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Published in:
Proceedings of the 18th International Working Seminar on Production Economics

Publication date:
2014

Document Version
Early version, also known as pre-print

Manufacturing best practices and performance: the effects of home and host country context

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Abstract

There is an impressive body of literature about best manufacturing practices. The question is whether these practices are always best, in every situation. Aimed at investigating the effects of home and host country characteristics on the "goodness" of manufacturing practices, the paper tests whether a) home and host country characteristics moderate the association between manufacturing practices and performance, and, thus, whether b) there are manufacturing practices that are universally best.

Manufacturing practices and performance are measured using data collected through the fifth round of the International Manufacturing Strategy Survey (IMSS V). The IMSS V database includes data from 725 plants from manufacturing and assembly industries covering 21 different (host) countries. The Global Competitiveness Report of the World Economic Forum is used to operationalize country characteristics. Cluster analysis is used to develop groups of companies based on home and host country development. Exploratory factor analysis is applied to create bundles of manufacturing practices and performance measures. Then, using moderated multiple regressions (MMR) with interaction factor, and separate multiple regression analyses for each group of companies, bundles of manufacturing practices are identified that lead to best-in-class performance improvements. A range of control variables is introduced to help interpret the results.

The study shows that home and host country context does affect the association between manufacturing practices and performance, and manufacturing practices that are best in one context are not necessarily best in another context.

Keywords: manufacturing practices, performance improvement, country context, survey.

1. Introduction

Sousa and Voss (2008) discuss a number of 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.

2. Theoretical Background and Hypotheses

2.1 Literature review. 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). Schonberger (1986), Voss (1995, 2005), Voss *et al*. (1997), Flynn *et al*. (1999) and Davies and Kochhar (2002) elaborate on this concept and argue that the implementation of best practices will lead to superior performance 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.

Initially, most researchers focused on individual practices. However, since Mills *et al.* (1995), who consider best practices "*... as bundles of actions ... which tend to work well together*", there has been a growing recognition that bundles of practices, rather than single practices, lead to high(er) performance improvement (Shah and Ward 2003; Voss 1995; MacDuffie 1995; Cua *et al.* 2001; Ahmad and Schroeder 2003; Laugen *et al.* 2005; Narasimhan *et al.* 2005; Voss 2005). However, only few studies, notably Sun (2000), Cua *et al.* (2001), Shah and Ward (2003) and Laugen *et al*. (2011), have empirically examined the effects of bundles of practices.

While the impact of context on the performance effects of design choices has been widely researched, for example in organization theory, 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. Sousa and Voss (2008) emphasize the importance of taking contingency factors into consideration when studying (what they call) operations management practices, and challenge the research community "*... to identify the contingencies that explain the greatest variance in performance*" (p. 704). Focusing on the influence of national context, this paper takes up part of that challenge.

Relatively little research has been published on the influence of national context on the adoption of manufacturing practices. Examples include Vastag and Whybark (1991), Voss and Blackmon (1996, 1998), Fleury and Arkader (1998) and Cagliano *et al*. (2001), who explore the impact of national context on a number of practices. Other authors focus on specific practices, such as lean practices (Oliver *et al.* 1996), 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).

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 (Fleury and Arkader 1998), usually some combination of Germany, Italy, Japan, the UK, and the USA (e.g. Ebrahimpour and Cullen 1993; Voss and Blackmon 1996, 1998; McKone *et al*. 1999; Cagliano *et al*. 2001; Ahmad and Schroeder 2003; Rungtusanatham *et al*. 2005; Flynn and Saladin 2006). All these articles operationalize country "simply" as country of origin, country of location, or national culture.

The publications referred to discuss the effects of national context on the *adoption* of manufacturing programs. We did not identify any articles addressing country effects on the performance *outcomes* of such programs.

2.2 Hypotheses. This paper builds on three observations. First, contingency theory on operations management practices in general (Sousa and Voss 2008) and manufacturing best practices in particular (Davies and Kochhar 2002) needs further development. One potentially important contingency factor is national context. Second, research on best practices should follow the suggestion to study bundles of practices (Mills *et al*. 1995) that help companies improve their performance (Davies and Kochhar 2005; Laugen *et al*. 2005). Third, existing studies have investigated the impact of national context on the adoption rather than the performance effects of manufacturing practices. Building on these observations, and using the term manufacturing practices to denote bundles of action programs (*cf*. Mills *et al*. 1995) that are aimed at achieving performance improvement (*cf*. Laugen *et al*. 2005), this paper aims to test the following hypotheses:

H1. *National context has a moderating effect on the association between manufacturing practices and performance improvement.*

H2. *(In effect) manufacturing practices that are best in one country may not be best in another country.*

3. Research Design

3.1 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 national context.

3.2 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. A re-run using the final database (711 companies, 21 countries) confirmed Laugen *et al*.'s (2011) findings. This paper considers only 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.
- 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.
- *New product development*, including increasing design, technological, and organizational integration between product development and manufacturing.
- *Servitization*, including developing service skills, expanding the service offering, and designing products for easier after sales service.

This paper aims to investigate 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, either explicitly or implicitly, as factors affecting the adoption of manufacturing practices (e.g. Vastag and Whybark 1991; Ebrahimpour and Cullen 1993; Oliver *et al*. 1996; Voss and Blackmon 1996, 1998; McKone *et al.* 1999; Cagliano *et al*. 2001; Ahmad and Schroeder 2003; Rungtusanatham *et al*. 2005; Flynn and Saladin 2006; Sila 2007). Furthermore, Sousa and Voss (2008), drawing on Venkatraman (1989), suggest three forms of fit between contingency factors, practices and performance: selection (matching), interaction (moderation, mediation) and system (gestalts, profile-deviation and co-variation). In this paper, the interaction perspective is adopted.

3.3 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 changes in performance in the last three years, using a five-point Likert scale ranging from 1 = "Deteriorated more than 5%" to 5 = "Improved more than 25%" for 22 operational indicators. Using exploratory factor analysis (EFA) with principal components extraction and VARIMAX rotation, the set of performance indicators was reduced to three groups (as suggested by Kaiser's criterion of eigenvalues>1): cost/speed, (C/S) flexibility/delivery (F/D) and quality (Q) performance. The data was also tested a priori for factorability (Kaiser-Maier-Olkin (KMO) measure for sampling adequacy, Bartlett's test for sphericity) and subsequent factor reliability (Cronbach's α for internal consistency of the scales, total variance expressed (TVE) by the factors). The detailed results are shown in Appendix 1. In the data analysis section, the effects on all the seven possible combinations of the three performance groups are investigated (see Tables 2 and 3).
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 (hereafter called (manufacturing) practices) used as independent variables in the data analysis, a similar EFA was performed, which resulted in a total of seven bundles, including the four best bundles which are the focus of the present study (see Table 3), namely:

- Lean manufacturing (LEAN).
- Supply chain management (SCM).
- New product development (NPD).
- Servitization (SERV).

The results of the EFA of the four best bundles are reported in Appendix 1.

3.4 Analysis. In order to identify the effect of national context on the manufacturing practice-performance relationships, 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 most competitive member of the developing group was China (GCI=4.84), and the least competitive 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, while companies from

Origin \ Location	**Developed**	**Developing**
Developed	1 – DD (N = 355)	2 – Dd (N = 101)
Developing	3 – dD (N = 11)	4 – dd (N = 244)

Legend: see below Table 3

Table 1. Four clusters, based on country of origin and location

"efficiency-driven countries" (Schwab 2010) were added to the "developing" group. The result is reported in Table 1. Due to its size, cluster 3 was excluded from the rest of the analysis.
While the clusters were developed based on macroeconomic factors, plant-level factors were included in the analysis to control for their possible effect on the differences between clusters with respect to best practices. Beside the common contingency variables (*size* – number of employees; *production process type* – percentage of volume that is mass produced; *order policy* – percentage of customer orders that are engineered to order, manufactured to order, assembled to order, and made to stock), several other factors were used that can be closely related to the primary factors of cluster development (home and host country development): *perceived market characteristics* (product focus – product/service focus on the market, geographical focus – national/international, competition intensity – low/high), *perceived location advantages* (low cost labor, access to skills and know-how, company image) and *the position of the plant in the global supply chain* (percentage of domestic sourcing, manufacturing and sales). Perceived market characteristics and location advantages were measured on five-point Likert scales, the other factors were expressed as percentages. ANOVA with Scheffe post-hoc test was used to identify the differences between the three groups. The detailed results are shown in Appendix 2.

4. Findings and (Empirical) Discussion

To test H1, i.e. whether the effects of practices on performance are moderated by home and host country characteristics, a moderated multiple regression (MMR) analysis was carried out for each performance bundle (altogether 7 MMR analyses) where the predictor, moderator, and interaction variables were taken into the regression equation in successive steps (Aiken and West 1991; Cohen et al. 2003). While there are several procedures to test and interpret moderator effects, MMR represents one of the most popular methods (Aguinis 1995; Aguinis and Gottfredson 2010; Helm and Mark 2012).
The four best practice bundles (*LEAN, SCM, NPD, SERV*) were introduced as predictors in the first stage (Model 1), assuming that they have a direct influence on performance. Since we had three different categories for the moderator variable, two dichotomous dummy variables (*DUMMY1, DUMMY2*) were developed following the guidelines of Aguinis (2004): cluster DD was considered as baseline, *DUMMY1* was coded 1 for cluster Dd, while *DUMMY2* was coded 1 for cluster dd (with zero for all other cases). Dummy variables were introduced in the second stage (Model 2). To test moderation, interaction terms were developed for each pair of manufacturing practice and dummy variable, resulting altogether in 8 product terms, which were introduced in the third stage (Interaction model). All predictor variables were standardized to reduce multicollinearity below acceptable levels. The results are summarized in Table 2 (for each model only the newly added predictors are shown).
The results of the MMR analyses offer only weak support for H1, i.e. for moderation on a general level. In the interaction models r-squared change (ΔR^2) is only significant when quality (Q) is the dependent variable. Effect size measures (f^2) indicate a weak moderation effect as well: only two values are > .02, which is the threshold value for low interaction (Cohen *et al*. 2003). However, one interaction term, namely *NPD×DUMMY1*, is significant in each model. Thus, there is a very strong moderation effect, meaning that the effect of NPD on performance is significantly higher in the Dd group than in the baseline DD group (*cf.* interpretation of *DUMMY1*). The effect of the other three practices seems not to differ between the DD, Dd and dd groups.
However, much caution is needed when drawing conclusions from the significance levels indicated by an MMR analysis. Many researchers argue that MMR suffers from the problem of too low statistical power and might easily lead to Type II errors, i.e. the erroneous rejection of a model containing a moderator effect, so that real moderator effects remain undiscovered

(e.g. Aguinis 1995; Carte and Russel 2003; Aguinis and Gottfredson 2010). Therefore, to gain further insight into possible moderation effects and test H2, subgroup analyses were carried out (Sharma et al. 1981; Helm and Mark 2012), i.e. separate multiple regression analyses for the three country clusters. The results of these analyses are presented in Table 3 (see Appendix 3 for all figures and significance levels). The control variables used in this part of the analysis, size and production process type, do not appear to have any significant influence.

Performance **Predictors**	**C/S**	**F/D**	**Q**	**C/S + F/D**	**C/S + Q**	**F/D + Q**	**C/S + F/D + Q**
Model 1							
LEAN	.219***	.159***	.227***	.203***	.242***	.209***	.225***
SCM	.211***	.194***	.183***	.219***	.214***	.204***	.219***
SERV	.113***	.196***	.152***	.167***	.144***	.188***	.172***
NPD	.030	.085*	.092**	.062	.066	.095**	.076*
Model 2							
DUMMY1	.021	.071*	.082**	.050	.055	.082**	.063*
DUMMY2	.108***	.120***	.163***	.124***	.149***	.155***	.147***
Interaction model							
LEAN×DUMMY1	-.010	.004	-.075	-.003	-.046	-.038	-.030
LEAN×DUMMY2	-.065	-.034	-.048	-.053	-.054	-.040	-.047
SCM×DUMMY1	-.035	-.035	-.079	-.037	-.064	-.062	-.057
SCM×DUMMY2	.040	.018	-.044	.032	-.006	-.017	.001
SERV×DUMMY1	.000	-.033	-.036	-.018	-.020	-.037	-.026
SERV×DUMMY2	-.018	.053	.061	.020	.028	.064	.041
NPD×DUMMY1	.096*	.096*	.170***	.104**	.144***	.143***	.134***
NPD×DUMMY2	.044	-.016	.056	.014	.052	.021	.029
ΔR^2 (Sig.)	.008 (.637)	.009 (.486)	.019 (.043)	.008 (.567)	.012 (.265)	.014 (.135)	.011 (.298)
Effect size - f^2	.010	.012	.027	.011	.017	.021	.016

*Beta (standardized regression coefficient) significant at the *p<0.1, **p<0.05, ***p<0.01 level*
Legend: see below Table 3

Table 2. Results of the seven MMR analyses

Performance **Action program**	**C/S**	**F/D**	**Q**	**C/S + F/D**	**C/S + Q**	**F/D + Q**	**C/S + F/D + Q**
LEAN	DD dd	DD Dd	DD dd	DD dd	DD Dd dd	DD dd	DD dd
SCM	DD dd	DD dd		DD dd		DD	DD dd
NPD		Dd	Dd	Dd	Dd	Dd	Dd
SERV	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

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

As noted before, Laugen *et al*. (2011) reported lean manufacturing, supply chain management, new product development, and servitization as best bundles of action programs, considering that these bundles have relatively strong positive and significant relationships with most or all (combinations of) performance groups. 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 (Dd). Supply chain management keeps its status as a best practice. However, this bundle does *not* affect the performance of plants that are located in developing countries but have their origin in a developed country (Dd). New product development is a best practice, too, but *only* for plants located in developing countries, whose origin is in a developed country (Dd). Finally, also servitization emerges as a best practice albeit *not* for plants located in a developing country but originating from a developed country (Dd).

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.

It is easier to identify these patterns than it is to explain them. Due to lack of support from existing theory, the following attempts, partly supported by the influence of the control variables reported in Appendix 2, are, indeed, very tentative and not without question marks:

- *Lean manufacturing* affects all performance combinations in developed-to-developed (DD), most combinations in developing-to-developing (dd) and some combinations in developed-to-developing (Dd) companies. This finding may indicate that one of the views on the relationship between lean and agile (Inman *et al.* 2011) is correct, namely that lean is an antecedent to agile. DD companies are in the process of moving beyond lean, and start to benefit from agility; dd companies lag behind in that they are implementing but benefitting from lean; Dd companies have implemented lean to such an extent that they are performing well but do not achieve significant performance improvement any longer.
- Companies are generally becoming more aware of the need to support offshoring and international outsourcing with appropriate *supply chain management* programs (Farooq *et al*. 2012). While this justifies the performance effects in DD and dd companies, it fails to explain the lack of performance effects in Dd companies. The control variables reported in Appendix 2 may shed light on this. Considering the percentages of sourcing from and sales in the host country, DD and dd companies are much more "locally" embedded than Dd companies, which source and sell significantly less in their country of location than DD and dd companies. This implies that DD and dd companies are part of international *supply chains*, while Dd companies are part of their parent's global *manufacturing network*, established offshore to benefit from low labor cost, mass producing to their parent's orders, and delivering back to the home country (see Appendix 2).
- Considering the performance effects of *new product development* (NPD), this picture may change, though. NPD solely affects the performance of Dd companies. As Appendix 2 shows, Dd companies are more internationally oriented than DD companies and feel that they operate in a more competitive environment than DD companies. After having transferred manufacturing operations abroad, the parents of Dd companies are increasingly offshoring NPD activities to keep up with or stay ahead of competition. In terms of Ferdows (1997) this means that these offshore plants are in the process of developing contributor capabilities, including development and engineering. In effect, a parent company and its Dd daughters have to put significant effort into design, technological and organizational integration of dispersed product development, which is in place in western DD companies and is (still) irrelevant for, mostly manufacturing-focused, dd companies. It would be interested to see if this leads to a future increase of the engineering-to-order percentage, on which Dd companies score lower than 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. Companies in developed countries are under pressure. Competition from companies in low-cost countries is increasing as these companies are increasingly capable of delivering cheap yet good products. One of the possible and, apparently, successful responses for developed countries is servitization. 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 less clear. As Appendix 2 shows, dd companies are significantly smaller and, possibly due to that, significantly more service-oriented than DD companies. The observation that servitization does not have significant performance effects for Dd companies is probably related to their role in their parents' manufacturing network – although their role seems to be changing, as mentioned before, they are still first and foremost offshore plants, i.e. production-focused (*cf.* Ferdows 1997).

5. Conclusion

The aim of this study is to investigate if best manufacturing practices are universally best. A confirmation of the regression analysis reported in Laugen *et al.* (2011) shows that current best practices are bundles of lean manufacturing, supply chain management, new product development and servitization action programs. However, when considering the competitiveness (as defined by the World Economic Forum; Schwab 2010) of the country of location (host country) and country of origin (home country), it appears that none of these practices are best everywhere. Additional, more plant-specific, control variables such as percentage of products that is mass produced, customer order decoupling point, product versus service focus, geographical focus, competition intensity, location advantages and position in the supply chain seem to explain the findings.
However, due to the lack of robust theory on this topic, these explanations are very tentative. Further research is needed to test and refine them.

6. Acknowledgement

The support provided by the Domus Hungarica Program of the Hungarian Academy of Sciences (DM/79/2013) for co-author Levente Szász is gratefully acknowledged.

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Appendix 1 – Factor analysis on variables of performance and manufacturing practices

A) Performance bundles

Factor	Performance indicators	Variable average	Variable variance	Factor loading	Factor average	Cronbach's alpha
Flexibility/delivery (F/D)	Volume flexibility	3.38	.999	.725	3.16	.871
	Mix flexibility	3.27	1.011	.729		
	Delivery speed	3.20	.935	.635		
	Product customization	3.06	.984	.605		
	Customer service & support	3.08	.958	.600		
	Product innovativeness	3.06	.975	.584		
	Delivery reliability	3.25	.992	.583		
	Time to market	2.97	.962	.558		
Cost/Speed (C/S)	Unit manufacturing cost	2.87	.918	.716	2.86	.873
	Manufacturing overhead cost	2.64	.892	.659		
	Procurement cost	2.75	.929	.659		
	Labor productivity	3.08	.886	.644		
	Manufacturing lead time	3.02	.882	.637		
	Procurement lead time	2.73	.929	.615		
	Inventory turnover	2.93	.951	.595		
	Capacity utilization	2.89	1.109	.514		
Quality (Q)	Social reputation	2.96	.993	.762	3.02	.861
	Employee satisfaction	2.71	.955	.733		
	Environmental performance	3.03	.925	.657		
	Employee knowledge	3.04	.846	.634		
	Product quality & reliability	3.22	.928	.527		
	Manufacturing conformance	3.16	.929	.456		

KMO=.944, Bartlett's test $\chi^2(231)=6914.84$ with $p<.001$, Factor loadings>.40, TVE=56.58% by three factors

B) Practice bundles

Factor	Action programs	Variable average	Variable variance	Factor loading	Factor average	Cronbach's alpha
Lean manufacturing (LEAN)	Lean organization	3.05	1.197	.759	3.20	.782
	Continuous improvement	3.36	1.237	.654		
	Delegation and knowledge	3.04	1.063	.577		
	Workforce flexibility	3.13	1.159	.570		
	Pull production	3.20	1.213	.511		
	Process focus	3.45	1.136	.479		
Supply chain management (SCM)	Coordination with customers	2.75	1.185	.726	2.82	.859
	Coordination with suppliers	2.86	1.132	.681		
	Distribution strategy	2.49	1.203	.667		
	Supply strategy	3.02	1.132	.615		
	Supply chain risk management	2.79	1.198	.574		
	Supplier development & rating	3.06	1.148	.516		
New product development (NPD)	Design integration	3.03	1.200	.695	2.99	.778
	Technological integration	3.00	1.174	.671		
	Organizational integration	2.95	1.153	.589		
Servitization (SERV)	Developing skills in services	3.16	1.188	.842	3.08	.817
	Expanding the service offering	2.97	1.273	.828		
	Design products for after sales	3.10	1.301	.637		

KMO =.942, Bartlett's test $\chi^2(630)=9607.75$ with $p<.001$, Factor loadings>.40, TVE=60.52% by seven factors

Appendix 2 – Analysis of variance (ANOVA) between company groups developed

Factor	DD	Dd	dd	Overall NOVA		Pairwise comparisons (Scheffe post-hoc test, sig.)		
				F-value	Sig.	DD-Dd	DD-dd	Dd-dd
Size	2401	2678	776	2.845	.059	.963	**.094***	.201
Mass prod. (%)	25.22	28.04	16.97	5.475	.004	.767	**.017****	**.025****
Orders – ETO (%)	17.45	9.62	16.31	3.222	.040	**.042****	.886	.123
Orders - MTO (%)	39.55	47.69	53.63	9.577	.000	.174	**.000*****	.431
Orders - ATO (%)	23.67	22.08	15.51	4.801	.009	.906	**.010****	.218
Orders - MTS (%)	19.33	20.61	14.55	2.565	.078	.923	.135	.197
Product focus (product-service)	2.72	2.88	3.04	5.050	.007	.509	**.007**	.528
Geographical focus (national-international)	3.84	4.34	3.40	20.942	.000	**.003*****	**.000*****	**.000*****
Competition intensity (low-high)	3.94	4.26	4.18	7.445	.001	**.008*****	**.008*****	.737
Core production processes change	2.81	3.15	2.96	4.539	.011	**.017****	.212	.328
Location advantage – low cost labor	2.46	3.00	2.92	13.506	.000	**.001*****	**.000*****	.864
Location advantage – skills & know-how	3.71	3.39	3.21	14.268	.000	**.044****	**.000*****	.416
Location advantage – company image	3.12	2.93	3.37	5.420	.005	.384	**.052***	**.010****
Sourcing – from host country (%)	56.18	39.06	68.59	31.381	.000	**.000*****	**.000*****	**.000*****
Manufacturing – in host country (%)	80.40	83.55	95.86	28.215	.000	.535	**.000*****	**.000*****
Sales – in host country (%)	48.21	36.83	53.19	7.369	.001	**.022****	.272	**.001*****

The difference between mean values of two groups is significant at the *p<0.1, **p<0.05, ***p<0.01 level

Appendix 3 – Results of subgroup analysis with multiple regressions

CLUSTER 1 – **Location**: developed country / **Origin**: developed country **(DD)**							
	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*****
Supply chain management	**.144***	**.217*****	.077	**.196****	.124	**.163****	**.166****
New product development	-.049	.086	-.051	.022	-.051	.022	-.002
Servitization	**.104***	**.154****	.081	**.140****	**.097***	**.126****	**.124****
CLUSTER 2 – **Location**: developing country / **Origin**: developed country **(Dd)**							
	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
Supply chain management	.005	.036	-.164	.022	-.080	-.066	-.042
New product development	.156	**.279***	**.424*****	**.236***	**.307****	**.388*****	**.320****
Servitization	.090	.069	-.013	.087	.046	.033	.058
CLUSTER 4 – **Location**: developing country / **Origin**: developing country **(dd)**							
	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****
Supply chain management	**.223***	**.280****	.021	**.270****	.127	.156	**.188***
New product development	.023	.003	.044	.014	.037	.027	.027
Servitization	.076	**.269*****	**.169****	**.185****	**.135***	**.233*****	**.190****

Beta (standardized regression coefficient) significant at the *p<0.1, **p<0.05, ***p<0.01 level