Are best manufacturing practices best everywhere? The effects of country characteristics on manufacturing practice and performance

Boer, Harry; Demeter, Krisztina; Szász, Levente

Published in:
Proceedings of the 20th International EurOMA Conference on Operations Management at the Heart of the Recovery

Publication date:
2013

Document Version
Early version, also known as pre-print

Are best manufacturing practices best everywhere? The effects of country characteristics on manufacturing practices and performance

Harry Boer (hboer@production.aau.dk)
Aalborg University, Denmark

Krisztina Demeter
Corvinus University of Budapest, Hungary

Levente Szász
Babes-Bolyai University, Romania

Abstract
There is an impressive body of literature about best manufacturing practices. The question is whether these practices are always best, everywhere. Thus, the objective of this paper is to investigate country effects on the "goodness" of manufacturing practices. The paper is based on data collected in 2009 using the 5th release of the International Manufacturing Strategy Survey (IMSS V) and country competitiveness data reported in Schwab (2010), and takes its outset in best practices identified by Laugen *et al*. (2011) who used essentially the same database. The analyses show that country competitiveness does affect what practices are best, or not.

Keywords: Manufacturing Practices; Performance Improvement; Country Effects; Survey.

Introduction
Sousa and Voss (2008) identified a number of academic studies addressing contingency factors affecting OM best practice in manufacturing operations. According to these authors these "… contingency variables … can be grouped into four broad categories: national context and culture, firm size, strategic context, and other organizational context variables" (p. 703). The latter category includes factors such as industry and plant age.

One of the challenges Sousa and Voss (2008) put forward "… is to identify the contingencies that explain the greatest variance in performance" (p. 704). This paper takes up part of that challenge, by arguing for and then testing two related hypotheses on the effect of national context on the association between manufacturing practices and performance, so as to identify if best manufacturing practices are best everywhere.

Theoretical background
One of the paradigms proposed by Voss (1995, 2005) sees manufacturing strategy as the development and adoption of best practices. Although *"... it can be argued that concern with best practice has been with mankind since the emergence of the first craft in*

prehistory" (Voss, 1995, p. 9), the best practice approach to manufacturing strategy seriously entered the industrial and academic agenda with the recognition of the success of Japan Inc. in the late 1970s and early 1980s. Early contributors are Hayes and Wheelwright (1984), who introduced the term World Class Manufacturing (WCM). Authors such as Schonberger (1986), Voss (1995, 2005), Voss *et al*. (1997), Flynn *et al*. (1999) and Davies and Kochhar (2002) elaborated on this concept and argued that the implementation of best practices will lead to superior performance, capability and increased competitiveness. According to Davies and Kochhar (2002), practices are best if they lead to *improvement* in performance, that is, help *"... lower performing companies to improve to medium performance, medium performers improve to higher performers, and higher performers to continue to be successful and achieve further benefits"*. Laugen *et al*. (2005) suggest that best practices are what the best performing companies do, that is, companies with the best performance improvement results. Table 1 contains examples of best practice publications, and shows that many different practices have been identified as best.

Initially, most researchers focused on individual practices. However, according to Mills *et al.* (1995), best practices "*... can be considered as bundles of actions ..., which tend to work well together*". Since that study, there has been a growing recognition that bundles of practices, rather than single practices, lead to high(er) performance improvement (Cua *et al.,* 2001; Ahmad and Schroeder, 2003; Laugen *et al.*, 2005; MacDuffie, 1995; Narasimhan *et al.*, 2005; Shah and Ward, 2003; Voss, 1995; Voss, 2005). However, only few studies, notably Sun (2000), Cua *et al.* (2001) and Shah and Ward (2003), have empirically examined the effects of bundles of practices.

In adjacent areas the effects of context on design choices have been widely researched. The contingency theory of organizations suggests that factors such as technology (Woodward, 1965), market dynamics (Burns and Stalker, 1961) and culture (Hofstede, 1980) are important determinants of the effectiveness of organizational design, meaning that companies need to achieve a fit between contextual factors and organizational design variables in order to be effective. Although the importance of context has been recognized in other areas of the OM literature, e.g. the volume-variety trade-off and its link with process choice (Hayes and Wheelwright, 1984; Hill, 1985), context has largely been neglected in best practice studies – best practices are usually considered to be universally applicable, and appropriate for all companies irrespective of the context in which they operate. Davies and Kochhar (2002), however, argue that best practices are context specific, and also Sousa and Voss (2008) emphasize the importance of taking contingency factors into consideration when studying best practices in manufacturing. Based on a review of the best practice literature, the latter authors identify four groups of contingency factors relevant for studies of best practices: national context and culture, firm size, strategic context, and other organizational contingency factors.

One of the challenges Sousa and Voss (2008) put forward "… is to identify the contingencies that explain the greatest variance in performance" (p. 704). This paper takes up part of that challenge, by arguing for and then testing the following hypotheses:

- H1. Country characteristics have a moderating effect on the association between manufacturing practices and performance.
- H2. (In effect) manufacturing practices that are best in one country may not be best in another country.

Table 1 – Examples of publications linking proposing best manufacturing practices

Researchers	Best manufacturing practice
Hayes and Wheelwright (1984)	Process automation, increasing delegation and knowledge
Schonberger (1986)	Pull production, lean organization
Womack *et al*. (1990)	Lean organization
Voss (1995, 2005)	World-class manufacturing, benchmarking, business process re-engineering, TQM, learning from the Japanese, continuous improvement (CI)
Ahmed *et al*. (1996)	TQM, JIT, FMS, CE, benchmarking
Flynn *et al.* (1999)	WCM, CI, JIT, TQM
Kathuria and Partovi (2000)	Cross-functional co-operation
Rondeau *et al.* (2000)	Work system practices, time-based competition
Davies and Kochhar (2000)	Manufacturing planning and control
Garver (2003)	Benchmarking, CI
Molina *et al.* (2007)	Quality practices (e.g. supplier and customer coordination)
Zhou and Benton (2007)	Supply chain practices: supply chain planning, JIT and delivery practices
Benner and Veloso (2008)	Process focused practices: TQM, Business Process Re-engineering
Montabon *et al.* (2007)	Environmental management (e.g. recycling, proactive waste reduction, remanufacturing, environmental design)
Caniato *et al.* (2009)	E-business practices (internet-based tools for interaction with customers and/or suppliers)

Relatively little research has been published on the influence of country characteristics on the adoption and performance effects of manufacturing improvement programs. Although there are exceptions (e.g. Cagliano *et al*., 2001; Fleury and Arkader, 1994 and other chapters in Lindberg *et al*., 1994), most studies have a relatively narrow focus.

Some authors (e.g. Vastag and Whybark, 1991; Oliver *et al*., 1996; Voss and Blackmon, 1998) explore the impact of national context on general manufacturing best practices. More authors focus on specific practices, such as quality management (e.g. Ebrahimpour and Cullen, 1993; Flynn and Saladin, 2006; Rungtusanatham *et al*., 2005); human resource management (e.g. Ahmad and Schroeder, 2003) and total productive maintenance (e.g. McKone *et al*., 1999). All these publications discuss the effects of national context on the *use* of manufacturing improvement programs. We did not identify any articles addressing country effects on the performance *outcomes* of such programs.

Some articles focus on one country (e.g. Vastag and Whybark, 1991), one continent (e.g. Oliver *et al*., 1996) or a comparison between two continents (Vastag and Whybark, 1994). Most studies compare a (limited) number of countries, usually some combination of Germany, Italy, Japan, the UK, and the USA (e.g. Ebrahimpour and Cullen, 1993; Voss and Blackmon, 1996; McKone *et al*., 1999; Ahmad and Schroeder, 2003; Flynn and Saladin, 2006). All these articles operationalize country "simply" as country of origin, country of location, or national culture.

This paper goes beyond the studies referred to above in that it addresses a (much) wider range of:

- Countries – the IMSS database comprises manufacturing and performance improvement data collected in 21 countries from all continents except Australia and Africa.
- Manufacturing practices – the IMSS instrument enquires about improvement programs

related to organizational practices, planning and control, process technology, quality management, product development, supply chain management, servitization and globalization.

Research design

Data

To analyze the hypotheses, practice and performance data are used from the 5th round of the International Manufacturing Strategy Survey (IMSS V). The data were collected in 2009, using a postal survey sent to production managers from manufacturing companies (ISIC 28-35). The dataset comprises information from 711 companies from 21 countries worldwide. Country competitiveness data (Schwab, 2010) are used to operationalize country characteristics.

Approach

Embarking on the bundles of practices approach (*cf*. Mills *et al*., 1995), following Davies and Kochhar's (2002) suggestion that best practices are those leading to improvement of performance and, thus, looking for best bundles of *action programs*, the paper takes its outset in Laugen *et al*. (2011). Based on an earlier release of the IMSS V database, including 677 companies from 19 countries, these authors identified four best bundles of action programs, two promising bundles and one, what they called, qualifying bundle. This paper focuses on the best bundles:

- *Lean manufacturing*, including practices related to implementing lean organization, continuous improvement and pull production, obtaining process focus, and increasing workforce flexibility and delegation and knowledge.
- *New product development*, including increasing design, technological, and organizational integration between product development and manufacturing.
- S*upply chain management*, including practices related to increasing the coordination with customers and suppliers, rethinking and restructuring the supply and distribution strategy, and implementing supplier development programs and supply chain risk management.
- *Servitization*, including developing service skills, expanding the service offering, and designing products for after sales.

This paper aims to check the extent to which country characteristics affect the findings reported by Laugen et al. (2011). In so doing, country of origin and country of location will be considered, both of which have been identified as factors affecting the adoption of manufacturing practices and/or manufacturing performance (e.g. Vastag and Whybark, 1991; Ebrahimpour and Cullen, 1993; Oliver *et al*., 1996; McKone *et al.*, 1999; Ahmad and Schroeder, 2003; Rungtusanatham *et al*., 2005; Sila, 2007). Furthermore, Sousa and Voss (2008), drawing on Venkatraman (1989), suggest three forms of fit between the groups of contingency factors, best practices and performance: selection (matching), interaction (moderation and mediation) and system (gestalts, profile-deviation and co-variation). In this paper, the interaction perspective is adopted.

Operationalization

Country was operationalized using each of the IMSS countries' Global Competitive Index (GCI) reported in the World Economic Forum Global Competitiveness Report 2010-2011

(Schwab, 2010).

The IMSS questionnaire enquires about the change in the performance on 22 operational indicators over the last three years, using five-point Likert scales ranging from 1 = "Deteriorated more than 5%" to 5 = "Improved more than 25%". Using factor analysis, the set of performance indicators was reduced to three groups of performance: cost/speed, flexibility/delivery and quality performance. In the data analysis also the effects on all the possible combinations of these three groups was investigated, leading to a total of seven bundles of performance (see Table 2).

The IMSS questionnaire also enquires about the effort put into the implementation of 36 action programs in the last three years, using a five-point Likert scale ranging from 1 = "None" to 5 = "High". To identify the bundles of action programs used as independent variables in the data analysis, a factor analysis was performed, which resulted in seven bundles (see Table 3).

Analysis

In order to identify the effect of country on the practice-performance relationship, the 21 countries were first classified into subgroups, developed and developing countries, respectively. The methods used to perform this classification included k-means cluster analysis based on the countries' Global Competitiveness Index (GCI, reported in Schwab 2010), consideration of GDP/capita values, and other country classifications. All these approaches converged toward the two-groups solution. The best member of the developing group was China (GCI=4.84), and the worst member of the developed group was Taiwan (GCI=4.93). Thus, the borderline between the two clusters lies between these two countries. Next, the total sample was split up into four subgroups, using responses to an IMSS question about the respondent company's country of origin. The GCI values of some of the countries of origin (not all countries of origin reported by the IMSS respondents are among the 21 countries represented in the IMSS database), fell exactly between China and Taiwan. This concerned fewer than 10 companies from the sample. The companies originating from "innovation-driven countries" (Schwab, 2010) were added to the "developed" group, companies from "efficiency-driven countries" (Schwab, 2010) were added to the "developing" group. The result is reported in Table 2. Due to its size, cluster 3 was excluded from the rest of the analysis.

Table 2 – Four clusters, based on country of origin and location

Location **Origin**	**Developed**	**Developing**
Developed	DD (N = 355)	Dd (N = 101)
Developing	dD (N = 11)	dd (N = 244)

Legend: see below Table 3

Findings and (empirical) discussion

Table 3 presents the significant effects of the four best bundles of action programs in the three country clusters considered here (see the Appendix for all figures and significance levels). The control variables used, namely size and production process type, do not appear to have any significant influence.

Table 3 – The performance effects of four best bundles of action programs in the three country clusters

Performance **Action program (bundle)**	**C/S**	**F/D**	**Q**	**C/S + F/D**	**C/S + Q**	**F/D + Q**	**C/S + F/D + Q**
Lean manufacturing	DD dd	DD Dd	DD dd	DD dd	DD Dd dd	DD dd	DD dd
New product development		Dd	Dd	Dd	Dd	Dd	Dd
Supply chain management	DD dd	DD dd		DD dd		DD	DD dd
Servitization	DD	DD dd	dd	DD dd	DD dd	DD dd	DD dd

C/S	Cost/Speed	D	Developed
F/D	Flexibility/Delivery	d	developing
Q	Quality	DD	Origin and location in a developed country
		Dd	Origin in a developed country – location in a developing country
		dd	Location and origin in a developing country

Laugen *et al*. (2011) reported lean manufacturing, new product development, supply chain management and servitization as best bundles of action programs, considering that these bundles have relatively strong positive and, in several cases, significant relationships with all performance indicators. Table 3 suggests a more nuanced picture. Relative to Laugen *et al*. (2011), lean manufacturing remains a best practice but not for plants located in a developing country with their origin in a developed country. New product development is a best practice, too, but only for plants located in developing countries, whose origin is in a developing country. Supply chain management keeps its status as a best practice. However, this bundle does not affect the performance of plants located in developing countries, but have their origin in a developed country. Finally, also servitization emerges as a best practice but not for plants located in a developing country but originating from a developed country.

Thus, country characteristics and, more precisely, country competitiveness does indeed affect the association between manufacturing practices and performance, *cf.* H1. Furthermore, as H2 suggests, manufacturing practices that are best in one country are not necessarily best in another country. Lean, the oldest and, probably therefore, the most universally applied bundle of the four considered here, is *not* best in companies located in a developing country with their origins in a developed country (the Dd companies in Table 3). Supply chain management and servitization are *not* best for Dd companies, either; they are in the other countries. New product development, in contrast, is *only* best for Dd companies and does not have any significant performance effects elsewhere.

It is easier to identify these patterns than it is to explain them. Due to lack of support from existing theory, the following attempts are, indeed, very tentative and not without question marks:

- Lean manufacturing affects all performance combinations in developed-to-developed (DD), most in developing-to-developing (dd) and some in developed-to-developing (Dd) companies. One explanation could lie in the lean-agile discussion. According to Inman *et al.* (2011), there are three views: lean and agile are mutually exclusive concepts, lean and agile are mutually supportive concepts, and lean is an antecedent to agile. If the latter view is correct, the findings presented here may indicate that the dd companies are in the process of, and benefitting from, lean, while the DD companies are in the process of moving beyond lean, towards agility. The Dd companies are in between – they have implemented lean to such an extent that they are performing well but do not achieve significant performance improvement any longer.

- New product development solely affects the performance of Dd companies. After having transferred sales, sourcing and, then, manufacturing operations abroad, western companies are increasingly offshoring new product development activities, which may explain the efforts they put into design, technological and organizational integration of dispersed product development and manufacturing units, which is in place in the west and (still) irrelevant for, mostly manufacturing-focused, dd companies.
- Supply chain management. Companies are becoming more and more aware of the need to support offshoring and international outsourcing with appropriate supply chain action programs (Farooq *et al*., 2012), which justifies the performance effects in DD and dd companies, but fails to explain the lack of performance effects in Dd companies.
- Servitization affects the performance of DD and dd companies, not that of Dd companies. The finding that DD companies benefit from servitization is not surprising. The observation that dd companies benefit is surprising, given the so-called servitization paradox (Neely, 2008), which holds that servitization efforts may lead to increased service offerings and higher cost but not always to higher returns. An analysis using the IMSS V data and country competitiveness data (Schwab, 2010) suggests this paradox is especially true for developing countries (Szász *et al*., n.y.). Why, then, this is different for dd and Dd companies, both located in developing countries, but from different origin, is unclear.

Conclusion

This study reveals that, and tries to explain how, the level of a country's development, expressed in terms of its competitiveness, affects the "goodness" of manufacturing practices. Further research is needed to refine these findings, especially as regards the tentative explanations put forward and question marks raised.

References

Ahmed, N.U., Montagno, R.V. and Firenze, R.J. (1996), Operations strategy and organizational performance: an empirical study, *International Journal of Operations & Production Management*, Vol. 16, No. 5, pp. 41-53.

Ahmad, S. and Schroeder, R. (2003), The impact of human resource management practices on operational performance: recognizing country and industry differences, *Journal of Operations Management*, Vol. 21, No. 1, pp. 19-43.

Benner, M.J., and Veloso, F.M. (2008), ISO 9000 practices and financial performance: A technology coherence perspective. *Journal of Operations Management*, Vol. 26, No. 5, pp. 611-629.

Burns, T. and Stalker, G.M. (1961), *The management of innovation*, Tavistock, London.

Cagliano, R., Blackmon, K. and Voss, C. (2001), Small firms under MICROSCOPE: international differences in production/operations practices and performance, *Integrated Manufacturing Systems*, Vol. 12, No. 7, pp. 469-482.

Caniato, F., Cagliano, R., Kalchschmidt, M., Golini, R. and Spina, G. (2009), Evolutionary patterns in e-business strategy, *International Journal of Operations & Production Management*, Vol. 29, No. 9, pp. 921-945.

Cua, K.O., McKone, K.E. and Schroeder, R.G. (2001), Relationships between implementation of TQM, JIT, and TPM and manufacturing performance, *Journal of Operations Management*, Vol. 19. No. 6, pp. 675-

694.
Davies, A.J. and Kochhar, A.K. (2000), A framework for the selection of best practices, *International Journal of Operations & Production Management*, Vol. 20, No. 10, pp. 1203-1217.
Davies, A.J. and Kochhar, A.K. (2002), Manufacturing best practice and performance studies: a critique, *International Journal of Operations & Production Management*, Vol. 22, No. 3, pp. 289-305.
Ebrahimpour, M. and Cullen, J. (1993), Quality management in Japanese and American firms operating in the US: a comparative study of styles and motivational beliefs, *Management International Review* Vol. 33, No. 1, pp. 23-38.
Farooq, S., Dukovska-Popovska, I. and Boer, H. (2012), Enabling globalization of manufacturing through supply chain improvement programs, *Proceedings of the 4th Joint World Conference on Production and Operations Management/19th International EurOMA Conference on Serving the World*, Amsterdam, The Netherlands, 1-5 July.
Fleury, P.F. and R. Arkader (1998), Environment and manufacturing strategy: comparing modernization paths and performance in Brazil and Argentina. In: P. Lindberg, C.A. Voss and K.L. Blackmon (eds.), *International manufacturing strategies*, Kluwer Academic Publishers, Dordrecht.
Flynn, B. and Saladin, B. (2006), Relevance of Baldrige constructs in an international context: a study of national culture, *Journal of Operations Management*, Vol.24, No. 5, pp. 583-603.
Flynn, B.B., Schroeder, R.G. and Flynn, E.J. (1999), World class manufacturing: an investigation of Hayes and Wheelwright's foundation, *Journal of Operations Management*, Vol. 17, No. 3 pp. 249-269.
Garver, M.S. (2003), Best practices in identifying customer-driven improvement opportunities, *International Marketing Management*, Vol. 32, pp. 455-466.
Hayes, R.H., and Wheelwright, S.C. (1984), *Restoring our competitive edge. Competing through manufacturing*, John Wiley & Sons, New York.
Hill, T.J. (1985), *Manufacturing strategy. The strategic management of the manufacturing function*, Macmillan, Basingstoke.
Hofstede, G. (1980), *Culture's consequences: International differences in work-related values*, Sage, London.
Inman, R.A., Sale, R.S., Green Jr., K.W. and Whitten, D. (2011), Agile manufacturing: relation to JIT, operational performance and firm performance, *Journal of Operations Management*, Vol. 29, No. 4, pp. 343-355.
Kathuria, R. and Partovi, F.Y. (2000), Aligning workforce management practices with competitive priorities and process technology: a conceptual examination, The Journal of High Technology Management Research, Vol. 11, No. 2, pp. 215-234.
Laugen, B.T., Acur, N., Boer, H. and Frick, J. (2005), Best manufacturing practices: what do the best-performing companies do?, *International Journal of Operations & Production Management*, Vol. 25, No. 2, pp. 131-150.
Laugen, B.T., Boer, H. and Acur, N. (2011), Best manufacturing practices: bundles and performance, *Proceedings 12th International CINet Conference on Continuous Innovation: Doing more with less*, Aarhus University, Aarhus, Denmark, 11-13 September.
Lindberg, P., Voss, C.A. and Blackmon, K.L. (eds.), *International manufacturing strategies*, Kluwer Academic Publishers, Dordrecht.
MacDuffie, J.P. (1995), Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the World Auto Industry, *Industrial and Labor Relations Review*, Vol. 48, No. 2, pp. 197-221.
McKone, K., Schroeder, R. and Cua, K. (1999), Total productive maintenance: a contextual view, *Journal of Operations Management*, Vol. 17, No. 2, pp. 123-144.
Mills. J., Platts, K. and Gregory, M. (1995), A framework for the design of manufacturing strategy processes. A contingency approach, *International Journal of Operations & Production Management*. Vol. 15. No. 1, pp. 17-49.
Molina, L.M., Lloréns-Montes, J. and Ruiz-Moreno, A. (2007), Relationship between quality management practices and knowledge transfer, *Journal of Operations Management*, Vol. 25, No. 3, pp. 682-701.
Montabon, F., Sroufe, R. and Narasimhan, R. (2007), An examination of corporate reporting, environmental management practices and firm performance, *Journal of Operations Management*, Vol. 25, No. 5, pp. 998-1014.
Narasimhan, R., Swink, M. and Wook. K.S. (2005), An exploratory study of manufacturing practice and performance relationships, *International Journal of Operations & Production Management*, Vol.25. No.10, pp.1013-1033.

Oliver, N., Delbridge, R. and Lowe, J. (1996), The European auto components industry: manufacturing performance and practice, *International Journal of Operations & Production Management*, Vol. 16, No. 11, pp. 85-97.

Rondeau, P.J., Vonderembse, M.A. and Ragu-Nathan, T.S. (2000), Exploring work system practices for time-based manufacturers: their impact on competitive capabilities, *Journal of Operations Management*, Vol. 18, No. 5, pp. 509-529.

Rungtusanatham, M., Forza, C., Koka, B., Salvador, F. and Nie, W. (2005), TQM across multiple countries: convergence hypothesis versus national specificity arguments, *Journal of Operations Management*, Vol. 23, No. 1, pp. 43-63.

Schonberger, R.J. (1986), *World class manufacturing – The lessons of simplicity applied*, The Free Press, New York.

Schwab, K. (ed.) (2010), *The global competitiveness report 2010-2011,* World Economic Forum, Geneva, Switzerland.

Shah, R. and Ward, P.T. (2003), Lean manufacturing: Context, practice bundles, and performance, *Journal of Operations Management*, Vol. 21, No. 2 pp.129-149.

Sila, I. (2007), Examining the effects of contextual factors on TQM and performance through the lens of organizational theories: an empirical study, *Journal of Operations Management*, Vol. 25, No. 1, pp. 83-109.

Sousa, R. and Voss, C.A. (2008), Contingency research in operations management practices, *Journal of Operations Management*, Vol. 26, No. 6, pp. 697-713.

Sun, H. (2000), A comparison of quality management practices in Shanghai and Norwegian manufacturing companies, *The International Journal of Quality and Reliability Management*. Vol. 17, No. 6, pp. 636-660.

Szász, L., Demeter, K. and Boer, H. (n.y.), Servitization effort and return – the impact of economic context (under revision).

Vastag, G. and Whybark, D. (1991), Manufacturing practices: differences that matter, *International Journal of Production Economics*, Vol. 23, Nos. 1–3, pp. 251-259.

Vastag, G. and Whybark, D. (1994), American and European manufacturing practices: An analytical framework and comparisons, *Journal of Operations Management*, Vol. 12, No. 1, pp. 1-11.

Venkatraman, N. (1989). The concept of fit in strategy research: toward verbal and statistical correspondence, *Academy of Management Review*, Vol. 14, No. 3, pp. 423–444.

Voss, C.A. (1995), Alternative paradigms for manufacturing strategy, *International Journal of Operations & Production Management*, Vol. 15, No. 4, pp. 5-16.

Voss, C.A. (2005), Paradigms of manufacturing strategy re-visited, *International Journal of Operations & Production Management*, Vol. 25, No. 12, pp. 1223-1227.

Voss, C.A., Åhlström, P. and Blackmon, K. (1997), Benchmarking and operational performance: some empirical results, *Benchmarking for Quality Management & Technology*, Vol. 4, No. 4, pp. 173-285.

Voss, C. and Blackmon, K. (1996), The impact of national and parent company origin on world-class manufacturing: findings from Britain and Germany, *International Journal of Operations & Production Management*, Vol. 16 No. 11, pp. 98-115.

Voss, C. and Blackmon, K. (1998), Differences in manufacturing strategy decisions between Japanese and Western manufacturing plants: the role of strategic time orientation, *Journal of Operations Management*, Vol. 16, Nos. 2-3. pp. 147–158

Womack, J.P., Jones, D.T. and Roos, D., (1991), *The machine that changed the world: How Japan's secret weapon in the global auto wars will revolutionize western industry*, Harper Perennial, New York.

Woodward, J. (1965), *Industrial organization. Theory and practice*, Oxford University Press, Oxford.

Zhou, H. and Benton Jr, W.C. (2007), Supply chain practice and information sharing, *Journal of Operations Management*, Vol. 25, No. 6, pp. 1348-1365.

Appendix – The influence of country characteristics on the performance effects of manufacturing action programs

CLUSTER 1 – **Location**: developed country / **Origin**: developed country							
	C/S	F/D	Q	C/S + F/D	C/S + Q	F/D + Q	C/S + F/D + Q
Lean manufacturing	**.234****	**.173*****	**.261*****	**.217*****	**.269*****	**.234*****	**.247*****
New product development	-.049	.086	-.051	.022	-.051	.022	-.002
Supply chain management	**.144***	**.217*****	.077	**.196****	.124	**.163****	**.166****
Servitization	**.104***	**.154****	.081	**.140****	**.097***	**.126****	**.124****
CLUSTER 2 – **Location**: developing country / **Origin**: developed country							
	C/S	F/D	Q	C/S + F/D	C/S + Q	F/D + Q	C/S + F/D + Q
Lean manufacturing	.193	**.211***	.041	**.221***	.134	.145	.174
New product development	.156	**.279***	**.424*****	**.236***	**.307****	**.388*****	**.320****
Supply chain management	.005	.036	-.164	.022	-.080	-.066	-.042
Servitization	.090	.069	-.013	.087	.046	.033	.058
CLUSTER 4 – **Location**: developing country / **Origin**: developing country							
	C/S	F/D	Q	C/S + F/D	C/S + Q	F/D + Q	C/S + F/D + Q
Lean manufacturing	**.174***	.158	**.198****	**.178***	**.202****	**.193****	**.196****
New product development	.023	.003	.044	.014	.037	.027	.027
Supply chain management	**.223***	**.280****	.021	**.270****	.127	.156	**.188***
Servitization	.076	**.269*****	**.169****	**.185****	**.135***	**.233*****	**.190****