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A PROPOSED MIXED METHOD METHODOLOGY TO IDENTIFY THE FACTORS IMPEDING THE ADOPTION OF SIX SIGMA IN LIBYAN MANUFACTURING COMPANIES

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ABSTRACT

This paper proposes a mixed method methodology to explore the impeding factors behind the lack of six sigma implementation in Libyan Manufacturing Companies (LMCs). The study suggests using a survey as the main strategy to investigate the reasons behind this shortcoming. The initial approach is by conducting interviews to collect qualitative data followed by the development of a questionnaire to obtain the quantitative data. This mixed data collection method is known as 'the exploratory sequential design'. Once interviews have been conducted and the data has been analysed, the results will be used in conjunction with the outcomes of the literature review to develop a questionnaire to be distributed to a range of LMCs. After this second set of data collection has been completed, the research will move to the next stage to analyse and interpret the collected data by using SPSS software. The survey findings will be used to develop a six sigma framework to be implemented in LMCs to improve the quality and competitiveness of such companies

INTRODUCTION

These days, nearly all organisations around the world are challenging severely competitive markets and environments to survive. Consequently, organisations are looking for drastic changes and movement to have an impact within a short period of time. It is proposed that six sigma can play a powerful role for organisations to compete and survive on the basis of

process improvement and product quality [1]. Libya is considered one of the developing countries where the weakness of quality level of the LMCs is due to the lack of consideration of adopting quality techniques such as six sigma [2].

To date, there is a lack of literature on the adoption of six sigma in the Libyan manufacturing industry. Thus, this paper proposes a mixed method methodology to explore the impeding factors behind the lack of six sigma implementation in LMCs.

WHAT IS SIX SIGMA?

Six sigma can be defined as a highly disciplined, systematic proactive, powerful and multifaceted problem-solving or continuous and/or breakthrough business/process improvement strategy that seeks to find and eliminate the sources of error or the causes of customer-defined mistakes or defects, drive out wastes in business processes, and reduce variation, and improve the efficiency and effectiveness of organisational operations, and strives to reach a level of 3.4 DPMO using extremely rigorous data gathering and statistical analysis, thereby meeting or even exceeding customers' needs and expectations with a focus on financially measurable bottom-line results [3].

SIX SIGMA BENEFITS

Six sigma applications have been described as a successful business improvement strategy in the last few decades. The

application of six sigma goes beyond manufacturing to services, healthcare, public sectors and government [3]. A “big dollar impact” was cited by Hoerl [4] as one of the key reasons for the success of six sigma implementation. This is not the only reason behind implementing it, however, there are several other benefits of six sigma implementation [5]:-

- ✓ Reduction of defects
- ✓ Reduction of cycle time
- ✓ Reduction of delivery time
- ✓ Reduction of process variability
- ✓ Reduction of customer complaints
- ✓ Reduction of costs
- ✓ Reduction of checking/ inspection
- ✓ Sales increase
- ✓ Profit increase

SIX SIGMA BARRIERS

Despite its reputation as a powerful technique, six sigma has faced some challenges and barriers. Raghunath and Jayathirtha [6] specified a number of barriers to six sigma implementation such as lack of resources, internal resistance, lack of leadership from top management and poor training and coaching. While Kreisler Buch and Tolentino [7] stated that a 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 [8] 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”.

RESEARCH FLOW CHART

Figure 1 shows the research flow chart 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.

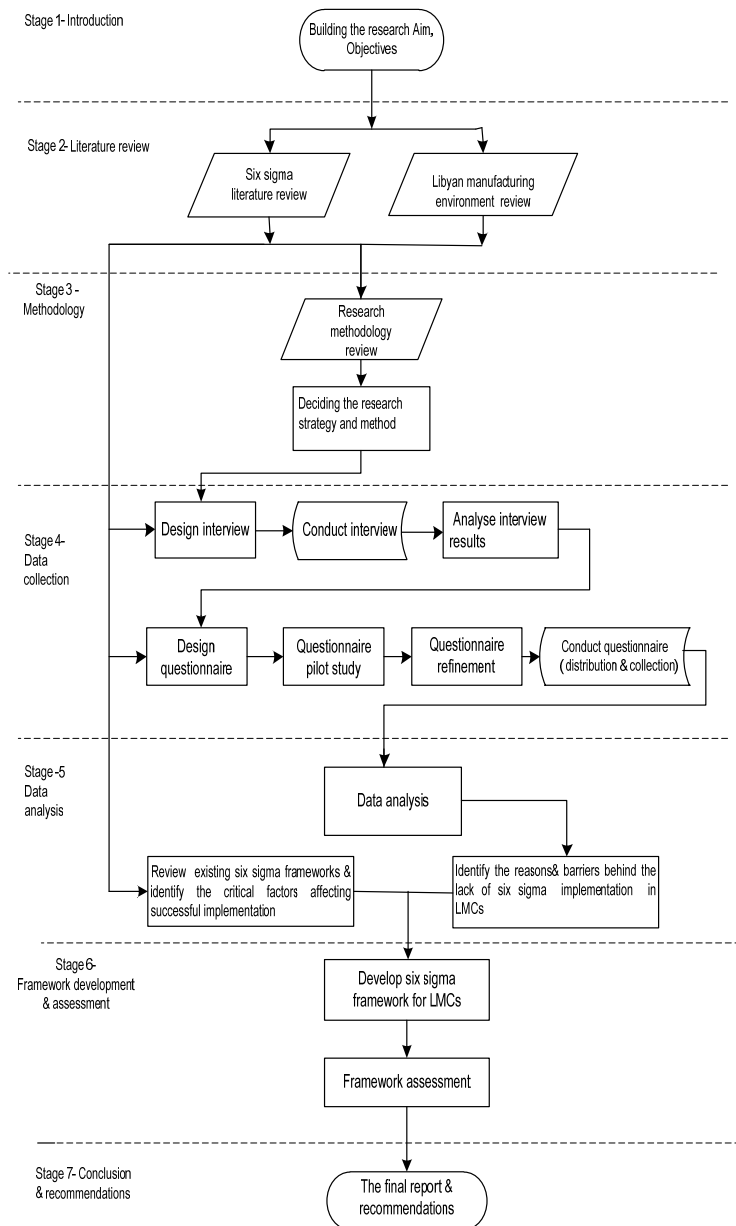


FIGURE 1: RESEARCH FLOW CHART

RESEARCH STRATEGY

A research strategy is a plan of how a researcher will go about answering the research question. It is a methodological relation between the philosophy and following the choice of methods of collecting and analysing data [9]. The main question for this research is what are the impeding factors behind the lack of six sigma use in LMCs?

Yin [10] introduced five types of research strategies as shown in Table 1. He said that each strategy depends on some conditions which should be taken into account when selecting the most suitable type. These conditions are:-

- The form of the research question
- The control that the researcher has over behavioural events
- The focus on contemporary events.

TABLE 1: RELEVANT SITUATIONS FOR DIFFERENT RESEARCH STRATEGIES

Strategy	Form of the research question	Required Control over behavioural events	Focus on contemporary events
Survey	What, Who, Where, How much, How many?	No	Yes
Case study	How, Why?	No	Yes
Experiment	How, Why?	Yes	Yes
History	How, Why?	No	No
Archival analysis	What, Who, Where, How much, How many?	No	Yes, No

For this research, the survey strategy has been selected as the main strategy. The justification for selecting this strategy is as follows:

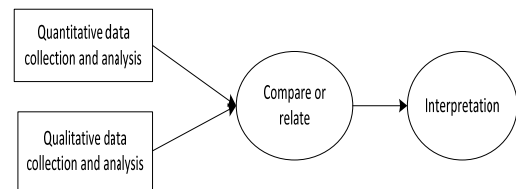
- As ‘what’ is the question under investigation
- As the aim of this research is to identify the impeding factors behind the underutilisation of six sigma in LMCs, Which will cover a wide range of varied and comprehensive participants in different companies, consequently the survey strategy is better than other strategies such as a case study which covers only a small number of participants in a few companies.
- Survey strategy gives the researcher an opportunity to gather quantitative data which can be analysed quantitatively by using descriptive and inferential statistics.
- Results of representative data can be produced at a lower cost than collecting the data for the whole population.

METHOD OF DATA COLLECTION

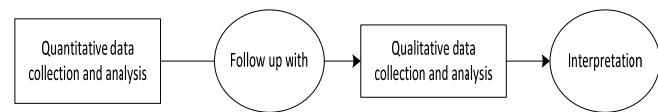
A survey has been chosen as the main strategy, the primary data collection for this research will be obtained by conducting both an interview and a questionnaire. This technique is known as mixed methods data collection [11]. This approach of combining methods is called triangulation. Thus, there is a broad consensus that mixing different kinds of methods can strengthen a research [12].

There are three major designs or prototypical versions of mixed method data collection as shown in Figure 2 [9] :-

1- The convergent parallel design



2- The explanatory sequential design



3- The exploratory sequential design

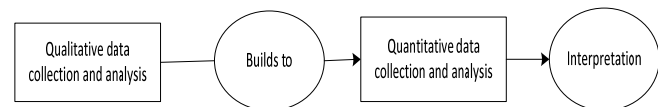


FIGURE 2: PROTOTYPICAL VERSIONS OF THE MAIN MIXED METHODS [9]

In the mixed method research, the matter is how to make a decision about what to start with qualitative data or quantitative data or to do them concurrently. The researcher who uses mixed methods can give equal priority to both qualitative and quantitative research, emphasize quantitative more, or emphasize qualitative more. This emphasis might come from practical restraints of data collection, the need to understand and extract data from one form before proceeding to the next.

For this research, the exploratory sequential design has been selected to be the data collection method approach. The main reason for selecting the exploratory design is that the aim

of this research is to explore the impeding factors behind the lack of six sigma in LMCs, so it has been decided to begin with conducting interviews to collect qualitative data and specify which impeding factors are faced by the LMCs, and then to investigate and quantify these factors more by conducting the questionnaire based on interviews results. The following Figure 3 shows the data collection stages

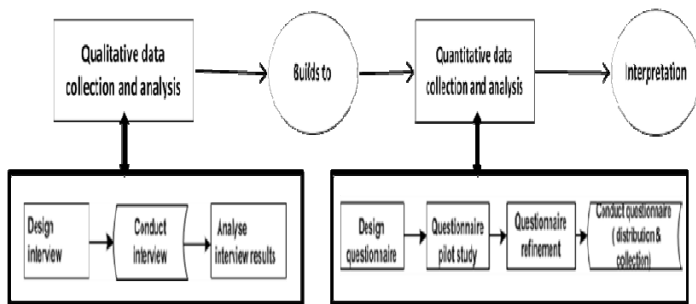


FIGURE 3: THE EXPLORATORY SEQUENTIAL DESIGN

Data collection will begin by conducting interviews to collect qualitative data. Semi-structured interviews were chosen for conducting the interviews. The interview questions are mainly generated from the literature review and are focused on the potential reasons and barriers behind the lack of six sigma use. The main targeting interviewees will be those who are responsible for quality management systems in their firms, and also managers who are responsible for decision making such as executives and chairmen. Once interviews have been conducted and analysed, the data will be used together with the outcomes of the literature review to develop the questionnaire for distribution to LMCs to obtain the quantitative data.

Once data collection has been completed, the research will move to the next stage to analyse and interpret the collected data in order to identify the real reasons and barriers behind the lack of six sigma use in LMCs. Finally, this data will then be used to develop a six sigma framework for implementation in LMCs to improve the quality and competitiveness of such companies.

CONCLUSION

This paper introduced a suggested mixed method methodology for data collection to identify the impeding factors behind the shortcoming of six sigma use in LMCs. A survey strategy was selected as the main strategy and the exploratory sequential design was the main method for data collection which starts by conducting interviews to collect qualitative data followed by the development of a questionnaire to obtain the quantitative data. The collected data will be interpreted and analysed and then be used for developing a six

sigma framework for implementation in LMCs to improve the quality and competitiveness of such companies.

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NOMENCLATURE

LMCs	Libyan Manufacturing Companies
DPMO	Defects Per Million Opportunities

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