A PROPOSED RESEARCH METHODOLOGY FOR SIX SIGMA DEPLOYMENT IN LIBYAN MANUFACTURING COMPANIES

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ABSTRACT

This paper investigates the current quality management processes in use in Libyan Manufacturing Companies (LMCs), and proposes a methodology to develop a novel six sigma framework. To date, there is no evidence of the use of six sigma in the Libyan manufacturing industry, and it is found that only 58 companies in Libya currently have ISO 9001 accreditation of which only 9 are manufacturing companies. This underutilisation of manufacturing systems such as six sigma is thought to be due to several barriers such as absence of performance measures, inadequate technical infrastructure, and lack of training programmes which have led to poor product quality and customer dissatisfaction. The research in this paper proposes a methodology to identify the real reasons behind the lack of six sigma utilisation in LMCs and use this data to develop a framework for implementation to improve the quality and competitiveness of such companies.

Keywords: six sigma, Libyan Manufacturing Companies (LMCs), research methodology, quality management.

1 INTRODUCTION

Today, almost all companies are facing severe realities of competitive markets and environments. Therefore companies are seeking for radical changes to have impact within a short period of time. It is suggested that six sigma can be a powerful technique for companies to compete and survive on the basis of product quality and process improvement (Henderson and Evans 2000). Libya is considered one of the developing countries where the weakness of quality level of the Libyan manufacturing companies is due to the lack of consideration of implementing quality techniques (Youssef.S 2006).

To date, there is a lack of literature on the implementation of six sigma in the Libyan manufacturing industry. Thus, this paper investigates the current quality management situation in LMCs and outlines a proposed methodology for six sigma deployment in LMCs to identify the barriers behind its underutilisation and then to propose a framework of six sigma deployment for the Libyan manufacturing industry.

2 ABOUT SIX SIGMA

Six sigma was originally developed by Motorola in 1987 to target a rigid goal of 3.4 defects per million opportunities. The approach was introduced in response to the threat from Japanese competitors who had lower defective rates. The major objective of six sigma is to improve customer satisfaction (Schroeder et al. 2008).

2.1 Six Sigma Benefits

The six sigma technique has been perhaps the most successful business improvement strategy in the last a few decades. The application of six sigma goes beyond manufacturing to services, healthcare, public sectors and government (Prabhushankar et al. 2008). A ‘‘big dollar impact’’ has been cited by Hoerl (1998) as one of the key reasons for the success of six sigma implementation. However, this is not the only reason behind implementing it, there are other key reasons for the benefits of six sigma implementation as highlighted by (Desai and Patel 2009) :-

- ✓ Reduction of defectives
- ✓ Reduction of cycle time
- ✓ Reduction of process variability
- ✓ Reduction of customer complaints
- ✓ Reduction of costs
- ✓ Productivity increment
- ✓ Profit increment
- ✓ Improved attitude of top management and employees towards quality and problem solving

2.2 Six Sigma Barriers

Despite its reputation as a powerful technique, six sigma implementation has faced some challenges and barriers. Raghunath and Jayathirtha (2013) specified a number of barriers to six sigma implementation such as lack of resources, internal resistance, lack of leadership from top management, poor training and coaching. While Kreisler Buch and Tolentino (2006) stated that lack of knowledge about six sigma and insufficient time to work on six sigma projects are considered as barriers facing the implementation of six sigma by some organizations. Chakrabarty and Kay Chuan (2009) also presented some reasons and barriers for not implementation six sigma by some organizations which are ‘‘unknown to us, not relevant, not interested, time consuming, insufficient resources, difficulty in collecting data, and too complex to use’’.

2.3 Six Sigma Success Factors

The success of six sigma depends on ‘‘Critical Success Factors’’ (CSFs). The CSFs are those factors that are critical to the success of a company, in the sense that if objectives linked with the factors are not achieved the company will fail (Rockart 1979).The reason behind finding CSFs as a base for determining the information needs of managers was promoted by Rockart (1979). Henderson and Evans (2000) performed a study and suggested top management support/involvement, organisational infrastructure, training, statistical tools, human resource (promotion, bonuses), early communication to employees, measurement system, and information technology as the major components for a successful implementation of six sigma.

Coronado and Antony (2002), identified the key elements for an efficient and effective six sigma implementation, based on reviewing of the existing literature, these keys are: top management commitment and involvement, cultural change, organisation infrastructure, training, project management skills, project prioritisation and selection, reviews and tracking, understanding the six sigma methodology, tools and techniques, linking six sigma to business strategy, linking six sigma to the customer, linking six sigma to the human resources, and linking six sigma to the supplier.

3 CURRENT QUALITY MANAGEMENT SITUATION IN LMCs

Literature on Libyan quality management implementation is scarce. The ISO survey in 2013 shows the number of ISO 9001 certified organisations reached 1.12M around the world, of which 337,033 were in China which is the highest number and 44,585 were in the UK. Within the developing countries the number reached 3,870 in the United Arab Emirates and 2,133 in Egypt. In Libya, however, this number up to the end of 2013 was still only 58. Moreover, according to the survey, the number of certified UK industrial companies was 19,041, whereas by comparison the number of certified Libyan industrial companies was only 49, of which only 9 are manufacturing companies (ISO 2013).

In terms of productivity, the 2007 annual report of CIID (the Centre for Industrial Information and Documentation) showed that the total value of production of Libyan manufacturing companies was around £947M for 2007, this figure was more than 45% higher than the value of around £653M achieved in 2006. However this figure of £947M only represented 66% of the total planed production for 2007 which was £1433M.

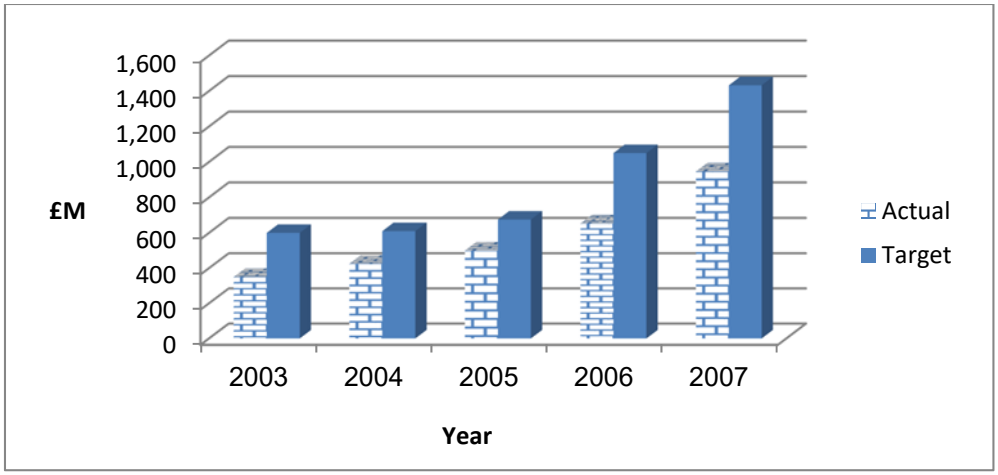

Figure 1: A comparison between the actual and targeted production level of the Libyan manufacturing industries for the period 2003-2007 (Abusa.F 2011).

Figure 1 shows a comparison between the actual and targeted production level of the Libyan manufacturing industries for the period 2003-2007 (Abusa.F 2011). It can be clearly seen that there was a continuous increase in the actual production rate of the LMCs from a value of £250M in 2003 to £947M in 2007. However, the figure also highlights a progressively increasing shortfall between the actual and targeted production levels across the same period. This result suggests that LMCs are facing some major barriers in producing their planned production output which could be attributed to many reasons such as poor management and infrastructure or lack of strategic planning. However, one key reason for this shortfall is due to the lack of consideration of implementing quality tools and techniques such as six sigma (Youssef.S 2006). Without such tools, it has been shown that companies are more likely to produce high numbers of reject products leading to production deficits. Many companies, such as Motorola, Allied Signal, and General Electric, have implemented six sigma into their businesses, and claimed that these programmes have transformed their organizations (Fursule; et al. 2012).The implementation of six sigma helped Motorola in reducing in-process defect levels by a factor of 200, reduced manufacturing costs by $1.4 Billion and increased employee production on a dollar basis by 126%. Allied Signal also achieved $1.4 Billion cost reductions, 14% growth per quarter, 24% bill/cycle reduction and reduced new product introduction time by 16% (Aviation Management Associates Inc.). These figures clearly justify the potential benefits of adopting six sigma techniques. In theory, these benefits of six sigma could be transferred to LMCs, in order to improve product quality and reduce the current shortfall in production levels. Hence, the aim of the paper is to propose a research methodology for six sigma deployment in LMCs as a solution for improving the levels of efficiency and effectiveness of the production processes.

4 A PROPOSED RESEARCH METHODOLOGY FOR SIX SIGMA FRAMEWORK FOR LIBYAN MANUFACTURING COMPANIES

This research will be conducted by undertaking the stages shown in Figure 2:

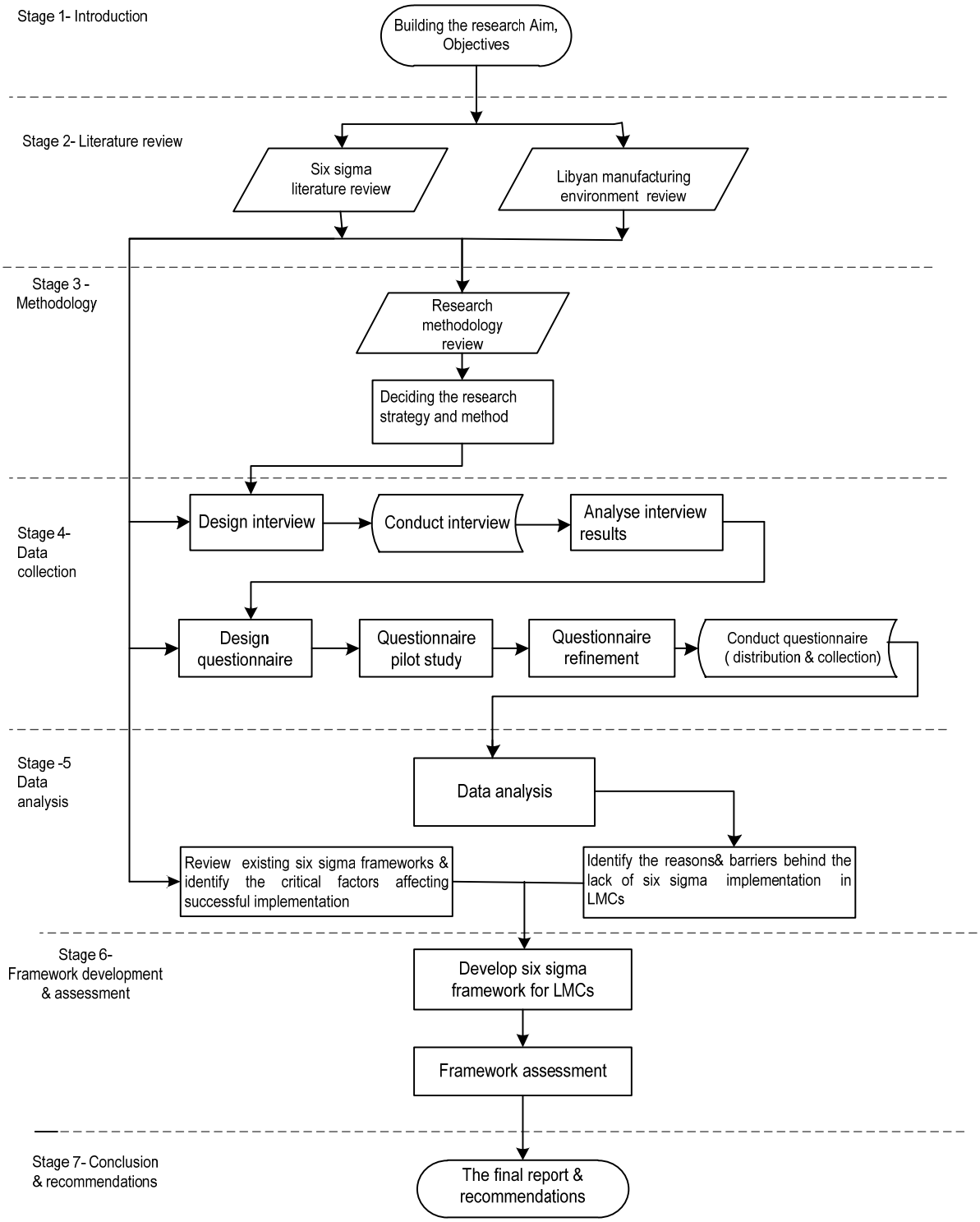

Figure 2: A proposed research methodology for six sigma framework for LMCs

Figure 2 shows the proposed research methodology which consists of seven stages, starting in stage 1 by building the research aim which is to develop a six sigma framework for deployment in LMCs. This will be achieved by reviewing six sigma literature as well as the Libyan manufacturing environment as shown in stage 2. Then the reasons and barriers behind the lack of six sigma implementation in LMCs will be identified using a survey which has been chosen as the main research strategy for data collection. The survey starts by conducting interviews to collect qualitative data followed by developing a questionnaire to obtain the quantitative data; this mixed data collection method is known as 'the exploratory sequential design' (Saunders et al. 2012).

The research methodology in stage 3 includes selecting a suitable research philosophy, research approach, research strategy, and time horizon. The selected research methodology can be summarised in figure 3.

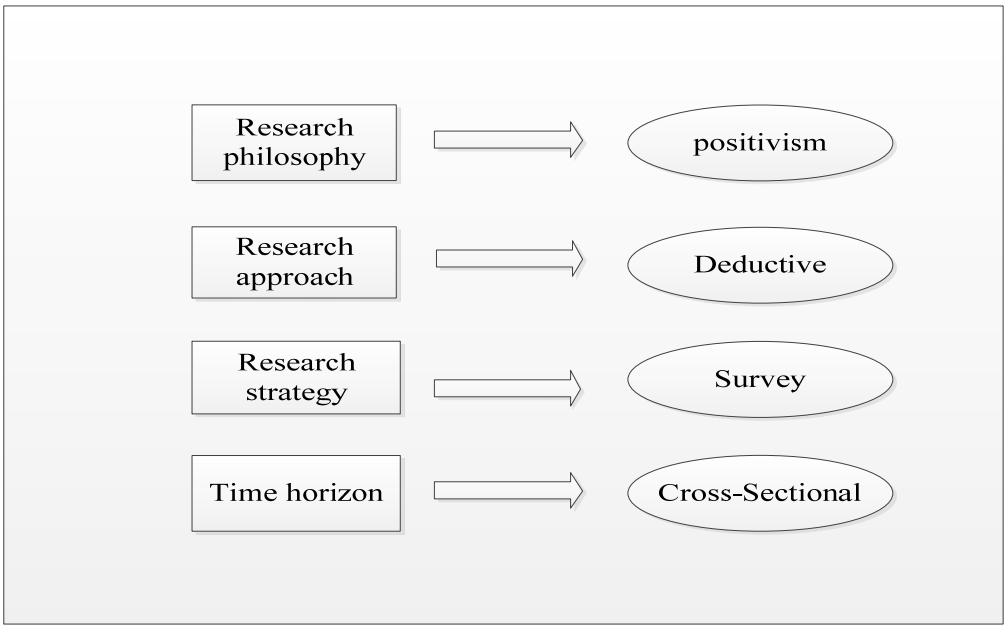

Figure 3: Research methodology adopted

Once data collection has been completed in stage 4, the research will move to stage 5 to analyse and interpret the collected data in order to identify the reasons and barriers behind the lack of six sigma implementation in the Libyan manufacturing industry, whilst also reviewing the literature to identify the critical factors affecting the success of existing six sigma frameworks. In stage 6 a preliminary framework of six sigma will be developed according to the needs of the LMCs, and then the developed framework will be assessed and evaluated using a combination of reviews by six sigma experts from established UK companies and potential users of the framework in Libya. The revised framework will then be presented to the LMCs as a guideline methodology to direct them towards successful six sigma implementation.

5 CONCLUSION

This paper highlights the benefits, barriers and critical success factors of six sigma which have been considered in the proposed research methodology of the six sigma framework for LMCs. The paper also shows the current quality situation in LMCs which reveals that they are suffering from mismanagement, poor infrastructure, lack of strategic planning, lack of quality management, and lack of following up with the latest quality tools and techniques. Consequently, a research methodology for developing a framework of six sigma deployment in LMCs has been presented in this paper to direct LMCs towards successful six sigma implementation for improving the levels of efficiency and effectiveness of their production processes.

REFERENCES

Abusa.F (2011). TQM implementation and its impact on organzational performance in developing countries a case study on Libya. PhD Thesis, University of Wollongong.

Aviation Management Associates Inc. "Six Sigma, Design for Six Sigma and Lean Six Sigma." 2015, from http://www.avmgt.com/ama/AMA_Six_Sigma.html.

Chakrabarty, A. and T. Kay Chuan (2009). "An exploratory qualitative and quantitative analysis of Six Sigma in service organizations in Singapore." Management Research News **32**(7): 614-632.

Coronado, R. B. and J. Antony (2002). "Critical success factors for the successful implementation of six sigma projects in organisations." The TQM magazine **14**(2): 92-99.

Desai, D. A. and M. B. Patel (2009). "Impact of Six Sigma in a developing economy: analysis on benefits drawn by Indian industries." Journal of Industrial Engineering and Management-Vol 2, No 3 (2009).

Fursule;, N. V., S. V. Bansod; and S. N. Fursule; (2012). "Understanding the benefits and limitations of six sigma methodology." International Journal of Scientific and Reserach Publications **2**(1).

Henderson, K. M. and J. R. Evans (2000). "Successful implementation of six sigma: benchmarking General Electric Company." Benchmarking: An International Journal **7**(4): 260-282.

Hoerl, R. W. (1998). "Six sigma and the future of the quality profession." Quality Progress **31**(6): 35-35,38+.

ISO. (2013). "ISO survey 2013." from http://www.iso.org/iso/iso-survey.

Kreisler Buch, K. and A. Tolentino (2006). "Employee expectancies for six sigma success." Leadership & Organization Development Journal **27**(1): 28-37.

Prabhushankar, G. V., S. R. Devadasan, P. R. Shalij and V. Thirunavukkarasu (2008). "The origin, history and definition of Six Sigma: a literature review." International Journal of Six Sigma and Competitive Advantage **4**(2): 133-150.

Raghunath, A. and R. Jayathirtha (2013). "Barriers for implementation of Six Sigma by Small and Medium Enterprises." International Journal of Advancements in Research & Technology **2**(2): 1-7.

Rockart, J. F. (1979). "Chief executives define their own data needs." Harvard business review **57**(2): 81-93.

Saunders, M. N., M. Saunders, P. Lewis and A. Thornhill (2012). Research methods for business students, sixth edition, Pearson Education India.

Schroeder, R. G., K. Linderman, C. Liedtke and A. S. Choo (2008). "Six Sigma: Definition and underlying theory." Journal of operations Management **26**(4): 536-554.

Youssef.S (2006). Total Quality Management Framework for Libyan Process and Manufacturing Industries. PhD Thesis, Cranfield University.