

EVALUATING SIX SIGMA IN THE INDONESIAN SME CONTEXT

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ABSTRACT

Small and Medium Sized Enterprises (SMEs) make an important contribution to the Indonesian economy and are a focus of Government attention aimed at improving their efficiency and competitiveness. In this paper we discuss the development of a research project to investigate the suitability of lean six sigma as an improvement methodology for Indonesian SMEs in the manufacturing sector. A key aim of the research is to design a suitable framework for introducing lean six sigma into Indonesian SMEs in the manufacturing sector.

Keywords: Indonesia, SMEs, Six Sigma, Diffusion of Innovation

INTRODUCTION

This paper presents an account of the development of the methodology of an ongoing research project the main objective of which is to design a framework for the introduction of lean six sigma into small and medium sized Indonesian manufacturing companies. A useful implementation framework serves as a working model or template which guides implementation. The framework should be supported by relevant theory and be compatible with the micro and macro environment into which the new initiative is to be introduced. An effective framework should identify key stakeholders and their roles and address important issues such as project planning, resource requirements, and performance monitoring. Economic, cultural and social issues need also to be considered.

Given these considerations the diffusion of innovations literature popularised by Rogers [30] was found to be particularly powerful in the development of the project methodology. At the time of writing piloting of the research instruments and data collection is being undertaken in Indonesia.

BACKGROUND AND JUSTIFICATION OF THE RESEARCH

There are two definitions of SMEs in Indonesia provided by the Central Bureau of Statistics and the Central Bank of Indonesia. The Central Bureau of Statistics [9] defines SME as organisations which have no more than 100 full-time employees. A financial definition is provided by the

Central Bank of Indonesia [8] using criteria such as having assets of not more than IDR. 5 billion (approximately USD 500,000) and sales \leq IDR. 3 billion (approximately USD 300,000).

In Indonesia, SMEs play a vital role in the economy, because they make up around 99% of the total number of enterprises and employ approximately 99.5% of the total work force [10]. However, their export contribution is small compared to ASEAN (Association of Southeast Asian Nations) countries such as Singapore and Malaysia [34]. Furthermore, in some industry sectors, for example the automotive component industry, local Indonesian SMEs have to compete fiercely in the local market with other countries' products e.g. imports from China [31]. This is regarded as a serious issue, because Indonesia has a large and continuously growing automotive market. On the other-hand, a survey conducted in 2004 [38] indicated there were many opportunities to be a vendor or subcontractor to large organisations in Indonesia, particularly in the automotive, machine and electrical sectors. For instance, about ninety percent of motorcycle components are produced by local companies, and around fifty percent of them are expected to be supplied by local SMEs [32]. However, SMEs are not able take full advantage of these opportunities because they are struggling to meet the increasingly demanding requirements of large customers in terms of quality, price and delivery performance.

Support to strengthen SMEs is provided by both government and non-government agencies through a number of programs, for example there are programs in the areas of human resources, production, networking and financial management. Also, attempts have been made to introduce new technologies. For example, a Japan/ASEAN Total Quality Management (TQM) Project was conducted in several ASEAN countries, including Indonesia, in 1995. This project was led by the Ministry of Trade and Industry (MITI) of Japan with the main objective of introducing and assisting TQM implementation in SMEs in ASEAN countries [24]. However the TQM initiative in Indonesia appears not to have been very successful. According to the project report for the period 1995-2000 prepared by the National Standardization Agency of Indonesia, although early enthusiasm towards the TQM initiative was quite encouraging, it faded quickly, and the program did not deliver the expected results during this implementation phase.

Six sigma is now being considered as a more promising improvement methodology than TQM for use by Indonesian SMEs. This initiative has support from the Indonesian government. The research reported in this paper is an important part of the process to evaluate the suitability of six sigma for use in Indonesian SMEs. The main aims of the research are to assess the readiness of Indonesian SMEs in the manufacturing sector to successfully adopt a technology like six sigma and to design a suitable implementation framework.

Justification for the research was based on potential to contribute to the national economy, the need to understand the culture into which six sigma would be introduced and the lack of solid research on six sigma, particularly in the Indonesian context. These arguments are now presented.

Economic

Clearly SMEs are vitally important to the Indonesia economy. They contribute significantly to employment and have the potential to contribute more to the national gross domestic product. In order to do this SMEs need to receive appropriate assistance to develop the efficiency and

effectiveness of their operations. Currently, Indonesian SMEs are still struggling to improve the performance of their products and services. They face problems such as poor product quality which inhibits their ability to enter and compete in foreign markets. Also, the majority of SMEs in Indonesia are suppliers to large organisation who are becoming more demanding of their performance on on quality, price and delivery [35] [23].

Cultural

There is growing evidence that the success or failure of improvement methodologies such as six sigma and TQM depends on having an effective implementation strategy at the organisation level [5]. So there is clearly a need to understand culture at the level of the individual SME. However, to achieve the economic benefits from the introduction of lean six sigma it is necessary for the approach to become generally popular and to be used successfully by a significant proportion of manufacturing SMEs within Indonesia. The diffusion of innovations literature [30] demonstrates that it is important to examine the broader cultural context into which the innovation is to be introduced e.g. at the industry level.

For example, there are not many successful stories of TQM implementation either in large organizations or SMEs in Indonesia. Some of the reasons for the lack of TQM success were recently reported by the National Standardization Agency of Indonesia. Key factors included low quality awareness by management and staff, lack of management commitment and lack of appropriate training [28]. The two Indonesian manufacturing companies which were involved in this Japan/ASEAN TQM project mentioned above did not report significant improvements in terms of financial gain. The major achievements that these two organisations reported were only standardising the use of quality control techniques and implementation of safety control measures [33]. A survey conducted by Amar & Zain [1] explored TQM applications in Indonesia by looking at the daily activities, tools and techniques used, and barriers faced during TQM implementation in large manufacturing organizations. The result indicated that the main barriers faced by those companies were related to management involvement, provision of resources (e.g. human, machine, information, raw material and funding), attitude toward quality, training, interdepartmental relations and culture.

KEY QUESTIONS ADDRESSED THROUGH THE LITERATURE

In this section we summarise literature related to three key questions that arose during the research: 1) What evidence is there that six sigma is likely to be successful in Indonesian SME manufacturing organisations? 2) What are the success factors for six sigma implementation? and 3) Are there any six sigma implementation frameworks for SMEs in the literature?

Why Six Sigma?

Due to lack of success with approaches like TQM, it is suggested that many organizations seek an approach or concept that is simple to use, improves processes or products and increases profit. One such approach in vogue is six sigma. The origins of six sigma go back some time, with Bill Smith, a reliability engineer at Motorola being credited with originating the concept in the mid

1980s [13]. It is important to ask the question: on what basis is lean six sigma considered to be a suitable improvement approach for Indonesian SME manufacturing companies?

The central idea of the six sigma approach is to design processes, or improve existing processes, to obtain very high process capability and hence defect rates that are close to zero. A six sigma target defect rate of 3.4 defects per million components/incidents is often cited [13, pp. 479-484]. General Electric (GE), under the leadership of CEO Jack Walsh was the organisation that probably did most to popularise six sigma [27]. Six sigma has undergone various developments since its inception but still has a statistical focus. As Raisinghani et al. [27] point out it is difficult to define six sigma in simple terms. In part this is probably due to the fact that six sigma is not controlled and developed by a central body, like for example the International Organization for Standardization (ISO) controls the quality assurance standard ISO 9000.

The DMAIC (Define, Measure, Analyse, Improve and Control) methodology is used to structure six sigma improvement projects. There are various analysis tools to aid in problem identification and improvement e.g. pareto analysis, and root cause analysis. Like other approaches to business improvement e.g. TQM and ISO 9000, six sigma has a strong customer focus, and contains key concepts related to strategy, organisational change, training and setting stretch objectives [13, p. 133].

Perhaps the most fascinating and successful development in six sigma has been the introduction of the 'belt' system used in training i.e. green belt, black belt and master black belt – presumably copied from martial arts. Recently, to help small businesses with limited resources for training a "white belt" course providing a cheaper introduction to six sigma than the green belt option has been introduced [18]. This idea may be particularly useful for some Indonesian manufacturing SMEs to begin to establish a knowledge base at low cost and with minimum disruption to day-to-day activities.

One well published variant of six sigma is lean six sigma, in which lean principles have been combined with the six sigma approach [3] [4] [20] [37]. Advocates of lean six sigma claim several benefits for this hybrid approach. The lean concept was first introduced by The Toyota Company and is popular today particularly in some large organizations which have successfully integrated it with six sigma. Hines, Holwe and Rich [20] provide a review of the lean approach, including a brief history. According to advocates of lean six sigma, the ideas of lean and six sigma can be integrated to provide the ability to respond to the changes in customer wants, which have resulted from globalization pressures. Based on the positive results of lean six sigma implementation in large organizations, SMEs also have the possibility to bring these concepts lean and six sigma into their organizations [6] [29]. More specifically it has been argued, mainly by practitioners, that combining the lean concept, which aims at reducing various types of wastes (e.g. inventory, processing, waiting, motion, transport and overproduction) with six sigma will lead to cost reductions and improved lead time performance [15] [3].

There is a prima facie case for lean six sigma having some advantages over six sigma, however there appears to be very little research which examines this issue in a rigorous way. Six sigma, with or without the addition of "lean", appears to differentiate itself from a TQM approach by

being more focused and project oriented. There is evidence that the success of TQM has been impeded by difficulties in implementation [5].

Critical Success Factors

Yusof [39] in his study of critical success factors of TQM implementation in SMEs, interpreted critical success factors as ‘those circumstances or practices which already exist or those that need to be developed in order to implement concept or approach successfully’. A knowledge of critical success factors should provide useful information for methodology development in this research. There are several studies which discuss critical success factors related to the implementation of six sigma and lean six sigma [7] [12] [14] [19] .

Coronado and Antony[12] investigated critical success factors in UK SMEs and identified eleven. These are management involvement and commitment, cultural change, communication, organization infrastructure, training, linking six sigma to business strategy, linking six sigma to customers, linking six sigma to human resources, linking six sigma to suppliers, understanding tools and techniques within six sigma, project management skills and lastly, project prioritization and selection.

Burton and Sams [7] listed sixteen key requirements, which were said to be critical factors in implementing Six Sigma successfully. These are: establish recognition of the need, provide leadership commitment and support, developing six sigma strategy and a deployment plan, incorporate enterprise wide scope, mandate linkage to the business plan, make proper investment in resources, develop communication and awareness effort, focus on customers and results, structure around the organization’s needs, implement regulated program management, build a team and employee involvement culture, manage controversy and confrontation, demand frequent measurement and feedback, implement a structured project closeout process, provide recognition and rewards and lastly leverage successes and stay the course. They believe that these factors have to be in place in order to implement six sigma successfully. Just using the DMAIC methodology and six sigma tools is not sufficient.

Based on his experience as a consultant, Goldstein [17] developed thirteen factors which he believed are the success factors to implement six sigma programs. Hayes [19] identified seven success factors.

There is some agreement on critical success factors between the various writers however, of the literature reviewed, only Coronado and Antony [12] provided some validation of their views through an industry survey.

Six Sigma Implementation Frameworks

There is a relative lack of research on six sigma [2] and this is particularly so for research in the Indonesian context. However, three six sigma implementations frameworks [7] [11] [26] and one lean six sigma implementation framework [14], aimed at local government applications, were found in the literature. These frameworks are useful to examine as a key objective of the present research is to develop an implementation framework for six sigma.

The models by Chang [11] and Furterer [14] draw on the MBNQA (Malcolm Baldrige National Quality Framework) which itself is closely related to TQM methodology. The models developed by Park [26] see Figure 1 and Furterer are the most general of the three and therefore arguably the most conceptually useful. None of the models seem to address to a significant extent the diffusion of six sigma at the industry or national level. Furterer's model for implementing lean six sigma into local government however does address some industry specific issues.

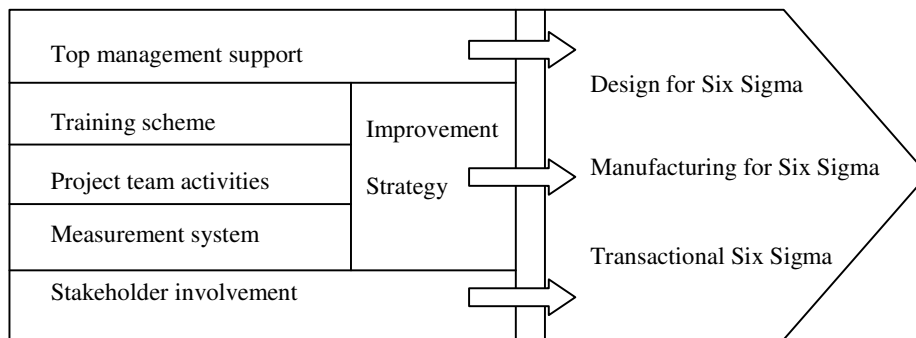


Figure 1. Park's Six Sigma Framework [26]

These frameworks provide a useful starting point, but a customised framework is required for the following reasons. First, the framework will attempt to incorporate idea of both six sigma and lean production. Second, it is necessary to incorporate cultural and structural issues related to the Indonesian context. For example, the framework needs to reflect the state of readiness of SMEs to adopt lean six sigma and the support that can be provided to SMEs by the Indonesian Government and other stakeholders. Furthermore, the framework needs to provide guidance not only to SMEs but also to other key stakeholders such as the Government support agencies. Lastly, the framework needs to address not only implementation at the individual SME level but also at the industry level. Guidance on diffusion of lean six sigma into the population of SME manufacturers is necessary in order to gain economic benefits at the national level.

DEVELOPING A RESEARCH METHODOLOGY

The literature reviewed was useful in identifying issues that were relevant to the present research and could be incorporated into the research methodology. It became evident that it was necessary to design an implementation framework for lean six sigma that was customised for the Indonesian context. In particular it was necessary to research the readiness of Indonesian manufacturing SMEs to implement lean six sigma in the context of the support that could be provided to them from various sources. The review of literature led to the following specific research objectives:

- a) To measure the readiness of Indonesian SMEs for innovation adoption that is needed for successful implementation of lean six sigma.
- b) To develop a theoretical model of lean six sigma based on ideas and concepts from the literature.
- c) To identify internal and external factors that have an impact on lean six sigma implementation.
- d) To develop a customised lean six sigma implementation framework for SMEs in the Indonesian context.
- e) To develop suggestions for future implementation and management of lean six sigma.

Diffusion of Innovation Framework

A framework for the research methodology that was relevant, theoretically rigorous and practical to use was found in the diffusion of innovations literature [30]. The diffusion of innovations literature is particularly useful for identifying important cultural variables. It was possible to incorporate variable identified in the literature discussed above, e.g. critical success factor literature, into the innovation diffusion model. According to Rogers [30] there are five main constructs that combine to determine the rate of adoption of innovations:

1. Perceived attributes of the innovation

- a) Relative advantage
- b) Compatibility
- c) Complexity
- d) Trialability
- e) Observability

2. Type of innovation decisions

- a) Optional
- b) Collective
- c) Authority

3. Communication channels e.g. mass media or interpersonal

4. Nature of the social system e.g. its norms, degree of network interconnectedness.

5. Extent of change agents' promotional efforts

Each of the categories and sub-categories are defined. For example 1.a) Compatibility

An innovation can be compatible or incompatible with:

- I. social and cultural values and beliefs;
- II. previously introduced ideas
- III. client needs for the innovation

After some consultation with Indonesian SME industry support groups and knowledge of relevant literature a methodology for the data collection was formulated around the diffusion of innovations model. Three main data collection initiatives were planned: 1) assessing the

readiness of SMEs for the adoption of lean six sigma 2) Assessing support available to SMEs for the adoption of lean six sigma and 3) assessing expert opinion within on the benefits of lean six sigma and the proposed implementation framework. A challenge of the research was that the various research instruments were designed using the English language and then had to be converted in the Indonesian language for the field work. The Indonesian government agencies that provide support for SMEs were an important stakeholder group in the research for two reasons. First, they provided assistance with the research. Second, part of the research agenda was to evaluate the support that they could provide to SMEs and to assess their position on the suitability of lean six sigma.

SMEs in automotive component sector in the Province of East Java (Sidoarjo and Pasuruan areas) of Indonesia were selected as the sample population for the research. The three areas of data collection are now explained in more detail.

Assessing Readiness of SMEs to Adopt Lean Six Sigma Questionnaire

Data are planned to be collected from SMEs through interviews and the use of a self-report questionnaire survey. The design of the self-report questionnaire was based on issues relevant to the diffusion of innovations as discussed above. The questionnaire is divided into five parts:

Part A. General Information e.g. company demographics, type of ownership, use of IT.

Part B. Program use and Support. One section enquires into the degree of understanding and extent of use by the SME of various types of management programs e.g. TQM, six sigma. A second section asks about the extent of, and importance to the SME, of various types of support e.g. from the Indonesian business development services, from universities, from significant customers and from suppliers.

Part C. Understanding and use of Tools and Techniques.

Part D. Readiness to Adopt Innovation. Questions in the first section are intended to measure the extent to which the SME have practices that support change and progress e.g. acknowledging and rewarding employees who make significant contribution to the company. A second section measures the extent to which different types of resources are available within the SME for the adoption of a new program. A third section measures the commitment of the person completing the questionnaire (owner or senior manager) to support the implementation of a new program once a decision to implement has been made. The fourth section asks the respondent to evaluate employees' willingness and ability to support a new program. The final section measures the ability of the SME to provide or facilitate training needed for a new program.

Part E. Influences and Expectations. The first section contains items to measure how influential different types of organisation (e.g. other SMEs, government agencies, key customers) are in influencing the respondent's decision to adopt a new program. A single item measures the degree of optimism that the respondent has that a new program would be successful.

The parts of the questionnaire had space for comments and there was an open-ended question at the end of the instrument.

A considerable amount of effort was put into refining and testing the questionnaire. Only limited piloting was possible working from Australia and at the time of writing further piloting and refinement is being undertaken in Indonesia.

SME managers attend monthly meetings organised by the Indonesian government SME support groups. It is planned to administer the bulk of the questionnaires during these meetings. This method should ensure a high response rate and the opportunity to communicate with attendees. This approach will be supplemented by a mail out. A sample size of approximately 200 completed questionnaires should be possible.

During the field trip interviews with a number of SME managers are planned in order to explore issues in more depth than is possible with the questionnaire survey. The interviews will voice recorded for later analysis.

Support for SMEs

It was considered essential to research the support available to SMEs from key stakeholders within Indonesia. Of prime importance are the government agencies that support SMEs. Interview will be held with some of their representatives to gauge their support for the lean six sigma approach and the resources they have to assist SMEs. It is likely that some large customers of SMEs may be able to provide support for a new initiative and an attempt will be made to assess the type and extent of support from this source.

Survey of Expert Opinion

Once a preliminary lean six sigma implementation strategy and framework evolves from the fieldwork it is planned to obtain feedback on its suitability for Indonesian SMEs from experts and key stakeholders. Feedback from government support groups and SME owners and managers is particularly important. The views of interested academics, and those who are involved in training and consulting to SMEs in Indonesia would also be sought. The feasibility of using an on-line survey instrument to facilitate some of the feedback is being investigated.

DISCUSSION AND CONCLUSIONS

This research has to potential to make a significant contribution to improving the competitiveness of Indonesian SMEs in the manufacturing sector. The development of the research methodology has been and is continuing to be challenging. Managers of SMEs are often “time poor” and usually get involved in a much wider range of activities than their counterparts in larger organisations, which employ more specialists. Although we believe that the planned data collection activities are soundly based, changes may have to be made in light of the situation on the ground in Indonesia. For example, fieldwork already carried out in Indonesia revealed that owners and managers of SMEs have a preference for discussing their businesses rather than completing questionnaires. If correct, this suggests that carrying out a greater number of

interviews with SME owners and managers than original planned would be beneficial. It is clear that support from relevant government agencies is really important in carrying out this type of research, especially by providing contacts and facilitating data collection.

There is a prima facie case that six sigma may be more suitable for Indonesian SME manufacturers than TQM, as it is more structured and also that lean six sigma may have some advantages over six sigma in resource utilization and facilitating agility. However, there is little solid research to test these hypotheses and it is hoped that this research will contribute understanding in this area.

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