

Impact of Company Size on Manufacturing Improvement Practices: *An empirical study*

C S Syan and K Ramoutar

The University of the West Indies, St. Augustine, Trinidad and Tobago

E-mail: chanan.syan@sta.uwi.edu

Abstract: There is a constant search for ways to achieve a competitive advantage through new manufacturing techniques. Best performing manufacturing companies tend to use world-class manufacturing (WCM) practices. Although the last few years have witnessed phenomenal growth in the use of WCM techniques, their effectiveness is not well understood specifically in the context of less developed countries. This paper presents an empirical study to investigate the impact of company size on improving manufacturing performance in manufacturing organizations based in Trinidad and Tobago (T&T). Empirical data were collected via a questionnaire survey which was sent to 218 manufacturing firms in T&T. Five different company sizes and seven different industry sectors were studied. The analysis of survey data was performed with the aid of Statistical Package for Social Sciences (SPSS) software. The study signified facilitating and impeding factors towards improving manufacturing performance. Their relative impact/importance is dependent on varying company size and industry sectors. Findings indicate that T&T manufacturers are still practicing traditional approaches, when compared with world class manufacturers. In the majority of organizations, these practices were not 100% implemented even though they started the implementation process more than 5 years ago. The findings provided some insights in formulating more optimal operational strategies, and later develop action plans towards more effective implementation of WCM in T&T manufacturers.

Keywords: Manufacturing Improvement, Manufacturing Performance, Trinidad and Tobago

1. Introduction

World class manufacturing (WCM) is under much discussion today. Regardless of this, there is no definition that is universally accepted [1]. Hayes and Wheelwright (1984) introduced the term to describe organizations that used their manufacturing competences to achieve a global competitive advantage [2]. World-class status is a never-ending journey since the concepts are constantly being improved upon. Despite the many shortcomings, the positive impact of WCM has been emphasized in



numerous studies [3][4]. Other factors that have an impact on company's performance such as type of industry and company size are generally not considered in many of these studies.

The government of T&T needs to diversify the economy to ensure its survival in this rapidly changing, international environment. T&T's economy comprises of the energy and the non-energy sectors with the major contributor to the country's economy being the energy sector. Globally, T&T competitiveness was ranked 84 out of 139 countries [5]. The contribution of the energy sector declined to 40.2 percent of total GDP in 2012. Manufacturing is the second largest non-energy sub-sector. The estimated contributions to a country's gross domestic product for manufacturing industry was computed and it was found that the manufacturing industry only contributed for 5 % of GDP.

The manufacturing sector in T&T today, still faces many challenges. Hence, T&T manufacturers should be forging ahead and implementing practices to improve its performance. Research of this nature is not prevalent in developing or less developed countries. This paper presents an empirical study to investigate the impact of company size on improving manufacturing performance in manufacturing organizations based in Trinidad and Tobago (T&T).

2. Literature Review

Many organizations implement practices to improve performance effectively and achieve benefits such as a reduction in errors/waste, improvements of profit margins competitive advantage and increase in productivity [6]. On the other hand, many encounter problems and are less successful [7][8]. Therefore there is a need to investigate why some organizations are less successful in their improvement initiatives and determine what can be done to facilitate these improvement plans.

2.1. Existing Frameworks/Models – Overview

Many techniques have been designed and justified by researchers to improve manufacturing performance. However, the dynamics between practitioners, consultants and researchers may deter organizations from understanding which best suits their organization [9]. Different techniques probably are continuously tried (partially implemented) and abandoned without any analysis as to why the implementation was unsuccessful [10]. The actual process of implementation is not sufficiently addressed in the literature. Ironically, the implementation process has been reiterated as crucial and needs more focus.

Before detailed guidelines are recommended, it is necessary to consider what are the facilitating factors which persuade an organization to obtain a sustainable advantage over the competition and the impeding factors which inhibit an organization from gaining advantage over the competition.

2.2. 2.2 Facilitating and Impeding Factors

Researchers have classified facilitating and impeding factors in various ways. For example, some authors discuss external facilitating factors such as global competition and international customers' needs [11][12]. Chan and Swatman (2000) include internal facilitating factors such as organizational strategies and saving cost [13]. Many researchers have argued that the implementation process has many limitations such as lack of training and education, overly optimistic expectations and cultural resistance to change [14][15]. These facilitating and impeding factors would differ depending on cultural, economical, social and political situations [16][17]. Many researchers conclude that impeding factors are more prevalent in developing countries than developed countries.

Based on a comprehensive literature review, four (4) facilitating and seven (7) impeding factors were identified. Each of these facilitating and impeding factors was then broken down into forty (40) sub-factors [18]. These are listed in the Appendix A.

2.3. 2.3 The Influence of Organization Size

The literature has presented different views on the effect of organizational size on WCM implementation. Haar and Spell (2008) and Temtime (2003) have concurred that the adoption of

WCM practices is affected by the size of an organization [19][20]. An increase in size means an increase in resources, investment and expertise, which positively affects the plans for improving performance. Conversely, Gulbro et al. (2000) argued that small firms are lagging behind large firms with regards to continuous improvement activities [21]. This is in contrast to Ahire et al. (1996) who found that the size of an organization does not affect their ability to effectively implement WCM practices [22].

3. An Empirical Study

Based on previous studies conducted in this research area, quantitative research was more prominent. The quantitative method requires the use of predetermined response categories. A standardized research instrument is employed to ensure that varying perspectives can be easily compared. Numbers/values are assigned instead of open-ended comments. The main advantages of this method are that it can collect data for a large sample size, data collection is fast and low cost [23]. However, Poolton (1994) emphasized that the design of the survey is critical because answers are final. Surveys result in a broad, generalized set of findings which is presented concisely [23].

3.1. Design of Survey Instrument

Two consecutive rounds of pre-testing were conducted. First, the questionnaire was reviewed by academic researchers from various developing countries (England and Egypt) experienced in questionnaire design. They returned the questionnaires with their comments and revisions were made based on their recommendations.

Next, the questionnaire was formally pre-tested (piloted) with two manufacturing firms in T&T. The pilot took the form of an interview. The participants were first asked to complete the questionnaire. Then the representatives were asked to provide feedback on ease of comprehension, clarity of the questions, possible changes and suggestions for additional items. The representatives' suggestions were then carefully evaluated and revisions were made to the questionnaire modified. The formal survey was started in 2010.

3.2. Actual Survey Process

A total of 218 light-manufacturing firms in T&T were selected to participate in this survey. Respondents were selected from the Trinidad and Tobago Manufacturers' Association membership as well as Central Statistical Office database. To ensure that the responses obtained were representative of the larger population, the manufacturing companies were stratified.

The target respondent was the production/operation manager or chief executive officer/managing director. Data collecting involved a face-to-face administered survey questionnaire where respondents are allowed to complete the questionnaire with the researcher there. If the respondent had any questions pertaining to the questionnaire, the matter could be resolved there. A face-to-face administered questionnaire was the method used in order to get a response rate that was acceptable for data analysis.

4. Findings

A total of 218 light-manufacturing firms in Trinidad and Tobago were selected as the sample and a total of 47 completed questionnaires were received yielding a response rate of 21.6%. According to Flynn et al (1994) a sample size (n) of 30 or more is statistically sufficient for the analysis.

4.1. Valid Responses – Descriptive Analysis

Table 1 shows more details of the general characteristics of the surveyed companies, based on the firm's size, the manufacturing sector, type of ownership and the certification attained. The respondent's role in the firm is also included. Most of the responses were obtained from Group 1 (1-49 employees) and Group 3 (100 – 249 employees). Pertaining to industry sectors, majority of responses

were received from the Food, Drink and Tobacco sub-sector (21 %). A great majority of surveyed organizations (77%) were of local private ownership. Majority (52.8 %) of the respondents were involved in implementation plans to improve their performance for more than 5 years. Only 8.3% were younger than 20 years old and the majority (91.7%) were more than 20 years old. Unfortunately, the majority of organizations had no certification (47%) such as ISO 9000 certified or other forms of certifications.

Table 1: Descriptive Analysis of Valid Responses

Size	%	Sector	%	Ownership	%	Certification	%	Respondents role in firms	%
1-49	32	Food, Drink & Tobacco	21	Local Private	77	ISO 9000 / 1/2 /3	28	Engineer	26
50 - 99	23	Textiles, garments, footwear & headwear	5	Local & Overseas	2	No Certification	47	CEO/MD	32
100 - 249	30	Printing, publishing & paper converters	17	Overseas	13	Other Certification	25	PM/OM	42
250-500	11	Wood & related products	4	Government	4				
> 500	4	Chemicals & non-metallic minerals	15	Joint Private & Govt	4				
		Assembly type & related industries	19						
		Miscellaneous manufacturing	19						

4.2. Analysis based on Company Size – Facilitating/Impeding Factors

Respondents rated the facilitating and the impeding factors towards initiatives to improve manufacturing performance. Table 2 (a) shows the mean and standard deviations (SD) of the facilitating factors and Table 2 (b) shows the impeding factors towards improving manufacturing performance. The data in both tables are arranged according to company size.

Overall, the top five facilitating factors were ‘Improving quality of Product/s’, ‘Local Competitiveness’, ‘Change in Customer Needs’, ‘Reducing Operating Cost’ and ‘Avoid Losing Market Shares to Competitors’. Findings also showed that Group 1 (1-49 Employees) and Group 2 (50 – 99 Employees) were encouraged to improve their performance because of ‘improving quality of Product/s’. The small manufacturers seem to be focused on quality improvement in order to compete. However, Group 5 (>500 Employees) were encouraged to improve manufacturing performance based on ‘Change in Customer Needs’ and ‘Reducing Operating Cost’.

Table 2 (a): Ratings of Facilitating Factors by Company Size

Facilitating Factors	Company Size (Employees)											
	1 – 49		50 – 99		100 – 249		250 – 500		> 500		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
IQP	4.17	0.994	4.27	0.704	4.00	0.734	4.44	0.727	4.16	0.898	4.208	1.570
LCm	3.96	0.991	4.00	0.926	4.25	0.930	3.71	1.490	4.00	1.118	3.984	0.983
EJ	3.06	1.130	3.59	1.121	4.06	0.772	3.64	1.151	3.40	0.876	3.550	0.899
ROC	3.80	1.110	4.00	1.054	3.47	1.060	3.79	0.579	4.41	0.998	3.894	1.673
CICN	3.77	1.091	4.00	0.907	3.85	0.899	3.36	0.842	4.56	1.890	3.908	1.117
COS	2.21	0.933	2.75	1.251	4.36	0.745	2.86	0.663	3.79	1.142	3.194	1.098
ALMS	3.92	0.973	4.06	0.998	3.43	1.016	3.93	0.884	3.84	1.167	3.836	0.908
GC	3.13	1.242	3.85	0.988	3.56	1.263	3.54	1.267	2.76	0.799	3.368	1.450
GP	3.53	0.998	3.75	0.910	3.75	1.000	3.92	0.954	2.99	3.017	3.588	1.021
BEA	3.58	1.256	3.31	0.946	4.00	0.966	3.08	1.188	3.96	1.309	3.586	0.914
DIT	3.60	1.397	3.76	0.903	2.93	1.438	3.92	0.881	3.50	1.552	3.542	1.402

Food, Drink and Tobacco are larger more prominent manufacturers in T&T. This explains their main facilitating factor as ‘Global Competition’. These manufacturers are at the level to compete globally. Printing, publishing & paper converters manufacturers are mainly small manufacturers struggling to survive. Hence, ‘Change in Organizational Strategy’, their main facilitating factor was necessary to attempt to improve manufacturing performance for survival.

The top five impeding factors were ‘Lack of Suitable Organizational Culture for Change’, ‘Improper Identification of Training Needs’, ‘Relevant Documents / Systems Unavailable’, ‘Insufficient Knowledge Base’ and ‘Need for Cost Justification’.

The findings also showed that Groups 1 (1-49 Employees) and 2 (50 – 99 Employees) highlighted ‘Lack of Knowledge’, ‘Unavailability of Resources’ and ‘Lack of Communication from those in Authority’ as impeding factors. Group 5 (>500 Employees) were deterred by ‘Lack of Implementation Knowledge’, ‘Managers/Employees Resistance to Change’ and ‘Insufficient level of education and skills of workers’. Both categories of company size on opposite sides of the spectrum ranked lack of knowledge whether it is implementation knowledge or the education level of their workers as impeding factors. Education seems to be major impeding factor for all sizes of companies. This fact can suggest why there is resistance to change within T&T manufacturers: lack of knowledge on these improvement practices / techniques.

Table 2 (b): Ratings of Impeding Factors by Company Size

Impeding Factors	Company Size (Employees)											
	1 – 49		50 – 99		100 – 249		250 – 500		> 500		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
LEIP	2.62	1.031	2.52	0.151	2.50	1.414	2.04	0.887	2.76	0.928	2.48	1.908
ILESW	2.60	2.850	2.59	0.418	2.80	1.424	1.86	0.963	3.04	1.930	2.57	0.934
LSOCC	3.51	0.983	2.91	0.155	3.00	1.195	3.02	1.059	2.98	1.089	3.09	2.019
MERC	2.49	1.109	2.21	1.311	3.33	1.397	2.43	1.176	3.10	0.941	2.71	0.998
ITIP	2.47	1.085	2.82	1.468	2.75	1.511	2.30	1.082	2.17	0.689	2.50	1.309
UEE	2.00	1.108	2.85	1.214	2.93	0.884	2.62	1.031	2.64	1.307	2.60	1.893
INP	1.57	0.824	2.64	1.216	2.69	0.947	2.60	2.850	2.93	1.223	2.48	1.016
LIK	1.99	0.944	2.64	1.307	2.64	1.084	2.51	0.983	3.22	1.166	2.60	0.875
UR	2.98	0.892	2.93	1.223	3.69	1.182	2.49	1.109	2.00	1.414	2.61	1.411
LK	3.00	1.103	3.22	1.166	2.64	1.284	2.47	1.085	2.40	0.986	2.74	1.605
IRS	2.13	1.038	2.00	1.414	3.69	1.251	3.42	1.240	2.50	1.414	2.74	0.908
IITN	2.30	0.932	3.40	0.986	3.57	1.284	3.08	1.165	2.80	1.424	3.03	0.795
IKB	2.47	1.089	2.93	1.335	3.31	1.251	2.93	0.829	3.00	1.195	2.95	1.905
NCJ	2.28	1.089	2.73	1.163	3.08	1.311	3.07	1.033	3.33	1.397	2.89	1.449
LCA	2.51	0.980	3.00	1.134	3.33	1.557	3.13	1.258	2.05	1.059	2.80	1.296

ED	2.11	0.946	3.02	1.240	2.44	1.365	3.17	0.937	1.99	0.943	2.62	0.893
LMM	2.69	0.905	3.08	1.165	2.75	1.571	3.56	1.365	1.57	0.826	2.73	0.947
LSS	2.04	0.887	2.93	0.829	2.60	1.298	2.86	0.939	1.98	0.890	2.48	0.947
LIIDC	1.86	0.963	3.00	1.033	3.23	1.015	3.63	1.147	1.86	0.963	2.71	1.013
LKSTM	2.02	1.059	3.13	1.258	2.83	1.264	3.22	1.166	2.02	1.059	2.64	1.519
LEE	2.43	1.176	3.17	0.937	2.09	0.980	2.09	0.980	2.43	1.176	2.44	0.989
LAMI	2.30	1.082	2.86	0.949	2.21	1.109	2.21	1.109	2.30	1.082	2.37	0.932
FACR	2.28	1.103	3.00	0.655	2.76	0.928	2.76	0.928	2.28	1.103	2.61	0.867
ISI	2.15	1.067	2.86	0.949	3.04	1.930	3.04	1.930	2.60	1.298	2.73	0.879
RDU	2.02	1.051	3.56	1.365	2.98	1.089	2.98	1.089	3.16	1.015	2.94	1.221
OOEM	2.05	1.059	2.86	0.939	3.10	0.941	2.00	1.103	2.83	1.264	2.56	0.889
LMI	1.99	0.943	3.63	1.147	2.17	0.689	2.13	1.038	2.09	0.980	2.40	0.889
BGIIG	1.57	0.826	3.22	1.166	1.84	0.779	2.30	0.932	2.21	1.109	2.22	1.097
LTMCS	1.98	0.890	2.67	1.155	1.99	1.326	2.47	1.089	2.76	0.928	2.37	0.990

4.3. Impact of Implementing Practices towards Improving Manufacturing Performance

The most modern practices/techniques are less implemented by the T&T manufacturing firms. This will lead T&T manufacturers to apply older techniques that lie under umbrella of mass production approach. From the data, 52.8% of T&T manufacturers had more than 5 years of experience with implementing practices and 30.6 % had 3 – 5 years' experience. The most benefit the organization had from implementing these practices is increasing their 'Competitiveness' and being more 'Quality oriented'.

5. Conclusions / Future Work

Adopting world class approaches to improve manufacturing performance has been studied but not common in the Caribbean. This research focused on the factors facilitating and impeding the implementation of such approaches. An assessment of the approach currently implemented within manufacturing organizations in T&T was also conducted to determine what is required to improve performance.

Research work of this nature has not been conducted in T&T so this information would be used to obtain a better understanding of the current status of the manufacturing sector and the direction these companies can take to improve their performance

The findings provided some insights in diagnosing and developing improvement plans/strategies for manufacturing organizations. This would be of value for both manufacturers and researchers in the areas of WCM.

This study focused mainly on organization size. Other factors on improving manufacturing performance such as industry type, type of ownership, age of firms and geographical location could be investigated. More analysis can also be carried out for the factors (organization size and industry type) studied in this research work. A hypothetical approach to improve manufacturing performance was utilized in this research. Longitudinal studies / case studies for assessing manufacturing performance can be researched. This type of detailed approach would provide the analysis required for developing model/framework.

6. References

- [1] Kodali R B, K S Sangwan and V K Sunnapwar 2004 Performance value analysis for the justification of world-class manufacturing systems *Journal of Advanced Manufacturing Systems* 3(1): 85–102.
- [2] Hayes, R H and S C Wheelwright 1984 *Restoring our Competitive Edge: Competing through Manufacturing* (John Wiley: New York)
- [3] Salaheldin I S and R Eid 2007 The implementation of world class manufacturing techniques in Egyptian manufacturing firms: an empirical study *Industrial Management & Data Systems* 107(4):551–566.
- [4] Sharma, M and R Kodali 2008 TQM implementation elements for manufacturing excellence *The*

TQM Journal 20(6):599–621.

- [5] World Economic Forum 2010 *The Global Competitiveness Report 2010-2011* (World Economic Forum: SRO-Kundig, Switzerland)
- [6] Tobon, F 2007 New survey reveals positive impact of ISO 9001:2000 in Colombia *ISO Management Systems Magazine* May/April:41-44.
- [7] Aarts, F M and E Vos 2001 The impact of ISO registration on New Zealand firms' performance: a financial perspective *The TQM Magazine*, 13(3):180-191.
- [8] Tannock, J, L Krasachol and S Ruangpermpool 2002 The development of total quality management in Thai manufacturing SMEs *International Journal of Quality and Reliability Management* 19(4):380-395.
- [9] Hermel, P and J Ramis-Pujol 2003 An evolution of excellence: some main trends *The TQM Magazine* 15(4):230–243.
- [10] Miller, T R and B J Vaughan 2001 Messages from the management past: Classic writers and contemporary problems *SAM Advanced Management Journal* 66:4–11.
- [11] Assiri A, M Zairi and R Eid 2006 How to profit from the balanced scorecard: an implementation roadmap *Industrial Management & Data Systems* 106(7):937–952.
- [12] Eid, R and M Trueman 2004 Factors affecting the success of business-to-business international internet marketing (B-to-B IIM): an empirical study of UK companies *Industrial Management and Data Systems* 104(1):16–30.
- [13] Chan, C and P M C Swatman 2000 From EDI to internet commerce: the BHL steel experiences *Internet Research: Electronic Networking Applications and Policy* 10(1):72–82.
- [14] Doyle, K 1992 Who's killing total quality? *Incentive* 16(8):12–19.
- [15] Westphal, J D, R Gulati and S M Shortell 1997 Customization or conformity? An institutional and network perspective on the content and consequences of TQM adoption *Administrative Science Quarterly* 42(2):366–394.
- [16] Mersha, T 1997 TQM implementation in LDCs: driving and restraining forces *International Journal of Operations and Production Management* 17(2):164-183.
- [17] Szirmai, A 1997 *Economic and Social Development* (Prentice Hall: London)
- [18] Ramoutar, K and C S Syan, 2010 Drivers and Barriers for WCM In Manufacturing Firms in Trinidad and Tobago *Proceedings of the 25th ISPE International Conference CAD/CAM, Robotics and Factories of the Future 2010, South Africa*
- [19] Haar, J M and Spell, C S 2008 Predicting total quality adoption in New Zealand *Journal of Enterprise Information Management*, 21(2):162-178.
- [20] Temtime, Z T 2003 The moderating impacts of business planning and firm size on total quality management practices *The TQM Magazine* 15(1):52-60.
- [21] Gulbro, R D, L Shonesy and P Dreyfus 2000 Are small manufacturers failing the quality tests? *Industrial Management and Data Systems* 100(6)76-80.
- [22] Ahire S L 1996 TQM age versus quality: An empirical investigation *Production and Inventory Management Journal* 1: 18–23.
- [23] Poolton, J 1994 *Concurrent Engineering Establishment: A Framework Proposal* (PhD Thesis, University of Liverpool)

Appendix A – List of Facilitating and Impeding Sub-factors

This list the facilitating and impeding sub-factors (abbreviations) used in paper.

#	FACILITATING SUB-FACTORS	
1	CICN	Change in Customer Needs
2	IQP	Improving Quality of Product
3	LC	Local Competitiveness

4	ALMS	Avoid Losing Market Shares to Competitors who already implemented practices Reducing Operating Costs Development in Technology Global Competition Economical Justification Change in Organizational Strategies Being an Early Adopter Government Pressures
5	ROC	
6	DIT	
7	GC	
8	EJ	
9	COS	
10	BEA	
11	GP	

#		IMPEDING SUB-FACTORS
12	LSOCC	Lack of Suitable Organizational Culture for Change
13	IITN	Improper Identification of Training Needs
14	ITIP	Insufficient Training in Implementation Process
15	IKB	Insufficient Knowledge Base
16	INP	Indiscipline - Non-conformance with Procedures
17	LIIDC	Lack of Inter and Intra Departmental Communication
18	LPK	Lack of Practices Knowledge
19	IESLW	Insufficient Education and Skills Level of Workers
20	LEE	Lack of Employee Empowerment
21	IRS	Insufficient Rewards Systems
22	LIK	Lack of Implementation Knowledge
23	LEI	Lack of Employee Involvement
24	LCA	Lack of Communication from those in Authority
25	RDU	Relevant Documents Unavailable
26	MERC	Managers/Employees Resistance to Change
27	LMM	Lack of Motivation from Management
28	UEE	Un-sustained Enthusiasm by Employees
29	LTMCS	Lack of Top Management Commitment and Support
30	UR	Unavailability of Resources
31	LKSTM	Lack of Knowledge and Skills of Top Management
32	LSS	Lack of Structural Support
33	LAMC	Lack of Appropriate Monitoring and Control
34	FACR	Failure to Analyze the Company's Readiness
35	OOEM	Overly Optimistic Expectations by Management
36	NCJ	Need for Cost Justification - Planning
37	ISI	Improper System Initiation
38	LMI	Lack of Management Involvement
39	ED	Empowerment Difficulties
40	BPGIIG	Business Performance Goals Inconsistent with Implementation Goals