	.011	1.175
2-Way Interaction Terms:				
Lean Practices X National Culture	-.149	3.112	.002	1.175
Lean Practices X Organizational Collectivistic culture	.124	1.977	.023	1.301
3-Way Interaction Term				
Lean Practices X IDV X Organizational Collectivistic Culture	-.023	-1.103	.454	1.385
Step 1: Adjusted R^2	.001			
Step 2: Adjusted R^2 (Incl. Independent Variables and Moderators)	.051			
Step 3: Adjusted R^2 (incl. Interaction Term)	.083			
Step 4: Adjusted R^2 (incl. 3-Way Interaction Terms)	.081			
F-Model (change)	6.662			

Figure 1. Research Model

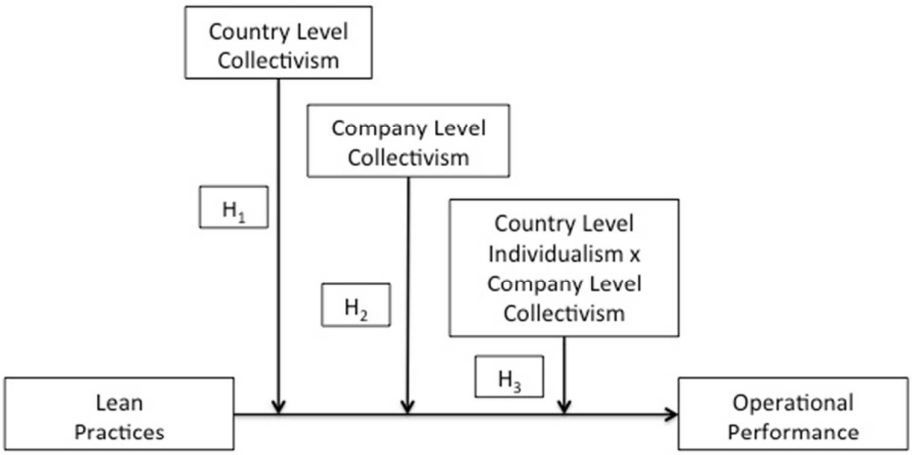

Figure 2. Interaction slopes for lean practices and IDV

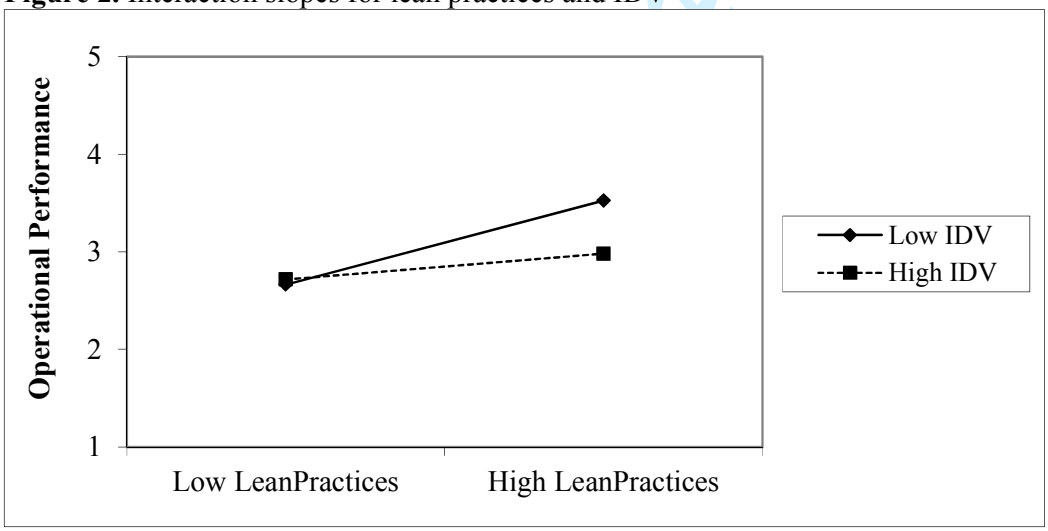

Figure 3. Interaction slopes for lean practices and organizational collectivism