University of Technology, Sydney

Development of a Lean Six Sigma Implementation Framework for Small and Medium Sized Indonesian Manufacturing Enterprises

By

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Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated and referenced in the thesis.

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I dedicate this thesis to my beloved parents:

Fatmah Ashiblie and Khalid Amar

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Amar, K. & Davis, D. (2007), "Evaluating Six Sigma in the Indonesian SME Context", published in the Proceedings of the 5th ANZAM and 1st Asian Pacific Operations Management Symposium, 6-7 June, Melbourne.

Amar, K. & Davis, D. (2008), "A Review of Six Sigma Implementation Frameworks and Related Literature", published in the Proceedings of the IAENG: International Conference on Industrial Engineering, 19-21 March, Hong Kong.

Amar, K. & Davis, D. (2008), "Are Indonesian SMEs Prepared for Lean Six Sigma?", published in the Proceedings of the 13th International Conference on ISO 9000 and TQM, 24-26 March, Kuala Lumpur.

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Glossary

ABS	Australian Bureau of Statistics
ASEAN	Association of South East Asian Nations
BDS	Business Development Services
BPR	Business Process Re-engineering
BPS	Central Bureau of Statistics
BSN	National Standardization Agency of Indonesia
CSF	Critical Success Factors
CTQ	Critical to Quality
DMAIC	Define-Measure-Analyse-Improve-Control
DOE	Design of Experiments
FAZAT	Research and Training Center for Labour and Technology Steyr
FFF	Austrian Industrial Research Promotion Fund
Five S (5S)	Seiri, Seiton, Seiso, Seiketsu, Shitsuke
FMEA	Failure Mode and Effect Analysis
GB	Green Belt
IDB	Islamic Development Bank
IFC	International Finance Corporation
IPO	Input-Process-Output
ISO 9000	International Standards Organisation
IT	Information Technology
JICA	Japan International Cooperation Agency
JIT	Just In Time
LIK-UPT	Centre for Small Industry
LSS	Lean Six Sigma
MBB	Master Black Belt
MBNQA	Malcolm Baldrige National Quality Award
MITI	Ministry of Industry and Trade of Japan
MSA	Measurement System Evaluation

NIES	National Industry Extension Service
P3ED	Regional Export Training and Promotion Center
PPM	Part per Million
PUPUK	Association for the Advancement of Small Business
QCC	Quality Control Circle
QM	Quality Management
ROA	Return on Assets
ROE	Return on Equity
SCM	Supply Chain Management
SIPOC	Supplier-Inputs-Process-Outputs-Customers
SME	Small and Medium Enterprise
SMED	Single Minute Exchange of Dies
SMIs	Small and Medium Industries
SENADA	Indonesia Competitiveness Program
SNI	Standard National of Indonesia
SPC	Statistical Process Control
SQC	Statistical Quality Control
STM	Vocational High School
STEP	Shell Technology Enterprise Programme
SWP	Software Park Hagenberg
TPM	Total Productive Maintenance
TQM	Total Quality Management
UIN	Universitas Islam Negeri
UTS	University of Technology, Sydney
VIF	Variance Inflation Factors

Abstract

The main objective of this research was to develop an implementation framework for the introduction of the Lean Six Sigma improvement approach into small and medium enterprises (SMEs) in Indonesia. It was expected that an appropriate diffusion of Lean Six Sigma would assist the SMEs to improve their competitiveness.

The research involved a close examination of Indonesian SMEs and their support networks in order to evaluate the suitability of the Lean Six Sigma approach and to inform the design of an effective implementation framework.

Six Sigma is a popular business improvement approach. In Lean Six Sigma ideas from Lean Production (Womack, Jones and Ross 1984) have been incorporated with Six Sigma. There is some evidence that Lean Six Sigma has advantages over Six Sigma and provides a strengthened business improvement approach.

Rogers' diffusion of innovations theory is used as the theoretical framework for the research (Rogers 2003). The theory is particularly useful in guiding the diffusion of an innovation developed in one cultural setting into a different cultural setting.

The literature review covers the history and development of Six Sigma and Lean Six Sigma. Also, related approaches such as TQM and ISO 9000 are reviewed. A number of existing Six Sigma implementation frameworks were found in the literature and reviewed.

A review of Rogers' diffusion of innovations theory was undertaken. Also research identifying critical success factors (CSFs) associated with the implementation of improvement approaches such as TQM was undertaken. Rogers' theory and the CSFs literature were important inputs in the research methodology.

Literature on SMEs in general and Indonesian SMEs in particular was reviewed. The contribution of SMEs to the Indonesian economy, the various forms of support available to them and the stage of development of improvement programs was reviewed.

The majority of data were collected through the development and administration of a questionnaire survey completed by SME owners/managers. A sample of 148 usable questionnaires was obtained. Interviews were also conducted with SME owners/managers and other stakeholders e.g., government, Business Development Services (BDS), universities, customers and suppliers.

The results showed that SMEs had a relatively low usage of improvement tools and Information Technology (IT). This low technical base presents a challenge to the successful implementation of Lean Six Sigma. However, owners/managers were relatively optimistic about the success of such an innovation and reported encouraging levels of commitment both by themselves and their employees for such change.

The results established that SME owners/managers were most influenced by their key customers and other SMEs when making decisions about adopting an innovation. The results indicated a preference for face-to-face rather than virtual (online) training. Areas for improvement in the support provided to SMEs from government were reported.

The main outcome of this research is an implementation framework of Lean Six Sigma for SMEs. The frameworks' elements are owner/manager commitment and involvement, training, employee involvement, culture change and external support. The framework is designed specifically for the Indonesian SMEs context and includes the element 'external support' which is not present in any of the existing frameworks that were reviewed.

Chapter 1
Introduction

1.1 Background to the Research

The main objective of this research was to develop an implementation framework for the introduction of the Lean Six Sigma improvement approach into small and medium enterprises (SMEs) in Indonesia. It was expected that an appropriate diffusion of Lean Six Sigma would assist the SMEs to improve their competitiveness.

The research involved a close examination of Indonesian SMEs and their support networks in order to evaluate the suitability of the Lean Six Sigma approach and to inform the design of an effective implementation framework.

According to Deming (1986), superior quality products and services are important for companies to increase sales and ensure their survival. However, in the era of globalisation, customers' expectations of quality have risen. Customers also consider other intangible factors that support products or services such as the image of the company, speed of product availability and after sales service (Feigenbaum and Feigenbaum 2005). This change in customer perceptions of quality should encourage companies to respond quickly to customers' concerns in order to compete with competitors. However, many organisations today are still not ready to enter the global market because they have internal problems that result in poor product or service performance such as quality, price or delivery time. This situation is faced by industries in Indonesia, and particularly by SMEs in both the manufacturing and service sectors which are struggling to achieve better performance of their products and services.

Based on data provided by the Indonesian Central Bureau of Statistics (BPS), SMEs make up approximately 99% of the total number of enterprises in Indonesia and employ a large proportion of the total work force (BPS 2003a, 2003b). Nevertheless, SMEs' export contribution is small compared to other Association of South East Asian Nations (ASEAN) countries such as Singapore and Malaysia (UNTDB 2003). Furthermore, in some industry sectors, for instance the automotive component industry, local Indonesian SMEs have to compete fiercely in the local market with other countries' products such as those imported from China (Sucofindo 2006). In the context of Indonesia's large and continuously growing automotive market, this can be regarded as a serious issue. On the other hand, a 2001 survey conducted by Yayasan Dana Bhakti Astra, an agency owned by a large automotive organisation that assists SMEs in Indonesia, indicated that there were many opportunities to be a vendor or subcontractor to large organisations in Indonesia, particularly in the automotive, machine and electrical sectors (YDBA 2004). For instance, approximately 99% of motorcycle components are produced by local companies, and around fifty percent of them are expected to be supplied by local SMEs (Tjahayana 2003). In spite of this significant opportunity, SMEs are not able to take full advantage of these opportunities because large organisations require a supply of better components at cheaper prices and on time delivery. Given this situation, the Government of Indonesia should be concerned with how to assist SMEs to perform better, and in particular to be able to compete with foreign products. With Government support, it is possible for Indonesian SMEs to contribute to the economy by increasing their export performance. However, several reports published by the Indonesian Government and foreign agencies highlighted that SMEs in Indonesia are still producing low quality goods and services (Urata 2000).

Despite the poor performance of SMEs, some programs have been run by the Indonesian Government and foreign agencies to strengthen SMEs in Indonesia. One example is the Japan/ASEAN Total Quality Management (TQM) Project conducted in several ASEAN countries, including Indonesia, in 1995. This project was led by the Japanese Ministry of Industry and Trade (MITI) with the main objective of introducing TQM and assisting its implementation within SMEs in ASEAN countries (Onitsuka 1999). According to the project report prepared by the National Standardisation Agency of Indonesia (BSN) for the period 1995-2000, however, 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. This is similar to TQM implementations observed in other parts of the world. For example, Harari (1993) claimed that TQM implementations in the USA and Europe led to insignificant results especially in relation to quality, productivity, competitiveness and profit. However, Eckes (2003) pointed out that failed TQM implementation in the past had occurred because of a lack of management support and involvement in this initiative.

Due to the lack of success with approaches like TQM, many organisations today seek an approach or concept that is simple to use, improves processes or products, and increases profit. A number of programs or initiatives have been introduced and adopted by organisations around the world, such as Six Sigma, Supply Chain Management (SCM), Business Process Re-engineering (BPR), and Lean Manufacturing. According to Pande and Holpp (2002, p. 2) 'Six Sigma is a smarter way to manage a business or a department. Six Sigma puts the customer first and uses facts and data to drive better solutions'. Some success stories of Six Sigma implementation have been reported by Motorola, General Electric, Allied Signal and other large organisations around the world. In Indonesia, most of the organisations that implemented Six Sigma are joint venture or foreign owned companies. The Astra Company, Guentner Indonesia Company, Alstom Company and Sheraton Hotel are amongst the Six Sigma adopters in Indonesia.

Due to increasing customer demands, some researchers and experts have noted that implementing Six Sigma as a stand alone program may not lead to significant results for organisations. From a practitioner perspective, it is believed that Six Sigma focuses on eliminating variation in processes and thus improving quality, but not necessarily improving other important aspects such as processing speed (George 2002). This suggests that Six Sigma should be adopted in combination with other concepts such as the Lean Manufacturing approach, which aims to reduce waste in areas such as inventory, processing, waiting, motion, transport and overproduction. The Lean Manufacturing approach is reported to have brought significant improvements in speed and reductions in cost, particularly in the manufacturing and other non-manufacturing processes, throughout an organisation (Arnheiter and Maleyeff 2005; George 2002). The Lean concept was first introduced by The Toyota Company and is popular today, most notably in some large organisations that have successfully integrated it with Six Sigma. The two concepts can be integrated to provide a flexible approach that can be adapted in response to changes in customer demands resulting from globalisation. Based on the positive results of Lean Six Sigma implementation in large organisations, SMEs also have the opportunity to bring these Lean and Six Sigma concepts into their organisations (Brue 2006; Burton and Sams 2005; Feigenbaum and Feigenbaum 2005).

Currently, the Indonesian Government provides financial support for SMEs to apply Lean tools, 5S: Seiri, Seiton, Seiso, Seiketsu, Shitsuke. This initiative is based on a recent study conducted by Japan International Cooperation Agency (JICA) (JICA 2004). The introduction and implementation of 5S may be a good foundation for the adoption of Lean Six Sigma by Indonesian SMEs in the future. However, bringing Lean Six Sigma to SMEs requires special attention, because SMEs have unique characteristics and limitations in a number of areas compared to large organisations. SMEs are limited in their financial resources, ability to adopt new technology, skill of employees and depth of management (Gunasekaran et al. 1996; McAdam, Reid and Gibson 2004). It is hypothesised that careful consideration of the characteristics and limitations of SMEs can help them to avoid the problems experienced in previous attempts by SMEs to adopt concepts from large organisations.

The Indonesian Government strives to strengthen SMEs in recognition of their potential to contribute significantly more to the national economy. This research project is therefore in line with the Indonesian Government's aim to improve the competitiveness of SMEs, and especially to help them provide more competitive products and better delivery performance. Specifically, this research will address the following questions:

1. To what extent are Indonesian SMEs ready to adopt innovations such as Lean Six Sigma?

2. Based on the SMEs' readiness level, what factors are important for the development of an effective framework for the introduction and diffusion of an innovation like Lean Six Sigma into Indonesian SMEs?

1.2 Research Objectives

The main objective of this research is the development of a Lean Six Sigma implementation framework for Indonesian SMEs. In order to achieve the main objective, specific secondary objectives will be addressed:

a) To measure the level of readiness of Indonesian SMEs for innovation adoption;
b) To identify internal and external factors that impact upon Lean Six Sigma implementation;
c) To develop a proposed Lean Six Sigma implementation framework for SMEs.

1.3 Scope of Research

This research will involve SMEs from the metal sector, the majority of which are located in two industrial centres, Pasuruan and Sidoarjo, in the Indonesian Province of East Java. The SMEs are categorised as such according to the criteria described by BPS which defines SMEs as organisations with 99 employees or less.

1.4 Justification of Research

The importance of this research is justified as follows:

a) SMEs are vitally important in Indonesia because they are the highest contributor to employment and can potentially contribute more to the national Gross Domestic Product (GDP) if they receive appropriate assistance to run their businesses. Indonesian SMEs are currently struggling to improve the performance of their products and services. SMEs are facing ongoing problems such as poor quality products and a resultant limited ability to compete with foreign products in both local and foreign markets. These observations are based on reports provided by Urata (2000) and the Indonesian Ministry of Cooperatives and SMEs (2004). This situation needs to be resolved because the majority of SMEs in Indonesia are suppliers to large organisations which demand a supply of products that meet their specifications at a low cost and with on time delivery.

b) TQM in both large organisations and SMEs in Indonesia has been relatively unsuccessful. Some of the reasons that were recently reported by the National Standardisation Agency of Indonesia include low quality awareness at all management and staff levels and lack of management commitment, as well as lack of training (Ritonga 2005). The two Indonesian manufacturing companies which were involved in the Japan/ASEAN TQM Project did not report significant improvements in terms of financial gain from this project. The only major achievements they reported were the standardised use of quality control techniques and the implementation of safety control measures (UNIDO and JSA 2001). A survey conducted by Amar and Zain (2002) explored TQM applications in Indonesia by looking at the daily activities, tools and techniques used, and the barriers faced during TQM implementation in large manufacturing organisations. According to the survey results, the main barriers were related to management involvement; resources such as human, machine, method, information, raw material, and funds; and attitudes toward quality, training, interdepartmental relations and culture.

c) There is a lack of research on Six Sigma and Lean Six Sigma implementation, particularly in the Indonesian manufacturing SME context. There is however some published work on the implementation of Six Sigma and Lean Six Sigma that the current research can build upon. Recent United States (US) research conducted by Chang (2002) introduced a Six Sigma framework consisting of elements based on the TQM concept and the Malcolm Baldrige National Quality Award (MBNQA) model. Other research by Furterer (2004) has focused on developing a framework or roadmap of Lean Six Sigma implementation in US local government. The current research will attempt to develop a similar framework that will integrate Lean and Six Sigma concepts specifically for SMEs in the Indonesian context.

d) There are potential applications for the output of this research. It is expected that this research will result in guidance for SMEs in Indonesia in implementing Lean Six Sigma. The research output will be a framework that addresses aspects such as simplicity of use and suitability of Lean Six Sigma for the Indonesian SMEs context.

Moreover, the proposed framework will help the Indonesian Government to assist SMEs to improve their organisational performance through the use of Lean Six Sigma.

1.5 Research Resources

This research is dependent on resources both within the university and outside, as listed below:

- Human resources: Principal supervisor, co-supervisors (internal and external), academic staff and non-academic staff of the University of Technology Sydney (UTS), people/staff from the Ministry of Cooperatives and SMEs, Ministry of Industry and Trade, Local Government and non-Government agencies
- Literature: UTS library, Indonesian Government reports, Statistical reports from Central Bureau of Statistics, JICA reports, web articles, and so on.
- Funding: Universitas Islam Negeri (UIN) Sunan Kalijaga Jogjakarta, Indonesia and the IDB (Islamic Development Bank)
- Other: Respondents to the research surveys

1.6 Structure of Thesis

This thesis is structured into seven chapters as outlined in Figure 1.1.

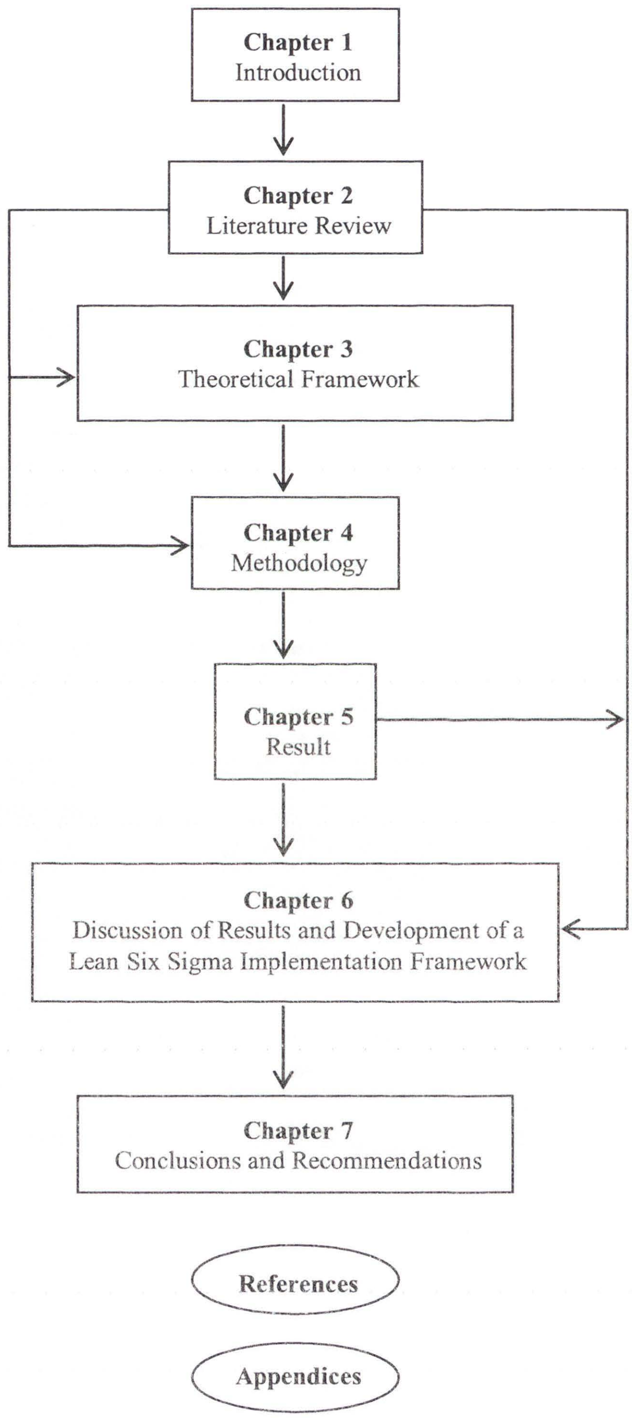


Figure 1.1 Structure of thesis

Chapter 2 reviews relevant literature. Three areas of literature are particularly noteworthy: SMEs, Lean and Six Sigma concepts, and diffusion of innovations theory. Discussion on SMEs is focused on the definition of an SME, the differences between SMEs and large organisations, the current condition of SMEs in Indonesia and support from Government and non-Government agencies. Following this, evolution of the quality concept and quality improvement journey in Indonesia is discussed. The definition of Six Sigma, its history and the similarities between Six Sigma and other improvement approaches are also part of the discussion in this chapter. A definition of Lean Six Sigma, the tools and techniques of Lean Six Sigma and the Lean Six Sigma structure are then explained. The other important focus of this chapter is exploring previous research on Six Sigma and Lean Six Sigma. The diffusion of innovations theory is explained and is used as the theoretical basis of this research. Lastly, this chapter analyses previous research into both Six Sigma and Lean Six Sigma frameworks using critical success factors (CSF) and diffusion of innovations theory.

Chapter 3 presents the theoretical framework, defines the issues and assists in the development of variables. The variables used in the hypothesis are explained in this chapter. The theoretical framework of this research draws on Rogers' theory of diffusion of innovations.

Chapter 4 describes the methodology used in this research. A questionnaire survey was developed to measure the readiness of Indonesian SMEs to adopt an innovation like Lean Six Sigma. Additional data was collected from SME owners/managers and other groups relevant to the research, for example, Government agencies, foreign agencies, and independent consultants through face-to-face interviews with the researcher. Survey methodologies such as questionnaire design, pre-testing, ethics, sample selection, sample recruitment and questionnaire administration are among aspects discussed in Chapter 4. The response rate, data coding procedure and methods of analysing quantitative data are also discussed.

Chapter 5 presents the results of the survey and interviews. The quantitative results come from the survey administered in SMEs and are presented mostly in the form of descriptive statistics; regression analysis is also used on this data. Qualitative results are presented in the form of a summary of interviews. The combination of these two kinds of results will help to develop a suitable framework for SMEs in Indonesia.

Chapter 6 presents discussion of the results and the development of a Lean Six Sigma implementation framework. The discussion of the Lean Six Sigma implementation framework is centred on key elements of the framework and the operational guidelines for implementing the framework.

Chapter 7 concludes by summarising the main findings of the research and explaining the contribution to the field. The limitations of the research and recommendations for further research are outlined.

Chapter 2
Literature Review

2.1 Introduction

The literature review that informs this research will focus on some pertinent aspects of SMEs, Lean and Six Sigma concepts and the diffusion of innovations theory. This literature is extremely important in underpinning the current research, which aims to develop a Lean Six Sigma implementation framework for Indonesian SMEs. In framework development, it is useful to consider the characteristics of SMEs in order for innovations such as Lean Six Sigma to be implemented successfully. In addition, diffusion of innovations theory expounded by Rogers (2003) provides a good foundation for transferring innovation into a different culture.

Literature on SMEs with an emphasis on the Indonesian context is presented first. This is followed by a review of improvement methods based on the quality management approach in which Six Sigma has its origins. This leads to a review of Six Sigma and Lean Six Sigma which includes a number of recently published implementation frameworks. An explanation of Rogers' diffusion of innovations theory that is used as the theoretical framework for this research follows. Literature on critical success factors (CSFs), mainly from quality management research is then presented. This literature on CSFs contributed to the design of the survey instruments.

Finally, a summary of the literature review is presented.

2.2 Small and Medium Enterprises (SMEs)

Small and Medium Enterprises (SMEs) have been known to contribute beneficially to the economies of most countries, including Indonesia. Berry, Rodriguez and Sandee (2001, p. 363) point to several advantages of SMEs such as 'their potential to grow into larger, more productive units; their ability to invest and adopt new technologies; and their ability to adapt to new economic circumstances'. This section now discusses several features of SMEs, such as how they are defined, the differences between SMEs and large organisations, the current situation of SMEs in Indonesia and the support networks available to them.

2.2.1 Definition of SMEs

There is diversity in the definition and categorisation of SMEs among countries worldwide. In Australia, the categorisation of industries is based on criteria used by the Australian Bureau of Statistics (ABS), based on the number of employees. Organisations with less than 20 employees are categorised as 'small', while those with less than 200 employees are categorised as 'medium' (ABS 2002). Malaysia uses annual sales turnover of less than RM 10 million and not more than 50 employees to categorise businesses as small in size. To qualify as being of medium size, the criteria are an annual sales turnover between RM 10 million and RM 25 million, and a total of full-time employees between 51 and 150 (Bank Negara Malaysia 2005).

In Indonesia, there are definitions of SME developed by the Indonesian Central Bureau of Statistics (BPS) and the Central Bank of Indonesia. The SME definitions in Indonesia are outlined in Table 2.1.

Table 2.1 Definitions of SMEs in Indonesia

Institution/Law	Size of businesses	Criteria
Law No. 9/1995 for small businesses	Small business	Asset ≤ IDR 200 million excluding land and building Annual sales ≤ IDR 1 billion Owned by Indonesian citizen Independent, not a subsidiary of another company or a branch of a business, owned, controlled or affiliated directly or indirectly to a medium or large enterprise
Law No. 10/1999 for medium business	Medium business	Asset IDR 200 million - IDR 10 billion
Central Bureau of Statistics (BPS)	Small business	Number of employees below 20
	Medium business	20-99 employees
Bank Indonesia (Central Bank)	Micro business (SK Dir BI No.31/24/KEP/DIR 5 May 1998)	Very small scale of business usually run by family members Local resources and simple technology
	Small business (Law No. 9/1995)	Asset ≤ IDR 200 million excluding land and building Annual sales ≤ IDR 1 billion
	Medium business (SK Dir BI No.30/45/DIR/UK 5 January 1997)	Asset ≤ IDR 5 billion for industrial sector Asset ≤ IDR 600 million excluding land and building, and excluding non-industrial sector manufacturing Annual sales ≤ IDR 3 billion

Source: adapted from Ministry of Industry and Trade (2002) and Rudjito (2003)

It can be seen that several institutions in Indonesia use different criteria to define SMEs. However, the most common criteria are based on the number of employees as defined by the BPS. As the table shows, small organisations are those with less than 20 employees and medium are those with 20-99 employees. This latter is the definition of Indonesian SMEs that will be used in this research.

2.2.2 Differences between SMEs and Large Organisations

The characteristics of large and small organisations have been explained in numerous literatures. For instance, Drilhon and Estime (1993) stated that the role of the owner or manager can determine an SME's competitiveness. Compared with large organisations, the role of the owner or manager of SMEs is more crucial, for example, in their decision to adopt innovation and make a strong commitment to it.

A comparison between characteristics of SMEs and large organisations that focused on their ability to adopt TQM was detailed in research conducted by Ghobadian and Gallear (1997). They compared these two sectors under the following six subheadings: organisational structure, procedures, behaviour, processes, people and contact, as shown in Table 2.2.

Table 2.2 Comparison between large organisations and SMEs

Large organisations	Small and medium-sized organisations
Structure	
Hierarchical with several layers of management	Flat with very few layers of management
Clear and extensive functional division of activities → high degree of specialisation	Division of activities limited and unclear → low degree of specialisation
Rigid structure and information flows	Flexible structure and information flows
Top management a long distance away from the point of delivery	Top management close to the point of delivery
Top management's visibility limited	Top management highly visible
Multi-sited and possibly multinational	Single-sited
Many interest groups	Very few interest groups
Normally slow response to environmental changes	Normally rapid response to environmental changes
Low incidence of innovativeness	High incidence of innovativeness
Cultural diversity	Unified culture
Procedures	
Activities and operations governed by formal rules and procedures → high degree of standardisation and formalisation	Activities and operations not governed by formal rules and procedures → low degree of standardisation and formalisation
System-dominated	People-dominated

Rigid and non-adaptable *(sic)* processes Incidence of fact-based decision making more prevalent Fragmented decision makers	Flexible and adaptable processes Incidence of 'gut feeling' decisions more prevalent Few decision makers
Behavior	
Mostly bureaucratic	Mostly organic
Strong departmental/functional mind-set	Absence of departmental/functional mind-set → corporate mind-set
Cultural inertia	Fluid culture
Meritocratic	Patronage
Rigid corporate culture dominating operations and behaviors	Operations and behavior of employees influenced by owners'/managers' ethos and outlook
Processes	
Extended decision-making chain	Short decision-making chain
Complex planning and control system	Simple planning and control system
Strategic process generally deliberate and formal	Strategic process incremental and heuristic
Formal evaluation, control and reporting procedures	Informal evaluation, control and reporting procedures
Control-oriented	Result-oriented
People	
Personal authority mainly low	Personal authority mainly high
Individual creativity stifled	Individual creativity encouraged
Dominated by professionals and technocrats	Dominated by pioneers and entrepreneurs
Range of management styles: directive, participative, paternal, etc.	Range of management styles: directive, paternal
Individuals normally cannot see the results of their endeavors	Individuals normally can see the results of their endeavors
Ample human capital, financial resources and know-how	Modest human capital, financial resources and know-how
Training and staff development is more likely to be planned and large scale	Training and staff development is more likely to be *ad hoc* and small scale
Specified training budget	No specified training budget
High incidence of unionisation	Low incidence of unionisation
High degree of resistance to change	Negligible resistance to change
Potentially many internal change catalysts	Very few internal change catalysts
Contact	
Wide span of activities	Span of activities narrow
Extensive external contacts	Limited external contacts
Greater scope for an extended customer base	Normally dependent on a small customer base
Large customer base	Limited customer base

Source: Ghobadian and Gallear (1997, p. 128)

From Table 2.2, we can see that some characteristics of SMEs could promote or impede the success of innovation adoption. Several characteristics of SMEs are advantageous for promoting successful adoption of innovation. These characteristics are:

- There are flexible structure and information flows
- There are high incidences of innovativeness
- Top management is highly visible
- There is normally rapid response to environmental changes
- They generally have a unified culture

The characteristics classified by Ghobadian and Gallear (1997) are present in Indonesian SMEs, particularly in that the owners or top management of Indonesian SMEs have the ultimate power to make an innovation successful or unsuccessful.

The characteristics of SMEs that could impede an innovation adoption are that:

- training and staff development is more likely to be *ad hoc* and small scale
- no specified training budget is usually available (or planned)

Limitations in training also emerged in Indonesia even though there is some support from Government and non-Government agencies for SMEs. Details of Government and non-Government support is described in the Section 2.2.4.

Specific concerns arise from the discussion of differences between SMEs and large organisations, particularly in their different ways of adopting innovation (Vossen 1998). Large organisations have the advantage of financial and technological resources to support adopted innovation (Rothwell and Dodgson 1994). However, the capacity of large organisations to provide resources does not absolutely assure the success of implementation of innovation. Meanwhile, SMEs are advantaged by their organisational behaviour toward the adopted innovation, for example entrepreneurial dynamism, internal flexibility and responsiveness to the changing circumstances (Rothwell and Dodgson 1994). It is believed that both sectors, SMEs and large organisations, have similar chances of successful adoption of innovation. This perspective has been supported through a study conducted by Ahire and Golhar (1996), which found that implementation of TQM in small firms was as effective as in large organisations even though small firms have limitations such as lack of expertise and resources.

2.2.3 Current Condition of SMEs in Indonesia

A number of facts indicate that the contribution of SMEs is important to a country's economy. When the economic crisis hit the South East Asian region in 1998, for instance, SMEs, including those in Indonesia, were seen to have a resilient survival capability. Besides the survival ability of SMEs, they also play an important role in employment in Indonesia. SMEs in all sectors employ up to 99.5% of the total work force in Indonesia (BPS 2003a). Moreover, the number of SMEs has been increasing year to year for example in the manufacturing sector as illustrated in Table 2.3 below.

Table 2.3 Total number of enterprises in the manufacturing sector in Indonesia

Classification	1998 (000 units)	1999 (000 units)	2000 (000 units)	2001 (000 units)	Annual growth rate (%)*
Total	2,115.03	2,539.89	2,725.38	2,886.58	11.10
Small	2,104.86	2,526.16	2,713.86	2,874.38	11.12
Medium	9.54	10.06	10.81	11.44	6.24
Large	0.63	0.67	0.71	0.76	6.45

* compared year to year

Source: Ministry of Industry and Trade Report 2002 (cited in Tambunan 2005, p. 28)

In his study, Hayashi (2003) claimed that SMEs' contribution to the national economy is not as significant in Indonesia as in other countries. This is despite the large number of SMEs in all sectors which make up about 99.99% of the total number of industry in Indonesia as reported by the Ministry of Cooperatives and SMEs (cited in Tambunan 2005, p. 27).

Table 2.4 presented SMEs' contribution to the value of total exports in each ASEAN country. It can be seen that Indonesian SMEs' contribution to exports was lower than that of Singapore and Malaysia but slightly higher than Thailand.

Table 2.4 Comparison of export share of ASEAN SMEs

Country	Exports/GDP	SMEs' country exports (%)
Indonesia	23	10.6
Malaysia	72	15.0
Philippines	n.a	n.a
Singapore	138	16.0
Thailand	29	10.0
Vietnam	7	20.0

Source: UN Conference on Trade and Development (UNTDB 2005, p. 20)

A report prepared by Urata (2000) highlighted several issues that may cause the low contribution by SMEs to the Indonesian economy. Some of the issues relate to lack of knowledge of production technologies and quality control.

There is scant information from research regarding SMEs' capabilities and readiness to adopt innovation such as new technology in Indonesia. Consequently, the current research aims to measure the level of readiness of SMEs to adopt innovation such as Lean Six Sigma. Obtaining a better understanding of the strengths and weaknesses of SMEs will help in developing an appropriate Lean Six Sigma implementation framework.

2.2.4 Government and Non-Government Support for SME in Indonesia

Support from Government and non-Government agencies is important for SMEs, particularly for improving their competitiveness. The support provided by Government is normally in the form of training and financial loans, while support from non-Government bodies, such as universities, large organisations and foreign agencies, normally takes the form of consultation, training and technical assistance. Based on several reports provided by Government and non-Government agencies, there have been - and still are in some cases - programs aimed at strengthening SMEs in Indonesia. The programs were centred on technology transformation, business development and marketing. Hayashi

(2003) has summarised the majority of the support provided by Government agencies, which can be seen in Table 2.5.

Table 2.5 Summary of policies and programs for the development of SMEs in Indonesia

Category	Year	Details of support
Technology	1969	MIDC (Metal Industry Development Centre) established.
	1974	BIPIK (Small Industries Development) Program established.
	1979	Under BIPIK program, LIK and PIK (Small Industrial estates) established and technical assistance extended to SMEs by UPT (Technical Service Units) and TPL (Extension Field Officers).
	1994	PIKM (Small-scale Enterprises Development Project) established to continuing BIPIK program.
Marketing	1979	Reservation Scheme introduced to protect markets for SMEs.
	1999	Anti-Monopoly Law enacted.
Financial	1973	KIK (Credit for Small Investment) and KMKP (Credit for Working Capital) introduced as government-subsidised credit programs for SMEs.
	1974	KK (Small Credit) administered by Bank Rakyat Indonesia (Indonesian People's Bank) launched and in 1984 changed to Kredit Umum Pedesaaan (KUPEDES) scheme (General Rural Savings Program).
	1989	SME loans from state-owned enterprises (1 to 5% benefits) introduced.
	1990	Government-subsidised credit programs for SMEs (KIK/KMKP) abolished and unsubsidised KUK (Credit for Small Businesses) scheme introduced.
	1999	The responsibility of directed credit programs transferred from Bank Indonesia (Central Bank) to PNM (State-owned Corporation for SMEs) and Bank Export Indonesia.
	2000	Major government credit programs for SMEs, including KUK, abolished.
	2001*	Low interest loan for SMEs from Ministry of Industry and Trade at the province level with maximum amount of IDR 50 million was launched.
General	1978	Directorate General for Small-scale Industry established in Ministry of Industry.
	1984	Foster Parent (*Bapak Angkat*) Program introduced to support SMEs.
	1991	SENTRAs (Group of Small-scale Industry) in industrial clusters were organised as KOPINKRA (Small-scale Handicraft Cooperatives).
	1993	The Ministry of Cooperatives started handling small business development.
	1995	Basic Law for promoting Small-scale Enterprises enacted.
	1997	Foster Parent *(Bapak Angkat)* Program changed to Partnership Program *(Kemitraan)*.
	1998	Ministry of Cooperatives and Small Business added medium-sized businesses to its responsibilities.
	1998	SME promotion emphasised in People's Economy as a national slogan.
	2003*	Support from Ministry of Industry and Trade in the province level to

		guide SME in certification on SNI (National Standard of Indonesia) and ISO.

* This information was obtained by the researcher through interviews with staff of Ministry of Industry and Trade at the Province of East Java

Source: adapted from Hayashi (2003, p. 14)

Despite the various assistance programs provided by the Indonesian Government, Tambunan (2006) in his research on technology transfer and diffusion in Indonesian SMEs highlighted inappropriate support from Government. He claimed that the support was inappropriate in several aspects including inadequate training being provided to SMEs, funding limitations being placed on the support of the operation of the technical service unit (UPT) and a lack of qualified trainers. These issues were also faced by United Kingdom (UK) SMEs, as reported in a study conducted by Miros and Dale (1996). Some of the UK SMEs in the industrial centre, the researchers claimed, were not helped in grant provision for external training.

As discussed in Section 2.2.2, SMEs are quite different from large organisations in some aspects, such as the limitation of their resources and funds that can lead to difficulty adopting innovation without support from Government. Given these limitations of SMEs', the Indonesian Government should address these weaknesses by providing appropriate and suitable support for SMEs.

Support from large organisations that have supplier relationships with SMEs is important for improving SMEs' performance. Existing support should be adaptable and include training, and assisting in new programs or technology. Figure 2.1 shows an example of a small organisation in Pasuruan, Province of East Java, that implemented quality practices. The organisation has been supported by its major customer, which is a large Japanese company operating in Indonesia.

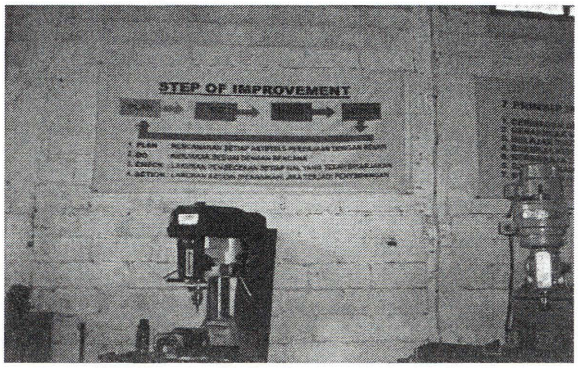


Figure 2.1 Small organisation assisted by large organisation in quality practice

Source: taken by researcher during field study in Indonesia (12 May 2007)

Several studies have been concerned with the support provided by large organisations to their suppliers, particularly SMEs. A study conducted by Stamm and Golhar (1991) shows that large organisations in the US were supporting SMEs to adopt Just in Time (JIT) program. The support mainly focused on sharing expertise and technical know-how in JIT, and facilitating the interchange of knowledge through plant tours and visits. Another study conducted in the US by Forker and Stannack (2000) highlighted the need for supplier development such as technical assistance and educational support to suppliers with the aim of increasing quality performance. The need for supplier development was also stated in a supplier quality management study in Southern China conducted by Lo, Sculli and Yeung (2006). The study confirmed that supplier development, such as technical assistance and the provision of education to suppliers, significantly influenced organisational quality performance. Meanwhile, Calabrese (2000) highlighted the support by car manufacturers for small and medium suppliers in the Italian car industry. Here, the direct support from large organisations for SMEs constituted training at the buyer's location, visits from technicians, basing personnel temporarily at the supplier's premises to improve the process, and technical and financial support for new investments.

The literature suggests that support from large organisations to their suppliers, particularly SMEs, is really helpful in improving the performance of SMEs. Furthermore, the literature suggests that large organisations can be a good source of support for SMEs when they adopt innovation.

2.2.5 Other Countries' Experience in Innovation Support for SMEs

An important source of information on development of SMEs is the experience of other countries, particularly those that are similar to Indonesia. In Korea for example, SMEs also depend on the support from Government and non-Government agencies, particularly to support them in innovation adoption. This is because SMEs in Korea have similar limitation to SMEs in other developing countries such as Indonesia.

There are three aspects discussed in this section: the main support provider in Korea, the extent of support provided for Korean SMEs and the model of innovation support for Korean SMEs.

The innovation support from Government and non-Government agencies in Korea is shown in Figure 2.2. This support was divided into three stages, i.e., general information, technological advice and joint research and development projects (Hwang and Ward 2001). The non-Government agencies involved were universities and public research institutes. In Korea, the non-Government agencies focus on technical assistance, training programs, information services and research and development collaborative projects.

According to Hwang and Ward (2001), the technical assistance that has been given to 44.1% of 8513 SMEs was provided by the state and public agencies. About 10.7% of 8513 SMEs received assistance from not-for-profit agencies. Meanwhile, 45.2% of 8513 SMEs received assistance from private agencies such as the other consulting firms and companies which have a relationship with SMEs such as parent, supplier and buyers. It is interesting to note that the greatest support for SMEs in Korea was from private agencies.

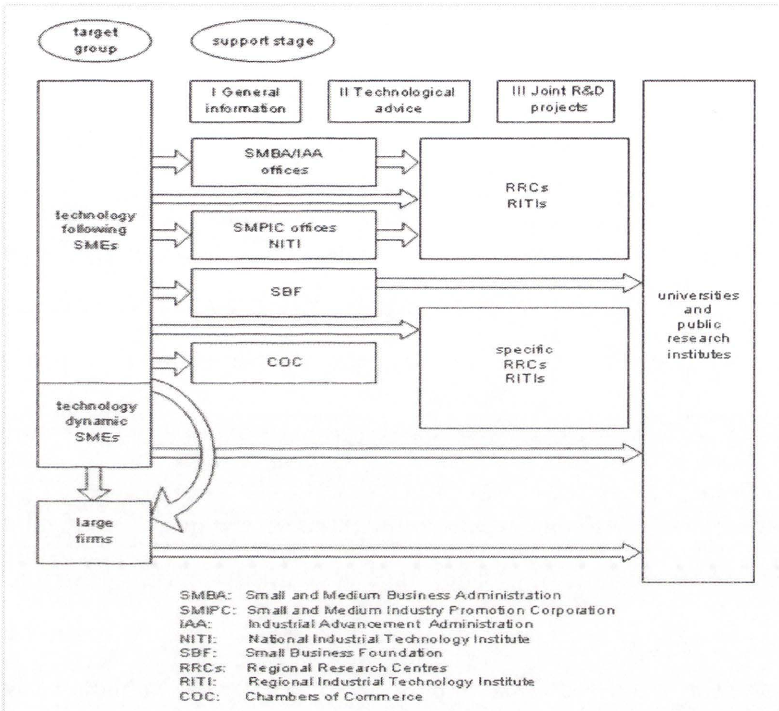


Figure 2.2 Innovation support system in Korea

Source: adopted from Hwang and Ward (2001, p. 30)

Appropriate support for SMEs is believed by the researcher to have contributed significantly to the success of Korean products in the global market.

The following section describes some western examples of support programs for SMEs aimed at encouraging innovation.

Kaufmann and Todtling (2002), describe support offered to SMEs by the Austrian Government. Support is in the form of the establishment of regional technology centres as well as direct support for innovation projects. There are six technology centers in Upper Austria, of these Software Park Hagenberg (SWP) and the Research and Training Center for Labour and Technology Steyr (FAZAT) are research-oriented. The SWP is a technology and research center for software development, industrial mathematics and involves a cooperative effort beween industry, university departments and technical colleges.

The other four technology centres mainly function as incubators for new ideas. These centres are: Incubation and Technology Center Wels, Technology Center Linz, Technology Center Innviertel in Braunau and Technology Center Salzkammergut in Lenzing. With regard to support provision, these technology centers focus on providing facilities for small firms in the software development, data processing and consulting services sectors.

Kaufmann and Todtling (2002) commented on the direct financial innovation support for SMEs in Upper Austria. The fund is named as the *Austrian Industrial Research Promotion Fund (FFF)* which is controlled by the Austrian Ministry for Economic Affairs. The main focus of FFF is to support firms in their early phase of innovation process, for example in research and prototype development. The actual support activities targeted to be funded are high technology, very risky R&D projects that represent more than incremental innovations. The FFF uses three types of fund support which are non-repayable grants, low interest loans and guarantees.

Smallbone and Welter (2001) have investigated the support needs of SMEs. In particular, through an empirical survey they highlighted the supports need of SMEs in Central and Eastern European countries. They suggested that for countries at an early stage of development, such as Belarus and Ukraine, the Government should reform the banking and tax system to provide financial assistance. They also assert that in some countries in the region corruption is seriously impeding entreprenaureship and that Governments need to address this issue. They also point to the benefits of direct support for SMEs to strengthen their potential by developing partnerships with international donors. They suggest that in contries such as Poland, where market reform is more advanced, priorities should be bringing relevant legislation and regulations in line with EU standards and encouraging the banks to facilitate SMEs through their services. Generally, Smallbone and Welter (2001) assert that Government support should focus in upgrading SMEs' competitive advantages.

In the UK, however, some support for SMEs comes from sources other than government. The Shell Technology Enterprise Programme (STEP) which started in 1986 is a good example (Westhead and Storey 1998). This program was initiated by Shell U.K. Limited and Durham University Business School. The program aimed to influence owners of SMEs' in the UK to become more aware of the benefits of employing graduates.

Kirby and Mullen (1990) listed several opportunities for STEP employers as follows:

- gain valuable technical and commercial assitance for their projects
- explore the opportunities for graduate recruitment
- extend the owner-managers' network of personal contacts by linking the business with an enterprise support agency and a higher education institute
- identify the scope for introducing new skills (such as computing skills) required to enhance the competitive position of the business
- contribute to the development and training of a future labour resource for the business

Further, Westhead and Storey (1998) assessed the contribution of STEP through a survey research project. The key findings of their survey were:

- SME owners were generally satisfied with the program. The most frequently cited areas of the business impacted of the programme were in areas related to information technology, this led to improved decision making in areas like marketing.
- There was increasing monetary contribution to SMEs through programme.
- Helped identified skill shortage in businesses e.g. computer system expertise.
- Contributed to the advancement of technological application in their businesses e.g. use of computer in design, computer-aided production.
- Encouraged host businesses (SMEs) to recruit graduates.

An Australian which had some success in enableing SMEs to adopt new ideas was the National Industry Extension Service (NIES) which was jointly administered by Federal and State Governments (Dwyer 1987). This service was initiated in July 1986 which focused strengthened Australian SMEs. The aims were providing advice for SMEs for the latest information on management, business planning, manufacturing technology, product innovation strategies, financial sources and so on.

These international examples illustrate that there are some commonalities related to SME support such as arranging appropriate financial incentives to encourage innovation and development. However, it is evident that specific contextual considerations are often of imporatance, such as the stage of development of SMEs in an economy or the impact of factors like corruption on the growth of innovation.

2.3 Quality Concepts

It is necessary to include a brief review of quality and approaches to business improvement based on quality principles for two reasons. Firstly, approaches to business improvement such as TQM have been widely used and reported in the academic literature. This literature provides a valuable source of information that can be applied to the implementation of Six Sigma. Secondly, the Six Sigma approach has many similarities to other approaches to business improvement that are based on quality management principles.

Quality can be defined from many perspectives and hence there has no universally agreed definitions of it. Deming, Juran and Garvin are some of the quality gurus who have devised their own definitions of quality. Juran has stated that quality has two meanings: firstly, 'quality consists of those product features which meet the needs of customers and thereby provide product satisfaction' and secondly, quality is 'freedom from deficiencies' (Juran and Gryna 1988, p. 2.2).

Garvin (1988), categorised definitions of quality based on five perspectives: transcendent, product-based, user-based, manufacturing-based and value-based. These definitions were summarised from other experts on quality. The transcendent definition associates quality with innate excellence, recognisable only through experience. The product-based definition views quality as a precise and measurable variable. The user-based approach views quality from the perspective of customer interest, which is variable and tries to focus on satisfying the customer. The manufacturing-based definition views quality as conformance to specifications, while the value-based view defines quality in terms of cost of production and price.

Despite these varied definitions of quality, the important issue to address in quality is to satisfy the customer by providing a quality product. Therefore, based on this need, the organisation should implement initiatives or programs that have the objective to improve quality. In Deming's chain reaction (Deming 1986), we can see clearly the need for organisations to improve quality as presented in Figure 2.3.

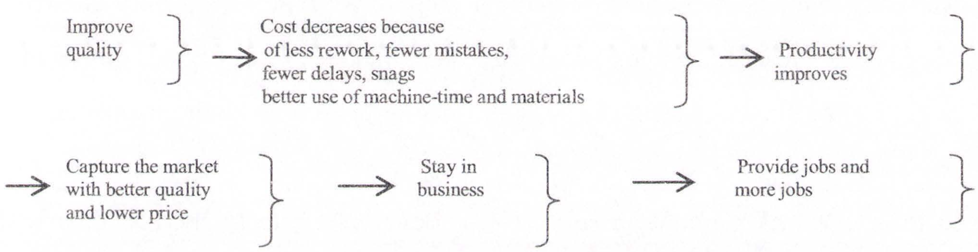


Figure 2.3 Deming's chain reaction

Source: Deming (1986, p. 3)

From Figure 2.3 we can see that by improving quality, organisations can stay in business. However, increasing and complex customer demands have resulted in a number of initiatives or programs arising. These initiatives have quite similar foundations, and these will be described briefly in the next sub-section.

2.3.1 Quality Concept Evolution

The quality concept has been implemented in daily life for the last hundred years having developed continuously in line with increasing customer needs. The quality concept was first implemented in western countries and diffused to the world, thereby becoming part of the culture of Japanese companies. Evans and Lindsay (2008), in their book *Managing for Quality and Performance Excellence,* reviewed a history of quality from ancient times to the performance excellence era in which TQM and Six Sigma have been implemented. The evolution is briefly described below with the research conducted in every stage, particularly with regard to SMEs.

The quality concept began with quality assurance which focused primarily on the design and quality control of products during the manufacturing stage, including measurement and inspection (Evans and Lindsay 2008). According to Dague (cited in Evans and Lindsay, 2008), quality assurance has been implemented for over a hundred years and its development can be traced from the construction of the Egyptian pyramids. Quality assurance was also developed during the age of craftsmanship. Up to this time, quality was only implemented conventionally and there were still no quality control approaches or modern techniques implemented. In other words, organisations at this stage implemented simple measurement and inspection to satisfy their customers.

In the early 1900s, quality assurance was developed effectively, particularly through the work of quality experts such as Walter Shewhart, Harold Dodge, George Edwards, Joseph Juran and Edwards Deming, who contributed to the development of useful techniques. For instance, Walter Shewhart founded Statistical Quality Control (SQC) with the famous control chart tool that is still used today. Next, Joseph Juran and Edwards Deming introduced SQC to Japanese organisations, leading to the success of Japanese organisations entering the US and world markets. The discussion that follows is focused on several stages of quality programs such as ISO 9000 certification, quality award, TQM, Six Sigma, and Lean Six Sigma.

ISO 9000

The ISO 9000 quality standards have been an important feature in the quality improvement evolution, in particular for organisations selling products in the European market. ISO 9000 certification has aimed to help organisations satisfy their customers by providing products which are consistent with standards (Basu and Wright 2003). The ISO standard including the revisions is under control of the International Organisation for Standardisation. The first version of ISO was ISO 9000 version 1987 which was based on BS 5750:1979. It provided guidelines to ISO 9000 series concepts and applications (Tricker and Sherring-Lucas 2005). Further, there were several refinements of ISO as a quality management standard, for example, ISO 9000:1994 which had series such as ISO 9001, ISO 9002, ISO 9003 and ISO 9004. To date, it has been refined to the 2000 version which is known as ISO 9001:2000 and combines three series i.e., ISO 9001, 9002 and 9003 (Tricker and Sherring-Lucas 2005).

ISO has attracted the attention of several researchers, with the majority investigating whether ISO 9000 certification increases organisational performance. A significant amount of research on ISO 9000 has been carried out in Australia, for example by Terziovski, Samson and Dow (1995, 1997); Terziovski and Samson (1999) and Terziovski, Power and Sohal (2003). Terziovski, Samson and Dow (1997) investigated whether ISO 9000 certification had a significantly positive effect on organisational performance. They also investigated whether the strength of the relationship between ISO 9000 certification and organisational performance is contingent on the presence of a strong or a weak TQM environment. Organisational performance was measured by several variables i.e. customer satisfaction, employee morale, cost of quality, delivery in full on time, defect rates, warranty costs, productivity, cash flow, employee growth, market share growth, sales growth, export growth and innovation. The findings of this study show that there were no significant differences between certified and non-certified organisations in almost all variables of organisational performance except cost of quality. Further findings show that there was no significant relationship between ISO 9000 certification and any of the variables of organisational performance when the relationship was moderated by a 'strong' TQM environment. Also, there was no relationship found between ISO 9000 certification and organisational performance when the relationship was moderated by 'weak' TQM environment.

Terziovski, Power and Sohal (2003) presented findings from a study of Australian manufacturing organisations that had been certified to the ISO 9000 standard. Two surveys were carried out. A survey of the manufacturing organisations was conducted primarily to assess their motivations for obtaining certification. A separate survey was administered to third party quality auditors which sought their perceptions of a number of ISO 9000 practices and their effectiveness in relation to aspects of business performance. Findings showed that organisations which persued certification willingly across a broad spread of objectives were more likely to report inproved organisational performance than thos organisations that did otherwise. Customer focus was the main element that contributed most to business performance. The main motivation for organisation surveyed to persue ISO 9000 certification was reported as pressure from their customers. It was also determined that the fit between the ISO 9001-2000 standard and the conformance and performance requirements of the organisation, particularly in regard to a continuous improvement strategy, was a prime determinant in selecting or rejecting the use of the standard.

Another informative study on ISO experiences in small companies, conducted by Brown, Van der Wiele and Loughton (1998), investigated ISO 9000 experiences within Australian SMEs. They investigated SMEs' reasons for seeking ISO 9000 certification, how they achieved certification, the benefits and disappointments with ISO 9000 certification, the difficulties of pursuing certification and how they solved these difficulties. The findings show that SMEs' reasons for seeking ISO 9000 were increased market share, improved organisational efficiency, desire to be considered for tenders, to improve customer service and as a foundation for implementing quality improvement approaches. To obtain ISO 9000 certification, the majority of SMEs utilised external support, for example, the use of a consultant. The use of an external consultant occured because of the limitations of SMEs, particularly in knowledge and time, even though the hiring cost for a consultant was high. Regarding the benefit of ISO certification, SMEs responded that there were several improvements from certification. The most significant improvement was in quality awareness, which was especially useful as a foundation to start a quality improvement process. Another significant benefit of ISO 9000 certification for SMEs was experienced internally and included improved awareness of problems within the organisation and improved product quality. This internal improvement was surprising to the researchers because most SMEs pursued ISO 9000 certification as a result of external pressures. Brown et al. (1998) found the difficulties faced by SMEs in pursuing ISO 9000 certification, and the way they solved these difficulties. Respondents to this study also reported several disappointments in ISO 9000 certification. The most significant disappointment for SMEs was that their customers forced them to obtain ISO 9000 certification, but would then sometimes choose non- ISO 9000 suppliers while the

SMEs had to bear the high costs of implementation. Finally, SMEs reported the three highest difficulties of ISO 9000 implementation facing by SMEs as being employee commitment, increased paperwork documentation and interpretation of standards. Additionally, the respondents suggested staff training, external consultation and extra hours or extra staff to help deal with these problems.

Singles, Ruel and Water (2001) investigated the relationship between ISO 9000 certification and the performance of organisations in the Netherlands using a questionnaire survey. The performance indicators used in their study were:

- production processes
- company results
- customer satisfaction
- personnel motivation
- the efforts to gain and hold ISO certification

According to Singles, Ruel and Water (2001), production processes were measured by improvement in throughput time, increase technical flexibility, improvement of coordination of activities, improvement in product specification, increase in internal and external delivery performance and improvement in efficiency. Company results were measured by the cost savings, increase in sales, increased market share and increase in net profit margin. For customer satisfaction, the indicators used were improvement in the interaction with customers and a reduction in the number of complaints. For personnel motivation, the researchers used indicators such as an increase in personnel involvement and motivation, and increased skill. For the efforts to gain and hold ISO certification, the researchers used the indicators of high investment cost, increase in bureaucracy and increase in paper workload. A finding of this study has shown that the ISO 9000 certification did not improve organisational performance. Singles, Ruel and Water believed that implementing ISO 9000 certification alone did not improve organisational performance because certification was pursued under external pressure, such as that from customers. However, they thought that the motivation behind obtaining ISO 9000 certification might lead to an improvement in organisational performance.

Total Quality Management

TQM is a broad approach to business improvement which was developed by the Japanese and popularised in the West, in particular by Deming. TQM aims to manage the quality of the overall organisational process, not only on the production floor (Evans and Lindsay 2008). Research on TQM has included the identification of critical success factors for implementing TQM in both large and small organisations.

Powell (1995) conducted an empirical study on TQM. He developed instruments to measure the consequences of TQM on organisational performance. Thirty-six responses were received from 143 questionnaires sent to manufacturing and service organisations in the US with 50 or more employees. Findings show that TQM success depends critically on executive commitment, open organisation and employee empowerment. The other factors that appeared less critical to TQM success were benchmarking, training, flexible manufacturing, process improvement and improved measurement. Powell stated that even though his data showed a significant TQM performance-correlation, the data did not strictly prove that TQM caused the increased organisational performance. The data only demonstrated the association existing between TQM and performance.

Another study on TQM conducted by Terziovski and Samson (1999) addressed the effect of TQM implementation on organisational performance in large manufacturing organisations in Australia and New Zealand. Their aim was also to identify whether there was a change in the strength of the relationship between TQM practice and organisational performance with the covariates: company size, industry type and ISO 9000 certification. In their study, organisational performance was characterised by customer satisfaction, employee morale, cost of quality, on time delivery, defect rates, warranty cost, productivity, cashflow, employee growth, market share growth, sales growth, export growth, innovation and organisational performance. Their findings showed that TQM had significantly positive effects on organisational performance such as customer satisfaction, employee morale, on time delivery, productivity, cashflow and sales growth. Also, they found that the relationship between TQM practice and defect rates and warrant costs changed from insignificantly negative to significantly negative when covaried by company size. Another finding showed that the relationship between

TQM and the innovation of new products changed from insignificantly positive to significantly positive when covaried by industry type. However, there was no significant change between TQM and all variables of organisational performance when covaried by ISO 9000 certification.

By contrast, a study conducted by Salegna and Fazel (2000) in the US listed several barriers to TQM implementation, such as a lack of company-wide definition about quality and lack of a formalised strategic plan for change.

Quality Award Models

There are number of quality frameworks based on the quality management approach. The two most well-known are the Malcolm Baldrige National Quality Award (MBNQA) and the European Quality Award. In Australia, there is the Australian Business Excellence Framework which is similar to the MBNQA.

The Malcolm Baldrige National Quality Award (MBNQA) was introduced in the US in 1989. The MBNQA is awarded by the US Government to organisations which have the best score of quality management implementation. According to the Baldrige National Quality Program online literature, the assessment uses several criteria such as leadership; strategic planning; customer and market focus; measurement, analysis and knowledge management; workforce focus; process management; and results (National Institute of Standards and Technology 2008) as presented in Figure 2.4.

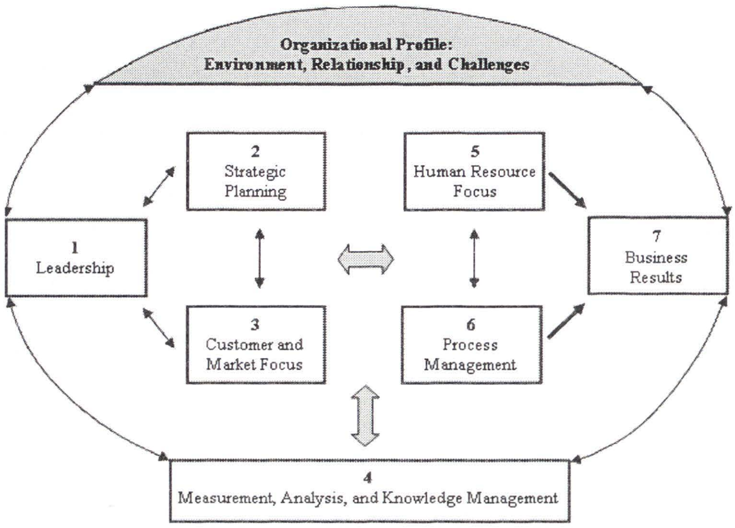


Figure 2.4 MBNQA framework

Source: National Institute of Standards and Technology (2008)

The majority of research on quality management uses MBNQA items to measure the level of quality management in organisations, for example in the research conducted by Lau, Zhao and Xiao (2004). Moreover, the criteria of the MBNQA can be used as self assessment for organisations to identify the areas that should be improved (Van der Wiele et al. 1996).

A study conducted by Lee, Rho and Lee (2003) examined the link between the MBNQA categories and organisational performance among Korean manufacturing firms. A questionairre-based survey was conducted. The respondents were senior middle managers who actively participated in the various quality management programmes conducted by Korean Productivity Center and Korean Standardization Association; 109 usable responses were received. This researchers developed several hypothesis based on MBNQA criteria. One of the key findings was that quality planning and analysis had a positive effect on strategic planning and process management.

The European Quality Award (EQA) was introduced in 1990. This award involves sixteen countries in Europe such as Austria, Belgium, Italy, the Netherlands, Norway and so on. As stated by Lee, Zuckweiler and Trimi (2006) the EQA criteria are split into enablers and results. The enablers are leadership, people management, policy and strategy, resources and processes. The results categories are people satisfaction, customer satisfaction, impact on society and business results (Conti 2007). This award framework can also used for self assessment assisting organisations to measure their performance and to identify areas to improve.

In Australia, the Australian Business Excellence Framework was originated in 1988. As stated by Vokurka, Stading and Brazeal (2000, p. 33), the award was created as part of Australian Government programme to 'develop and deploy a comprehensive and contemporary body of quality principles and best practices'. The award contains seven categories: leadership; strategy, policy and planning; information and analysis; people; customer focus; quality of process, product and service; and organisational performance (Zink, Schmidt and Vob 1997).

2.4 Six Sigma

As a relatively new management approach, Six Sigma has gained popularity among organisations both in manufacturing and service sectors (Tang et al. 2006). The popularity of Six Sigma has come about because organisations which implemented this concept reported significant improvements such as in financial savings. This is slightly different from previous management approaches and it is difficult to know whether there is improvement in their organisational performance.

In order to view Six Sigma clearly, the approach will be defined further in this section. There are many definitions from the literature which are mainly written by consultants. However, several Six Sigma definitions come from an academic viewpoint. Definitions from both practicioner/consultants of Six Sigma and academician/researchers are briefly discussed below.

From a consultant viewpoint, Burton and Sams (2005, p. 12) stated that Six Sigma is 'a data driven methodology that strives for perfection in the organisation's entire value chain'. Meanwhile, Pande and Holpp (2002) defined Six Sigma is a smarter way to manage a business by putting the need of customer first and employing data and facts to drive better solutions. Eckes (2003, p. 16) stated that as a management strategy, Six Sigma 'may be defined as a plan or method for obtaining some goal or result'. Harry and Schroeder (2000, p. vii) defined Six Sigma as a 'business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimise waste and resources while increasing customer satisfaction'.

From an academic viewpoint, Schroeder et al. (2008), based on their research defined Six Sigma as 'an organised, parallel-messo structure to reduce variation in organisational processes by using improvement specialists, a structured method, and performance metrics with the aim of achieving strategic objectives'.

A core concept in Six Sigma is reducing the number of defects from a process to a very low level. Six Sigma quality is often associated with obtaining a quality defect level of 3.4 defects per million opportunities. This statistic originated at Motorola (see Section 2.4.1). Figure 2.5 shows how the 3.4 defects per million is assumed to be normally distributed. Importantly, an allowance for drift in the process mean of $\pm$ 1.5 standard deviations is made to reflect how processes often perform in practice.

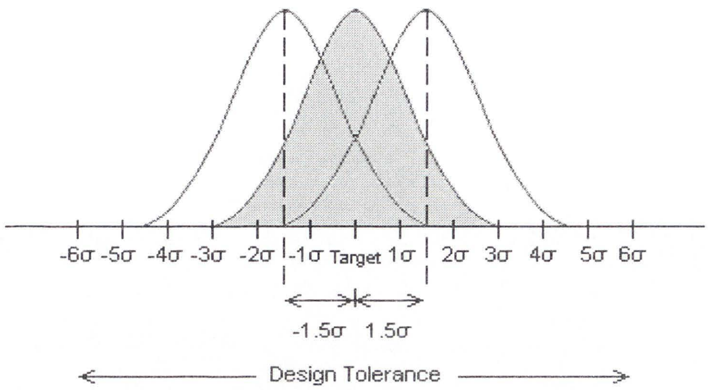


Figure 2.5 Theoretical basis of Six Sigma

Source: Evans and Lindsay (2008, p. 503)

Even though many authors define Six Sigma slightly differently, the principles of this concept hinge on the same purpose which is to eliminate variations in the critical process in manufacturing or service organisations. The implementation of Six Sigma is focused on data collection and analysis of critical problems using selective tools and techniques. The methodology used is the DMAIC (Define-Measure-Analyse-Improve-Control) which is based on PDCA (Plan-Do-Check-Action). In other words, the DMAIC methodology is used to structure Six Sigma improvement projects. The structure of DMAIC methodology is presented in Figure 2.6.

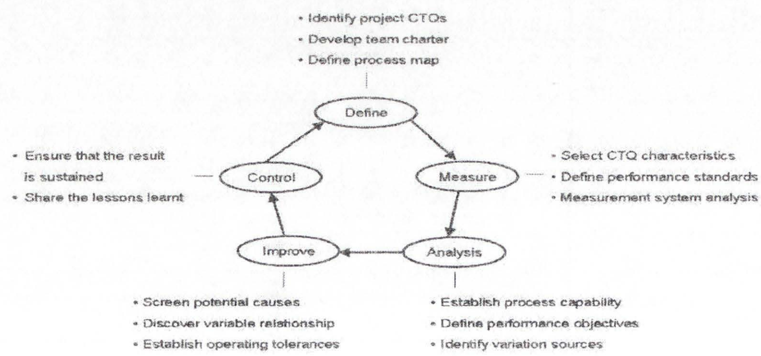


Figure 2.6 DMAIC circle

Source: Antony, Kumar and Tiwari (2006, p. 81)

2.4.1 History of Six Sigma

The roots of Six Sigma can be traced back to Motorola in 1985 when Bill Smith, an engineer in the company, suggested the 'reinserting of hard-nosed statistics into the blurred philosophy of TQM' (Basu and Wright 2003, p. 37). This approach was further developed in 1987, based on the study of variations in a range of processes within Motorola. This study was conducted by Mikel Harry and led to the conclusion that variations in processes resulted in poor product quality (Eckes 2003).

Shortly after Motorola successfully implemented this concept, General Electric, Allied Signal and other large organisations adopted Six Sigma. At that time, General Electric, under former CEO Jack Welch, became a pioneer in dispersing Six Sigma worldwide through their organisations (Basu and Wright 2003). General Electric (GE) believed that the customer, the process and the employee were the key elements to achieving a world class company, and consequently implemented Six Sigma in their companies all over the world. The evolution of Six Sigma in GE is shown in Figure 2.7.

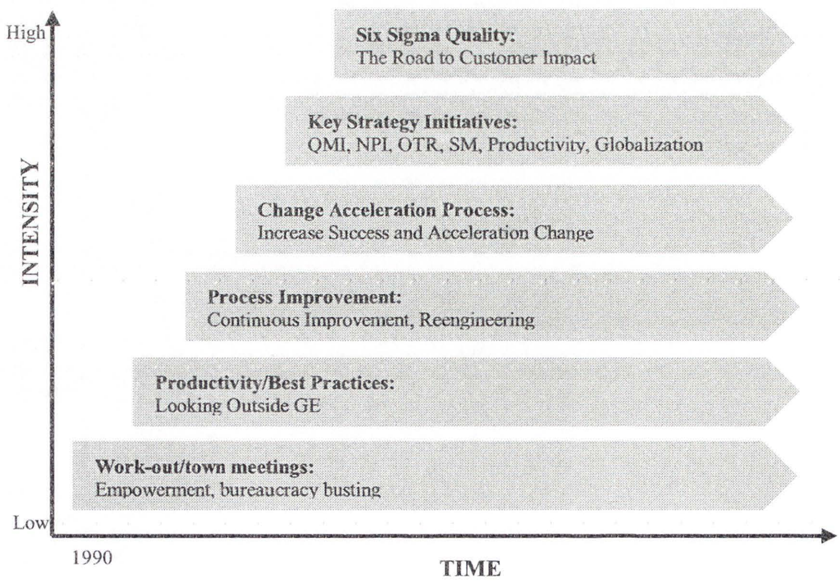


Figure 2.7 Evolution of quality practices in General Electric

Source: adopted from GE (1999, p. 2)

Following implementation, GE reported many Six Sigma success stories, including achievement of USD 320 million in productivity gains and profits from 1996 to 1997 (Evans and Lindsay 2008). Publishing success stories encouraged the diffusion of Six Sigma.

Since its inception, Six Sigma has undergone a number of significant developments, including having been combined with other approaches such as Lean manufacturing (as discussed in Section 2.5). Moreover, a system of training based on the martial arts 'belts' hierarchy has been widely adopted. It is interesting to note that the belt system in Six Sigma was firstly introduced in 1988 with a black belt (PQA 2006). The idea to name Six Sigma skills came from Mikel Harry and Cliff Ames who was a plant manager in the Unisys Corporation. In 1993 the belt system was refined by Mikel Harry into champion, master black belt, black belt and green belt. Details of these belt systems are covered in Section 2.5.3.

Basu and Wright (2003) framed the movement from a basic quality management approach to Lean Six Sigma as presented in Figure 2.8.

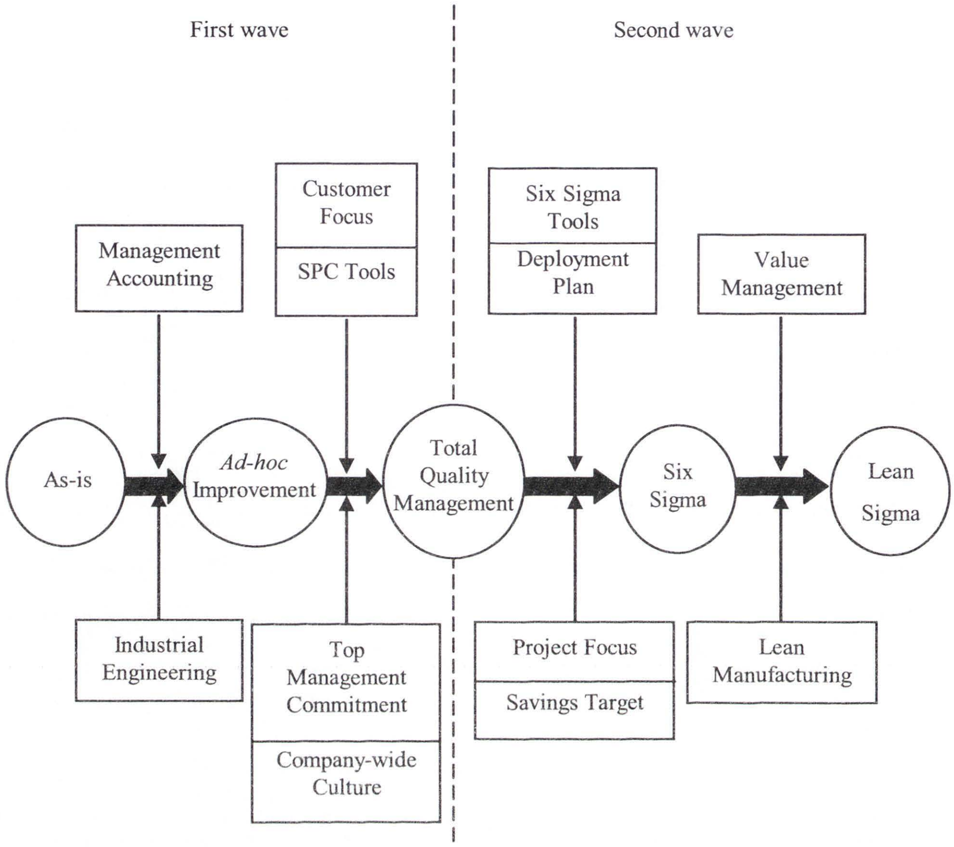


Figure 2.8 Movement from simple approach to Lean Six Sigma

Source: adapted from Basu and Wright (2003, p. 7)

2.4.2 Similarities between Six Sigma and Other Improvement Approaches

It could be said that Six Sigma does not differ greatly from many other improvement initiatives such as TQM. For instance, ideas such as customer focus, that quality is the responsibility of all employees and the need for training for employees in Six Sigma are all derived from TQM (Arnheiter and Maleyeff 2005). Moreover, Schroeder et al. (2008, p. 537) stated that 'philosophy and tools/techniques of Six Sigma are strikingly similar to prior quality management approaches'.

As mentioned previously, Six Sigma has a strong customer focus, like other approaches to business improvement such as TQM and ISO 9000. It also contains key concepts related to strategy, organisational change, training and setting stretch objectives (Evans and Lindsay 2005, p. 133).

The DMAIC methodology and training system are seen as significant new elements that define Six Sigma. Antony, Kumar and Tiwari (2006) explained that Six Sigma methodology integrates human and process elements. The human elements are culture change, customer focus and belt system infrastructure, while the process elements are process management, statistical analysis of process data and measurement system analysis. Moreover, Evans and Lindsay (2008) and Antony, Kumar and Tiwari (2006) have stated that there are several aspects that could be used to differentiate Six Sigma and TQM which are presented in Table 2.6.

Table 2.6 Some differences between TQM and Six Sigma based on the literature

Aspect	TQM	Six Sigma
People in improvement teamwork	existing staff who work as part time basis for improvement activities	a significant number of full time employees i.e. Green belt, Black belt
Activities	within a function, process, or individual workplace	cross functional
Training	limited training to improve process with less emphasis on the use of data/structured method	intense training in statistical and non-statistical tools for solving problem using structured DMAIC methodology
Focus	improvement with little financial accountability	achieving measurable and quantifiable financial returns from improvement projects to the bottom line of an organisation

Source: summarised from Antony, Kumar and Tiwari (2006), Evans and Lindsay (2008) and Schroeder et al. (2008)

There are similarities between Six Sigma and previous quality improvement programs such as TQM, and these are the use of tools and techniques. Most of the basic and advanced quality improvement tools in TQM are also used in Six Sigma. However, the use of either basic or advanced tools depends on the complexity of the problem.

2.5 Lean Six Sigma

The previous section reviewed the Six Sigma concept with a focus on its definition, history and similarities to other improvement approaches, as well as the evolution from Six Sigma to Lean Six Sigma. This section explains the integration of Lean and Six Sigma to form what is generally known a Lean Six Sigma, starting with the Lean Six Sigma concept, and the tools and techniques used.

2.5.1 Explanation of Lean Six Sigma

The concept of Lean Manufacturing originated from Taiichi Ohno of Toyota Motor Corporations, whose ultimate aim was to eliminate seven types of waste *(muda)* mainly in the shop-floor or production area. There was basic waste which needed to be eliminated such as inventory, processing, waiting, motion, transportation, overproduction and defects (Womack, Jones and Ross 1984). Explanation of the waste in Lean is presented in the table below.

Table 2.7 Waste type in Lean concept

Waste type	Explanation
Inventory	Maintaining excess inventory of raw materials, parts in process or finished goods
Processing	Doing more work than is necessary
Waiting	Any non-work time waiting for tools, supplies, parts, etc.
Motion	Any wasted motion to pick up parts or stack parts
Transportation	Any wasted effort to transport materials, parts or finished goods into or out of storage, or between processes
Overproduction	Producing more than is needed before it is needed
Defects (rework)	Repair or rework

Source: Gaspersz (2007, p.13)

Further to the idea of reducing waste, Womack, Jones and Ross (1996) pointed out five principles of Lean Thinking, which are: value, the value stream, flow, pull and perfection. This period of Lean evolution stimulated a value creation which was linked to customer requirements (Hines, Holwe and Rich 2004). The first principle of Lean Thinking encourages organisations to think about value from the customers' point of view. It is what the customers expect from the organisation. To fulfill the customers' need, the organisation should understand the value stream. This means they should identify or map all the activities from design up to final product when it reaches customers. From this, the organisation is able to eliminate activities that are not adding value to the product. By putting value and the processes or activities map together, organisations can eliminate all non-value added activities. Thus, organisations should assure that the process is flowing well without any obstacles. Pull means that organisations should consider their production size. There should be a rational number in their production rather than overproduction that creates waste for the organisation. The last principle of Lean is perfection, which is to carefully run all the principles of Lean without defect or waste (Hines, Holwe and Rich 2004).

Lean Six Sigma is a new integrated concept that assumes a fit with current customer expectations to buy good, cheap products and services that are available when customers require them. The development of these concepts by leading organisations such as Motorola and Toyota Motor Corporations is aimed to enhance their competitiveness.
At the operational level, Lean Six Sigma can be defined as an approach which claims to help organisations eliminate waste related to inventory, processing, waiting, motion, transportation, overproduction and defects using Lean tools; and to solve critical and complex problems related to the quality of products or processes using Six Sigma tools (Arnheiter and Maleyeff 2005; Basu and Wright 2003; Conti et al. 2006; George 2002).

For a better understanding of both concepts, Figure 2.9 captures both Lean and Six Sigma concepts and their contribution to organisational performance.

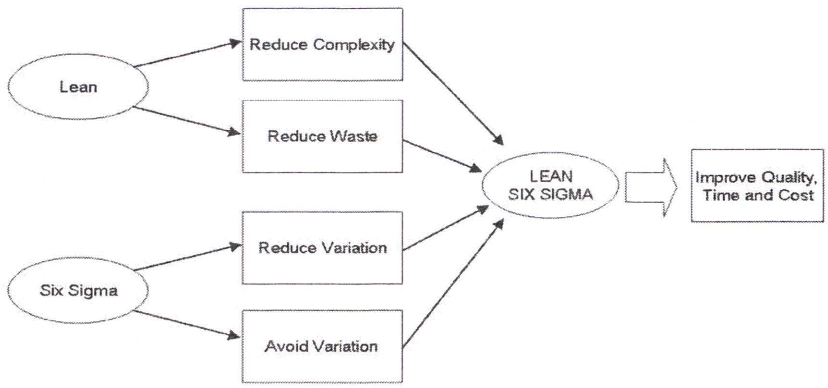


Figure 2.9 Integration of Lean and Six Sigma to improve overall organisational performance

Source: adapted from Basu and Wright (2003, p. 79)

According to Basu and Wright (2003), Lean and Six Sigma tools and techniques have different benefits (see Figure 2.8). By implementing Lean tools and techniques, organisations will reduce the complexity of the process and waste whereas Six Sigma tools and techniques will reduce process variation and also avoid future variation.

Hines, Holwe and Rich (2004) argued that Lean strategy can be integrated with other approaches that are used with the same aim (Six Sigma, TQM) of achieving customers' needs. The integration exists at the operational level which the compatible Lean and Six Sigma tools employed to solve problems. However, with the aim of being both effective and efficient, George, Rowlands and Kastle (2004) suggested that organisations should implement these concepts together if they need to satisfy their customers by providing products of better quality with speed and improved processes through process flow and variation reduction.

A number of studies on Lean have been carried out by Conti et al. (2006) and Sohal and Egglestone (1994), amongst others. Conti et al. (2006) studied the effects of Lean Production implementation on worker job stress. The study was based on questionnaires, interviews and field visits. The independent variable was the degree of Lean implementation in the organisation and the dependent variable was total worker job stress from physical and mental stresses. The main finding showed that Lean Production implementation was not inherently stressful for the employees. On the other hand, Sohal and Egglestone (1994) investigated Lean implementation in Australian manufacturing organisations. This study used a telephone survey and produced findings showing that the majority of organisations contacted were practising Lean methods.

2.5.2 Tools and Techniques of Lean Six Sigma

After discussing the concept of Lean Six Sigma, there is a need to present the tools that are normally used to solve problems within the approach. The tools and techniques are fundamental to Six Sigma and Lean concepts. Table 2.8 presents Lean and Six Sigma tools. As previously mentioned, Six Sigma and Lean Six Sigma were drawn from previous improvement approaches such as TQM. Based on this, Six Sigma and Lean Six Sigma tools have mainly been adapted from such approaches.

Table 2.8 Lean and Six Sigma tools

Lean Tools	Six Sigma Tools
5S (*Seiri, Seiton, Seiso, Seiketsu, Shitsuke*) Flow charts Takt time Visual controls One-piece flow Cellular/product layout Standard work Pull replenishment/production (*kanban*) Point-of-use material storage Mistake proofing (*poka yoke*) and method sheets Single minute exchange of dies (SMED) Total productive maintenance Mixed model scheduling and small batch production	Project charter Cost of quality analysis Pareto analysis Check sheets Measurement system evaluation (MSA) Process capability analysis Benchmarking Cause and effect diagram Failure mode and effect analysis (FMEA) Design of experiments (DOE) Seven management and planning tools Statistical process control (SPC)

Source: summarised from Evans and Lindsay (2008) and Srinivasan (2004)

A description taken from the literature on how organisations typically structure teams for Lean Six Sigma projects will be discussed in the following section. This discussion will also include the important issue of staff training in Lean Six Sigma. The information presented is drawn mainly from sources addressing Lean Six Sigma applications in large organisations and some modification may be required for the Indonesian SME situation.

With regard to Indonesian SMEs context, 5S seems important as a foundation for the implementation of Lean Six Sigma. Thus, 5S is explained briefly in this section.

Wheat, Mills and Carnell (2003) suggested that the implementation of Lean Six Sigma should be started with 5S (*Seiri, Seiton, Seiso, Seiketsu, Shitsuke*). They believed that the implementation of 5S would help organisations to keep their workplace clean and organised so that problems could be easily identified.

According to Ho (1997), 5S can be translated as follows:

a) *Seiri* means organisation, which is to clearly distinguish needed items from those that are not needed
b) *Seiton* means neatness, which is to keep needed items in the correct place for easy retrieval
c) *Seiso* means cleanliness, which keeps the workplace clean and should be the responsibility of everyone in the organisation
d) *Seiketsu* means standardisation, which is to apply *Seiri, Seiton* and *Seiso* consistently
e) *Shitsuke* means discipline, which is the ability to follow work procedures continuously.

In Indonesia, JICA has carried out a pilot project assisting SMEs in one industrial centre to implement 5S (JICA 2004). This 5S program should form a good foundation for more advanced programs like Lean Six Sigma.

From the literature, particular tools are recommended for different stages of the DMAIC methodology. It is noted that these tools are often a mixture of Lean and Six Sigma tools (see Table 2.9).

Table 2.9 The common use of Lean Six Sigma tools based on DMAIC cycle

Define	Project charter IPO (Input-Process-Output) diagram Pareto analysis FMEA (Failure Mode & Effect Analysis)	QFD (Quality Function Deployment) SIPOC (Supplier-Inputs-Process-Outputs-Customers) map Value stream map
Measure	SPC (Statistical Process Control) Process flow mapping Cause and Effect diagram MSA (Measurement System Analysis) Graphical analysis (histogram, run chart, etc.)	Capability studies 5 S Takt time Benchmarking
Analyse	Capability studies Graphical analysis DOE (Design of Experiments)	FMEA (Failure Mode & Effect Analysis)
Improve	DOE (Design of Experiments) Kanban Pull systems Cell design SMED	5S Mistake Proofing *(Poka Yoke)* Control chart Line balancing TPM (Total Productive Maintenance)
Control	Control charts SPC Visual Management	

Source: Gaspersz (2007, p. 132)

In terms of training and how Six Sigma should be integrated into the organisation, the literature reviewed does not differentiate between Six Sigma and Lean Six Sigma.

2.5.3 Organisation of Lean Six Sigma

This section describes the activities required for implementing Lean Six Sigma, such as team structure and Lean Six Sigma training.

Several literatures have pointed to slight differences of team structure and training between Six Sigma and Lean Six Sigma. The organisational structure for Lean Six Sigma has the same basic structure as Six Sigma. The belt system is commonly used in the Lean Six Sigma structure and is also employed in the training levels of Lean Six Sigma. According to Gaspersz (2007), the Lean Six Sigma structure normally has a master black belt who is the mentor, trainer, and coach of black belts and others in the organisation. A black belt is a leader of teams from Lean Six Sigma projects in the organisation. A green belt is an employee who has training to solve organisational problems using Lean Six Sigma tools.

Returning to the level of training in Lean Six Sigma, there are three levels, as presented in Table 2.10 below. After pursuing this training and completing projects, they will receive certification.

Table 2.10 Levels of Six Sigma training

Level of training	Explanation
Green Belt (GB)	- Complete 4 days' Green Belt training - Complete one project to improve quality in their workplace using DMAIC
Black Belt (BB)	- Complete 3 weeks' Black Belt training - Complete 1 week of change management training - Complete 1 week of project management training - Complete all Green Belt requirements for certification - Complete a Black Belt (end-to-end) project as a team leader - Demonstrate commitment to the quality/productivity agenda through one or more: a. Mentoring Green Belt projects b. Facilitating Green Belt trainings c. Designing Green Belt materials - A Black Belt has a strong understanding of Six Sigma and DMAIC methodology and how to apply DMAIC to improve performance
Master Black Belt (MBB)	- Have a thorough understanding of the improvement process, DMAIC, Six Sigma, statistics and change management - Can lead or coach end-to-end projects and can coach Green Belt and Black Belt, provide training and provide leadership to the overall quality program - Have Black Belt certification - Complete at least 5 Black Belt (end-to-end) projects in a team leader role - Deliver at least 3 Green Belt projects or quality awareness training session - Demonstrate commitment to the quality/productivity agenda through one or more of the following: a. Mentoring Green Belt and Black Belt projects b. Facilitating Green Belt or quality awareness training c. Designing Green Belt or other program materials, etc.

Source: Gaspersz (2007, p. 222)

Harry and Crawford (2004) highlighted the evolution of Six Sigma from focusing on defects and costs to focusing on value that provides good products with competitive price and on time delivery. For this new generation of Six Sigma, Harry and Crawford suggested a new level of Six Sigma training: the white belt. The training was focused on the use of a graphical approach rather than advanced tools/techniques. This new type of belt system has less training time and is inexpensive compared to green and black belts. Harry and Crawford also suggested online training as an efficient way for SMEs to receive white belt training. This is because SMEs may not be able to send their employees away for several weeks' training outside the organisation. The white belt online training initiated by Harry and Crawford used video to deliver training. This type of training delivery was believed to be as effective as class or face-to-face training. The training included, for instance, Six Sigma concepts, and steps to use statistical software for data analysis.

2.6 Research on Six Sigma and Lean Six Sigma

To date, Six Sigma and Lean Six Sigma have been the subject of only a modest amount of academic research. A number of researchers have examined Six Sigma implementation in order to identify critical success factors e.g., Burton and Sams (2005), Coronado and Anthony (2002) and Furterer (2004) and their research will be reviewed.

Of particular relevance to the present research is a number of published accounts of Six Sigma implementation frameworks which will also be reviewed in this section.

2.6.1 Critical Success Factors of Six Sigma and Lean Six Sigma

Critical Success Factors (CSFs) can be defined as characteristics that should be present in the work environment to help facilitate the success of a change program like Six Sigma or Lean Six Sigma.

Coronado and Antony (2002) listed eleven critical success factors for implementing Six Sigma. The objective of their research was to identify key ingredients necessary for the successful implementation of Six Sigma from literature by analysing the success and failure stories of a number of organisations. Eleven CSFs were identified in the study: management involvement and commitment, cultural change, communication, organisation 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, project prioritisation and selection.

The study by Antony, Kumar and Madu (2005) investigated Six Sigma implementation in UK manufacturing SMEs. One of the objectives of the study was to rank the degree of importance of the CSFs provided. This rank was based only on the views of respondents who were project champions, black belts, green belts or yellow belts. The findings show that the three most important factors for successful implementation of Six Sigma were (in order of importance): management involvement and participation, linking Six Sigma to customer requirements and linking Six Sigma to the business strategy of the organisation.

In their book, Burton and Sams (2005) listed sixteen key requirements, which were said to be critical factors in successfully implementing Six Sigma in SMEs. These were:

a) establish recognition of the need for change
b) provide leadership commitment and support
c) develop Six Sigma strategy and a deployment plan
d) incorporate enterprise-wide scope
e) mandate of Six Sigma activities linkage to the business plan
f) make proper investment in resources
g) develop communication and awareness effort
h) focus on customer and results
i) structure the Six Sigma program around the organisation's needs
j) implement regulated program management
k) build a team and employee involvement culture

l) manage controversy and confrontation that arise when change is applied in the organisation
m) demand frequent measurement and feedback
n) implement a structured project closeout process
o) provide recognition and rewards
p) leverage successes and stay the course

Burton and Sams believe that these factors have to be in place in order to implement Six Sigma successfully, not just the DMAIC methodology and use of Six Sigma tools.

Schon (2006) studied three Swedish companies to identify success factors of Six Sigma implementation. The results of her study show that management commitment, focus on training, project selection, strategy for implementation, linking Six Sigma to business strategy and focus on results were factors that were chosen by respondents.

Furterer (2004) identified thirty-nine factors that need to be considered when implementing Lean Six Sigma. These factors are based on the seven components of her implementation framework shown in Figure 2.13. Of note is that Furterer advocates the use of value propositions to link Six Sigma project outcomes to tangible customer benefits. Furterer also emphasised the importance of top management support for Six Sigma and appropriate training.

Only Antony, Kumar and Madu (2005) empirically tested the CSFs. Schon (2006) also tested Six Sigma success factors, which were developed from literature, on three companies in Sweden. The other authors developed CSFs based on literature or their experience as consultants.

The following five CSFs were the ones most commonly identified in the literature reviewed in this section. They are:

1. Management commitment
2. Training
3. Communication
4. Employee involvement

5. Customer focus

2.6.2 Six Sigma and Lean Six Sigma Frameworks/Models

Three frameworks for implementing Six Sigma were found in the literature (Burton and Sams 2005; Chang 2002; Park 2003) and one framework for implementing Lean Six Sigma (Furterer 2004). These frameworks mainly used elements or factors from quality awards such as the Malcolm Baldrige National Quality Award (MBNQA) and the European Business Excellence Model.

Chang developed his framework (see Figure 2.10) based mainly on the MBNQA model which contains TQM elements such as strategic planning, leadership, process management, human resource, education and training, quality tools, customer management, supplier management and information and analysis. Chang claimed that these elements are critical factors for SMEs in adopting Six Sigma. His framework is built around the idea of continuous improvement following MAIC (Measure-Analyse-Improve-Control) steps. The development of Chang's framework lacks discussion about cultural considerations relating to implementation and the limitations that SMEs can have compared to large organisations. He did not explain comprehensively how to bring these factors into implementation. For instance, for education and training in Six Sigma projects, he did not suggest what the best type of training might be for SMEs. SMEs may find it difficult to follow the common training scheme of Six Sigma (green belt, black belt, etc.) because they have limited funds. Generally speaking, for SMEs which have limitations on resources and technology, an ideal framework should provide guidance on how to deal with issues like limited resources and expertise. This argument correlates with Yusof (2000a) who stated that small organisations need a clear and less complex framework that can assist them towards the implementation of concepts and approaches. Further, Yusof and Aspinwall (2000b, p. 293) in their paper stated that SMEs which implement TQM should have a framework that 'represent a road map and a planning tool for implementation'.

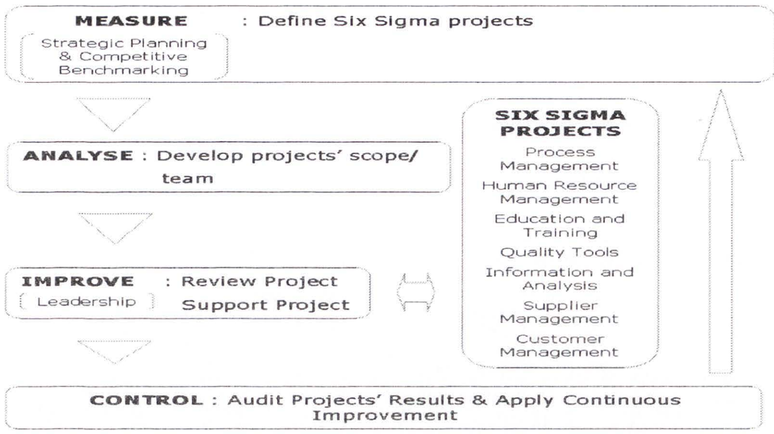


Figure 2.10 Chang's Six Sigma framework for SMEs

Source: Chang (2002, p. 152)

The framework developed by Park (2003) (see Figure 2.11) based on his experience as a consultant, appears to be more suitable for large organisations. There is inadequate explanation and justification of the model and there is no specific guidance on its relevance to SMEs.

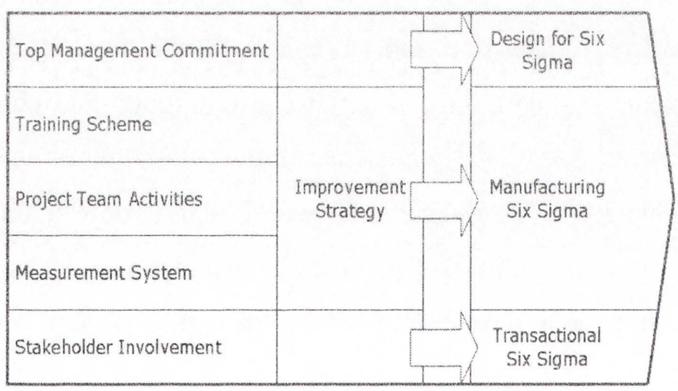


Figure 2.11 Park's Six Sigma framework

Source: Park (2005, p. 30)

The framework developed by Burton and Sams (2005) (see Figure 2.12) appears to be more suitable for SMEs. They suggest a Six Sigma pilot project as the first stage when an SME plans to implement this concept. The purpose of the pilot project is to demonstrate the applicability of the concept and is therefore a way to help convince skeptics of the benefits of the new program and thereby gain their acceptance, or at least reduce their resistance to it.

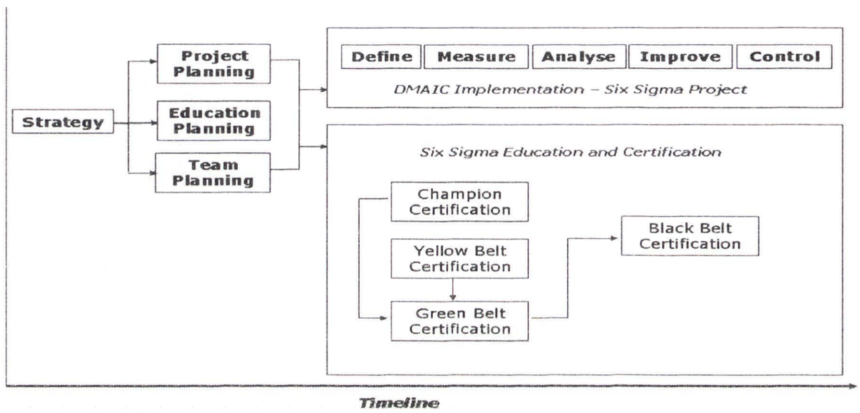


Figure 2.12 Six Sigma implementation framework for SMEs

Source: Burton and Sams (2005, p. 38)

Burton and Sams' framework emphasises education and certification (i.e., Champion, Yellow Belt, Green Belt and Black Belt certification) as an important aspect of their implementation model. However, it can be argued that certification cannot assure the success of Six Sigma implementation. Six Sigma teams should have enough understanding to use basic and advanced quality tools to solve organisational problems. This is not a difficult task since these basic and advanced tools of Six Sigma are not new tools, rather they have been used in the TQM or other improvement programs in the past.

Additionally, in situations where SMEs are starting from a relatively low educational base and may be short of resources, the conventional 'belt' training programs may not be the most appropriate. To cater for these situations, Harry and Crawford (2004) have introduced the 'White Belt' system discussed in Section 2.5.3. This 'White Belt' is another training alternative for small and medium enterprises that have limitations to sending their employees for Six Sigma Green Belt training. Harry and Crawford (2004) also suggest online Six Sigma training for SMEs that have difficulty in releasing employees for face-to-face training.

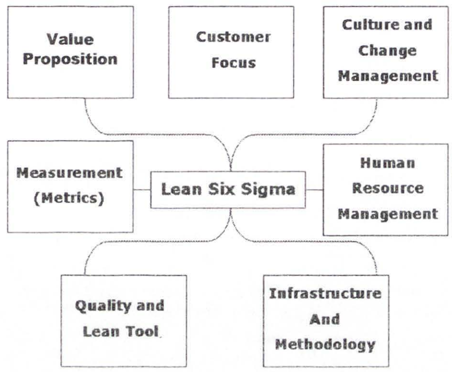


Figure 2.13 Lean Six Sigma framework

Source: Furterer (2004, p. 41)

A Lean Six Sigma framework developed by Furterer (2004) (see Figure 2.13) is specifically aimed at the needs of local government. This framework together with its elements was developed from the literature and from Furterer's experience as a consultant. The value proposition was intended by Furterer as a way to convince the US local government to implement Lean Six Sigma. It can be seen that the majority of the framework's elements are based on quality award models such as the Business Excellence Model and the MBNQA.

This analysis of existing frameworks has focused on the organisational level without considering other aspects, such as the spread of Six Sigma or Lean Six Sigma to other organisations.

2.7 Quality Improvement in Indonesia

This section explains the experience of quality improvement programs in Indonesia by covering studies to date. Although there is a lack of published research on quality management in Indonesia, there are a few studies that can help build an understanding of quality improvement initiatives in the country. These studies have been conducted by Amar and Zain (2002), Hernadewita, Rahman and Deros (2008), and Chan and Quazi (2000).

Amar and Zain's (2002) research identified barriers to implementing TQM in large manufacturing organisations. The study received 78 usable responses from 364 manufacturing organisations that were selected from a directory of manufacturing industries of Indonesia for a questionnaire survey. Findings from this study show that human resource issues related to the education level of employees, lack of skills and lack of understanding of quality management were the highest barriers to implementing TQM. These were followed by resource issues such as inadequate machine tools which also impeded the implementation of TQM. Even though this study reported a useful picture of barriers to TQM implementation in Indonesia, its stated limitation was that it did not discriminate between partial or full TQM implementation in the organisations surveyed.
Other research on TQM was conducted by Hernadewita, Rahman and Deros (2008). They studied whether the practices of 5S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) have made a significant contribution to the success of TQM implementation in SMEs. They provided a checklist for respondents to measure the 5S implementation in their organisations. The researchers seemed to assume that an organisation which has ISO 9000 certification was also implementing TQM. In other words, they did not measure the implementation of TQM in the organisation based on the common TQM factors such as leadership and employee involvement. Findings of this study showed that 28 out of 36 SMEs achieved high scores of 3, 4 and 5 on their 5S implementation. Meanwhile, the other eight SMEs obtained a score of less than 3. However, findings of this study did not clearly address the objective to identify whether 5S practices contributed to TQM implementation. It may have been necessary to include organisational performance to know the contribution of 5S implementation in the organisation.

Chan and Quazi (2000) studied quality management practices in selected Asian countries. They reported the evolution of quality management practice in Bangladesh, Brunei, India, Indonesia, Malaysia, Philippines, Singapore, South Korea and Thailand.

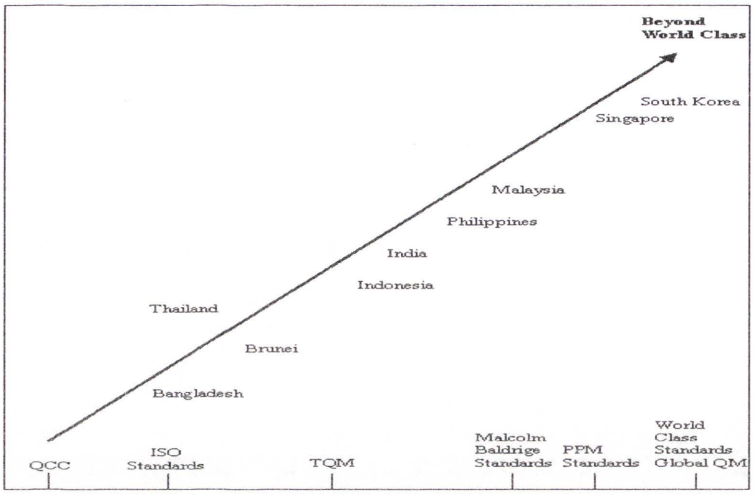


Figure 2.14 Quality management journey in Asian countries

Source: adopted from Chan and Quazi (2000)

Figure 2.14 is based on their findings and provides a comparison of the 'quality journey' of nine Asian countries. It can be seen that the majority of organisations in Indonesia are in the TQM stage. This means they may understand and implement TQM concepts, or understand them, but implement this concept only partially. Chan and Quazi's (2000) paper reported other information relating to quality management activities in Indonesia. For instance, a QCC (Quality Control Circle) convention was held in 1985 (Prajogo 1999). In Indonesia, TQM were diffused by the Japanese Government under their program to introduce TQM in South East Asian countries (UNIDO and JSA 2001). A TQM program was also introduced for Indonesian SMEs by JICA in 1995.

Based on the discussion in this section, it can be concluded that Indonesian organisations are moderately familiar with quality management practices. However, the level of implementation of practices is quite low compared with other ASEAN countries such as Malaysia, The Philippines and Singapore.

2.8 Diffusion of Innovations Theory

As mentioned in Chapter 1, the diffusion of innovations theory by Rogers is used as a framework for the methodology of this research. This is appropriate because this research aims to diffuse innovation on an industry level. It means that aspects related to the diffusion of innovations should be considered and it is therefore important to discuss the diffusion of innovations theory as part of the literature review of this thesis.

Diffusion of innovations theory was introduced by Rogers with regard to successfully implanting an innovation developed in one cultural setting into a different cultural setting. Culture is defined by Hofstede (1984) as the way things are done in business and believed by O'Regan and Ghobadian (2005, p. 1109) to be 'the firms' philosophy or character and distinguish[es] the members of one organisation from another'.

Diffusion of innovations theory has been refined over many years and its application has been extended from focusing on the adoption of new ideas by individuals to adoption of new ideas by organisations (Rogers 2003). Consideration of the culture - at the national, local, industry and individual levels - into which an innovation is introduced is a strong aspect of the theory. Rogers argues that to enable successful adoption, innovations should be suitably modified when they are transferred from one cultural setting to another. Problematic innovation experienced in the past, including the diffusion of TQM in Indonesian SMEs, may have suffered a lack of consideration of the cultural aspect.

2.8.1 Elements in the Diffusion of Innovations Theory

According to Rogers (2003), there are four elements related to diffusion of an innovation: the innovation itself, communication channels, a time dimension and the social system into which the innovation is to be introduced. *Innovation* can be defined as the 'idea, practice, or object that is perceived as new by an individual or other unit of adoption' (Rogers 2003, p. 12). Innovation is needed by organisations in order for them to compete with competitors. According to O'Regan and Ghobadian (2005), innovation such as new technology affects organisational performance and is critical to competitiveness.

A *communication channel* is defined as 'the means by which messages get from one individual to another' (Rogers 2003, p. 18). *Time* is a dimension involved in the diffusion in 'the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection' (Rogers 2003, p. 20). Also, time is involved in 'the innovativeness of an individual or other unit of adoption', time is used to measure the relative earliness or lateness with which an innovation is adopted compared to other members of a system. The *social system* is defined as 'a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal' (Rogers 2003, p. 23).

Further, there are five main variables that combine to determine the adoption rate of innovations as presented in Figure 2.15 (Rogers 2003).

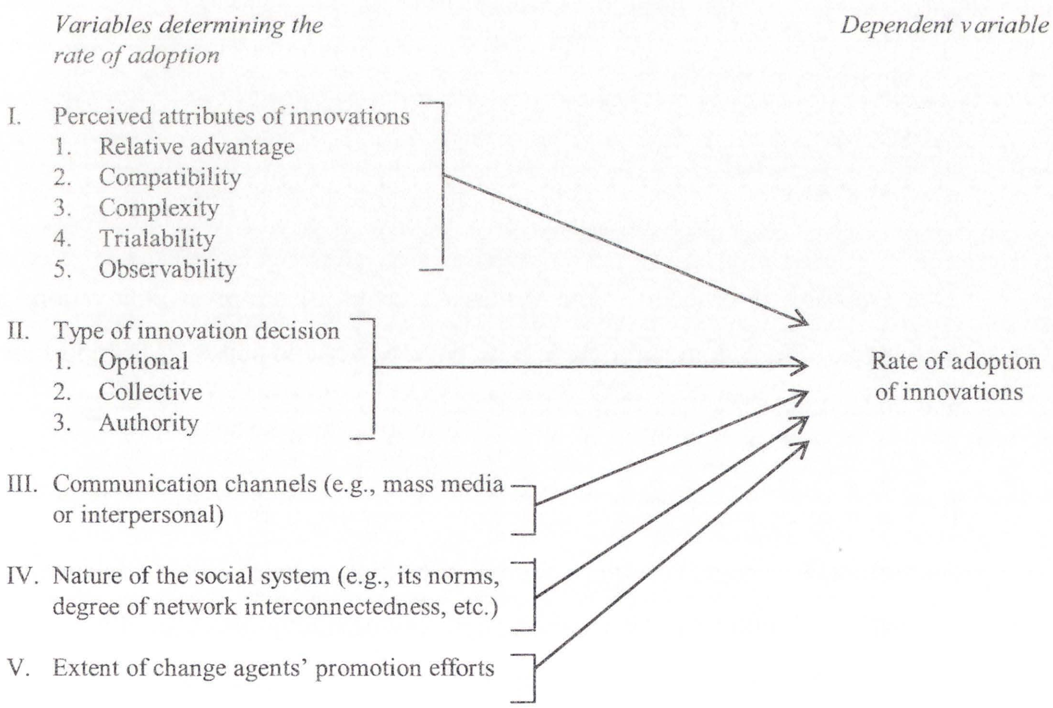


Figure 2.15 Variables that influence the rate of adoption of innovations

Source: Rogers (2003, p. 222)

Elements of the framework shown in Figure 2.15 are now explained.

I. Perceived attributes of the innovation:

a) Relative advantage

b) Compatibility

c) Complexity

d) Trialability

e) Observability

Relative advantage is 'the degree to which an innovation is perceived as being better than the idea it supersedes' (Rogers 2003, p. 229). *Compatibility* concerns the compatibility or incompatibility of innovation with social and cultural values and beliefs, previously introduced ideas or client need for the innovation (Rogers 2003). *Complexity* is 'the degree to which an innovation is perceived as difficult to understand and use' (Rogers 2003, p. 257). *Trialability* is 'the degree to which an innovation may be experimented with on a limited basis' (Rogers 2003, p. 258). *Observability* is 'the degree to which the results of an innovation are visible to others' (Rogers 2003, p. 258).

II. Type of innovation decisions

a) Individual-Optional

b) Collective

c) Authority

This typology is based on who makes decisions to adopt an innovation; individuals, members of the system and people who have power and status. It is important to identify and understand these decision makers.

III. Communication channels e.g., mass media or interpersonal

According to Rogers (2003), communication channels can influence the rate of innovation adoption. However, the complexity of innovations should be considered when choosing the communication channels. For example, mass media is suitable for a less complex innovation or the preliminary introduction of an innovation. For a complex innovation, interpersonal or face-to-face communication is more appropriate.

IV. Nature of the social system e.g., its norms, degree of network interconnectedness. *Norms* is defined as 'the established behavior patterns for the members of a social system' (Rogers 2003, p. 26). Further, Rogers (2003) stated that organisational norms can impede the adoption of innovation, so an innovation should be not contrary to the norms.

V. Extent of change agents' promotional efforts.
Change agents' promotional efforts are important because attitudes and behaviours towards change may depend on effective promotion. A change agent is 'an individual who influences clients' innovation decisions in a direction deemed desirable by a change agency' (Rogers 2003, p. 27). The need for a change agent to diffuse innovation is in line with a study conducted by Tambunan (2006) which aimed to explore the main channels for transferring technology from abroad to Indonesia with regard to SMEs. The findings of this study showed that multinational companies played an important role in diffusing technology to SMEs in Indonesia.

As mentioned earlier in this section, Rogers' theory has been refined over many years and its application has been extended from focusing on the adoption of new ideas by individuals to the adoption of new ideas by organisations. Husband and Mandal (1999) stated the need to adopt innovation for SMEs in order to sustain their organisation.

To understand the independent variables that may influence organisational innovativeness better, a framework is presented in Figure 2.16.

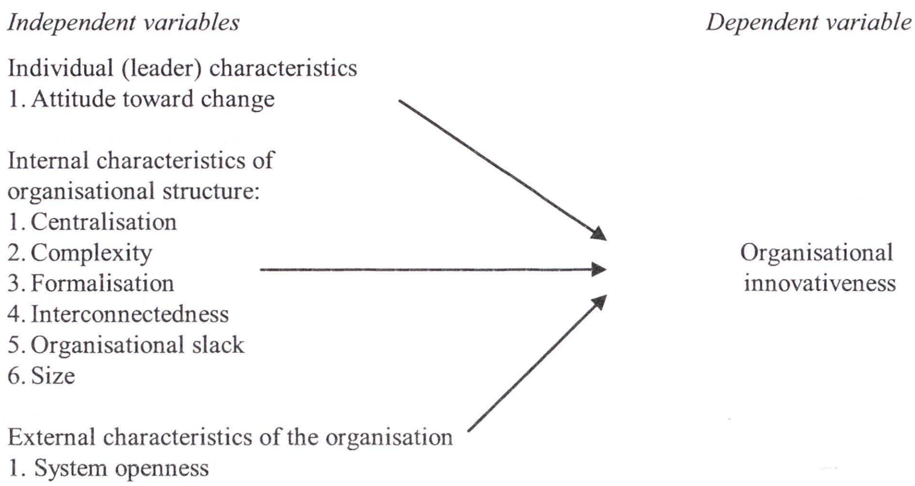


Figure 2.16 The relationship between independent variables and organisational innovativeness

Source: Rogers (2003, p. 407)

It is interesting to note that the above framework was intended to identify variables that are important to organisational innovativeness, in other words, those variables that make organisations more receptive to the innovation. For instance, characteristics of the owner may influence the receptiveness to innovation adoption. All the independent variables in Figure 2.16 are discussed below.

Attitude towards change refers to the leader's or management's attitude toward supporting new ideas when they are adopted into their organisation. According to Rogers (2003, p. 412), *centralisation* is 'the degree to which power and control in a system are concentrated in the hands of a relatively few individuals'. *Complexity* is 'the degree to which an organisation's members possess a relatively high level of knowledge and expertise, usually measured by the members' range of occupational specialties and their degree of professionalism (expressed by formal training)' (Rogers 2003, p. 412). *Formalisation* is 'the degree to which an organisation emphasised following rules and procedures in the role performance of its members' (Rogers 2003, p. 412). *Interconnectedness* is 'the degree to which the units in a social system are linked by interpersonal networks' (Rogers 2003, p. 412). *Organisational slack* is 'the degree to which uncommitted resources are available to an organisation' (Rogers 2003, p. 412).

System openness is 'is the degree to which the members of a system are linked to other individuals who are external to the system' (Rogers 1995, p. 377).

Figure 2.16 shows the relationship between independent variables and organisational innovativeness. Based on past research, almost all independent variables have a positive relationship to organisational innovativeness (Rogers 2003). However, centralisation and formalisation have been found not to have a relationship to organisational innovativeness. Even though the relationship between centralisation and formalisation in Rogers' study was shown to be negative, it may be positive for organisations in different countries.

Both frameworks presented in this section are relevant to the aim of this research which is to develop a Lean Six Sigma implementation framework and diffuse it to SMEs such as those located in industrial centres.

2.8.2 Examples of Research on Diffusion of Innovations

Research has investigated the role of diffusion of innovations factors in the success of innovation implementation (Bradford and Florin 2003), and barrier factors to innovation adoption (Hadjimanolis 1999; Kaufmann & Todtling 2002). Another research project conducted by Oh, Cruickshank and Anderson (2009) has explored the adoption of e-trade innovation by Korean SMEs. Sarosa (2007) has also investigated the adoption of IT in Indonesian SMEs. This body of research will now be discussed.

Bradford and Florin (2003) have examined the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. The diffusion of innovations factors in this research included innovation characteristics such as technical compatibility, perceived complexity and Business Process Reengineering. Organisational characteristics such as top management support, organisational objectives consensus and training were also examined, as was another independent variable that was an environmental characteristic which was competitive pressure. The dependent variables of this research were organisational performance and user satisfaction. Using a survey methodology, this study found a significant relationship between performance and consensus in organisational objectives and competitive pressure. On the other hand, complexity, training, competitive pressure and top management support were significantly related to user (manager) satisfaction regarding the use of a new system.

Hadjimanolis (1999), in his study, listed barriers to innovation adoption in SMEs in Cyprus. These barriers were divided into external and internal barriers. The external barriers were the difficulty of copying innovations, government bureaucracy, limited government assistance, lack of skilled labour and the policies of banks on credit. Internal barriers to adopting innovation were lack of time, inadequate research and development, design and testing, and inadequate finances.

A study conducted by Kaufmann and Todtling (2002) identified similar findings on inovation barriers in SMEs in the province of Upper Austria in Austria. The main barriers to innovation identified were related to financial aspects such as lack of funds, many innovation projects that were too risky and excessively expensive technology. Other barriers indicated by respondents related to human resource aspects such as inadequate qualified personnel and also lack of employee time for innovation activities.

Oh, Cruickshank and Anderson (2009) have explored the adoption of e-trade innovation in South Korean SMEs. They used the Technology Acceptance Model (TAM) which is an information systems theory that models how users accept and use a technology. Several hypothesis were developed in this study to explore factors influenced in the adoption of e-trade in SMEs. For instance, one hypothesis was the greater the perceived usefulness, the more likely SMEs will undertake the "practical use" of e-trade system. Other hypothesis stated that the greater the perceived usefulness, the more likely SMEs will undertake the "continuous adoption" of e-trade system. The results shown that perceived usefulness predicted both practical use and continuous adoption of e-trade system.

A study conducted by Sarosa (2007) investigated factors which influenced IT adoption in Indonesia. In-depth interviews were used to gain data from 35 furniture and handicraft SMEs. The results shown that there were internal and external factors which influenced IT adoption in Indonesian SMEs. The internal factors were support from managers, resources and staff. For instance, Sarosa (2007) pointed out that managers' attitudes towards IT adoption was significantly related in decision to IT adoption. Having a university degree was found to be supportive of IT adoption. External factors found to influence IT adoption were support from government, customers, competitors and IT vendors/consultants. Sarosa (2007) highlighted the lack support from Indonesian Government for SMEs in their IT adoption. For instance, he stated that the public infrastructures such as telecommunications were poor. This study also identified that customer pressure was sometimes a factor related to the adoption of IT e.g. foreign customers prefered to use electronic mail to deal with Indonesian SMEs.

2.9 Evaluation of Six Sigma and Lean Six Sigma Frameworks

In Section 2.6.2 a number of Six Sigma implementation frameworks from the literature were reviewed. An analysis was carried out by mapping the content of the frameworks against Rogers' theory of diffusion of innovations and the critical success factors approach. This analysis will be useful for the development of an implementation framework for Indonesian SMEs.

2.9.1 Analysis Based on Diffusion of Innovations Theory

Table 2.11 provides an analysis of the four Six Sigma frameworks (section 2.6.2) in relation to a number of key constructs that Rogers' diffusion of innovations approach suggests should be considered in an implementation framework. An evaluation of the degree of emphasis and clarity of each framework in relation to Rogers' constructs of the innovation adoption is also provided. A blank cell indicates that the construct does not seem to be included in a framework. It can be seen that the frameworks of Chang (2002) and Park (2003) are particularly weak in their alignment. The frameworks of Burton and Sams (2005) and Furterer (2004) are stronger in alignment, but still relatively weak.

Table 2.11 Examination of existing frameworks based on Rogers' diffusion of innovations

Rogers' constructs	**Frameworks**			
	Chang (2002)	Park (2005)	Burton and Sams (2005)	Furterer (2004)
Relative advantage	unclear	emphasised	emphasised	emphasised
Compatibility	unclear	emphasised	emphasised	emphasised
Complexity	unclear	unclear	unclear	unclear
Trialability		unclear	emphasised	emphasised
Observability		emphasised	emphasised	emphasised
Communication channels	emphasised	unclear	emphasised	emphasised
Nature of social system/culture	less emphasised	less emphasised	emphasised	emphasised
Extent of change agents' promotion	less emphasised		less emphasised	unclear

2.9.2 Analysis Based on Critical Success Factors (CSFs)

Table 2.12 below analyses the four frameworks against five key critical success factors related to implementation. An evaluation of the degree of emphasis and clarity of each framework related to CSFs is also provided. A blank cell indicates that the CSF is not included in a framework. It can be seen in Table 2.12 that frameworks developed by Chang, Burton and Sams, and Furterer all emphasised common CSFs i.e., management commitment, training, communication, employee involvement and customer focus.

Table 2.12 Examination of existing frameworks based on CSFs

Frameworks	**CSF item**				
	Management commitment	*Training*	*Communication*	*Employee involvement*	*Customer focus*
Chang (2002)	emphasised	emphasised	emphasised	emphasised	emphasised
Park (2005)	emphasised	emphasised	unclear	emphasised	emphasised
Burton and Sams (2005)	emphasised	highly emphasised	emphasised	emphasised	emphasised
Furterer (2004)	emphasised	emphasised	emphasised	emphasised	emphasised

2.10 Summary

In this chapter, the relevant literature has been reviewed to support the research and the development of a Lean Six Sigma framework for Indonesian SMEs. Firstly, characteristics of SMEs that could be advantageous to innovation adoption were reviewed. It can be seen that simple organisational structure and information flows in SMEs could help communicate innovation to people in organisations in a shorter time than is possible in large organisations.

Next, a review of the support provided by the Indonesian Government and non-Government agencies was presented. The Government and non-Government agencies normally provide support for training, seminars, financial loans and consultations. In fact, there are many training programs provided by Government but it seems that there is little training directed toward quality improvement for SMEs. However, there is an ongoing 5S training and assistance for SMEs which is supported by the Government.

A discussion of quality improvement evolution was also presented in this chapter. A number of quality practices such as TQM, Six Sigma and Lean Six Sigma have been discussed, along with research on these programs. However, there appears to be more similarities than differences between Six Sigma and TQM concepts. They both include aspects such as strong customer focus, key concepts related to strategy, organisational change, training and setting stretch objectives. Where Six Sigma appears to differ from other improvement approaches is in the training system and the use of DMAIC methodology in problem solving.

A review of research on Six Sigma and Lean Six Sigma with regard to critical success factors (CSFs) and frameworks and models has been presented in this chapter. The existing Six Sigma and Lean Six Sigma frameworks, however, are focused at organisational level and the concept is not diffused at industry level. As this research aims to diffuse Lean Six Sigma at an industrial level, Rogers' theory in diffusion of innovations was used as a theoretical framework. This theory considers cultural aspects, which is important for transplanting innovation to different countries and scales of industry. Literature reviewed relating to a broad range of innovation initiatives e.g. quality, IT clearly shows the important role that government support can play in achieving good outcomes. It is also evident that the diffusion of innovation may be inhibited in business cultures where a high level of corrupt practice exists.

By incorporating Lean Six Sigma concepts and diffusion of innovations theory, the proposed framework of Lean Six Sigma will be valuable for Indonesian SMEs in their implementation of this competitive strategy.

Chapter 3
Theoretical Framework

3.1 Introduction

Rogers' theory of diffusion of innovations is used as the theoretical framework for this research. A review of this theory, which has been widely used in research work, is presented in Section 2.8 of the literature review. The theory is particularly useful in guiding the diffusion of an innovation developed in one cultural setting into a different cultural setting.

The theory is used for two specific reasons which are discussed in this chapter. Firstly, to identify subject that are relevant to this research and secondly to identify broad issues and concerns that should be incorporated in the methodology. Rogers' work addresses factors which affect the rate of adoption of a particular innovation of interest and the characteristics of organisations that are receptive to adopting innovations.

3.2 Identification of Subjects for Research

Clearly SME owners/managers should be a major focus of the research. Rogers points out that leader's characteristics are strongly related to innovation adoption.

Consideration of subjects who can act as communication channels and change agents to facilitate the diffusion of an innovation like Lean Six Sigma identifies the following:

- Government agencies
- Non-government agencies such as universities, the BDS, customers of SMEs, suppliers to SMEs and SME themselves.

3.3 Link to the Methodology

This section describes the link between Rogers' theory and the methodology. Several elements from Figure 2.15 and 2.16 were used in this research methodology as explained below.

3.3.1 Issues Related to Compatibility

It is necessary to assess the compatibility of Lean Six Sigma with the values, culture and so on that exists in SMEs. This was approached in two ways. Firstly, it was considered important to measure SMEs degree of understanding of related management approaches to Lean Six Sigma and associated management tools. Secondly, it was considered important to assess the actual usage of these approaches and tools. In other hands both relevant knowledge and actual practice related to the intended innovation.

3.3.2 Issues Related to Communication Channels

Communication channels influences the rate of innovation adoption, particularly the speed of adoption (Rogers 2003). Rogers claimed that interpersonal communication may result in faster adoption of complex innovation. On the other hand, less complex innovation can be communicated through magazines, newspapers and so on. All of the subjects identified in Section 3.2 can perform an important role in the effective communication of an innovation, these include SMEs themselves.

In particular, the expanding use of virtual communication using IT should be investigated to assess its potential as a means of communicating information and supporting training related to an innovation.

3.3.3 Issues Related to the Leader Characteristics

According to Rogers (2003) the position, especially the attitude, that a leader takes towards organisational change significantly influences the introduction of innovations. Also, as discussed in the literature review, top management support for change has been identified as a key success factor in studies related to quality management.

The literature on SMEs emphasised the importance of the SME owners/managers in controlling and influencing decisions in the organisations (Ghobadian and Gallear 1997). Further, in the Indonesian culture the leadership role of the SME owner/manager is particularly strong.

Therefore, it is important to measure owner/manager characteristics related to innovation adoption. For instance, their willingness to be actively involved in the implementation of an innovation.

Also, the strength of the belief that an owner/manager has in relation to the success of an innovation is indicator of general support.

3.3.4 Issues Related to the Organisational Slack

According to several studies, organisational slack has a positive relationship with organisational innovativeness (Rogers 2003). This means that organisations with available resources are more ready to adopt an innovation.

Therefore, it is important to measure the ability of SMEs to resource an innovation. Also, it is important to measure the degree of readiness of employees to suport the innovation adoption with appropriate skills and levels of education.

3.3.5 Issues Related to Change Agents

Rogers (2003) explains the importance of change agents to the successful diffusion of an innovation like Lean Six Sigma. Besides the owner/manager of SMEs, there are entities that belief has influence in SMEs' decision to adopt innovation. These are other SMEs, key customer of SMEs, supplier to SMEs, universities, BDS and government agencies. It is therefore important to assess the nature and extent of these change agents role in the diffusion of Lean Six Sigma into SMEs.

Chapter 4
Methodology

4.1 Introduction

An important component of research is the employment of an appropriate methodology to gather data. According to Veal (2005) there are several considerations that should be taken into account when choosing a research method:

- the research questions or hypotheses
- previous relevant research
- data availability/access
- resources required
- time available
- validity, reliability and generalisability of findings
- ethics
- uses/users of the findings

Apart from the above considerations, it is important to consider the skills of the researcher.

As explained in Chapter 3, Rogers' theory on diffusion of innovations was used as a theoretical framework for this research. Rogers' theory was also used to identify key subjects of this research. The research subjects were owners/managers of SMEs, Government and non-Government representatives. These subjects were important to gain necessary data for this research.

This research employed a questionnaire-based survey and interviews. A questionnaire survey was developed and administered to obtain a representative sample across the chosen population of SMEs. Complementary to the questionnaire approach, interviews with a small number of representatives from Government and non-Government agencies and SME owners/managers were also carried out. The main objective of the interviews with Government and non-Government representatives was to identify current and future support for Indonesian SMEs.

This chapter will cover several pertinent aspects related to the research methodology and comprises four sections: data collection from SMEs, data collection from other relevant subjects, analysis of data, and a summary.

4.2 Data Collection from SMEs

The majority of the data from SMEs was obtained through the design and administration of a survey questionnaire. This method enables the collection of a relatively large amount of data to support statistical analysis. The method is generally cost effective. Complementing the questionnaire survey, a number of interviews were conducted with SME owners/managers. Interviews were able to cover issues in more depth than the questionnaire survey and also provided a means of data triangulation.

This section covers the sample plan for the questionnaire survey, questionnaire design, questionnaire translation pre-testing and questionnaire administration. Questionnaire response rate, data coding, an analysis of missing data and the design and conduct of interviews with SME owners/managers is also covered.

4.2.1 Sample Plan for the Questionnaire Survey

According to Veal (2005), there are two questions that arise with regard to sample selection; these are the sample plan procedure to assure the representativeness of the population, and the sample size. Thus, the sampling design should be chosen based on the concern of generalisability and cost (Sekaran 2000).

The research employed a list of SMEs in the metal sector from data provided by an independent consultant and BPS as the sampling frame. SMEs from the metal sector were selected because the majority of these SMEs, particularly those located in industrial centres, have been quite involved in Government programs or research conducted by foreign agencies such as JICA.

The actual number of the metal sector SMEs, in particular those located in the Province of East Java, was difficult to establish because the current directory from BPS was not very up to date. A directory for organisations located in two industrial centres was supplied by an independent consultant and used by the researcher. However, this directory had some missing data e.g., missing addresses. It was estimated that the actual number of metal sector SMEs in the Province of East Java was about 1000.

Having selected the target population a suitable sample size requires to be determined. The sample size needs to be sufficiently large to adequately describe the target population including sub-groups. The sample size also needs to be sufficiently large to ensure validity of the various statistical tests that are intended to be carried out. In this latter respect, the multiple regression analysis (see Section 5.3.4) is the most critical for data requirements. A relevant rule-of-thumb when testing b coefficients is that the sample size should at least 104 + m cases, where m is the number of independent variables in the regression equation (Tabachnick and Fidell as cited in Garson 2008). Based on this rule-of-thumb, the minimum sample size required is 104 + 9. There being an expectation subject to expected data reduction, of nine independent variables. Given the uncertainty of the result of data reduction process, it was decided to aim for a sample size of 130.

In order to gain appropriate responses, the researcher planned to distribute the questionnaire through the SMEs' regular meetings. For organisations outside the industrial centres, the plan for questionnaire distribution was to use the postal service. A set of questionnaire forms with a stamped envelope to return the completed questionnaire were sent to the respondents. The intention was then to send a follow-up letter to postal respondents (see Appendix F for English version of follow-up letter).

4.2.2 Questionnaire Design

The questionnaire was designed to address the research objective, and was informed by current literature reviews and preliminary interviews with six SMEs in Indonesia (see Appendix A). Ideas from literature on critical success factors (CSFs) and the diffusion of innovations theory (Rogers 2003) were used to design the questionnaire items. The diffusion of innovations theory was particularly useful for identifying cultural issues related to innovation adoption that needed to be included in the survey.

Several administrative issues needed to be taken into account when designing the questionnaire, for example, the questionnaire length, how easy it would be to read and understand, and the use of an accompanying cover letter to briefly explain the research objectives (see for example Cooper and Schindler 2003). Addressing these issues is important because respondents are usually very concerned about their time when they fill out a questionnaire. Also, based on previous experience conducting survey research in Indonesia, response rate can be very low and questionnaires returned can have a significant amount of missing data (Amar 2002).

An explanation of the design of the questionnaire survey is now presented. A copy of the final English version that was used to collect data can be found in Appendix B, and a copy of the Indonesian version can be found in Appendix C.

Part A. General Information e.g., company demographics, type of ownership, length of time in business. A question on the level of IT usage by SMEs was included in this section to assist in evaluating the feasibility of online training for SMEs. Also, a question on certification to a recognised quality system was included. The literature review demonstrated the links between Lean Six Sigma and quality systems like ISO 9001.

Part B. Program Use and Support. This section has links to the diffusion of innovations theory (Rogers 2003). The question regarding program use was related to the compatibility element of innovation adoption. According to Rogers (2003) the more an innovation is compatible with current organisational values and culture the faster it is likely to be adopted. In the questionnaire, this section enquires into the degree of understanding and the extent of use by the SME of various types of management programs e.g., TQM, Six Sigma. The degree of understanding was measured as this indicates relevant knowledge, even in an organisation that does not use a particular program.

A second section asks about the extent of various types of support from stakeholders, and its importance to the SME, e.g., government, Business Development Services (BDS), universities, customers and suppliers as identified in Chapter 3. This question was based on an article by Kaizer, Dijkstra and Halman (2002) that pointed to the need for support to adopt innovation. Research on innovation in SMEs identifies strong external support as a key success factor of innovation adoption.

Part C. Understanding and Use of Tools and Techniques. This question related to the compatibility of innovation to the current culture and its value in the organisation. It is measured by items relating to previous and current tools/techniques used in the organisation. Questions were based on research conducted by Antony, Kumar and Madu (2005) who identified Six Sigma tools and techniques used by SMEs in the UK. Modifications were made to items to include Lean tools and techniques. It was noted in the literature review that many Six Sigma and Lean Six Sigma tools are common to other approaches to business improvement.

Part D. Readiness to Adopt Innovation. Questions in this part were mainly based on the diffusion of innovations theory. However, researchers from other management improvement areas have contributed literature that has been used in constructing questionnaire items. Questions in Part D were designed with the expectation that they would form composite variables (see Section 4.4.1).

Questions in Part D are described briefly below and the items' sources are provided in more detail in Table 4.1.

Questions in the first section are intended to measure the extent to which the SME has practices that support change and progress e.g., acknowledging and rewarding employees who make significant contributions to the company.

The second section measures the extent to which different types of resources are available within SMEs for innovation adoption. According to Rogers (2003, p. 411), the rate of innovation adoption is influenced by the availability of resources.

The third section measures the commitment of the person completing the questionnaire (owner or manager) to supporting the implementation of a new program once a decision to implement has been made. This question related to diffusion of innovations theory (Rogers 2003, p. 411). More generally, top management support for change is widely cited as a critical success factor, as discussed in the literature review.

The fourth section asks the respondent to evaluate employees' willingness and ability to support a new program.

The final section measures the ability of SME to provide or facilitate training needed for a new program. This question related to CSF, regarding training provision as one of critical elements to the success of innovation implementation.

Table 4.1 Summary of questionnaire item sources for Part D

Variables	Items	Source of Item(s)
D1. Company practice	D1.1	Based on TQM instrument developed by Flynn, Schroeder and Sakakibara (1994)
	D1.2	Based on Yusof (2000a)
	D1.3	Based on several TQM literatures that point to the need for the usage of improvement tools and quality awards e.g., Flynn, Schroeder and Sakakibara (1994)
	D1.4, D1.5 and D1.6	Based on Lean Six Sigma concept which is to improve quality by solving problems with regard to quality, cost and delivery e.g., Flynn, Schroeder and Sakakibara (1994)
	D1.7	Based on TQM literatures, related to Deming's 14 points for instance, e.g., Ross (1999)
	D1.8	Based on TQM instrument developed by Flynn, Schroeder and Sakakibara (1994)
D2. Resource availability	D2.1 and D2.4	Based on Yusof (2000a)
	D2.3	Adopted from Yusof (2000a)
	D2.2	Designed by the researcher
	D2.5	Based on Yusof (2000a)
D3. Management support	D3.1, D3.2, D3.3	Based on Six Sigma literatures which emphasise the importance of active leadership involvement in improvement projects (Burton and Sams 2005). Also, several literatures on change management such as McAdam, Reid and Gibson (2004), Hale and Cragg (1996)
	D3.4, D3.5	Based on Yusof (2000a)
D4. Employee commitment and ability	D4.1, D4.2, D4.3, D4.4	Based on TQM literature which state the important of employee commitment and ability for successful change
	D4.5	Based on Kaizer, Dijkstra and Halman (2002)
D5. Provision of training	D5.1 and D5.2	Based on preliminary interview with some SMEs and Six Sigma literature (Burton and Sams 2005)
	D5.3	Based on Yusof (2000a)

Part E. Influences and Expectations. The first section of Part E contains items to measure how influential different types of stakeholder (e.g., other SMEs, government, key customers) are in influencing the respondent's decision to adopt a new program. This question related to the role of a change agent to diffuse innovation (Rogers 2003). The data collected from this section will be particularly useful in designing the implementation framework.

A single item was also included to measure the respondents' level of optimism in the likelihood that a program like Lean Six Sigma would succeed. This question related to the attitude of management toward supporting innovation adoption, as stated in diffusion of innovations theory (Rogers 2003, p. 411). Moreover, in SMEs generally and particularly in the Indonesian context, the owner's/manager's attitude is very important in influencing people in their organisations and in guiding organisational change.

Part D and E of the questionnaire had space for open-ended responses.

4.2.3 Questionnaire Translation Pre-testing

The questionnaire was developed in English and then translated into Indonesian by the researcher.

After questionnaire development, pre-testing of the Indonesian version was needed to ensure that the respondents would understand and be able to answer the questions. The Indonesian version of questionnaire has been checked by person who was competent in both languages.

Veal (2005) pointed out some of the purposes of questionnaire pre-testing as listed below.

- testing the wording of questionnaire
- testing sequencing of questions
- layout testing
- gaining familiarity with respondents

- testing fieldwork arrangements (if required)
- training and testing fieldworkers (if required)
- estimating response rate
- estimating interview or questionnaire completion time
- testing analysis procedures

Five SMEs were selected for pre-testing the questionnaire. All the questionnaires were distributed directly so there was face-to-face discussion with the respondents. The responses and feedback showed that respondents had quite a high level of understanding in relation to the wording of the questionnaire. Minor grammatical improvements were made to ensure the wording would be understood by respondents in the main survey.

The final version of the questionnaire can be found in English in Appendix B and in Indonesian languages in Appendix C.

4.2.4 Questionnaire Administration

As highlighted earlier in Section 4.1, the main subjects of the questionnaire survey were owners or managers of each organisation surveyed, who were approached with the assumption that they would be capable of answering the questionnaire. However, respondents were not limited to this position; other senior people/staff from a surveyed organisation were allowed to participate in the survey. Moreover, the questionnaire responses were anonymous which meant that information provided by respondents would not be linked to them or their organisations.

The initial plan and the revised plan for questionnaire distribution will now be explained. Changes were made to the distribution plan in response to unforeseen events during the fieldwork.

4.2.4.1 Initial Plan for Questionnaire Distribution

This section explains the initial plan for questionnaire distribution before the researcher left Australia to collect data in Indonesia. Preliminary contacts by phone were first made with two leaders in the industrial centres of Pasuruan and Sidoarjo. It was believed that approaching leaders in these industrial centres and gaining their support and advice was important before starting data collection in SMEs.

During the phone conversation, the project objective was explained and the need for their help to introduce this research in the SMEs' community. After the conversation over the phone, a formal letter was sent to those leaders. The formal letter explained more of the research details that were not covered during the previous conversation. Further to this, the idea to distribute questionnaires during the SME's regular meeting emerged and this strategy was approved by the SME leaders. There were a number of distinct advantages in this method of data collection:

- Support for the research and completion of the questionnaires from leaders of SMEs could be made directly with attendees who would be asked to complete the questionnaire.
- The researcher would be on hand to provide background information, answer questions and provide assistance in completion of the questionnaires when appropriate.
- Because questionnaires would be completed and handed back during the meetings there was an expectation of obtaining a high response rate and an adequate sample size.
- Time spent getting the completed questionnaire back would be minimised.

4.2.4.2 Revision to Questionnaire Distribution

For reasons beyond the control of the researcher, the plans to distribute questionnaires at the regular SME meeting had to be abandoned. This was due to a social problem between one leader in one industrial centre and the SMEs there. Furthermore, it became evident that the response rate from questionnaires mailed to SMEs was very low and was unlikely to yield a satisfactory sample size. These events posed a significant challenge and dilemma for the researcher. A solution was found that provided some unexpected benefits, but it involved a significant extension (to four and a half months) of the time spent doing fieldwork in Indonesia, and resulted in some compromise on the composition of the final sample of SMEs. The solution was to arrange visits to SMEs in the areas of Pasuruan and Sidoarjo and to have respondents fill in the survey questionnaire in the presence of the researcher. This resulted in the following benefits:

- The researcher was able to gain the confidence and cooperation of the owner/manager. Owners/managers were often interested in the researcher's experience of living in Australia and engaging in this polite conversation served as a way to gain their trust and cooperation in completing the questionnaire.
- The researcher was able to guide the respondent through the questionnaire and clarify questions when asked to do so. However, the researcher was careful not to influence the responses in any way.
- The face-to-face encounters enabled the researcher to make observations that would not be possible with postal distribution of the questionnaire and also to ask additional questions related to the research.

Although time-consuming, persistence with this method of data collection resulted in a satisfactory sample size with very little missing data.

4.2.5 Questionnaire Response Rate

A summary of the response rate for the two methods of questionnaire distribution is shown in table 4.2. The overall response rate was 30% and it is evident that direct collection was much more productive than the postal distribution method. As already mentioned, postal distribution had previously proved to be problematic.

Table 4.2 Distribution of questionnaire

Distribution	Number of questionnaire sent	Number of questionnaire received	Response rate (%)
Direct collection	300	130	26
Postal distribution	200	20*	4
Total	500	150	30

* two questionnaires were received from non-SMEs

4.2.6 Data Coding

Coding is 'the process of organising a large amount of data into smaller segments that, when needed, can be retrieved easily' (Bailey 2007). De Vaus (2002) classified coding into six main steps: classifying responses, allocating codes to each variable, allocating column numbers to each variable, producing a codebook, checking for coding errors and entering data.

A total of 148 questionnaire responses were converted into code in order to carry out further analysis. Data entries were double checked against the hard copy to avoid data entry errors. After the data had been entered into SPSS, the next stage was to analyse the data using statistical tests as explain in Section 4.3.

A summary of data coding from the questionnaire survey can be found in Appendix H.

4.2.7 Missing Data

The number of missing data from 148 completed questionnaires is generally low. For instance, the maximum percentage of missing data for any item of Part D (Readiness

Variables) of the questionnaire is 2%. A full analysis of missing data is shown in Appendix I.

4.2.8 Design and Conduct of Interviews with SME Owners/Managers

Interviews were conducted with several owners/managers of SMEs in order to obtain additional information related to this research. The SMEs involved were selected based on several criteria e.g., large and small sizes of SMEs in the industrial centres, closeness to the Government. Based on these selection criteria, there were ten potential SMEs that could be involved, but only six SMEs agreed to participate. Three of these six were medium sized orgaisations. Interviews in each organisation lasted up to one hour.

Interviews were semi-structured, focusing on the following points:

1. General description of their organisation
2. Support they received from Government and non-Government agencies such as the type, frequency and continuity of support
3. Type of support they need in the future.

A copy of the interview questions can be found in Appendix D.

Interviews with SME owners and managers were recorded using a digital recorder. The interview was then backed up and stored on a computer. The files were later transcribed to assist analysis. The accuracy of transcriptions was checked prior to undertaking this analysis.

4.3 Data Collection from Other Relevant Subjects

Besides SMEs as the main subjects of the questionnaire survey, this research involved five Government and non-Government representatives. It was condered that the information provided by them would be valuable for this research, in particular to identify the possible roles for Government and non-Government representatives in the diffusion of Lean Six Sigma in Indonesian SMEs.

The sample plan and interview design is described briefly in the following section.

4.3.1 Sample Plan of Interviews

Interviewees were selected mainly with staff from Government and non-Government agencies in the Province of East Java.

Ten Government and non-Government agencies were approached by the researcher for the interviews. Of these, five representatives agreed to participate. They were staff of MIT at the provincial level, LIK and UPT. Meanwhile the non-Government agencies were represented by a staff member of SENADA, a foreign agency, and a staff member from PUPUK, which is a not-for-profit independent and non-political private organisation. Both of these non-Government representatives were from agencies that actively support SMEs in Indonesia.

4.3.2 Interview Design

Interviews with Government and non-Government representatives took the form of semi-structured interviews, to give interviewees the opportunity to express their own opinions. The main themes of this semi-structured interview were:

1. General description of the agency
2. Type of support provided for SME

3. Future plans for programs/support for SMEs.

As per the interviews with SME owners and managers (see Section 4.2.8) these interviews were also digitally recored and later transcribed for analysis.

4.4 Analysis of Data

Once data are collected, it is necessary to analyse them using the appropriate statistical tests. Qualitative data from interviews was analysed using content analysis. These analyses are explained below.

4.4.1 Analysis of Questionnaire Responses

The quantitative data of this research were analysed using SPSS version 14.0 with the guidance on the use of this software from George and Mallery (2007). A combination of descriptive and advanced statistics was used in presenting the information for this research. Descriptive statistics used in this research were mainly for the demographic aspects of respondents i.e., using chart (Bar), mean, and percentage. The other statistical test performed in this research, including the procedures, is now explained.

Data Reduction using Factor Analysis

Part D of the questionnaire survey was designed with the expectation that the items in each section could be combined to form single composite variables. This data reduction is particularly useful when performing advanced statistical procedures such as multiple regression. A reduction in the number of independent variables in multiple regression can ensure that the procedure is valid with a smaller sample size than would otherwise be the case. Also, factor analysis results in a more parsimonious set of variables.

Data reduction was carried out on each section of Part D of the questionnaire separately using factor analysis. The extraction method is Principal Component Analysis, and the Varimax method is used for rotation.

Reliability

According to Cooper and Schindler (2003), reliability is 'concerned with estimates of the degree to which a measurement is free of random or unstable error'. A study is considered reliable if it could be replicated by other people (Lewis-Beck, Bryman and Liao 2004), for instance: research instruments such as questionnaires which are used by several people for their research. For reliability testing, Cronbach's Alpha was used to measure internal consistency between items under the same dimension or factor. According to Nunnaly (1967) alpha is considered to be acceptable if it is 0.7 or more.

In this research, values of Cronbach's alpha were calculated to assess the realiability of composite scales formed through the application of factor analysis in Part D of the questionnaire. The results of factor analysis and reliability analysis of Part D of the questionnaire are presented in section 5.2.5 of the results.

Correlation Analysis

The Pearson correlation coefficient was used to estimate linear association based on sampling data (Cooper and Schindler 2003). The correlation itself varies between +1 to -1. The correlation analysis is needed to perform further statistical analysis such as regression.

Multiple Regression

Multiple regression is used to investigate the relationship between dependent and independent variables of this research. Several assumptions have to be considered when using multiple regression. The common assumptions are no autocorrelation and multicolinearity. Autocorrelation can be explained by the value of Durbin-Watson (Montgomery, Peck and Vining 2001). To ensure no multicolinearity exists between variables, the proportion of variance for two or more coefficients should not be 0.9 or more (Montgomery, Peck and Vining 2001). The other assumption of multicolinearity is having no Variance Inflation Factors (VIF) values exceeding 10 (Montgomery, Peck and Vining 2001). As stated in section 4.2.1, sample size has to be sufficiently large in order for the procedure to be valid i.e., sample size should have at least 104 + m cases, where m = number of independent variables (Tabachnick and Fidell cited in Garson 2008).

After number of checks on the validity of data, for example, that no multicolinearity exists between variables then multiple regression was carried out. The independent variables were entered in blocks in the regression analysis using the enter method. Entering data in the blocks enables the significance of demographic variables to be explored in a systematic way.

4.4.2 Analysis of Qualitative Data

After the transcription process, the next stage was analysis of this qualitative data. The content analysis was applied, resulting in identification of several specific themes under the main questions. According to Berg (1995), in content analysis the researcher usually counts the words, themes, characters, paragraph, concepts and semantics in the text. This research used basic content analysis, which involved counting the text based on frequent themes discussed during the interviews.

4.5 Ethics Approval

This research has been approved by the UTS Ethics Committee. The final version of the questionnaire was submitted to the Research Office for approval before starting data collection. The clearance number is UTS HREC REF NO. 2006-268A and a copy of the Ethics approval letter can be found in Appendix E.

4.6 Summary

This chapter has discussed the research methodology and methods employed for data collection and analysis. Methods adopted in this research were questionnaire survey and interviews. The questionnaire survey was intended to gain information mainly regarding the SMEs' readiness to adopt innovation. The questionnaire items were substantially based on the diffusion of innovations theory and management improvement. The questionnaire survey subjects were mainly owners or managers of SMEs. Several interviews were conducted to gain additional information regarding support for innovation adoption. The interview subjects were several SME owners/managers and their stakeholders.

There was an interesting point to note in the questionnaire distribution plan. The revision of the questionnaire distribution resulted in several benefits for this research e.g., minimising bias by being able to clarify questions when the respondents asked the researcher to do so.

A total of 148 completed questionnaires were returned from SMEs and the majority of respondents were located in the industrial centres. This sample size is sufficient for the intended analysis.

For qualitative data collection, content analysis was used to identify important information from interviews. Further, this information will support the framework development.

The next chapter will discuss the result of the data analysis.

Chapter 5
Results

5.1 Introduction

This chapter presents an analysis of the data and information collected in this research. A discussion of the results and the development of a Lean Six Sigma implementation framework are presented in Chapter 6.

The results of the quantitative data from the questionnaire survey completed by SME owners/managers, sample size 148, are presented first. A number of different analyses were used to explore the quantitative data. Descriptive statistics (e.g., frequency counts, percentages, mean values and standard deviations) of the demographic and other variables are presented first. Data reduction using factor analysis is then performed to enable associations between variables to be explored. The rationale for using data reduction is explained in the methodology. Correlation analysis and multiple linear regression is used to explore relationships between variables. Multiple linear regression is used to identify variables related to a respondent's evaluation of the likelihood that a new program, like Six Sigma, would be successful if implemented in their organisation.

The results from the qualitative data are then presented. Qualitative data was collected through open ended questions on the survey completed by SME owners and managers that required a written response and through interviews carried out with Government and non-Government agencies and SME owners/managers.

5.2 Quantitative Results

This section reports the findings from the quantitative data analysis from the questionnaire survey. A total of 150 usable responses were obtained. Two of these were from large organisations and were discarded, leaving a sample size of 148. A summary of the coding sheet of the questionnaire survey is presented in Appendix H. In the analysis that follows, question numbers that refer to the survey questionnaire (see Appendix B) will be provided where this adds clarity.

5.2.1 Demographics and General Information

These are responses to questions in Part A of the Questionnaire (see Appendix B for a copy of the questionnaire).

5.2.1.1 Position of Respondent in the Organisation (QA1)

Of the 147 respondents, 130 (88.4%) were owners of the business and 13 (8.8%) were managers. Four respondents were Quality Control and Production staff.

Table 5.1 Position of the respondent

Position	Number	Percent
Owner	130	88.4
Manager	13	8.8
Others	4	2.7
Valid case	147	100.0

5.2.1.2 Location of Responding SMEs (QA6)

Table 5.2 shows that the majority of respondents came from the two centres in the metal industrial sector in the Province of East Java. As explained in the methodology (see Chapter 4), SMEs in these two centres completed the questionnaire in the presence of the researcher who visited all the sites. The postal method used for other areas outside these centres proved ineffective and produced a very low response rate. As SMEs outside the centres were know to be generally larger in size than SMEs in the centres, this low postal response rate probably contributed to larger SMEs being under-represented in the overall sample.

Table 5.2 Location of responding SMEs

Location	Number	Percent
Sidoarjo	69	46.6
Pasuruan	69	46.6
Surabaya	2	1.2
Others	8	5.4
Valid case	148	100.0

5.2.1.3 Company Size (QA2)

A breakdown of company size by number of employees is shown in Table 5.3. The most striking feature is the very large proportion of companies with less than ten employees (53%). Eight companies had more than 50 employees. This distribution may be a reflection of the population of SMEs in the industrial centres of Pasuruan and Sidoarjo where the majority of responses were obtained. The sampling method was designed to select a representative sample from the populations surveyed. However, as explained in Section 5.2.1.2, the majority of respondents were from two industrial centres and in these two areas SMEs tend to be small. SMEs outside those centres in locations such as Surabaya and other areas are larger in terms of workforce and were under-represented in the survey sample.

During discussions with SME owners/managers, it emerged that SMEs often employ part-time staff. The statistics in Table 5.3 include only full-time staff and therefore to some extent underestimate total workforce size.

Table 5.3 Number of employees

Number of Employees	Number	Percent
< 10 employees	78	53.1
10 – 25 employees	49	33.3
26 – 50 employees	12	8.2
51 – 75 employees	3	2.0
76 – 99 employees	5	3.4
Valid case	147	100.0

5.2.1.4 Length of Time in Business (QA3)

Table 5.4 shows that the majority of organisations involved in this research were well established with a significant amount of operational experience. About 45 percent of organisations had been operating for more than 15 years.

Table 5.4 Length in business

Length of time in business	Number	Percent
1-5 years	23	15.9
6-10 years	25	17.2
11-15 years	32	22.1
> 15 years	65	44.8
Valid case	145	100.0

5.2.1.5 Company Ownership (QA4)

Table 5.5 shows that 97.3 percent (144) of SMEs responding to the survey were locally-owned. This is because under Indonesian Law, small organisations have to be owned by locals.

Table 5.5 Company ownership

Company ownership	Number	Percent
Locally-owned	144	97.3
Join-venture	1	0.7
Foreign	2	1.4
Others	1	0.7
Valid case	148	100.0

5.2.1.6 Main Products Produced (QA5)

Respondents were asked about their main products, that is, automotive components, electrical components and other products. The results are shown in Table 5.2. It can be seen that a large proportion of the SMEs are involved in the automotive industry. Just under half produced goods in the 'other' category and examples of these are given in Table 5.6.

Table 5.6 Product type

Main product type	Number	Percent
Automotive component	39	26.4
Automotive interior and exterior parts	30	20.3
Electricity component	6	4.1
Others (furniture, handicraft, agricultural tools, etc.)	73	49.3
Valid case	148	100.0

5.2.1.7 Market Orientation (QA8)

Table 5.7 shows that most of the responding SMEs did not export their products.

Table 5.7 Market orientation

Market orientation	Number	Percent
Yes (export)	4	2.7
No (not export)	144	97.3
Valid case	148	100.0

5.2.1.8 Quality Certification (QA7)

Certification to a recognised quality standard is a direct indication of familiarity with ideas of quality management. Table 5.8 shows that the majority of SMEs did not have quality certification, for example, to ISO 9001 or the National Indonesian Standard (SNI). This result may be because the majority of SMEs sell their products in the local market rather than internationally. During administration of the questionnaire, some SME owners/managers told the researcher that they felt that certification was not particularly important for competing in the local market.

Table 5.8 Quality certification

Location	Number	Percent
ISO 9001	5	3.4
SNI	1	0.7
None	142	95.9
Valid case	148	100.0

5.2.1.9 Use of IT (QA9)

Respondents were asked to rate the degree of IT usage in terms of their use of internet access, electronic mail, and so on in their business. Evaluation was made on a seven point Likert scale which range from 1 (not used at all) to 7 (very high use). The mean IT use was 1.56. It is evident that in general SMEs were not actively using IT for their business. However, there were several SMEs that used IT extensively. The distribution of responses is shown in Figure 5.1.

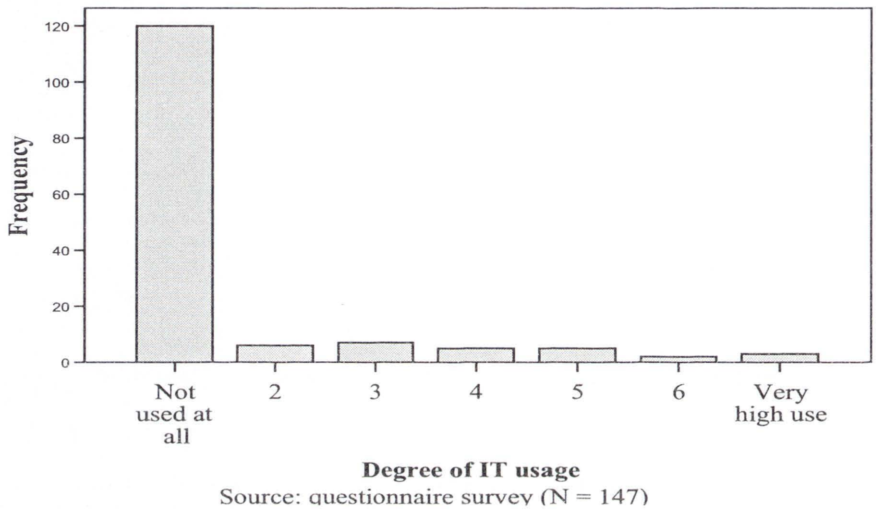


Figure 5.1 Degree of IT usage

5.2.2 Understanding and Usage of Improvement Programs (Part B1 of Questionnaire)

Questions in this section of the questionnaire measured the level of understanding and the degree of usage of improvement programs such as TQM, QCC and Six Sigma. Respondents were asked to rate their degree of understanding and usage of improvement programs using the seven-point Likert scale. The results are shown in Table 5.9. The three right hand columns of Table 5.9 provide additional information on the distribution of usage of improvement programs across the sample of SMEs.

Table 5.9 Understanding and usage of improvement programs

Type of Program	Understanding		Usage					
	Mean[1]	Std. Dev.	Mean[2]	Std. Dev	No use[3] (%)	Low use[4] (%)	Medium use[5] (%)	High use[6] (%)
TQM	2.16	1.84	1.70	1.55	79.5	6.1	8.2	6.2
Six Sigma	1.32	1.04	1.19	0.82	92.5	4.8	1.4	1.4
QCC	1.91	1.74	1.58	1.44	81.4	8.9	4.9	4.8
JIT	1.69	1.52	1.53	1.39	82.9	9.6	3.4	4.1
Lean-Manufacturing	1.56	1.47	1.51	1.43	86.3	4.2	5.5	4.1
Lean Six Sigma	1.36	1.09	1.28	1.01	90.3	5.6	2.1	2.1

[1] Scale from 1 = none at all to 7 = very high level
[2] Scale from 1 = never been used to 7 = high use
[3] No use = score of 1 on usage scale
[4] Low = score of 2 and 3 on usage scale
[5] Medium = score of 4 and 5 on usage scale
[6] High = score of 6 and 7 on usage scale

The results show relatively low levels of both understanding and usage across the different types of program. TQM is clearly the most understood and widely used type of program. This may have resulted from the TQM and QCC program conducted by the Indonesian Government and JICA several years ago (UNIDO and JSA 2001) .

5.2.3 Understanding and Usage of Improvement Tools and Techniques (Part C of Questionnaire)

Respondents were asked to rate their level of understanding and usage of improvement tools and techniques such as 7 basic QC tools, 5S, etc. The understanding scale was from 1 (none at all) to 7 (very high level) and the usage scale was from 1 (never been used) to 7 (very high usage). The results are shown in two forms. Figure 5.2 provides a graphical comparison of the mean values of understanding and usage for each of the improvement tools and techniques that were evaluated. Table 5.10 provides information on the distribution of the evaluations across SMEs in the sample

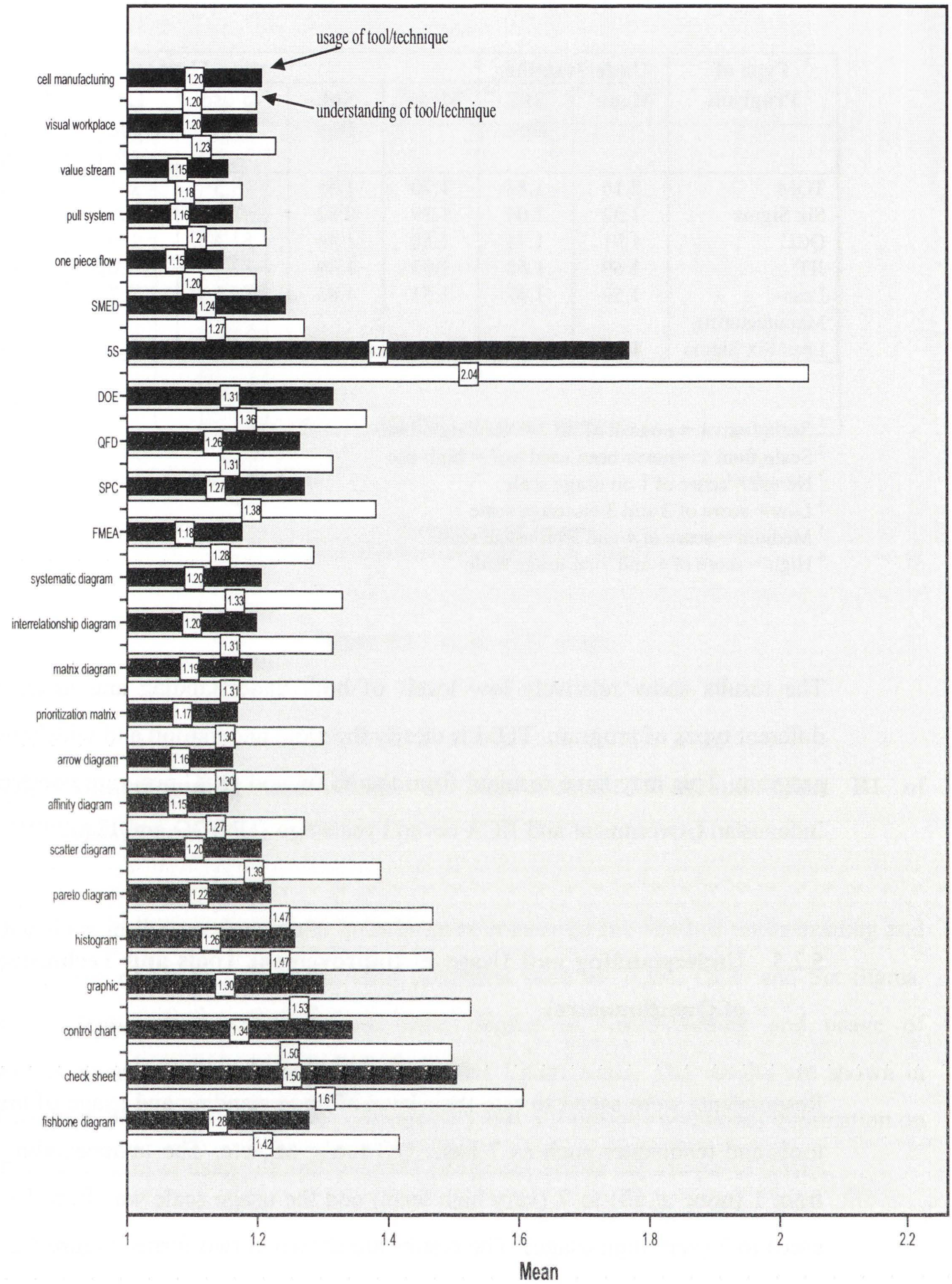


Figure 5.2 Mean values of understanding and usage of improvement tools/techniques

Source: sample size for items ranged from 145 to 147

Table 5.10 Understanding and usage of improvement tools and techniques

No	Tools/Techniques	Understanding[1] (percentage)				Usage[2] (percentage)			
		None	Low	Med	High	None	Low	Med	High
1	Fishbone diagram	83.4	8.9	3.5	4.2	87.8	6.1	5.4	0.7
2	Check sheet	78.2	9.6	6.1	6.2	80.3	8.8	6.8	4.0
3	Control chart	81.0	9.6	4.0	5.4	84.2	7.5	6.1	2.1
4	Graph/chart	81.6	7.5	4.7	6.1	87.1	6.8	3.4	2.8
5	Histogram	84.4	5.5	6.1	4.1	89.8	4.8	4.1	1.4
6	Pareto chart	83.7	6.8	5.4	4.1	91.2	3.4	4.7	0.7
7	Scatter diagram	86.4	5.4	4.8	3.4	91.8	2.8	4.8	0.7
8	Affinity diagram/KJ method	89.7	4.1	4.2	2.1	94.5	2.1	2.8	0.7
9	Arrow diagram	87.8	5.4	4.1	2.8	92.5	3.4	3.4	0.7
10	Prioritisation matrix	88.4	4.1	5.4	2.1	93.2	3.4	2.7	0.7
11	Matrix diagram	89.1	3.4	4.0	3.4	92.5	3.4	2.7	1.4
12	Interrelationship diagram	87.8	5.4	3.4	3.4	91.8	4.1	3.4	0.7
13	Systematic diagram/tree diagram	87.1	5.5	3.4	4.1	91.8	3.4	2.7	2.0
14	Failure Modes and Effects Analysis (FMEA)	88.4	6.2	2.1	3.5	93.8	2.1	2.1	2.1
15	Statistical Process Control (SPC)	85.6	5.5	4.8	4.1	91.8	1.4	3.5	3.5
16	Quality Function Deployment (QFD)	87.8	4.8	4.1	3.4	91.2	2.7	3.4	2.7
17	Design of Experiment (DOE)	85.0	6.8	4.1	4.0	89.1	4.0	2.8	4.1
18	5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke)	69.4	8.9	11.6	10.2	72.8	13.6	7.4	6.1
19	Set up time reduction (SMED)	88.4	4.1	5.5	2.1	89.7	3.5	4.8	2.1
20	One piece flow	90.4	6.9	1.4	1.4	91.8	5.5	2.1	0.7
21	Pull system (kanban)	89.7	6.9	0.7	2.8	91.2	4.1	3.4	1.4
22	Value stream mapping	91.8	5.5	1.4	1.4	92.5	3.4	3.4	0.7
23	Visual workplace	91.0	3.5	3.5	2.1	92.5	1.4	4.1	2.1
24	Cellular/flow manufacturing	89.0	6.2	2.8	2.1	89.0	5.5	2.8	2.8

[1] None = score of 1 on understanding scale
Low = score of 2 and 3 on understanding scale
Medium = score of 4 and 5 on understanding scale
High = score of 6 and 7 on understanding scale
[2] None = score of 1 on usage scale
Low = score of 2 and 3 on usage scale
Medium = score of 4 and 5 on usage scale
High = score of 6 and 7 on usage scale

The most striking aspect of these results is the large proportion of SMEs that have no knowledge and no usage of the tools and techniques. The most understood and used technique was the 5S improvement approach with about one third of organisations using this. Approximately twenty percent of organisations have some experience of the basic quality improvement tools such as graphs and check sheets. Understanding and use of the more sophisticated tools and techniques were reported by around ten percent of respondents.

5.2.4 Strength and Importance of Support for SMEs (Part B2 of Questionnaire)

Questions on this part of the questionnaire measured the strength and importance of Government support and various forms of non-Government support for a new program like Six Sigma, from the perspective of the SME owner/manager. Here, support from Government and non-Government sources was mainly related to training, consultancy and other support such as provision of loans and credit facilities that would be of use to SMEs in developing a new program. Respondents reported very few types of support in the 'other category' and these have been omitted from Figure 5.3. Other types of support included financial support such as subsidies and loans.

The results (mean values) are shown graphically in Figure 5.3. Generally, mean values of both strength and importance of support for SMEs were low. However, respondents rated their main customer as the strongest provider of consultation support. The second highest mean in support strength was consultation support, which was provided by the SMEs' main supplier. Meanwhile, the mean of strength of support, i.e., training, provided by the Government came beneath the support from the main customer and main supplier.

Figure 5.3 also shows that consultation with the main customer was important, based on the respondents' view followed by consultation with their main supplier. Respondents held the view that training provided by Government was also important, but the mean was below the main customer and the main supplier.

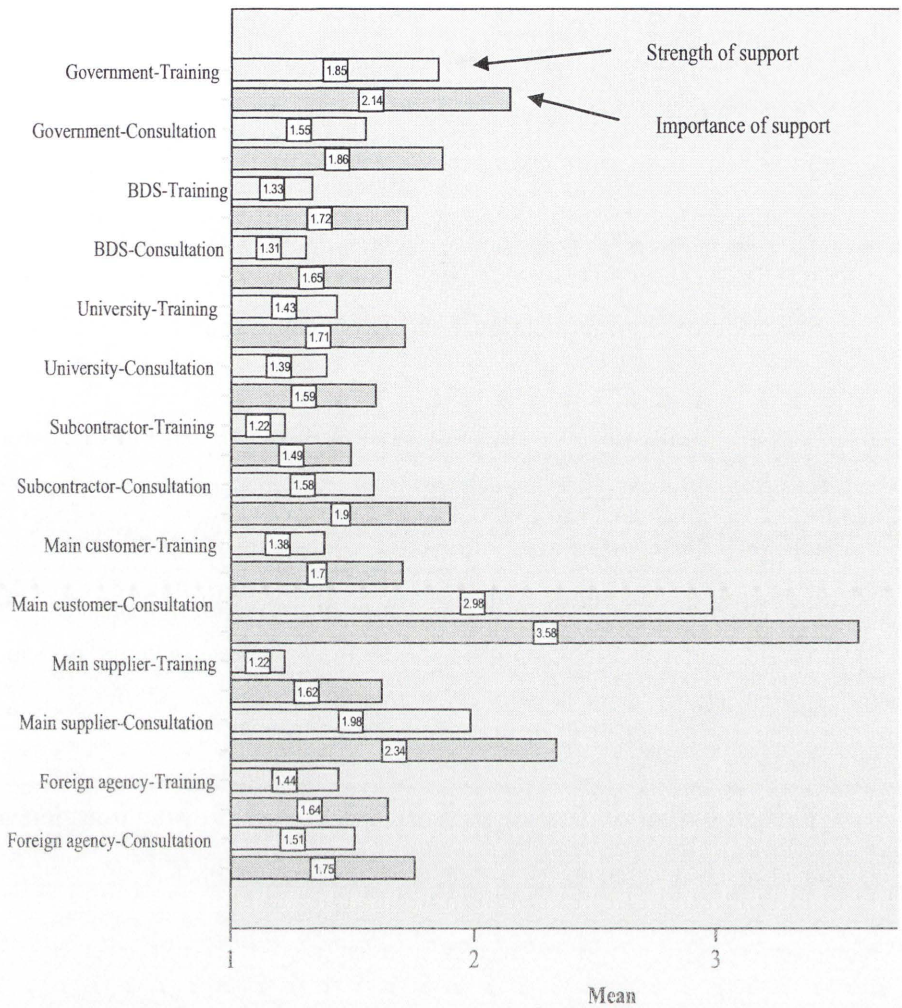


Figure 5.3 Mean values strength and importance of support for SMEs

Source: sample size for items ranged from 128 to 147

5.2.5 Readiness to Adopt Innovation (Part D of Questionnaire)

There were five sets of questions in Part D of the questionnaire that explored practices and forms of support considered relevant to the successful adoption of an innovative management approach. Section D1 covered work practices, section D2 resources, section D3 support from owners/managers who completed the questionnaires, D4 evaluation of employee support and D5 training support.

Descriptive statistics are presented below for each section of Part D. In Section 5.3.1, a data reduction analysis is carried out on each of the five sections of Part D using factor analysis. The purpose of this data reduction is to obtain a reduced set of more parsimonious variables to use in multivariate analysis. This data reduction uses factor analysis and reliability analysis. These techniques are explained in section 4.4.1 of the methodology.

The distribution of data for the variables in Part D of the questionnaire was examined by plotting hisograms. These are presented in Appendix J.

5.2.5.1 Company Practices (Section D1)

The extent of each practice was evaluated on a scale from 1 (very low) to 7 (very high).

Table 5.11 Company practices

Item	Mean	Standard Deviation
Having regular communications with customers in order to meet their requirements (D1.1)	5.45	1.61
Having regular measurement of customer satisfaction and acting on the results of measurement (D1.2)	6.11	1.42
Decision making and action taking based on data rather than gut feel or guesswork (D1.3)	2.80	2.04
Using improvement tools/techniques to improve quality of product (D1.4)	2.32	2.03
Using improvement tools/techniques to reduce cost (D1.5)	2.22	1.91
Using improvement tools/techniques to reduce time of production (D1.6)	2.12	1.82
Having a culture in which people are not blamed for new ideas that do not work (D1.7)	5.29	1.69
Acknowledging and rewarding employees who make a significant contribution to the company (D1.8)	4.25	2.10

It can be seen from Table 5.11 that communicating with customers and tracking customer satisfaction are by far the most well developed practices among those reported. The mean scores for the use of tools/techniques for improvement is low. This result is consistent with the findings for the use of specific tools and techniques in Section 5.2.2. The mean values for the last two items in the table i.e., not blaming employees for trying, and rewarding contribution to the company, are supportive of a culture of improvement and change.

5.2.5.2 Resource Availability (Section D2)

The extent to which the SME could provide each resource was evaluated on a scale from 1 (very low) to 7 (very high).

Table 5.12 Resource availability

Item	Mean	Standard Deviation
Financial resources to support new program/approach (D2.1)	4.43	1.87
Technical resources e.g., software, equipment (D2.2)	4.68	1.96
Consultant hiring to help implementation of a new program/approach (D2.3)	3.17	2.10
A work environment that enables employees to work together as a team on an new program/approach (D2.4)	5.24	1.92
Employees (other than managers) who are able to be allocated full-time to work on a new program/approach (D2.5)	4.32	2.04

Table 5.12 shows a generally positive position regarding resource availability for a new program. Hiring consultants is an exception, perhaps because of the expense involved. The positive score of teamwork (5.24) is encouraging for change.

5.2.5.3 Management Support (Section D3)

Respondents to the questionnaire i.e. owners or managers, were asked to evaluate their support given a decision to go ahead with a new program/approach had been made.

Table 5.13 Management support

Item	Mean	Standard Deviation
I am willing to be actively involved in a new program/approach that is adopted (D3.1)	5.70	1.70
I am willing to change the thinking in our company to support a new program/approach (D3.2)	5.66	1.69
I am willing to change policies in this company to support a new program/approach (D3.3)	5.22	1.88
I am willing to attend training in order to improve my knowledge and ability to lead the implementation of a new program/approach in my company (D3.4)	5.34	1.89
I am willing to support a new program/approach with adequate resources (D3.5)	5.76	1.71

Table 5.13 shows a very positive position regarding program support.

5.2.5.4 Employee Commitment and Ability (Section D4)

Respondents were asked to evaluate their employees' commitment to a new program and to evaluate a number of employee abilities that would assist the successful implementation of a new program. Evaluations were made on a scale from 1 (very low) to 7 (very high).

Table 5.14 Employee commitment and ability

Item	Mean	Standard Deviation
Employees' willingness to work as a team (D4.1)	5.47	1.64
Employees' willingness to learn new things (D4.2)	5.36	1.63
Employees' ability to solve problems in their workplace (D4.3)	4.85	1.66
Employees' skill with regard to their job (D4.4)	4.92	1.43
Employees' educational background that enables them to analyse operational problems e.g., use of statistics (D4.5)	2.79	1.85

Generally, the results shown in Table 5.14 depict a workforce that is willing and to some degree capable of responding to changes in technology. The evaluation of educational background is however quite low and suggests that this could be an impediment to changes in the organisation that require more use of analysis by workers. Training would be required to address this deficiency.

5.2.5.5 Provision of Training (Section D5)

The ability of the SMEs to provide training for a new program/approach was evaluated by respondents on a scale from 1 (very low) to 7 (very high).

Table 5.15 Provision of training

Item	Mean	Standard Deviation
To train selected people at management level in key aspects related to a new program/approach (D5.1)	4.65	1.99
To train selected employees in key aspects related to a new program/approach (D5.2)	4.38	2.01
Provide training time to employees who have training opportunities outside the company related to a new program/approach (D5.3)	4.51	1.98

Given the general lack of resources in SMEs, the results in Table 5.15 are encouraging as they suggest a moderate ability across the sample to provided training for a new program.

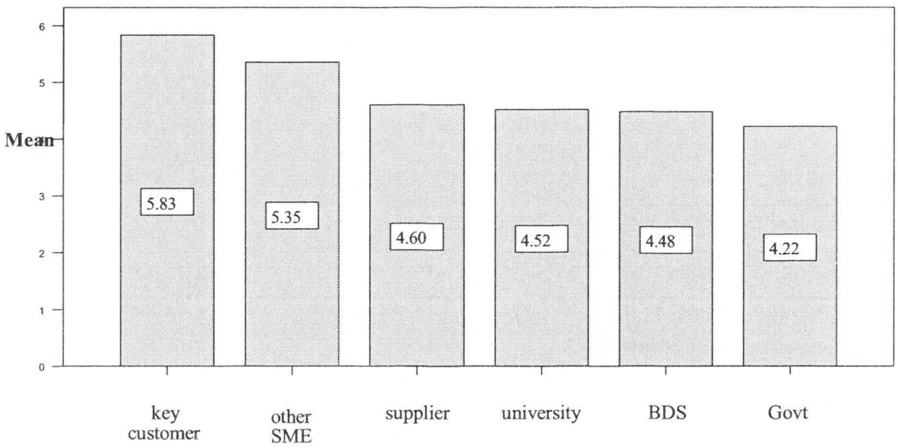
5.2.6 Influences and Expectations (Part E)

The first section in Part E evaluates the degree to which respondents are influenced by external entities when deciding to adopt a new program or approach. The scale used was from 1 (not influential) to 7 (very influential). The results are shown in Table 5.16 and in Figure 5.4 where the entities have been arranged in order of their mean values.

Table 5.16 External influences on SMEs to adopt innovation

Influencing Entity	Mean*	SD
Key customers	5.83	1.66
Other SMEs	5.35	1.89
Suppliers	4.60	2.31
University/institution	4.52	2.32
Business Development Services (BDS)	4.48	2.28
Government	4.22	2.24

* Scale from 1 (not influential) to 7 (very influential)



Source:questionnaire survey

Figure 5.4 External entities' influence on SMEs in adopting innovation

It can be seen that the two most influential entities are key customers and other SMEs. To confirm that these two entities were statistically the most influential, Paired t Tests (two sided) were performed for equality of mean values. Results confirmed that 'key customers' were rated significantly higher than all other entities (at the .05 level) and that 'other SMEs' were rated significantly higher than all other entities with lower mean values (at the .05 level). Details of these tests are provided in Appendix K.

5.2.7 Belief that Program Will Succeed (Part E2 of Questionnaire)

A single item was used to measure the respondents' level of optimism regarding the success of a new program i.e., 'Please indicate on the scale below the extent to which you believe that implementing a new program/approach in your company such as TQM, Lean Six Sigma, etc. is likely to be successful'. The response to this question is shown in Figure 5.5. Of note is that just over one third of respondents gave an evaluation of four suggesting uncertainty or perhaps lack of understanding of what these kinds of initiatives mean in practice. However, on a positive note, over one third of respondents returned optimistic evaluations of 5 and above.

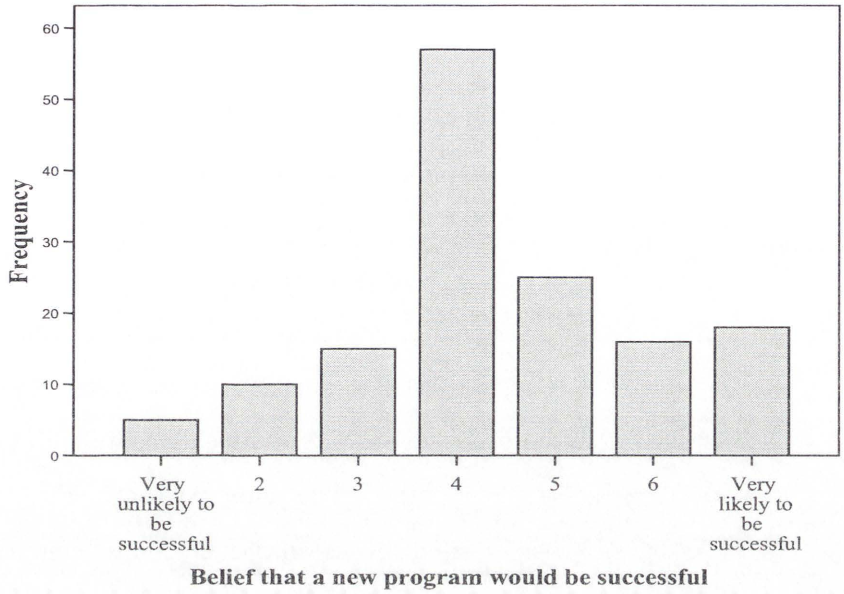


Figure 5.5 Belief that a new program will succeed

Further analysis using t tests was conducted to compare mean values of 'believe that a new program would be successful' between group of samples based on location and length in business. No significant differences were found at the .05 level. See Appendix L for details of these tests.

5.3 Further Analysis of Quantitative Data

In the following section further analysis is carried out to investigate relationships between variables in order to obtain a deeper understanding of the data. Data reduction using factor analysis and reliability analysis is first performed. Correlation analysis is then used to explore associations between variables. Multiple linear regression is then used to identify variables that influence respondents' beliefs about the success of a new program.

5.3.1 Data Reduction

Data reduction was carried out on each section of Part D of the questionnaire separately using factor analysis. The extraction method was Principal Component Analysis, and the Varimax method was used for rotation. Items in sections D2, D3, D4 and D5 loaded onto single factors. Items in section D1 loaded onto two factors. Items 3, 4, 5 and 6 formed one factor that could be interpreted as: the extent and use of tools and techniques for improvement. This factor had a satisfactory Cronbach's Alpha value of 0.91. Items 1, 2, 7 and 8 loaded onto the second factor which was difficult to interpret and had a low value of Cronbach's Alpha of 0.55. The value of Cronbach's Alpha for items 1 and 2 was checked as both were related to customer focus and found to be unacceptably low at 0.43. As customer focus was considered an important variable for subsequent analysis the first item in section D, i.e., having regular communications with customers in order to fulfil their requirements, was selected as a single item for use in subsequent analysis. The result for 'key customers' shown in Table 5.12 supports the importance of this variable.

Table 5.17 lists the variables formed from part D of the questionnaire that will be used in subsequent analysis. It can be seen that the values of Cronbach's Alpha for the composite variable are satisfactory. Further details of the factor analysis of part D are provided in Appendix N.

Table 5.17 Readiness variables (Part D of questionnaire)

Variable Name	Explanation of Variable	Cronbach's Alpha*
Use of improvement tools (4 items from section D1)	Extent of use of tools/techniques to improve quality, reduce cost, reduce production times. (These 4 items grouped when subject to factor analysis)	0.911
Communication with customers (1 item from section D1)	Extent of regular communication with customers in order to fill their requirements.	n/a
Resource availability (all 5 items from section D2)	Extent to which company is able to provide resources (financial, technical assistance, employees etc.) to support a new program.	0.841
Management support (all 5 items from section D3)	Extent to which the respondent (owner/manager) is willing to support a new program e.g., willingness to involve actively in the implementation phase, attend training, provide resource, etc.	0.881
Employee commitment and ability (all 5 items from D4)	Respondent's assessment of employees' willingness to support a new program e.g., learning new things, solving problems, working as a team.	0.760
Provision of training (all 3 items from D5)	Evaluation of company's ability to provide training for a new program.	0.897

*Cronbach's Alpha is a measure of internal reliablity of a group of items; values > 0.7 are considered acceptable (see Section 4.4.1)

5.3.2 Descriptive Statistics of Readiness Variables

Descriptive statistics on the variable derived from part D of the questionnaire and described in Table 5.17 above are presented in Table 5.18. Composite variables, i.e., variables formed from a number of items, can be derived in a number of ways; for example, factor scores can be used. Here the mean value of items comprising the composite variables has been used. An advantage of using the mean value is that the comparison with the original 1 to 7 Likert scales can be made as shown in Table 5.18. With the exception of 'use of improvement tools', all the readiness variables have mean values significantly greater than four: the mid point of the one to seven scale.

Table 5.18 Mean of readiness variables

Variables	Mean*	Standard Deviation
Use of improvement tools	2.355	1.718
Communication with customers (single item)	5.453	1.609
Resource availability	4.358	1.539
Management support	5.538	1.446
Employee commitment and ability	4.666	1.184
Provision of training	4.450	1.881

*Items comprising these variables were measured on a scale from 1 (very low) to 7 (very high)

Further, comparing between group of samples based on location and length in business were explored using independent sample t tests. The length in business data has been re-grouped into two categories which is those with less than 10 years in business and those with more than 10 years in business. Re-grouping the categories of samples has been done because some of the categories used on the questionnaire contained a low number of responses. The findings shown that the difference in means of use of improvement tools, resource availability, management support, employee commitment and ability and provision of training between samples in Sidoarjo and Pasuruan was statistically significant at the .05 level. Only means of communication with customers was not siginificantly difference between samples in Sidoarjo and Pasuruan. It can be seen from the test results in Appendix M that the SMEs in the Pasuruan location had higher mean values for all but one of the variables for which there was a significant difference in means between the two locations. There were no significant differences in means between SMEs with less than 10 years business experience and those with more than 10 years experience (see test results in Appendix M).

5.3.3 Correlation Analysis

Table 5.19 shows correlations between the six readiness variables and the item evaluating belief that a new program will succeed. It can be seen that key resources variables three to six are positively correlated with 'belief program will succeed' at the 0.01 level.

Table 5.19 Correlation of readiness variables

Variables	*Correlation*					
	1	2	3	4	5	6
1. Use of improvement tools						
2. Communication with customers	.201*					
3. Resource availability	-.181*	.317**				
4. Management support	-.224*	.373**	.623**			
5. Employee commitment and ability	.001	.408**	.424**	.441**		
6. Provision of training	-.198*	.286**	.528**	.636**	.428**	
7. Belief program will succeed	-.035	.141	.383**	.401**	.370**	.358**

* Correlation significant at the 0.05 level (two-tailed)
** Correlation significant at the 0.01 level (two-tailed)

5.3.4 Regression Analysis

To gain further insight into variables related to respondents' belief that a new program will succeed, multiple linear regression results are now presented. The dependent variable was a single item in Part E of the questionnaire: 'Please indicate on the scale below the extent to which you believe that implementing a new program/approach in your company such as TQM, Lean Six Sigma, etc. is likely to be successful'. The independent variables (predictor variables) used were as follows:

- The six readiness variables (see Table 5.17 for a list of these variables)

Plus the following 'control variables' which were entered as 'dummy variables':

- Respondent to questionnaire (owner/senior manager/other)
- Length of time company has been in business - four categories: 1-5 years, 6-10 years, 11-15 years, more than 15 years
- Number of employees - three categories: less than 10 employees, 10-25 employees, 26-99 employees

A relevant rule of thumb for testing the b coefficient was confirmed, that was N more than 104 plus the number of independent variables. See Chapter 4 for further explanation of sample size when performing a multiple regression test.

A number of standard checks were made to assess the validity of data for multiple regression, for example, for autocorrelation and collinearity. These tests confirmed the suitability of the data (see Appendix N). Table 5.20 shows the results (using the enter method) which identified three significant predictor variables i.e., resource availability (std. Beta=0.176, p=0.084), management supports (std. Beta=0.190, p=0.094) and employee commitment and ability (std. Beta=0.217, p=0.016). As presented in Table 5.20, the overall regression model was significant (F=4.379, $p<0.01$, R^2=0.288). For the overall multiple regression, output from SPSS is presented in Appendix O.

Table 5.20 Regression result

Dependent variable: belief that a new program will succeed

Variables	1	2	3	4
Position-manager and other levels	-.092	-.039	-.068	-.026
Employees – 10 to 25		-.015	-.015	-.051
Employees – 26 to 99		-.099	-.092	-.062
Length in business – 1 to 5 years			-.090	-.083
Length in business – 6 to 10 years			-.130	-.169**
Length in business – 11 to 15 years			.054	.036
Use of improvement tools				.081
Communication with customers				-.092
Resource availability				.176*
Management support				.190*
Employee commitment and ability				.217**
Provision of training				.112
R^2	.009	.015	.043	.288***
F	1.216	.700	1.021	4.379***
ΔR^2	.009	.006	.028	.245
F	1.216	.448	1.337	7.447***

* $p \leq 0.1$
** $p \leq 0.05$
*** $p \leq 0.01$

All numbers are standardised regression coefficients (Beta values)

5.4 Identifying Leading SMEs

The literature suggests that SMEs themselves can play an important part in encouraging innovation, for example through involvement in pilot/demonstration projects. The results of this research (see Section 5.2.6) support the notion that other leading SMEs can be particularly influential in the diffusion of innovation. The analysis shown in Table 5.21 demonstrates how SMEs could be selected to play a role in the diffusion of an innovation. In this case it is assumed that SMEs who score high on readiness variables will be the most suitable to be early adopters and take a leadership role in a new technology. The mean values of readiness variables i.e., use of improvement tools, communication with customers and so on were used as a method to rank the respondents. The minimum score was limited to 5.5. However, the criteria for identifying pilot SMEs could be refined by considering other aspects such as location of the SMEs, willingness of SMEs to be involved in a pilot project and so on. The actual selection for pilot SMEs especially the number of SMEs may also be related to the amount available for SMEs development.

From this analysis fifteen SMEs were identified as having high scores on readiness variables and these are ranked in order in Table 5.21.

Table 5.21 Ranking of SME based on mean of readiness variables

Company number	Mean use of improve ment tools	Mean communication with customers	Mean resource availability	Mean management supports	Mean employee commitment and ability	Mean training provision	Average of overall mean*
18	4.00	7.00	7.00	7.00	6.20	7.00	6.37
115	5.25	7.00	5.00	7.00	6.80	7.00	6.34
136	4.00	7.00	7.00	7.00	5.40	7.00	6.23
114	4.00	7.00	3.80	7.00	7.00	7.00	5.97
72	2.50	7.00	6.60	6.40	5.80	7.00	5.88
34	3.25	7.00	6.20	7.00	4.80	7.00	5.88
118	6.25	7.00	3.60	6.60	5.80	5.67	5.82
29	2.50	7.00	6.40	7.00	7.00	5.00	5.82
44	1.00	6.00	6.60	7.00	7.00	7.00	5.77
41	1.25	7.00	7.00	7.00	5.20	7.00	5.74
141	1.00	7.00	7.00	7.00	5.40	7.00	5.73
100	5.75	7.00	3.60	7.00	6.00	5.00	5.73
94	6.50	5.00	4.60	7.00	4.80	6.33	5.71
122	6.00	7.00	3.80	6.20	5.40	5.33	5.62
32	1.00	7.00	5.80	7.00	5.80	7.00	5.60

* *In rank order based on the highest average of overall mean*

5.5 Qualitative Result

Findings from qualitative data collected are reported in this section. Qualitative data was obtained from interviews with key stakeholders and written comments on questionnaires. Semi-structured interviews (see Appendix D) were carried out with six owners/managers of SMEs, three Government representatives, and a representative of the foreign agency. An independent consultant who worked with SMEs was also interviewed. Only six of the questionnaires contained written comments. As reported in the methodology, the majority of questionnaires were completed in the presence of the researcher. This provided an opportunity to gain additional information through questioning and observation.

5.5.1 Views of SME Owners/Managers

Interviews with six owners/managers of SMEs were mainly aimed at exploring the level of support from Government and non-Government agencies for SMEs. The qualitative data shows that views on Government and non-Government support from SMEs were mixed. There were a number of specific concerns in relation to Government support that were raised by SME owners/managers. For example, the frequency of support and the extent of support were significant issues, and these two issues are explained below.

Regarding frequency of support, support was only given to some SMEs. Four owners/managers reported that they never received any support from Government either at the Local or Provincial level. On the other hand, the other two owners/managers reported that although they received Government support, this support was not given to all SMEs located in those centres. The following comments describe the SMEs' views on Government support.

'Support from Government were many, for instance technical assistance in the 1970s, foster parent program in 1985, training, providing a field instructor for SME in 1976' (owner/company B)

'Government support still does not cover all of SMEs in the industrial centre, for instance financial loans are still only given to certain SMEs' (owner/company A)

Regarding training, five owners/managers reported that they received training from Government on technical, management, and marketing issues. However, some of them said that the training was still inappropriate for them, some reported that there is lack of continuity of training, and in some cases the capability of the trainers was questioned. Some comments regarding these aspects are presented below.

'..the training was good but not continuous' (owner/company B)

'Regarding training, the government should recruit trainers from outside like consultant, academics and industry practitioners' (owner/company B)

One owner/manager reported that they need a person to guide them through the process of innovation adoption and implementation of technology and new approaches to management. Here, the person should act as a consultant for SMEs and be located in the industrial centre. Also, one owner/manager stated that the establishment of a pilot/model SME would be of assistance in encouraging the diffusion of innovation. In the Indonesian context, a typical way in which new ideas are propagated is through the establishment of model plants in selected organisations supported by Government. These plants act as a role model from which other organisations can learn the innovation. For example, if one organisation has success in the implementation of a particular approach or program, then other SMEs will naturally follow in the implementation of that approach or program.

On the other hand, SMEs reported positively about support from non-Government agencies. The non-Government agencies in question were the foreign agency, independent consultants funded by foreign countries, large organisations, and key customers of SMEs. Types of support that non-Government agencies provide to SMEs were technical assistance, partnerships and training. One owner/manager reported that his organisation received technical assistance from JICA. He was also provided with specialised software for his organisation. Regarding training, another owner/manager reported that he received TQM training from a big Japanese automotive company in Indonesia.

There were six comments in the questionnaire responses regarding SMEs readiness to adopt innovation. One SME owner/manager reported that there are financial limitations to providing resources for innovation activities. Another owner/manager stated that he would provide the resources if they were needed by his organisation for a new innovation. Four owners/managers commented on the capability of their employees. They observed that the practical experience employees had were more valuable to their performance in the workplace than their educational level. However, these views on employees were reported by small-scale organisations and may be different from the views of medium-sized organisations.

5.5.2 Views of Government Representatives

Three people from Government agencies were interviewed separately. They were representatives of the Ministry of Industry and Trade (MIT) in the Province of East Java, LIK-UPT Trosobo which is a technical support agency, and P3ED which is a training centre for SMEs. Both LIK-UPT Trosobo and P3ED are agencies under MIT in the Province of East Java.

During the interview, the representative from East Java MIT stated that the Government provides a low interest financial loan for SMEs. This program was supported by the Government Bank in the Province of East Java. With regards to training, the representative of East Java MIT stated that they provide several training opportunities for SMEs. These initiatives included training on quality control aspects such as HACCP certification for the food industry. This is because SMEs that are export-oriented need certification to enter foreign markets. The representative of East Java MIT also explained that they provide free training to guide SMEs who are interested in gaining SNI/ISO 9000 certification. They further stated that the majority of training provided by the Government is free and if it is located in another city, they will provide accommodation and travel fees for SME personnel to attend the training.

Despite the availability of these opportunities, the P3ED representative stated that some aspects of training were not satisfactory. For example, TQM training is delivered in a teleconference mode using Japanese language which is interpreted into English. The representative of P3ED stated that this type of training was not suitable for SMEs in Indonesia. SMEs in Indonesia, particularly small-sized organisations, prefer to engage in face-to-face training, and this is illustrated by the following comment:

'..industries do not like distance training i.e., teleconferences, they prefer face- to- face training..' (P3ED representative)

On the other hand, the P3ED representative stated that they provide good trainers who may be from Government, or may be experts and consultants if they are needed.

In addition, MIT provides support for product improvement to enable SMEs' products to compete with foreign products in either local or foreign markets. This type of support is focused on product design and packaging, particularly for SMEs who have an export orientation. Training for guiding export is also provided, and the representative of MIT in the Province of East Java stated that the Government provides support for organisations for the patenting of their product.

5.5.3 Views of Non-Government Representatives

Results of interviews with representatives of independent consultants and foreign agencies are reported here. To help SMEs who have an export orientation, PUPUK, which is a not for profit, independent and non-politic private organisation, provided training in 2004 on HACCP for SMEs in the food and beverages sector. In order to gain significant outcomes from their programs, their training is delivered by highly skilled trainers. They can be academics or consultants depending on the training content. The comment below is from a representative of PUPUK in response to a question regarding the trainer.

'they can be from university or consultants under our network' (PUPUK representative)

The other agency, SENADA, is a foreign agency that has several programs for strengthening SMEs in Indonesia. Their focus is mainly on SMEs in the furniture, shoes, garment, automotive parts and IT sectors. One method of support provided by SENADA is training. SENADA design their training to suit the needs of SMEs and they deliver this training directly in the industrial centres. This is because Indonesian SMEs, particularly small-scale organisations, prefer to engage in on-site training.

The SENADA training program is mainly focused on improving SMEs in the areas of finance, production and marketing. This focus is reflected in the comment below, which was given in reponse to a question about training type and content.

'We give direct training which gives fast improvement to the companies i.e., finance, production, marketing' (SENADA representative)

5.6 Summary

There are several important points to be summarised in this section. These constitute results from the quantitative and qualitative data analysis from 148 usable questionnaires and six interview sessions. The most challenging stage in this research was the data collection, which involved delivering the questionnaires directly to SMEs in two industrial centres. However, the advantage gained from this face-to-face meeting with SMEs to collect quantitative data was the opportunity to collect additional information that was not covered in the questionnaire form. Several interviews were also carried out with Government and non-Government representatives in order to gain qualitative information for this research.

Quantitative findings show that Indonesian SMEs are generally still low in their understanding and implementation of quality improvement programs. The use of improvement tools/techniques, as well as the understanding and implementation of these in SMEs, is also low. Only the understanding and implementation of 5S was found to be good in SMEs. This is because there was support from the Government in the 5S implementation for SMEs. Based on this result, training should be focused on tools and techniques to ensure successful implementation of Lean Six Sigma.Regarding support for SMEs, most of the support provided by Government is still not appropriate for SMEs' needs. In order to support SMEs to be successful in innovation adoption, the main entity, that is Government, should provide appropriate support to SMEs.

Even though the majority of SMEs lacked understanding and implementation of improvement programs and tools/techniques, their enthusiasm for adopting innovation was evident. This claim is based on the result of a single question in the questionnaire that addresses SMEs' belief or optimism in the success of innovation. Additionally, the result from the readiness variables questions shows that resource availability, management support and employee commitment and ability were variables that explained managers' belief or optimism in the success of innovation. These facts suggest that there is a good foundation to deliver innovation such as Lean Six Sigma.

Chapter 6

Discussion of Results and Development of a Lean Six Sigma Implementation Framework

6.1 Introduction

This chapter presents a discussion of results of the research and a proposed Lean Six Sigma implementation framework for SMEs in Indonesia.

The Lean Six Sigma implementation framework will be presented in the last part of this chapter. Key elements of the framework will be reviewed, including owner/manager commitment and involvement, training, employee involvement, culture change and external support to assist SMEs to implement Lean Six Sigma. Guidelines to operationalise the framework will be presented. The framework and operational guidelines are intended to be of use to all stakeholders involved in the implementation of Lean Six Sigma e.g., SMEs, Government agencies, key customers of SMEs and suppliers to SMEs.

6.2 Key Findings

The discussion in this section will focus on the key findings of the questionnaire survey and interviews. Findings from the questionnaire survey were from owners/managers of the SMEs. Interviews were conducted with SMEs, Government and non-Government representatives. The implications of the results in relation to the development of a Lean Six Sigma implementation framework development will also be discussed.

6.2.1 General Aspects of Respondents

Most of the participating respondents to the questionnaire survey were SME owners because the majority of respondents were from small rather than medium sized organisations. In Indonesia as elsewhere, the operation of small organisations is normally undertaken by the business owner.

As previously stated, organisations involved in this research were mainly small- scale enterprises. This is because the majority of them were located in two industrial centres, Pasuruan and Sidoarjo. Further, the results show that most of the organisations were owned by Indonesian citizens, which is in line with the result that the majority of respondents were from small-scale organisations.

It is important to note that about half of respondents had established their business more than 15 years ago (see Table 5.4). Moreover, several SMEs were founded shortly after World War II and have grown into larger businesses. As their businesses have grown, their range of products has also changed. Interviews with SMEs owners/managers confirmed that they typically were competing with foreign products in the local market. Several SME owners/managers stated that competing on quality and price had become serious issues for them in the Indonesian local market.

Regarding the product type, the majority of SMEs produced furniture, agricultural tools, handicrafts and automotive components. All the products made by the SMEs are categorised under the metal sector.

The majority of respondents were located in two industrial centres, Pasuruan and Sidoarjo. This type of geographical area -- which was developed as an SME cluster -- seems suitable for the diffusion of a new idea like Lean Six Sigma. Moreover, these two centres are well situated for the provision of organised training.

6.2.2 ISO 9001 Certification

Rogers (2003) stated that compatibility of an innovation with the organisations' culture and norms will influence the rate of innovation adoption. It is highly likely that organisations which have ISO 9001 certification in place will be more receptive to other improvement approaches based on quality principles e.g., Lean Six Sigma.

Based on the quantitative data analysis, only a small number of SMEs have quality certification such as ISO 9001 or SNI in place. The reasons why this is so, particularly for SMEs located in the two industrial centres, are explained here. First, the majority of SMEs sell their products to the local market so they were did not consider quality certification to be necessary. Second, the cost to obtain ISO 9001 certification in Indonesia is high, and this discouraged the SMEs from pursuing this certification. The high cost of certification for ISO 9000 was cited as a barrier to uptake in the research carried out in Australia by Brown, van der Wiele and Loughton (1998) and in research carried out in Singapore by Quazi and Padibjo (1998).

According to an interview with a Government representative, there is a new Government program in Indonesia to assist SMEs to pursue ISO 9001 certification. However, this support is still limited to preliminary training on how to pursue ISO 9001 for export-oriented SMEs in the food and beverages sector.

6.2.3 IT Usage

As stated in Section 2.5.3 of the literature review, Harry and Crawford (2004) pointed out that SMEs could consider online Six Sigma training in order to avoid time being spent by their employees attending outside training. However, findings of this research have shown that most of the respondents were not using IT to support their businesses. This finding is similar to research conducted by Duan and Kinman (2000) which shows the low level of IT usage among SMEs in the UK. Also, a recent study conducted by Kartiwi and MacGregor (2007) explored barriers in e-commerce adoption in Indonesia. They listed the barriers to e-commerce adoption based on SMEs owner/manager perspectives e.g. e-commerce is not suited to SMEs products/services, no advantage gained by implementing e-commerce to their organisation, not suited to their business way, not suited to their customers' business way and not secure.

Based on the findings, it can be said that the low level of IT usage in Indonesia could impede the delivery of training by an online mode. Further explanation and suggestions about training issues in the light of this finding will be covered in Section 6.2.5.

6.2.4 Understanding and Implementation of the Improvement Programs, Tools and Techniques

As discussed in the literature review, an improvement program for Indonesian SMEs was conducted by JICA in 1995. This program aimed to introduce TQM into Indonesian SMEs (Onitsuka 1999). Two Indonesian SMEs were selected to receive assistance from JICA in the implementation of TQM. This program ended after five years and the diffusion of TQM in Indonesian SMEs seems to have faded. This phenomenon was supported by a research conducted by Amar and Zain (2002) which pointed to a low level of TQM implementation in large Indonesian organisations.

Based on the findings of the questionnaire survey, the understanding and implementation of improvement programs and tools/techniques was shown to be low. This result is similar to research conducted by Thomas and Barton (2006) regarding the low implementation of statistical methods in the UK SMEs. The low implementation of statistical tools was due to insufficient knowledge to implement them, and lack of resources such as personnel and time.

Despite the low understanding of improvement programs and tools/techniques in most SMEs surveyed, TQM, QCC and 5S were found to be the programs and techniques best understood by SMEs. Also, some basic QC tools such as histograms, fishbone diagrams, and so on were quite well understood by SMEs.

TQM and QCC were used by a small number of the organisations surveyed. It was found that 5S was the most-used technique among respondents. The reason for this is that TQM, QCC and 5S were introduced through training and workshops conducted several years ago either by the Government or foreign agencies, in particular JICA. This finding is similar to the research conducted by Ahmed and Hassan (2003) in their survey of Malaysian SMIs (Small and Medium Industries) regarding their use of improvement tools/techniques. Their research showed that most Malaysian SMIs used only basic QC tools.

The implication of these findings for stakeholders, particularly Government, is that they should provide a more appropriate training program for SMEs. The training should focus on the improvement of tools and techniques that are useful for implementing Lean Six Sigma successfully.

According to JICA reports (2004), 5S has already been introduced to SMEs by the Indonesian Government. This program continues to reach out to SMEs, particularly those located in industrial centres. With regard to Lean Six Sigma implementation, the 5S introduction and implementation support from the Indonesian Government will provide a good foundation on which to implement Lean Six Sigma.

6.2.5 Strength and Importance of Support for SMEs

The literature reviewed in Chapter 2 revealed that many kinds of support are provided for SMEs by Government and non-Government agencies, such as training, consultancy and financial support. With regard to consultancy support, interviews with several SMEs found that consultancy support, particularly for SMEs located in the industrial centres, is very rare. Regarding financial support, SMEs stated that financial loans were provided by Government. However, some interviewees believed that financial loans could be distributed in a more effective way.

With regard to training, SMEs viewed most of the training provided by Government as not appropriate for their needs. The type of training, mode of training delivery and time schedules were among the aspects of training that SMEs felt were not suitable for them. For instance, TQM training provided by the Indonesian Government was delivered in Japanese via video conference and translated into English. Based on several interviews with SMEs, it was evident that this type of training is not suitable for SMEs in Indonesia because they prefer to have face-to-face training. Moreover, SMEs faced difficulty when the training was delivered in English, because English is not used widely in Indonesia. Because training was generally not very suitable, programs delivered to SMEs have not been very effective. The interviewees believed that insufficient training and assistance for SMEs to implement improvement tools/techniques and programs resulted in a low level of usage of those programs. For example, programs like TQM, QCC and 5S were not greatly used by Indonesian SMEs.

This finding is similar to the research conducted by Miros and Dale (1996) who examined the quality training needs of small organisations in the UK. They suggested that limitations of time, personnel and finance in small organisations should be considered with regard to training design. They also suggested that training for small organisations should not follow the training styles used for large organisations.

Based on the above discussion, it is believe that training for innovation should be modified to achieve the training goals. Some suggestions are presented in Table 6.1 focuses on the current and ideal supports that should be provided for SMEs.

Table 6.1 Current and ideal supports for SMEs

Current Support	Ideal Support
Training - Type: face-to-face, video conference - Trainer: mainly people from Government - Time: weekdays - Language: Indonesian, English and Japanese - Content: theory - Location: Ministry of Industry and Trade at province level - Fees: half fee is paid by SME	Training - Type: face-to-face - Trainer: people from industry, university and Government - Time: weekend - Language: Indonesian - Content: combination between theory and practice *(how to)* - Location: industrial centres - Fees: free
Consultation: - Very rare; majority of SMEs solve problems by themselves	Consultation: - Should be one consultant paid by Government and available to give consultation to SMEs particularly in industrial centres
Financial: - There was financial loan/support but not captured by all SMEs, majority of them are using their own money to run business	Financial: - Should not be provided in the form of loans or subsidies. It is better to use the financial budget to improve other supports such as training and consultation

Source: summarised from interviews with SMEs, Government and non-Government representatives

As presented in table 6.1, there are several points that the Indonesian Government should consider when providing training for SMEs. All these points are described briefly below.

Face-to-face training is preferred to a teleconference type of training. It is also believed by interviewees that online training would be less successful in delivering an innovation like Lean Six Sigma.

With regard to trainers, SMEs would prefer to be trained by practitioners, independent consultants and university staff rather than trainers from Government. People from industry or independent consultants may be better able to deliver the technical aspects of Lean Six Sigma. People from university may be more suitable for delivering the theory of Lean Six Sigma. This division of training is incorporated in the Korean SME support model (Hwang and Ward 2001) which is explained in Section 2.2.5.

6.2.6 Decision to Adopt Innovation in SMEs

This section discusses the findings regarding the stakeholders who influence Indonesian SMEs in their innovation adoption. Also discussed is one of the findings related to the optimism of SMEs' owners/managers about the success of a program like Lean Six Sigma.

The results of the data analysis suggest that all the stakeholders listed i.e., key customers, other SMEs, suppliers, Government, BDS and university, are influential to some extent (see Table 5.16). However, in relative terms, other SMEs and key customers are the most influential stakeholders in guiding SME owners/managers to adopt an innovation. A similar finding regarding customers emerged from a study conducted by Stam and Golhar (1991) which reported that customers created the main pressure for JIT adoption for small US manufacturing organisations. Another research project conducted by several European scholars on SME Policy and Regional Dimension of Innovation (SMEPOL) also found that customers were the most influence in SMEs' innovation process (Kaufmann & Todtling 2002). Research conducted by Brown, Wiele and Loughton (1998) also found that customers were the main drivers for an SME to pursue ISO 9000 certification.

The evidence that other SMEs are particularly influential is an important finding of this research and supports the benefit of establishing pilot/model companies as part of an implementation strategy. This type of diffusion of innovation seems suitable for the Indonesian context. Interviews with SME owners/managers confirmed the benefit of a pilot operation. They explained that actually seeing an innovation in action provides a much more powerful message than, for example, reading about it.

6.2.7 Other Important Issues Related to the Readiness to Adopt Innovation

This section will discuss the other issues that are important in innovation adoption. They are the optimism of SME owners/managers regarding the success of implementing programs/approaches, and the readiness of SMEs to adopt innovation, and are briefly described below.

Optimism of owner/manager

The relatively positive overall attitudes that SME owners/managers have that an innovation like Six Sigma would succeed (see Figure 5.5) can be seen as a positive. However, respondents mostly do not have direct experience of Lean Six Sigma and are basing their judgment on the proxies e.g., TQM, that were used in the questionnaire survey. Nevertheless, a positive general attitude towards change is supportive of innovation adoption.

Observations made during face-to-face data collection suggested that SME owners/managers who were better educated, generally the younger ones, seemed to be more enthusiastic in adopting innovation. This is in line to the findings of a study conducted by Saridakis, Mole and Storey (2008) who were investigating the determinants of the survival of small firms in England between 2001 and 2004. In their research they used financial, strategic, human capital and firm type variables were examined in relation to firm survival. However, only education and firm type were found to be significantly related to firm survival. Manufacturing firms were found to less significant to firm survival than other firm types and those firms with owners with a higher level of eduction were likely to be survivers. In retrospect, it would have been useful to obtain additional data on the age and qualifications of respondents and their employees in a more formal way using additional items on the questionnaire.

Readiness of SMEs to adopt innovation

A positive result was gained from respondents with regard to readiness factors: use of improvement tools, communication with customers, resource availability, management support, employee commitment and ability and provision of training. Only the use of improvement tools had a low mean, because the majority of respondents were still not familiar with the use of improvement tools/techniques for problem solving.

Multiple regression results used to explore variables that explained the degree of optimism of respondents have identified three significant variables. The three variables that appear to most influence owner/manager optimism about the success of a new innovation are their personal commitment to supporting innovation, their evaluation of employee commitment and ability, and resource availability in their organisations. These three significant variables are explained below.

Management support for innovation is the most important factor in supporting innovation in SMEs. Rogers (2003) stated in his diffusion of innovations theory that management should give their commitment to the innovation adopted, for example, by providing appropriate resources. As discussed in the literature review, top management support is widely cited as a key success factor for programs like TQM and Six Sigma. For example, Ahire and O'Shaughnessy (1998) highlighted the need for management commitment to be shown by providing resources for implementing quality management programs. Zu, Fredendall and Douglas (2008) also pointed out the importance of management support in Six Sigma implementation. They stated that it was critical for top management to accept the concept of Six Sigma and to be willing to provide resources to implement Six Sigma.

Employees' willingness to work as a team, to learn new things and solve problems in the workplace is undoubtedly a major factor in the ability of a SME to adopt new ideas and improve. For example, several TQM studies have mentioned the need for employee involvement, such as those of Rao et al. (1996) and Tonnessen (2005).

As Rogers' (2003) stated in his book on *Diffusion of Innovations*, organisations should be able to provide resources to support innovation adoption. His findings show that an SME owner/manager who is optimistic about the success of an innovation is more willing to provide adequate resources for its adoption. This is because being able to finance and support a new initiative where training and equipment costs have to be met is clearly also a significant issue for SMEs.

6.3 Key Points of the Research for Framework Development

There are several key points from discussion of the results that should be considered in the development of the framework. These are:

1. Low level of IT usage among the SMEs surveyed

The low level of IT usage in Indonesian SMEs indicates the suitability of non-online training for Lean Six Sigma. This is further supported by the preference for face-to-face instruction expressed by SME owners/managers.

2. Low level of understanding and implementation of the improvement tools and techniques

Training should be focused initially on addressing these deficiencies.

3. SMEs are particularly influenced in their decision regarding innovation by other SMEs already using the technology

As discussed in the previous section, SMEs in Indonesia, particularly those located in industrial centres, were influenced by other SMEs in their innovation adoption. Based on this fact, there is a need to diffuse Lean Six Sigma through several SMEs that are leading in industrial centres. Some readiness factors have already used as factors for grouping the involved SMEs in the questionnaire survey of this research (see Section 5.4). These groups can be used as pilots to introduce Lean Six Sigma into SMEs in industrial centres.

4. The need for Government support in innovation adoption

Based on the results discussion, SMEs in Indonesia depend on the support provided by Government in their innovation adoption. The support most needed by SMEs is provision of a resource centre when Lean Six Sigma is diffused. The resource centre should be located in industrial centres and act as a consultant for SMEs.

In addition to these key points from discussion of the results, Rogers (2003) believed that the *trialability* of innovation could increase the rate of innovation adoption. Based on Rogers' perspective, the framework should incorporate opportunities to trial Lean Six Sigma to solve the SMEs' problems.

6.4 Development of a Lean Six Sigma Implementation Framework for Indonesian SMEs

There are two important issues to present in this section, which are key elements of the framework, including the operational guidelines. The key elements of the framework are owner/manager commitment and involvement, training, employee involvement, culture change and external support. An implementation framework will be presented in the last part of this chapter.

6.4.1 Key Elements of the Framework

After discussing results from the surveys and interviews as well as studying the literature on Lean Six Sigma and diffusion of innovations theory, it is concluded that there are five key elements for implementing Lean Six Sigma in SMEs. The elements are owner/manager commitment and involvement, training, employee involvement, culture change and external support, as presented in Figure 6.1.

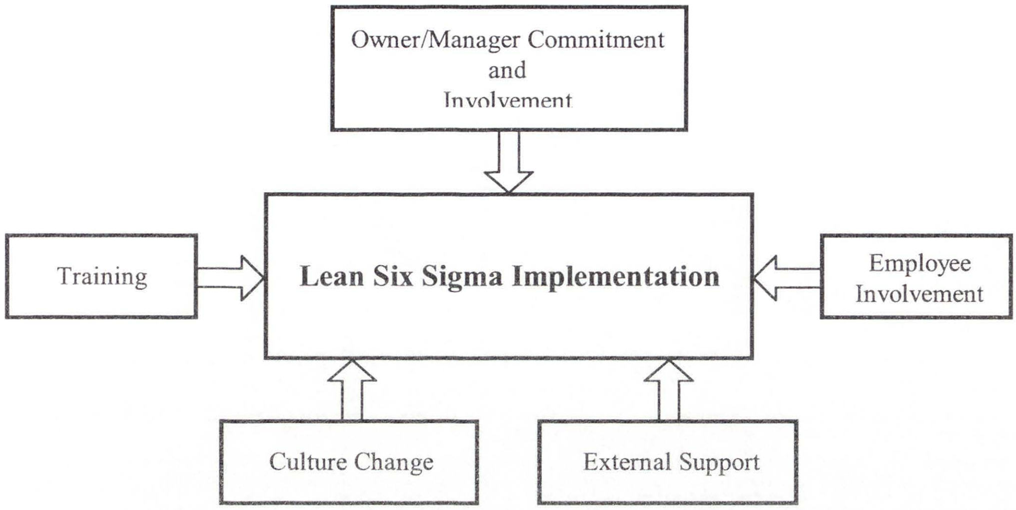


Figure 6.1 Framework for Lean Six Sigma Implementation in SMEs

Some of the elements assembled in the framework above have also been used by others. Antony, Kumar and Madu (2005), Coronado and Antony (2002), Park (2003), Schon (2006) and Yusof (2000b) have used these elements in their TQM and Six Sigma studies. Management commitment towards innovation also features as a key factor in diffusion of innovation studies conducted by Bradford and Florin (2003) and Rogers (2003). This research has shown that it is essential that external support should be a component of an effective implementation model.

Each element of the framework and specifically operational guidelines of these elements are discussed. The presentation of operational guidelines related to the framework will help stakeholders to determine what activities should be carried out in the pre-implementation and implementation stages of Lean Six Sigma.

6.4.1.1 Owner/manager Commitment and Involvement

As stated in many TQM or other quality improvement programs and innovation studies, management commitment to, and involvement in, the implemented program is crucial.

The literature on SMEs emphasises the importance of the role of owners in organisation development. The justification of choosing this element is that the role model in SMEs is on the owner or management level, particularly in Indonesia. For instance, if the organisation adopts innovation, the entire organisation will commit as their leader does. In other words, owner/manager commitment towards innovation will influence their employees' commitment to the adopted innovation.

Table 6.2 is based on the research findings and presents a list of items that should be considered by the owner or manager of SMEs. These items show activities that should be employed by an owner/manager as their commitment to and involvement in Lean Six Sigma. The activities are divided into pre-implementation and implementation stages.

Table 6.2 Management commitment and involvement at pre-implementation and implementation stages of Lean Six Sigma

Items	Stage
Allow Government or other parties to evaluate the organisation	Pre-implementation
Attend Lean Six Sigma training	Implementation
Communicate Lean Six Sigma to entire organisation as new strategy to compete i.e., direct communication through meeting, poster, etc.	Implementation
Giving support for training i.e., time	Implementation
Financial support if Government only covers half training fees	Implementation
Implementing 5S as a foundation to implement Lean Six Sigma	Implementation
Give rewards to critical problem solving	Implementation
Actively involve in all problem solving activities	Implementation
Actively involve in seminars, workshops, etc. to build knowledge particularly in relation to Lean Six Sigma and innovation	Implementation

However, the items listed above are not activities that absolutely have to be done by the owner or management of SMEs. The activities can be modified according to the level of readiness of adopters. For instance, implementing 5S as a foundation to implement Lean Six Sigma can be omitted if the organisation is sufficiently advanced e.g., already practising 5S.

6.4.1.2 Training

The research shows that training is a very important component to help employees in the organisation understand the requirements for adopting innovation. In Lean Six Sigma organisation, training normally involves sending a number of people at the management level, and employees, to attend Lean Six Sigma training. The Lean Six Sigma training is quite similar to Six Sigma training which uses a belts system i.e., green belt, black belt. These training types have been discussed clearly in Chapter 2.

In Indonesia, training is an important component when a Government or non-Government agency introduces new technology to SMEs. Thus, training is also needed to introduce Lean Six Sigma in SMEs. This is because the majority of SMEs perceive Lean Six Sigma as a new approach, even though past training conducted by the Indonesian Government and JICA have introduced some improvement tools and techniques used in Lean Six Sigma. Basically, training should contain the *what* of Lean Six Sigma (the fundamental concept of Lean Six Sigma) and *how to* implement Lean Six Sigma (DMAIC methodology and tools/techniques).

As presented in Table 6.1, it is suggested that training in Lean Six Sigma should be designed for SMEs with special attention paid to:

- The trainer → academics, independent consultants and people from industry
- The language → Indonesian, both for training material and presentation
- Mode of training → face-to-face
- The location → in industrial centres
- The time → weekend
- The fees → free

Table 6.3 suggests the focus of training, type of trainer and the stage of the implementation process at which training should be given to SMEs. Most of the suggestions are based on Green Belt and Black Belt training in Lean Six Sigma. However, they are modified according to the real conditions of Indonesian SMEs, such as a special training focus on 5S. From the survey results and also a field trip to SMEs, it was found that the majority of SMEs are not implementing 5S techniques. It is believed that establishing 5S as a foundation of Lean Six Sigma will help organisations to detect any problems more easily and faster. The need for implementing 5S has also been acknowledged by Wheat, Mills and Carnell (2003) as an important aspect for implementing Six Sigma and Lean Enterprise.

Table 6.3 Training design on Lean Six Sigma for SMEs

Trainee	Focus	Trainer	Stage
	Lean Six Sigma which explains basic understanding of Lean Six Sigma includes benefits of this approach, key elements to implement Lean Six Sigma	Academic or independent consultant	Pre-implementation
Owner or manager level	5S as foundation of Lean Six Sigma implementation	Academic or independent consultant	Implementation
	- Improvement tools and techniques includes DMAIC methodology - Real simple case study in the sample organisation that solve using DMAIC	Independent consultant or people from industry who implement Lean Six Sigma	Implementation
Employees	Lean Six Sigma which explains basic understanding of Lean Six Sigma includes benefits of this approach, key elements to implement Lean Six Sigma	Academic, independent consultant	Pre-implementation
	- Improvement tools and techniques includes DMAIC methodology - Real simple case study in the sample organisation that solve using DMAIC	Independent consultant or people from industry who implement Lean Six Sigma	Implementation

At the early stages of implementation, it seems advisable to focus training on acquisition of the skills required to implement Lean Six Sigma rather than gaining belts certification. Table 6.3 shows that training is important for employees to provide the necessary knowledge to implement Lean Six Sigma. People in the organisation should be able to solve problems using Lean Six Sigma principles. A 'white belt' training as created by Harry and Crawford (2004) may be useful as introductory training for Indonesian SMEs. Further, if Lean Six Sigma becomes widely implemented in Indonesia, training certification may become important particularly in motivating employees.

6.4.1.3 Employee Involvement

The main involvement of employees in Lean Six Sigma implementation is in the infrastructure of Lean Six Sigma itself. Integration between the owner or management and employees is formed in a team that normally works together to solve problems in their organisation. The infrastructure itself is not permanent. It means that the number of people in a group is dependent on the complexity of the problem.

A crucial aspect arising from this research which should be kept in mind is that it is important to keep the approach simple. Apart from training modification to suit the Indonesian context, the terms used in Lean Six Sigma should be changed. For instance terminology, such as 'project team' may be more suitable than 'Lean Six Sigma infrastructure'. It is believed that the replacement of this term does not conflict with the Lean Six Sigma concept, and it would serve to make Indonesian SMEs feel more comfortable with the terms they use. The use of a particular term can significantly influence the willingness of an Indonesian SME to implement or reject innovation.

It was mentioned that the research shows that part-time employees are widely used by SMEs in Indonesia. This issue will be a dilemma for SMEs in relation to involving their part-time employees in Lean Six Sigma training.

Table 6.4 presents a list of employee activities during the implementation of Lean Six Sigma.

Table 6.4 Employee involvement activities

Activities	Stage
Attend and participate actively in Lean Six Sigma training	Implementation
Be involved in 5S implementation as a foundation to Lean Six Sigma implementation	Implementation
Be actively involved in problem solving activities in his/her project team	Implementation
Be responsible to his/her process e.g., data record	Implementation

6.4.1.4 Culture Change

Organisations that implement Lean Six Sigma need to use the improvement tools and techniques that are part of DMAIC methodology. Every step in DMAIC involves tools or techniques, from basic to advanced, to solve a problem. Based on the problem solving concept in Lean Six Sigma and the current condition of SMEs in Indonesia, there are activities which should be used in the implementation stage of Lean Six Sigma as presented in Table 6.3.

One of the elements that assures the success of innovation, particularly Lean Six Sigma, is having an appropriate culture. In the context of Lean Six Sigma, culture focuses on the use of data and problem solving ability based on data analysis. The need for this culture change is based on the low use of data by Indonesian SMEs to solve their operational problems. The research largely found that SMEs tend to solve problems based on their experience or gut feelings.

Table 6.5 Culture change in SMEs at the implementation stage of Lean Six Sigma

Activities	Stage
Implementing 5S	Implementation
Data record of every processes in organisation	Implementation
Follow DMAIC cycle to solve problems	Implementation

As presented in Table 6.5, 5S should be implemented first as a foundation of Lean Six Sigma. The principles behind 5S such as sort, simplify, clean, standardise and follow procedure should become the standard culture in the day to day operations of SMEs. The recording of data for every process in the organisation should also become part of the culture of the organisation.

6.4.1.5 External Support

External support is a very important element in helping SMEs in their innovation (see Korean experience in Section 2.2.5). This research has shown that external support is also important for Indonesian SMEs. The support can vary from training to assistance provided by Government and non-Government agencies to support in implementation of Lean Six Sigma. This research also shows that other SMEs, particularly the more advanced ones and key cutomers can provide appropriate support to SMEs that are interested in adopting an innovation.

In order to make the support valuable for SMEs, there are several activities that should be used during the pre-implementation and implementation stages of Lean Six Sigma, as listed in Table 6.6.

Table 6.6 External support to implement Lean Six Sigma

Activities	Stage
SME's owner/manager should be open to the evaluation of organisational weaknesses conducted by assessors from Government or non-Government agencies	Pre-implementation
SME's owner/manager should be open to becoming a leader in innovation by actively participating in all supports conducted by external parties such as Government and university.	Pre-implementation and implementation

The evaluation of SME weaknesses is aimed at helping the design of future support for SMEs. SMEs should be open to this evaluation and not avoid sharing information with the assessor. Also, the openness of SMEs to the support provided such as training and assistance of Lean Six Sigma by external parties will help them successfully implement Lean Six Sigma.

6.4.2 Implementation Framework of Lean Six Sigma

After discussing key elements of the framework and operational guidelines of the elements, the following section presents a roadmap to implement Lean Six Sigma in SMEs. The roadmap would be used by Government to diffuse Lean Six Sigma in Indonesian SMEs, particularly those in the industrial centres. The knowledge centre should be built in the centres to help SMEs in their implementation of Lean Six Sigma. The framework is presented in Figure 6.2.

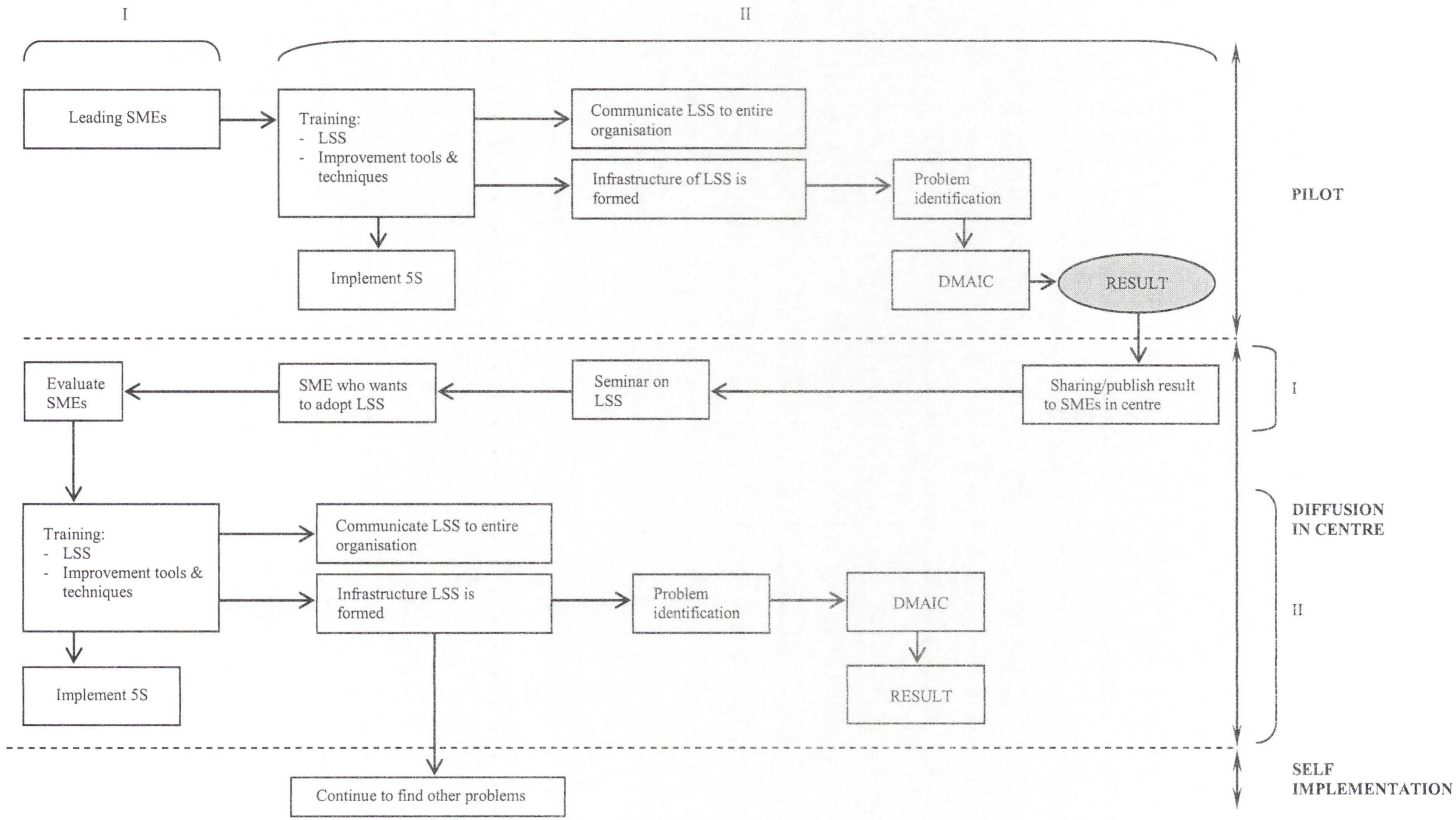


Figure 6.2 Lean Six Sigma roadmap for Indonesian SMEs

[I: pre-implementation; II: implementation]

It can be seen from Figure 6.2 that the framework is divided into three components: a pilot project, diffusion in the industrial centre and self implementation. Each component of the framework is discussed below.

Pilot

The pilot component of the framework aims to publish an early result of Lean Six Sigma around SMEs who are located in the industrial centres. Publishing results within the industrial centres will be a good strategy to influence SMEs towards Lean Six Sigma adoption. This strategy would be used because, based on the survey and interview results, SMEs are more influenced by their customers and colleagues (other SMEs) in their decision to adopt innovation. This correlates with a study conducted by Hamzah and Ho (1994) in TQM implementation of Malaysian SMEs. They pointed to the need to publish and circulate the success stories of TQM in pilot companies widely.

Further, this pilot component should involve independent consultants supported by Government. For instance, consultants should choose SMEs in the centres that are leaders and are willing to adopt Lean Six Sigma. In this research, the leading SMEs were chosen based only on evaluation of readiness factors. Thus, the leading SMEs could be trained in Lean Six Sigma understanding and the use of Lean Six Sigma tools and techniques. This would be followed by building Lean Six Sigma infrastructure and further assisting SMEs to implement 5S. The most important part of the implementation of Lean Six Sigma will be the use of DMAIC methodology to solve problems. Lean Six Sigma infrastructure assisted by a consultant should start to solve problems in the organisation. It is important to note that problem solving should begin with the easiest problem, to make sure that improvement results can be seen by SMEs in a short time. Improvement results could be published for distribution to the industrial centres.

Diffusion in centre

The diffusion stage (see framework), it is aimed at SMEs who intend to implement Lean Six Sigma. First of all, publication of improvement results of the pilot should be delivered in the industrial centres. This would be followed by a seminar/workshop on the basics of Lean Six Sigma for SMEs that are willing to adopt Lean Six Sigma. Training would then be given based on evaluation. Basically, training in Lean Six Sigma and tools/techniques would be conducted with the SMEs involved. Next, SMEs would be assisted by a consultant in their preliminary implementation of Lean Six Sigma. One or two problem solving projects could be done in this stage.

Self implementation

Following projects on problem solving, an SME could continue implementing Lean Six Sigma by themselves. However, a consultant who is appointed by Government should be in the centres to guide SMEs in their Lean Six Sigma implementation.

There are some points to be considered by Government in order to make Lean Six Sigma implementation successful. They are:

- Consultant paid by Government should be based in the industrial centres
- Government should facilitate Lean Six Sigma implementation for SMEs through training subsidies and the like
- A cost effective process to assess the effectiveness of the implementation program on an on-going basis should be put in place.

6.5 Reflection on Research Questions

As mentioned in Chapter 1, this research had two research questions:

1. To what extent are Indonesian SMEs ready to adopt innovation like Lean Six Sigma?
2. Based on the SMEs' readiness level, what factors are important for the development of an effective framework for the introduction and diffusion of an innovation like Lean Six Sigma into Indonesian SMEs?

These two questions were useful in guiding the research and helping keep the researcher focused. It is believed that through engagement with the literature, the development and implementing of an appropriate research methodology and the design of a framework for implementing Lean Six Sigma in Indonesian SMEs, these questions have been adequately addressed. In some respects, the first question has been the most problematic to address.

This is because of the intangible and uncertainty nature of many issues that contribute to the success of adopting an innovation i.e., at the time of writing this thesis in early 2009 the world is in economic crisis which is undoubtedly impacting Indonesian SMEs.

Chapter 7
Conclusions and Recommendations

7.1 Conclusions

This research can be said to be the first research conducted in Indonesia which has used diffusion of innovations theory as the theoretical framework. The diffusion of innovations theory was useful for the overall framework particularly in the design of the methodology.

This research had the main objective of developing an implementation framework for Lean Six Sigma in SMEs. Several objectives have been created in order to address the main objective (see Chapter 1). One of them was measuring the readiness of SMEs to adopt innovation.

In order to gain information from Indonesian SMEs, a questionnaire survey was designed and employed to collect data. The questionnaire items were developed mainly from literatures on Six Sigma and diffusion of innovations theory. Moreover, several interviews were conducted with Government and non-Government representatives to gain additional information.

The quantitative responses have come from 148 SMEs, the majority being from small organisations in Pasuruan and Sidoarjo industrial centres. Even though the research has a small sample size, it is believed that the sample size was sufficient to represent Indonesian SMEs, particularly those located in the industrial centres. The sample size was selected because the researcher had to visit the majority of the respondents in the two industrial centres. However, all information gained from the respondents to the survey questionnaire was reliable because the questionnaire was filled out by appropriate people who were familiar with the operation of the organisations.

The main result of the questionnaire survey shows that respondents are ready to adopt innovation. Only the use of improvement tools and techniques was found to be low among the respondents. The optimism of respondents toward innovation is quite encouraging, as enthusiasm for the innovation is important to the success of innovation adoption. Meanwhile, for qualitative results, the main finding shows that many supports for SMEs are provided by Government, but the support is not continuous and is limited to certain SMEs.

Based on the quantitative and qualitative results, an implementation framework for Lean Six Sigma was developed. Here, it can be said that aim of this research has been achieved. The framework consists of five elements that influence Lean Six Sigma implementation in SMEs. They are owner/manager commitment and involvement, training, employee involvement, culture change and external support. Training for SMEs should be delivered before the implementation of Lean Six Sigma. The training has to be delivered in the Indonesian language in face-to-face mode. Details of the frameworks' elements were clearly discussed in Chapter 6 and act as guidelines both for SMEs who are going to implement Lean Six Sigma and their stakeholders i.e., Government as the main support provider.

7.2 Contribution of the Research

There has been very little information to date on the operational aspects of Indonesian SMEs. It is believed that this research has made a significant contribution to addressing this issue. The development of a framework to diffuse innovations such as Lean Six Sigma also provides a contributed to the Indonesian Government and other stakeholders involved in the economic development of SMEs. This framework will provide a basis to guide the stakeholders particularly Government on how to diffuse innovations.

For academic researchers, this study contributes to a theoretical understanding of the factors support the diffusion of Lean Six Sigma in SMEs particularly in the developing country like Indonesia.

The particular contributions of this research are as follows:

1. Contributes to the theory, in particular by providing items to measure the readiness of SMEs to adopt innovation
2. Contributes to gaining a better understanding of the operation of Indonesian SMEs
3. Contributes to the possible development of SMEs in Indonesia
4. Contributes to the practice by providing an implementation framework for Lean Six Sigma for SMEs based on the research findings.

7.3 Policy Implications

There are three main themes emerge from the research e.g. training, IT usage, on-site support for diffusion of innovation.

Training

Training on new technology or approach should be delivered to SMEs continuously. Content of training should be customised to the SMEs needs. This is to avoid the common training delivery in Indonesia. As majority Indonesian SMEs are not familiar to IT usage, the training should be delivered on face to face. Furthermore, training should be designed in a practical way emphasising 'how to' implement innovations rather than focusing on the theory of the innovation.

IT usage

Government policies should encourage and support the appropriate use of IT in SMEs. SMEs should be informed kept up to date on developments in IT which can support their businesses. Moreover, the easiest way to introduce SMEs' products into the global market is by using A higher level of IT knowledge and implementation in Indonesian SMEs should improve their overall competitiveness significantly.

On-site support

As noted in literature reviews (Chapter 2), Indonesian Government support to SMEs was low. This was supported by findings of this research in particular the need of on-site support for introducing innovations. Indonesian Government should build a knowledge center which is located close to the SMEs. The center should be acted as consultant to guide SMEs in the implementation of the innovations. This is to avoid previous situation which was innovation unsuccessful introduced in Indonesian SMEs.

7.4 Limitation and Recommendation of Further Research

All research has limitations and this research is no exception. This section outlines the limitations of the research and the opportunities for further research in this area.

7.4.1 Limitations

1. Sample

   Caution should be exercised in generalising the results of the research to a wider population of Indonesian SMEs. The sample was taken from a sub-population of SMEs. The sample size was relatively small and could have better represented the proportion of medium-sized enterprises. The views expressed in the survey questionnaire were those of owners/managers of SMEs.

2. Interviews

   The number of interviews carried out was limited by availability of time and various difficulties in setting them up.

7.4.2 Recommendations for Further Research

1. More information should be collected from medium-sized organisations to better establish their capacity and role in innovation diffusion.

2. Having a group meeting with Government and non-Government representatives to discuss the framework and its potential improvement to suit the support capability of the Government and non-Government agencies for Lean Six Sigma implementation.

3. Research should be extended to obtain the views of employees working in SMEs. Additional data collection would be a challenge.

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Appendix A

Preliminary interview questions

a. How many SMEs are in the metal sector in Pasuruan?

b. What are the main products of SMEs here? How about your company, what your main products?

c. How many full-time and part-time employees are there in your company?

d. On average, how many employees work in SMEs here?

e. Are the SMEs here locally owned?

f. Does your company implement:
   - Total Quality Management (TQM):
   - Six Sigma:
   - Gugus Kendali Mutu (QCC):
   - Just in Time (JIT):
   - Lean Manufacturing:
   - Others programs?

   If yes, when did your SME implement these programs?

   Are these programs you fully implemented or partially, for example in certain departments/divisions?

g. Do you have ISO 9000 certification, SNI or other certifications?

   How about other SMEs in this centre? Are they certified with ISO 9000 or SNI?

h. Do you export your products?

i. Has your company received any Government support from MIT at the local or provincial level?

   How about other SMEs, did they receive similar supports from the Government?

What type of supports was provided by the Government? Training, consultation, etc?

If training, what was the focus of the training?

If financial support, what type of financial support was provided?

If consultancy, in what area did they provide support for consultancy?

Is there any other support provided by the Government?

j. Have you ever received any support from non-Government agencies for example, for training, consultancy, etc?

   Is the larger company that has a relationship with your company i.e. your customer giving any supports to your company for example, training, consultancy, etc?

k. Is this support received by other SMEs in this center?

l. What do you think about these types of support? Are they useful?

m. In future, what support will you need from Government and non-Government agencies?

n. What type of technology is used in your company? Traditional or advanced?

o. How about other SMEs in these centers?

p. In relation to IT, your company has a website so it seems that your company uses IT in daily business? Is this right?
   How about other SMEs?

q. What do you think is the main problem faced by your company and other SMEs here? What is the most common complaint customers have with your company?

r. Other questions regarding improvement tools/techniques, to measure their understanding and implementation of the improvement tools/techniques.

Appendix B

English version of questionnaire

University of Technology, Sydney

UTS

Survey of Readiness to Adopt Innovation in SMEs

This questionnaire is designed to gain information regarding conditions in Indonesian SMEs with regard to innovation adoption, and in particular to the adoption of Lean Six Sigma. Lean Six Sigma is a new integrated concept that helps companies to solve their operational problems leading to an increase the quality of their products, improved process times, and a reduction in the price of the product itself. There has been little attention given to ways of insuring the successful implementation of a new concept successfully in SMEs in particular on Lean Six Sigma. The main objective of this research is to develop an appropriate framework that can guide SMEs in Indonesia when adopting and implementing innovations, and in particular Lean Six Sigma.

INSTRUCTIONS

I would be grateful if you would take the time to complete the scales all of the questions and you are also encouraged to make comments where appropriate in the spaces provided. It should take you about 20 minutes to complete this questionnaire. Your responses will be confidential and will not be used in anyway that would identify you or your company with the information you have provided.

RETURNING THE QUESTIONNAIRE

When you have completed the questionnaire please place it in the reply paid envelope and post it back to the address provided. Response within two weeks will be appreciated.

MORE INFORMATION

This research has been approved by Ethics Committee at the University of Technology, Sydney - Australia, and the clearance number is UTS HREC REF NO. 2006-268A. However, if you need further information or questions regarding this research, please do not hesitate to contact me by email at: kifayah.amar@eng.uts.edu.au or call to: +62 81 216585003. You can also contact my supervisors Dr. Douglas Davis at: doug.davis@uts.edu.au or Dr. Udisubakti Ciptomulyono at: udisubakti@ie.its.ac.id. The Research Ethics Office at the University of Technology, Sydney - Australia can be contacted on: +60 2 9514 9615 or by email at: Research.Ethics@uts.edu.au

Part A. General Information

For each statement below, please tick (✓) the appropriate option and provide additional information where required

1. What is your position in this company?
   O Owner O Manager O Other, please specify ....

2. How many employees does your company have in total? (people)
   O Less than 10 O 10 - 25 O 26 - 50 O 51 - 75 O 76 - 99 O more than 99

3. How long has your company been in the business? (years)
   O 1 - 5 O 6 - 10 O 11 - 15 O more than 15 years

4. Please indicate the ownership structure of your company.
   O Local O Foreign owned O Joint venture O Other, please specify ....

5. What type of main product do you produce?
   O Automotive components O Electrical components O Other, please specify ....

6. Please indicate the location of your company.
   O Ngingas, Sidoarjo O Pasuruan O Surabaya O Jakarta
   O Other, please specify ....

7. To which of the following is your company's quality system certified?
   O ISO 9001 O SNI
   O QS 9000 O Other, please specify ....
   O None

8. Does your company export directly products to customers overseas?
   O Yes
   O No

9. Please circle the number which best describes the extent to which information technology (IT) i.e. internet access, usage of electronic mail, etc. is implemented in your company?

   Not used at all 1 2 3 4 5 6 7 Very high use

Part B. Program Use and Support

1. For each of the programs listed below, please make the following two evaluations:
   a. Indicate the degree of understanding in your company of each of the type of program listed, circle the most appropriate number on the 1 (none at all) to 7 (very high level) scales.

   AND:

   b. Indicate the degree of usage of the program in your company by circling the most appropriate number on the 1 (never been used) to 7 (high use) scales.

Program	Degree of understanding these program							Degree of usage these program in your company						
	None at all						Very high level	Never been used						High use
Total Quality Management (TQM)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Six Sigma	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Quality Control Circle (QCC)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Just in Time (JIT)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lean Manufacturing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lean Six Sigma	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Others, please specify:														
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7

2. For each of types of support listed below, please make the following two evaluations:
   a. Indicate the strength of the support given to your company from the provider by circling the most appropriate number on the 1 (no support) to 7 (very strong support) scales.

   AND:

   b. Indicate the degree of importance of each type of support from the support providers by circling the most appropriate number on the 1 (not important at all) to 7 (very important) scales.

No	Support Provider	Strength of support for your company							Importance of this type of support to your company						
		Very strong support						No support	Not important at all						Very important
1	Government:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify:	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2	Business Development Services (BDS):														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify:	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3	Institution/university:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7

	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4	Other company which has subcontract relationship with your company:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5	Your large customer:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6	Your supplier:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7	Foreign agencies i.e. JICA, Usaid, PEP Canada, etc.:														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	Other, please specify: ………………………………														
	- Training	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Consultation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Other, please specify: ………	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Part C. Understanding and Use of Tools or Techniques

For each of the tools/techniques listed below, please make the following two evaluations:

a. Indicate the degree of understanding of the tool/technique in your company by circling the most appropriate number on the 1 (none at all) to 7 (very high level) scales.

AND:

b. Indicate the degree of usage of the tool/technique in your company by circling the most appropriate number on the 1 (never been used) to 7 (very high use) scales.

No	Tool/Technique	Degree of understanding of tool/technique							Degree of usage						
		None at all						Very high level	Never been used						Very high use
1	Fishbone diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2	Check sheet	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3	Control chart	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4	Graph/chart	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5	Histogram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6	Pareto chart	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7	Scatter diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	Affinity diagram/KJ method	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9	Arrow diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10	Prioritization matrix	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11	Matrix diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12	Interrelationship diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13	Systematic diagram/tree diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14	Failure Modes and Effects Analysis (FMEA)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15	Statistical Process Control (SPC)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16	Quality Function Deployment (QFD)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
17	Design of Experiment (DOE)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
18	5 S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
19	Set up time reduction (SMED)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
20	One piece flow	1	2	3	4	5	6	7	1	2	3	4	5	6	7
21	Pull system (kanban)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
22	Value stream mapping	1	2	3	4	5	6	7	1	2	3	4	5	6	7
23	Visual workplace	1	2	3	4	5	6	7	1	2	3	4	5	6	7
24	Cellular/flow manufacturing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
25	Other tools/techniques please specify:														
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Part D. Readiness to Adopt Innovation

D.1. Please indicate on the 1 (very low) to 7 (very high) scale, the extent that the following practices are used in your company.

		Very low						Very high
1.	Having regular communication with customers in order to fill their requirements	1	2	3	4	5	6	7
2.	Having regular measurement of customer satisfaction (e.g. number of complaints, etc.) and acting on the results of measurement	1	2	3	4	5	6	7
3.	Decision making and action taking based on data rather than gut feel or guesswork	1	2	3	4	5	6	7
4.	Using improvement tools/techniques to improve quality of product	1	2	3	4	5	6	7
5.	Using improvement tools/techniques to reduce cost	1	2	3	4	5	6	7
6.	Using improvement tools/techniques to reduce time of production	1	2	3	4	5	6	7
7.	Having a culture in which people are not blamed for new ideas that do not work	1	2	3	4	5	6	7
8.	Acknowledging and rewarding employees who make significant contribution to the company	1	2	3	4	5	6	7

Comments, if any:

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D.2. Please indicate on the 1 (very low) to 7 (very high) scale, the level of ability within your company to provide each of the resources listed below.

		Very low						Very high
1.	Financial resources to support a new program/approach	1	2	3	4	5	6	7
2.	Technical resources i.e. software, equipment	1	2	3	4	5	6	7
3.	Consultant hiring to help implementing of a new program/approach	1	2	3	4	5	6	7
4.	A work environment that enables employees to work together as a team on a new program/approach	1	2	3	4	5	6	7
5.	Employees (other than managers) who are able to be allocated full-time to work on a new program/approach	1	2	3	4	5	6	7

Comments, if any:

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D.3. Given that your company has decided to implement a new program or approach, to what extent would you, as the company's owner or manager, give support to a new program/approach. Please indicate on the 1 (very low) to 7 (very high) scale.

		Very low						Very high
1.	I am willing to be actively involved in a new program/approach that is adopted	1	2	3	4	5	6	7
2.	I am willing to change the thinking in our company to support a new program/approach	1	2	3	4	5	6	7
3.	I am willing to change policies in this company to support a new program/approach	1	2	3	4	5	6	7
4.	I am willing to attend training in order to improve my knowledge and ability to lead the implementation of a new program/approach in my company	1	2	3	4	5	6	7
5.	I am willing to support a new program/approach with adequate resources	1	2	3	4	5	6	7

Comments, if any:

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D.4. Please indicate on the 1 (very low) to 7 (very high) scale, your employees' willingness and ability to support a new program/approach.

		Very low						Very high
1.	Employees' willingness to work as a team	1	2	3	4	5	6	7
2.	Employees' willingness to learn new things	1	2	3	4	5	6	7
3.	Employees' ability to solve problem in their workplace	1	2	3	4	5	6	7
4.	Employees' skill with regard on their job	1	2	3	4	5	6	7
5.	Employees' educational background that enables them to analyse operational problems i.e. use of statistics or statistics software, etc.	1	2	3	4	5	6	7

Comments, if any:

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D.5. Please indicate on the 1 (very low) to 7 (very high) scale your company's ability to provide training for a new program/approach.

		Very low						Very high
1.	To train selected people at management level in key aspects related to a new program/approach adopted	1	2	3	4	5	6	7
2.	To train selected employees in key aspects related to a new program/approach	1	2	3	4	5	6	7
3.	Provide training time to employees who have training opportunities outside the company related to a new program/approach.	1	2	3	4	5	6	7

Comments, if any:

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Part E. Influences and Expectation

Please rate how influential the views of the following are in forming your decision to adopt a new program or approach?

		Not influential						Very influential
1.	Other SMEs	1	2	3	4	5	6	7
2.	Government	1	2	3	4	5	6	7
3.	Your key customers	1	2	3	4	5	6	7
4.	Your suppliers	1	2	3	4	5	6	7
5.	University/institution	1	2	3	4	5	6	7
6.	Business Development Service (BDS) or consultant	1	2	3	4	5	6	7
7.	Others, please specify:							
	....	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7

Please indicate on the scale below the extent to which you believe that implementing a new program/approach in your company, such as TQM, Lean Six Sigma, etc. is likely to be successful?

Very unlikely to be successful	1	2	3	4	5	6	7	Very likely to be successful

Do you intend to implement a new program or approach?
○ Yes
○ No

If Yes, briefly describe (e.g. TQM, Lean Six Sigma, other):

Finally, if you have any additional comments to this survey please state here:

----THANK YOU FOR COMPLETING THIS QUESTIONNAIRE----

Appendix C

Indonesian version of questionnaire

UTS

University of Technology, Sydney

Survei Kesiapan UKM Untuk Mengadopsi Inovasi

Kuesioner ini didesain untuk mendapatkan informasi mengenai kondisi UKM di Indonesia untuk mengadopsi inovasi, khususnya Lean Six Sigma. Lean Six Sigma merupakan suatu integrasi konsep Six Sigma dan Lean yang membantu perusahaan untuk mengatasi problem operasional, dengan tujuan memperbaiki mutu produk, mempersingkat waktu proses yang pada akhirnya akan menurunkan harga produk. Namun kenyataannya tidak banyak perhatian ditujukan kepada UKM terutama untuk sukses mengadopsi dan mengimplementasikan suatu program atau pendekatan baru. Oleh sebab itu penelitian ini memiliki satu objektif untuk membangun framework yang dapat memberikan arah yang benar kepada UKM dalam mengadopsi dan mengimplementasikan suatu program atau pendekatan baru.

PETUNJUK PENGISIAN

Saya berterima kasih atas waktu yang anda luangkan untuk menjawab semua pertanyaan dan tambahan komentar pada bagian yang anda rasa perlu. Anda hanya memerlukan waktu kurang lebih 20 menit saja untuk mengisi kuesioner ini. Semua jawaban yang anda berikan akan dijaga kerahasiaannya dan publikasi yang dihasilkan dari penelitian ini tidak akan mencantumkan nama perusahaan anda.

PENGIRIMAN KEMBALI KUESIONER

Setelah anda selesai menjawab semua pertanyaan pada kuesioner ini, mohon berikan lembar kuesioner yang telah anda isi ke peneliti secara langsung atau masukkan dalam amplop yang sudah dilengkapi perangko dan kirimkan ke alamat yang tercantum pada amplop tersebut. Anda bisa juga mengirimkan kuesioner yang sudah diisi melalui faksimili di nomor: (031) 5939362.

INFORMASI LAIN

Penelitian ini telah mendapatkan persetujuan dari Komite Etika Penelitian (Research Ethics Committee) University of Technology, Sydney - Australia, dengan nomor: UTS HREC REF NO. 2006-268A. Bagaimanapun, jika anda memerlukan informasi lanjutan atau pertanyaan berkaitan penelitian ini jangan segan untuk menghubungi saya di alamat email: kifayah.amar@eng.uts.edu.au atau melalui telepon: +62 81 357 880960. Anda juga dapat menghubungi pembimbing saya Dr. Douglas Davis di alamat email: doug.davis@uts.edu.au dan Dr. Udisubakti Ciptomulyono di alamat email: udisubakti@ie.its.ac.id. Adapun Kantor Etika Penelitian (Research Ethics Office) University of Technology, Sydney - Australia dapat dihubungi melalui nomor telepon: +60 2 9514 9615 atau melalui alamat email: Research.Ethics@uts.edu.au

Bagian A. Informasi umum

Berikan tanda cawang (✓) untuk salah satu pilihan jawaban yang anda anggap sesuai atau tuliskan informasi tambahan jika diminta

1. Apakah jabatan anda di perusahaan ini?
   O Pemilik perusahaan   O Manajer   O Lainnya, sebutkan ....

2. Berapa orang jumlah pekerja di perusahaan anda?
   O Kurang dari 10   O 10 - 25   O 26 - 50   O 51 - 75   O 76 - 99   O Lebih dari 99

3. Berapa lama perusahaan anda telah berdiri?
   O 1 - 5   O 6 - 10   O 11 - 15   O Lebih dari 15 tahun

4. Sebutkan struktur kepemilikan perusahaan anda.
   O Modal sendiri   O Joint venture (modal bersama asing)
   O Milik asing   O Lainnya, sebutkan ....

5. Apakah produk utama yang dihasilkan perusahaan anda?
   O Komponen otomotif   O Komponen listrik   O Lainnya, sebutkan ....

6. Dimanakah lokasi perusahaan anda?
   O Ngingas, Sidoarjo   O Pasuruan   O Surabaya   O Jakarta
   O Lainnya, sebutkan nama kota ....

7. Manakah sertifikasi mutu yang dimiliki perusahaan anda?
   O ISO 9001   O SNI
   O QS 9000   O Lainnya, sebutkan ....
   O Tidak memiliki sertifikasi

8. Apakah perusahaan anda mengekspor produk secara langsung ke luar negeri?
   O Ya   O Tidak

9. Lingkari salah satu angka yang disediakan di bawah ini untuk menjelaskan sejauhmana penggunaan teknologi informasi (Information Technology/IT) di perusahaan anda seperti misalnya : akses internet, penggunaan email atau surat elektronik, dll.

Tidak menggunakan sama sekali	1	2	3	4	5	6	7	Sangat tinggi tingkat penggunaannya

Bagian B. Program yang digunakan dan dukungan terhadap UKM

1. Untuk setiap program yang disebutkan dalam tabel di bawah, berikan penilaian anda berupa :
   a. Pilih salah satu angka diantara 1 (tidak paham sama sekali) hingga 7 (sangat paham) untuk menggambarkan tingkat pemahaman anda mewakili perusahaan terhadap program-program tersebut.
   DAN :

b. Pilih salah satu angka diantara 1 (tidak pernah menggunakan) hingga 7 (sangat tinggi tingkat penggunaannya) untuk menggambarkan tingkat penggunaan program-program tersebut di perusahaan anda.

Program	Tingkat pemahaman program							Tingkat penggunaan program						
	Tdk paham sama sekali						Sangat paham	Tdk pernah menggunakan						Sangat tinggi tingkat penggunaannya
Manajemen Mutu Terpadu atau Total Quality Management (TQM)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Six Sigma	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Gugus Kendali Mutu (GKM) atau Quality Control Circle (QCC)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Just in Time (JIT)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lean Manufacturing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lean Six Sigma	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Lain-lain, sebutkan :														
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
....	1	2	3	4	5	6	7	1	2	3	4	5	6	7

2. Untuk setiap dukungan (support) berupa pelatihan (training), konsultasi atau aspek lainnya yang diberikan oleh badan pemerintah atau non-pemerintah seperti yang disebutkan dalam tabel di bawah, mohon berikan penilaian berkaitan banyaknya dukungan yang diterima oleh perusahaan anda dan tingkat pentingnya atau manfaat dari dukungan (support) tersebut :

   a. Pilih salah satu angka diantara 1 (tidak pernah mendapatkan dukungan) hingga 7 (sangat banyak mendapatkan dukungan) untuk menggambarkan banyaknya dukungan yang diterima perusahaan anda.

   <u>**DAN**</u> :

   b. Pilih salah satu angka diantara 1 (tidak bermanfaat sama sekali) hingga 7 (sangat bermanfaat) untuk menggambarkan tingkat pentingnya atau manfaat dari dukungan yang diterima perusahaan anda.

No	Penyedia	Banyaknya dukungan yang diterima perusahaan anda							Penting atau manfaat dukungan bagi perusahaan anda						
		Tidak pernah dapat						Sangat banyak	Tidak bermanfaat sama sekali						Sangat bermanfaat
1	Pemerintah :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2	Jasa Pengembangan Bisnis atau Business Development Services (BDS) :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3	Institusi / Universitas :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4	Perusahaan lain yang memiliki hubungan subkontrak dengan perusahaan anda :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5	Pelanggan utama (main customer) :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6	Pemasok utama (main supplier) :														
	- Pelatihan	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Konsultasi	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	- Lainnya, sebutkan ……..	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7	Agensi asing seperti														

	JICA, Usaid, PEP Canada, ADB, etc.: - Pelatihan - Konsultasi - Lainnya, sebutkan	1 1 1	2 2 2	3 3 3	4 4 4	5 5 5	6 6 6	7 7 7	1 1 1	2 2 2	3 3 3	4 4 4	5 5 5	6 6 6	7 7 7
8	Agensi / badan lainnya, sebutkan : .... - Pelatihan - Konsultasi - Lainnya, sebutkan	1 1 1	2 2 2	3 3 3	4 4 4	5 5 5	6 6 6	7 7 7	1 1 1	2 2 2	3 3 3	4 4 4	5 5 5	6 6 6	7 7 7

Bagian C. Pemahaman dan penggunaan alat atau teknik

Untuk setiap alat (tool) atau teknik yang disebutkan dalam tabel di bawah, mohon berikan penilaian berkaitan tingkat pemahaman terhadap alat atau teknik tersebut dan tingkat penggunaannya di perusahaan anda.

a. Pilih salah satu angka diantara 1 (tidak paham sama sekali) hingga 7 (sangat paham) untuk menggambarkan secara umum tingkat pemahaman anda mewakili perusahaan berkenaan alat atau teknik di bawah ini.

<u>DAN :</u>

b. Pilih salah satu angka diantara 1 (tidak pernah digunakan) hingga 7 (sangat tinggi penggunaannya) untuk menggambarkan secara umum tingkat penggunaan alat atau teknik di bawah ini.

No	Alat/Teknik	Tingkat pemahaman dari alat dan teknik dibawah ini							Tingkat penggunaan di perusahaan anda						
		Tdk paham sama						Sangat paham sekali	Tdk pernah digunakan						Sangat tinggi penggunaannya
1	Diagram tulang ikan (fishbone diagram)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2	Check sheet	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3	Peta kendali (control chart)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4	Grafik (graph/chart)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5	Histogram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6	Diagram pareto (pareto chart)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7	Diagram tebar (scatter diagram)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	Affinity diagram/KJ method	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9	Arrow diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10	Prioritization matrix	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11	Matrix diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12	Interrelationship diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13	Systematic diagram/tree diagram	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14	Failure Modes and Effects Analysis (FMEA)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15	Statistical Process Control (SPC)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16	Penjabaran fungsi kualitas atau Quality Function Deployment (QFD)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
17	Rancangan percobaan atau Design of Experiment (DOE)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
18	5 R (Ringkas, Rapi, Resik, Rawat dan Rajin) atau 5 S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
19	Set up time reduction (SMED)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
20	One piece flow	1	2	3	4	5	6	7	1	2	3	4	5	6	7
21	Sistem tarik (pull system / kanban)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
22	Value stream mapping	1	2	3	4	5	6	7	1	2	3	4	5	6	7
23	Visual workplace	1	2	3	4	5	6	7	1	2	3	4	5	6	7
24	Cellular/flow manufacturing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
25	Alat atau teknik lainnya, sebutkan :														
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Bagian D. Kesiapan untuk mengadopsi inovasi

D.1. Lingkari salah satu pilihan angka diantara 1 (sangat rendah) hingga 7 (sangat tinggi) untuk menggambarkan tingkat implementasi dari hal-hal yang disebutkan di bawah pada perusahaan anda.

		Sangat rendah						Sangat tinggi
1.	Komunikasi berkala dengan pelanggan dalam rangka untuk menghasilkan produk yang sesuai dengan keinginan mereka	1	2	3	4	5	6	7
2.	Pengukuran kepuasan pelanggan secara berkala misalnya dari tingkat komplain, dll dan menyelesaikannya berdasarkan hasil pengukuran tersebut	1	2	3	4	5	6	7
3.	Pengambilan keputusan dan penyelesaian masalah didasarkan pada penggunaan data daripada sekedar coba-coba atau perkiraan	1	2	3	4	5	6	7
4.	Penggunaan alat/teknik untuk meningkatkan mutu produk	1	2	3	4	5	6	7
5.	Penggunaan alat/teknik untuk menurunkan biaya produksi	1	2	3	4	5	6	7
6.	Penggunaan alat/teknik untuk menurunkan waktu produksi	1	2	3	4	5	6	7
7.	Budaya untuk tidak menyalahkan karyawan jika ide atau gagasan mereka tidak sukses	1	2	3	4	5	6	7
8.	Penghargaan yang diberikan kepada karyawan/tim jika mereka memberikan kontribusi yang signifikan (berarti) bagi perusahaan	1	2	3	4	5	6	7

Jika ingin menambahkan komentar, silahkan tulis secara singkat di sini :

D.2. Lingkari salah satu pilihan angka diantara 1 (sangat rendah) hingga 7 (sangat tinggi) untuk setiap pertanyaan berkaitan kemampuan perusahaan anda untuk menyediakan sumberdaya (resource) apabila suatu saat perusahaan anda memutuskan untuk mengadopsi suatu program atau pendekatan baru.

		Sangat rendah						Sangat tinggi
1.	Aspek finansial untuk mendukung implementasi suatu program atau pendekatan baru	1	2	3	4	5	6	7
2.	Aspek teknikal seperti misalnya penyediaan software, peralatan, dll. yang diperlukan jika perusahaan mengadopsi program atau pendekatan baru	1	2	3	4	5	6	7
3.	Menyewa jasa konsultan apabila diperlukan untuk membimbing implementasi suatu program atau pendekatan baru	1	2	3	4	5	6	7
4.	Lingkungan kerja yang memberikan kemudahan bagi karyawan untuk bekerja bersama-sama dalam sebuah tim jika hal ini disyaratkan oleh program atau pendekatan baru	1	2	3	4	5	6	7
5.	Pengalokasian sejumlah karyawan khusus untuk bekerja *full time* dalam suatu program atau pendekatan baru	1	2	3	4	5	6	7

Jika ingin menambahkan komentar, silahkan tulis secara singkat di sini :

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D.3. Misalnya perusahaan anda telah memutuskan untuk mengimplementasikan suatu program atau pendekatan baru, maka seberapa jauh anda sebagai pemilik perusahaan atau manajer akan mendukung program atau pendekatan baru tersebut ? Lingkari salah satu pilihan angka diantara 1 (sangat rendah) hingga 7 (sangat tinggi) untuk setiap pertanyaan yang menggambarkan tingkat dukungan anda.

		Sangat rendah						Sangat tinggi
1.	Saya bersedia untuk berpartisipasi secara aktif dalam implementasi suatu program atau pendekatan baru	1	2	3	4	5	6	7
2.	Saya bersedia untuk mengubah cara berpikir orang-orang di perusahaan agar mendukung program atau pendekatan baru tersebut	1	2	3	4	5	6	7
3.	Saya bersedia untuk mengubah kebijakan perusahaan untuk mendukung implementasi suatu program atau pendekatan baru	1	2	3	4	5	6	7
4.	Saya bersedia untuk menghadiri pelatihan yang bertujuan meningkatkan pengetahuan dan memudahkan saya untuk memimpin implementasi program atau pendekatan baru di perusahaan	1	2	3	4	5	6	7
5.	Saya bersedia untuk mendukung program atau pendekatan baru dengan menyediakan sumber daya (resource) yang mencukupi	1	2	3	4	5	6	7

Jika ingin menambahkan komentar, silahkan tulis secara singkat di sini :

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D.4. Lingkari salah satu pilihan angka diantara 1 (sangat rendah) hingga 7 (sangat tinggi) untuk setiap pertanyaan berkaitan kemampuan karyawan di perusaahaan anda jika suatu saat perusahaan memutuskan untuk mengadopsi suatu program atau pendekatan baru.

		Sangat rendah						Sangat tinggi
1.	Kemauan karyawan untuk bekerja dalam tim	1	2	3	4	5	6	7
2.	Kemauan karyawan untuk belajar sesuatu yang baru	1	2	3	4	5	6	7
3.	Kemampuan karyawan untuk menyelesaikan masalah di tempat kerja	1	2	3	4	5	6	7
4.	Keahlian karyawan yang berhubungan dengan pekerjaannnya	1	2	3	4	5	6	7
5.	Latar belakang pendidikan karyawan yang akan memudahkan mereka menyelesaikan masalah/problem operasional dengan menggunakan pendekatan statistik atau program statistik	1	2	3	4	5	6	7

Jika ingin menambahkan komentar, silahkan tulis secara singkat di sini :

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D.5. Lingkari salah satu pilihan angka diantara 1 (sangat rendah) hingga 7 (sangat tinggi) untuk setiap pertanyaan berkaitan kemampuan perusahaan untuk menyediakan pelatihan jika suatu saat perusahaan memutuskan untuk mengadopsi suatu program atau pendekatan baru.

		Sangat rendah						Sangat tinggi
1.	Peluang level manajer untuk mendapat pelatihan mengenai aspek penting dari program atau pendekatan baru	1	2	3	4	5	6	7
2.	Peluang level karyawan untuk mendapat pelatihan berkaitan aspek penting dari program atau pendekatan baru	1	2	3	4	5	6	7
3.	Pengalokasian waktu pelatihan untuk manajer/karyawan yang mendapat kesempatan pelatihan di luar perusahaan	1	2	3	4	5	6	7

Jika ingin menambahkan komentar, silahkan tulis secara singkat di sini :

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Bagian E. Pengaruh dan ekspektasi

Lingkari salah satu pilihan angka diantara 1 (tidak berpengaruh) hingga 7 (sangat berpengaruh) untuk menggambarkan tingkat pengaruh dari lembaga-lembaga seperti yang disebutkan dalam tabel di bawah terhadap keputusan perusahaan anda untuk mengadopsi suatu program atau pendekatan baru.

		Tdk berpengaruh						Sangat berpengaruh
1.	UKM lain	1	2	3	4	5	6	7
2.	Pemerintah	1	2	3	4	5	6	7
3.	Pelanggan utama perusahaan anda	1	2	3	4	5	6	7
4.	Pemasok (supplier)	1	2	3	4	5	6	7
5.	Universitas/institusi pendidikan	1	2	3	4	5	6	7
6.	Jasa Pengembangan Bisnis (Business Development Service) atau konsultan	1	2	3	4	5	6	7
7.	Lain-lain, sebutkan :							
	....	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7
	....	1	2	3	4	5	6	7

Lingkari salah satu pilihan angka diantara 1 (sangat tidak mungkin untuk sukses) hingga 7 (sangat mungkin untuk sukses) untuk menggambarkan keyakinan anda mengenai tingkat keberhasilan suatu program atau pendekatan baru misalnya TQM, Lean Six Sigma, dll jika program tersebut diimplementasikan di perusahaan anda?

Sangat tidak mungkin untuk sukses	1	2	3	4	5	6	7	Sangat mungkin untuk sukses

Apakah anda memiliki rencana untuk mengimplementasikan program atau pendekatan baru di waktu mendatang?

O Ya

O Tidak

Jika Ya, jelaskan secara singkat program atau pendekatan baru apa yang akan diimplementasikan di perusahaan anda (misalnya: TQM, Six Sigma, Lean Six Sigma atau lainnya) :

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Jika masih ada pendapat atau komentar lain yang ingin anda sampaikan, silahkan anda tulis di sini:

----TERIMA KASIH UNTUK PARTISIPASI ANDA DALAM SURVEI INI----

Appendix D
Semi-structured interviews

Interviews with SMEs

Several semi-structured questions were prepared for SMEs. These questions were open-ended which encourages the interviewees to expand their answers.

1. General information about the company.

2. Does your company receive any support from stakeholders i.e. Government, customers, suppliers, foreign agencies, university, BDS or other agencies? [Guide them to explain more about the supports from SMEs stakeholders]

3. Regarding training, what is your perception of Government training so far? [Guide them to explain more about the advantage and weaknesses of the training]

Interviews with SMEs' stakeholders

1. General information about the agency.

2. What programs have been created by your agency to strengthening SMEs?

3. If the company says that they provide training for SMEs, ask them to explain more about training provided by their agency. Guide them to explain more about training type, trainers, training continuity, etc.

Appendix E

Letter of approval from UTS research ethics committee

23 November 2006

Dr Doug Davis
CM05C.04.04
Faculty of Business
UNIVERSITY OF TECHNOLOGY, SYDNEY

Dear Doug,

UTS HREC REF NO 2006-268 – DAVIS, Dr Doug, MOULTON, Mr Bruce, (for AMAR, Ms Kafayah PhD student) - "Development of a Lean Six Sigma Implementation Framework for Small and Medium Sized Indonesian Manufacturing Enterprises"

At its meeting held on 14/11/2006, the UTS Human Research Ethics Committee considered the above application, and I am pleased to inform you that ethics clearance has been granted. The Committee commented that it was low risk research.

Your clearance number is UTS HREC REF NO. 2006-268A

Please note that the ethical conduct of research is an on-going process. The *National Statement on Ethical Conduct in Research Involving Humans* requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

If you have any queries about your ethics clearance, or require any amendments to your research in the future, please do not hesitate to contact the Ethics Secretariat at the Research and Innovation Office, on 02 9514 9615.

Yours sincerely,

Professor Jane Stein-Parbury
Chairperson,
UTS Human Research Ethics Committee

Appendix F

English version of follow-up letter

[Owner/manager]

[Company address]

[Date]

Dear Sir/madam

Re: Returning the completed questionnaire

I am Kifayah Amar, a PhD student from University of Technology, Sydney – Australia, who has sent a questionnaire form to your company. The questionnaire has been designed to measure the readiness of Small and Medium Enterprises (SMEs) in Indonesia with regard to innovation adoption. However, I have still not received a completed questionnaire from your company.

Because of the importance of the questionnaire to provide information for my research, I would appreciate if you could return the completed questionnaire as soon as possible. I have already provided a stamped envelope in the previous document sent.

Thank you for your good response to this letter.

Yours sincerely,

Kifayah Amar
PhD Candidate
Faculty of Engineering
University of Technology, Sydney
AUSTRALIA

Appendix G

Indonesian version of follow-up letter

[Tanggal]

[Pimpinan/Manajer]
[Company address]

Dengan hormat,

Re: Memohon pengiriman kembali kuesioner yang telah diisi

Saya, Kifayah Amar, mahasiswi S3 dari University of Technology Sydney - Australia yang beberapa waktu lalu mengirimkan kuesioner penelitian untuk mengukur kesiapan UKM di Indonesia dalam mengadopsi inovasi. Namun hingga surat ini dikirimkan, saya belum menerima kembali kuesioner tersebut dari perusahaan Bapak.

Karena kuesioner tersebut sifatnya sangat penting bagi keberhasilan penelitian saya, mohon kiranya Bapak bersedia untuk mengirimkan kembali kuesioner yang telah diisi lengkap secepatnya ke alamat yang tertera di amplop berperangko yang telah saya lampirkan bersama kuesioner tersebut.

Demikian surat ini saya kirim dengan harapan segera mendapatkan respon positif dari Bapak selaku pimpinan atau manajer di perusahaan ini.

Terima kasih.

Hormat saya,

Kifayah Amar
PhD Candidate
Faculty of Engineering
University of Technology Sydney
AUSTRALIA

Appendix H

Questionnaire coding sheet

Item being coded	Variable name	Description
Part A Question 1	Position	Position of the respondent 1 = owner 2 = manager 3 = others
Part A Question 2	Employees	Number of employees 1 = < 10 employees 2 = 10-25 employees 3 = 26-50 employees 4 = 51-75 employees 6 = > 99 employees
Part A Question 3	Years	Years in business 1 = 1-5 years 2 = 6-10 years 3 = 11-15 years 4 = > 15 years
Part A Question 4	Ownership	Ownership 1 = private 2 = join venture 3 = foreign 4 = others
Part A Question 5	Product	Main product 1 = automotive component 2 = electricity component 3 = others
Part A Question 6	Location	Location of the company 1 = Sidoarjo 2 = Pasuruan 3 = Surabaya 4 = Jakarta 5 = others
Part A Question 7	Certification	Quality certification 1 = ISO 9001 2 = SNI 3 = QS 9000 4 = others 5 = none
Part A Question 8	Export	Export orientation 1 = Yes 2 = No
Part A Question 9	IT	Degree of IT usage 1 = Not used at all to 7 = very high use
Part B1.1a	TQMunderstanding	Understanding of TQM 1 = none at all to 7 = very high level
Part B1.1b	TQMusage	Usage of TQM 1 = never been used to 7 = high use
Part B1.2a	Sixsigmaunderstanding	Understanding of Six Sigma 1 = none at all to 7 = very high level

Part B1.2b	Sixsigmausage	Usage of Six Sigma 1 = never been used to 7 = high use
Part B1.3a	QCCunderstanding	Understanding of QCC 1 = none at all to 7 = very high level
Part B1.3b	QCCusage	Usage of QCC 1 = never been used to 7 = high use
Part B1.4a	JITunderstanding	Understanding of JIT 1 = none at all to 7 = very high level
Part B1.4b	JITusage	Usage of JIT 1 = never been used to 7 = high use
Part B1.5a	Leanmanufunderstanding	Understanding of Lean Manufacturing 1 = none at all to 7 = very high level
Part B1.5b	Leanmanufusage	Usage of Lean Manufacturing 1 = never been used to 7 = high use
Part B1.6a	Leansixsigmaunderstanding	Understanding of Lean Six Sigma 1 = none at all to 7 = very high level
Part B1.6b	Leansixsigmausage	Usage of Lean Six Sigma 1 = never been used to 7 = high use
Part B2.1.1a	StrengthGovttrain	Strength of Training – Government 1 = No support to 7 = Very strong support
Part B2.1.1b	StrengthGovtconsult	Strength of Consultation – Government 1 = No support to 7 = Very strong support
Part B2.1.1c	StrengthGovtothers	Strength of Other supports – Government 1 = No support to 7 = Very strong support
Part B2.1.2a	ImportanceGovtrain	Importance of Training – Government 1 = Not important at all to 7 = Very important
Part B2.1.2b	ImportanceGovtconsult	Importance of Consultation – Government 1 = Not important at all to 7 = Very important
Part B2.1.2c	ImportanceGovtothers	Importance of Other supports – Government 1 = Not important at all to 7 = Very important
Part B2.2.1a	StrengthBDSttrain	Strength of Training – BDS 1 = No support to 7 = Very strong support
Part B2.2.1b	StrengthBDSconsult	Strength of Consultation – BDS 1 = No support to 7 = Very strong support
Part B2.2.1c	StrengthBDSothers	Strength of Other supports – BDS 1 = No support to 7 = Very strong support
Part B2.2.2a	ImportanceBDStrain	Importance of Training – BDS 1 = Not important at all to 7 = Very important
Part B2.2.2b	ImportanceBDSconsult	Importance of Consultation – BDS 1 = Not important at all to 7 = Very important

Part B2.2.2c	ImportanceBDSothers	Importance of Other supports – BDS 1 = Not important at all to 7 = Very important
Part B2.3.1a	Strengthinstituiontrain	Strength of Training – institution 1 = No support to 7 = Very strong support
Part B2.3.1b	Strengthinstituionconsult	Strength of Consultation – institution 1 = No support to 7 = Very strong support
Part B2.3.1c	Strengthinstituionothers	Strength of Other supports – institution 1 = No support to 7 = Very strong support
Part B2.3.2a	Importanceinstitutiontrain	Importance of Training – institution 1 = Not important at all to 7 = Very important
Part B2.3.2b	Importanceinstitutionconsult	Importance of Consultation – institution 1 = Not important at all to 7 = Very important
Part B2.3.2c	Importanceinstitutionothers	Importance of Consultation – others 1 = Not important at all to 7 = Very important
Part B2.4.1a	StrengthSubcontrain	Strength of Training – Subcontractor 1 = No support to 7 = Very strong support
Part B2.4.1b	StrengthSubconconsult	Strength of Consultation – Subcontractor 1 = No support to 7 = Very strong support
Part B2.4.1c	StrengthSubconothers	Strength of Other supports – Subcontractor 1 = No support to 7 = Very strong support
Part B2.4.2a	ImportanceSubcontrain	Importance of Training – Subcontractor 1 = Not important at all to 7 = Very important
Part B2.4.2b	ImportanceSubconconsult	Importance of Consultation – Subcontractor 1 = Not important at all to 7 = Very important
Part B2.4.2c	ImportanceSubconothers	Importance of Other supports – Subcontractor 1 = Not important at all to 7 = Very important
Part B2.5.1a	StrengthCusttrain	Strength of Training – Main Customer 1 = No support to 7 = Very strong support
Part B2.5.1b	StrengthCustconsult	Strength of Consultation – Main Customer 1 = No support to 7 = Very strong support
Part B2.5.1c	StrengthCustothers	Strength of Other supports – Main Customer

		1 = No support to 7 = Very strong support
Part B2.5.2a	ImportanceCusttrain	Importance of Training – Main Customer 1 = Not important at all to 7 = Very important
Part B2.5.2b	ImportanceCustconsult	Importance of Consultation – Main Customer 1 = Not important at all to 7 = Very important
Part B2.5.2c	ImportanceCustothers	Importance of Other supports – Main Customer 1 = Not important at all to 7 = Very important
Part B2.6.1a	StrengthSuppliertrain	Strength of Training – Main Supplier 1 = No support to 7 = Very strong support
Part B2.6.1b	StrengthSupplierconsult	Strength of Consultation – Main Supplier 1 = No support to 7 = Very strong support
Part B2.6.1c	StrengthSupplierothers	Strength of Other supports – Main Supplier 1 = No support to 7 = Very strong support
Part B2.6.2a	ImportanceSuppliertrain	Importance of Training – Main Supplier 1 = Not important at all to 7 = Very important
Part B2.6.2b	ImportanceSupplierconsult	Importance of Consultation – Main Supplier 1 = Not important at all to 7 = Very important
Part B2.6.2c	ImportanceSupplierothers	Importance of Other supports – Main Supplier 1 = Not important at all to 7 = Very important
Part B2.7.1a	StrengthForeigntrain	Strength of Training – Foreign agency 1 = No support to 7 = Very strong support
Part B2.7.1b	StrengthForeignconsult	Strength of Consultation – Foreign agency 1 = No support to 7 = Very strong support
Part B2.7.1c	StrengthForeignothers	Strength of Other supports – Foreign agency 1 = No support to 7 = Very strong support
Part B2.7.2a	ImportanceForeigntrain	Importance of Training – Foreign agency 1 = Not important at all to 7 = Very important
Part B2.7.2b	ImportanceForeignconsult	Importance of Consultation – Foreign agency 1 = Not important at all to 7 = Very

		important
Part B2.7.2c	ImportanceForeignothers	Importance of Other supports – Foreign agency 1 = Not important at all to 7 = Very important
Part C1a	Fishboneunderstand	Understanding of Fishbone Diagram 1 = None at all to 7 = Very high level
Part C1b	Fishboneuse	Use of Fishbone Diagram 1 = Never been used to 7 = Very high use
Part C2a	Checksheetunderstand	Understanding of Check Sheet 1 = None at all to 7 = Very high level
Part C2b	Checksheetuse	Use of Check Sheet 1 = Never been used to 7 = Very high use
Part C3a	Controlchartunderstand	Understanding of Control Chart 1 = None at all to 7 = Very high level
Part C3b	Controlchartuse	Use of Control Chart 1 = Never been used to 7 = Very high use
Part C4a	Graphunderstand	Understanding of Graphic 1 = None at all to 7 = Very high level
Part C4b	Graphuse	Use of Graphic 1 = Never been used to 7 = Very high use
Part C5a	Histogramunderstand	Understanding of Histogram 1 = None at all to 7 = Very high level
Part C5b	Histogramuse	Use of Histogram 1 = Never been used to 7 = Very high use
Part C6a	Paretounderstand	Understanding of Pareto Diagram 1 = None at all to 7 = Very high level
Part C6b	Paretouse	Use of Pareto Diagram 1 = Never been used to 7 = Very high use
Part C7a	Scatterunderstand	Understanding of Scatter Diagram 1 = None at all to 7 = Very high level
Part C7b	Scatteruse	Use of Scatter Diagram 1 = Never been used to 7 = Very high use
Part C8a	Affinityunderstand	Understanding of Affinity Diagram 1 = None at all to 7 = Very high level
Part C8b	Affinityuse	Use of Affinity Diagram 1 = Never been used to 7 = Very high use
Part C9a	Arrowdiagunderstand	Understanding of Arrow Diagram 1 = None at all to 7 = Very high level
Part C9b	Arrowdiaguse	Use of Arrow Diagram

		1 = Never been used to 7 = Very high use
Part C10a	Prioritizationunderstand	Understanding of Prioritization Matrix 1 = None at all to 7 = Very high level
Part C10b	Prioritizationuse	Use of Prioritization Matrix 1 = Never been used to 7 = Very high use
Part C11a	Matrixdiagrunderstand	Understanding of Matrix Diagram 1 = None at all to 7 = Very high level
Part C11b	Matrixdiagruse	Use of Matrix Diagram 1 = Never been used to 7 = Very high use
Part C12a	Interrelationdiagrunderstand	Understanding of Interrelationship Diagram 1 = None at all to 7 = Very high level
Part C12b	Interrelationdiagruse	Use of Interrelationship Diagram 1 = Never been used to 7 = Very high use
Part C13a	Systematicdiagrunderstand	Understanding of Systematic Diagram 1 = None at all to 7 = Very high level
Part C13b	Systematicdiagruse	Use of Systematic Diagram 1 = Never been used to 7 = Very high use
Part C14a	FMEAunderstand	Understanding of FMEA 1 = None at all to 7 = Very high level
Part C14b	FMEAuse	Use of FMEA 1 = Never been used to 7 = Very high use
Part C15a	SPCunderstand	Understanding of SPC 1 = None at all to 7 = Very high level
Part C15b	SPCuse	Use of SPC 1 = Never been used to 7 = Very high use
Part C16a	QFDunderstand	Understanding of QFD 1 = None at all to 7 = Very high level
Part C16b	QFDuse	Use of QFD 1 = Never been used to 7 = Very high use
Part C17a	DOEunderstand	Understanding of DOE 1 = None at all to 7 = Very high level
Part C17b	DOEuse	Use of DOE 1 = Never been used to 7 = Very high use
Part C18a	FiveSunderstand	Understanding of 5S 1 = None at all to 7 = Very high level
Part C18b	FiveSuse	Use of 5S

		1 = Never been used to 7 = Very high use
Part C19a	SMEDunderstand	Understanding of SMED 1 = None at all to 7 = Very high level
Part C19b	SMEDuse	Use of SMED 1 = Never been used to 7 = Very high use
Part C20a	Onepieceflowunderstand	Understanding of One Piece Flow 1 = None at all to 7 = Very high level
Part C20b	Onepieceflowuse	Use of SMED 1 = Never been used to 7 = Very high use
Part C21a	Pullsystemunderstand	Understanding of Pull System 1 = None at all to 7 = Very high level
Part C21b	Pullsystemuse	Use of Pull System 1 = Never been used to 7 = Very high use
Part C22a	Valuestreamunderstand	Understanding of Value Stream 1 = None at all to 7 = Very high level
Part C22b	Valuestreamuse	Use of Value Stream 1 = Never been used to 7 = Very high use
Part C23a	Visualworkplaceunderstand	Understanding of Visual Workplace 1 = None at all to 7 = Very high level
Part C23b	Visualworkplaceuse	Use of Visual Workplace 1 = Never been used to 7 = Very high use
Part C24a	Cellmanufunderstand	Understanding of Cell Manufacturing 1 = None at all to 7 = Very high level
Part C24b	Cellmanufuse	Use of Cell Manufacturing 1 = Never been used to 7 = Very high use
Part D1.1	Dailypractice1	1 = Very low to 7 = Very high
Part D1.2	Dailypractice2	1 = Very low to 7 = Very high
Part D1.3	Dailypractice3	1 = Very low to 7 = Very high
Part D1.4	Dailypractice4	1 = Very low to 7 = Very high
Part D1.5	Dailypractice5	1 = Very low to 7 = Very high
Part D1.6	Dailypractice6	1 = Very low to 7 = Very high
Part D1.7	Dailypractice7	1 = Very low to 7 = Very high
Part D1.8	Dailypractice8	1 = Very low to 7 = Very high
Part D2.1	Resource1	1 = Very low to 7 = Very high
Part D2.2	Resource2	1 = Very low to 7 = Very high
Part D2.3	Resource3	1 = Very low to 7 = Very high
Part D2.4	Resource4	1 = Very low to 7 = Very high
Part D2.5	Resource5	1 = Very low to 7 = Very high
Part D3.1	Ownercharact1	1 = Very low to 7 = Very high
Part D3.2	Ownercharact2	1 = Very low to 7 = Very high
Part D3.3	Ownercharact3	1 = Very low to 7 = Very high
Part D3.4	Ownercharact4	1 = Very low to 7 = Very high
Part D3.5	Ownercharact5	1 = Very low to 7 = Very high

Part D4.1	Employcharact1	1 = Very low to 7 = Very high
Part D4.2	Employcharact2	1 = Very low to 7 = Very high
Part D4.3	Employcharact3	1 = Very low to 7 = Very high
Part D4.4	Employcharact4	1 = Very low to 7 = Very high
Part D4.5	Employcharact5	1 = Very low to 7 = Very high
Part D5.1	Training1	1 = Very low to 7 = Very high
Part D5.2	Training2	1 = Very low to 7 = Very high
Part D5.3	Training3	1 = Very low to 7 = Very high
Part E1.1	SME	Influence from other SMEs towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.2	Govt	Influence from Government towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.3	Keycust	Influence from key Customer towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.4	Supplier	Influence from Supplier towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.5	University	Influence from University towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.6	BDS	Influence from BDS towards innovation adoption 1 = Not influential to 7 = Very influential
Part E1.2a	Believe	Strength of believe in success of a new program 1 = Very unlikely to be successful to 7 = Very likely to be successful
Part E1.2b	Plan	Plan to implement a new program 1 = Yes 2 = No

Appendix I

Questionnaires variables, summary statistics and missing data

Part in the quest.	Variable	Mean	Std Dev	Min	Max	Total N	Valid N	Missing Data	% Mis Data
A_9	Degree of IT usage	1.56	1.326	1	7	148	148	0	0
$B1_{1A}$	Understanding of TQM	2.16	1.835	1	7	148	147	1	0.7
$B1_{1B}$	Implementation of TQM	1.70	1.546	1	7	148	146	2	1.4
$B1_{2A}$	Understanding of Six Sigma	1.32	1.042	1	7	148	146	2	1.4
$B1_{2B}$	Implementation of Six Sigma	1.19	0.816	1	7	148	146	2	1.4
$B1_{3A}$	Understanding of QCC	1.91	1.736	1	7	148	147	1	0.7
$B1_{3B}$	Implementation of QCC	1.58	1.442	1	7	148	145	3	2.0
$B1_{4A}$	Understanding of JIT	1.69	1.524	1	7	148	147	1	0.7
$B1_{4B}$	Implementation of JIT	1.53	1.396	1	7	148	146	2	1.4
$B1_{5A}$	Understanding of Lean Manufacturing	1.56	1.467	1	7	148	147	1	0.7
$B1_{5B}$	Implementation of Lean Manufacturing	1.51	1.430	1	7	148	146	2	1.4
$B1_{6A}$	Understanding of Lean Six Sigma	1.36	1.094	1	7	148	146	2	1.4
$B1_{6B}$	Implementation of Lean Six Sigma	1.28	1.014	1	7	148	144	4	2.7
$B2.1_{A.1}$	Strength of training from government	1.85	1.468	1	7	148	147	1	0.7
$B2.1_{A.2}$	Strength of consultation from government	1.55	1.313	1	7	148	146	2	1.4
$B2.1_{A.3}$	Strength of other supports from	3.78	2.224	1	7	148	9	139	93.9

	government								
$B2.1_{B.1}$	Importance of training from government	2.20	1.858	1	7	148	133	15	10.1
$B2.1_{B.2}$	Importance of consultation from government	1.89	1.6884	1	7	148	131	17	11.5
$B2.1_{B.3}$	Importance of other supports from government	3.63	2.387	1	7	148	8	140	94.6
$B2.2_{A.1}$	Strength of training from BDS	1.30	0.910	1	7	148	147	1	0.7
$B2.2_{A.2}$	Strength consultation from BDS	1.30	0.931	1	7	148	148	0	0
$B2.2_{A.3}$	Strength of other supports from BDS	2.50	2.121	1	4	148	2	146	98.6
$B2.2_{B.1}$	Importance of training from BDS	1.72	1.604	1	7	148	131	17	11.5
$B2.2_{B.2}$	Importance of consultation from BDS	1.66	1.547	1	7	148	132	16	10.8
$B2.2_{B.3}$	Importance of other supports from BDS	4	-	4	4	148	1	147	99.3
$B2.3_{A.1}$	Strength of training from institution/university	1.39	1.066	1	7	148	146	2	1.4
$B2.3_{A.2}$	Strength of consultation from institution/university	1.34	0.927	1	7	148	146	2	1.4
$B2.3_{A.3}$	Strength of other supports from institution/university	3.00	1.732	1	4	148	3	145	98.0
$B2.3_{B.1}$	Importance of training from institution/university	1.74	1.523	1	7	148	130	18	12.2
$B2.3_{B.2}$	Importance of consultation from institution/university	1.62	1.382	1	7	148	2	146	98.6
$B2.3_{B.3}$	Importance of other supports from institution/university	6.33	1.155	5	7	148	3	145	98.0
$B2.4_{A.1}$	Strength of training from organisation which has subcontract relationship	1.21	0.735	1	6	148	145	3	2
$B2.4_{A.2}$	Strength consultation from organisation which has	1.55	1.303	1	7	148	146	2	1.4

	subcontract relationship								
B2.4$_{A.3}$	Strength of other supports from organisation which has subcontract relationship	2.50	2.121	1	4	148	2	146	98.6
B2.4$_{B.1}$	Importance of training from organisation which has subcontract relationship	1.52	1.381	1	7	148	129	19	12.8
B2.4$_{B.2}$	Importance of consultation from organisation which has subcontract relationship	1.91	1.777	1	7	148	128	20	13.5
B2.4$_{B.3}$	Importance of other supports from organisation which has subcontract relationship	6.50	0.707	6	7	148	2	146	98.6
B2.5$_{A.1}$	Strength of training from main customer	1.35	1.027	1	7	148	144	4	2.7
B2.5$_{A.2}$	Strength of consultation from main customer	2.96	2.118	1	7	148	145	3	2.0
B2.5$_{A.3}$	Strength of other supports from main customer	2.50	2.121	1	4	148	2	146	98.6
B2.5$_{B.1}$	Importance of training from main customer	1.74	1.678	1	7	148	133	15	10.1
B2.5$_{B.2}$	Importance of consultation from main customer	3.74	2.541	1	7	148	138	10	6.8
B2.5$_{B.3}$	Importance of other supports from main customer	7.00	-	7	7	148	1	147	99.3
B2.6$_{A.1}$	Strength of training from main supplier	1.23	0.887	1	7	148	146	2	1.4
B2.6$_{A.2}$	Strength of consultation from main supplier	1.97	1.708	1	7	148	146	2	1.4
B2.6$_{A.3}$	Strength of other supports from main supplier	3.33	2.082	1	5	148	3	145	2
B2.6$_{B.1}$	Importance of training from main supplier	1.70	1.670	1	7	148	132	16	10.8
B2.6$_{B.2}$	Importance of consultation from	2.40	2.096	1	7	148	131	17	11.5

	main supplier								
$B2.6_{B.3}$	Importance of other supports from main supplier	5.67	1.528	4	7	148	3	145	98.0
$B2.7_{A.1}$	Strength of training from foreign agency	1.42	1.161	1	7	148	146	2	1.4
$B2.7_{A.2}$	Strength of consultation from foreign agency	1.46	1.207	1	7	148	145	3	98.0
$B2.7_{A.3}$	Strength other supports from foreign agency	2.33	2.309	1	5	148	3	145	98.0
$B2.7_{B.1}$	Importance of training from foreign agency	1.66	1.476	1	7	148	131	17	11.5
$B2.7_{B.2}$	Importance of consultation from foreign agency	1.75	1.609	1	7	148	130	17	11.5
$B2.7_{B.3}$	Importance of other supports from foreign agency	4.20	2.683	1	7	148	5	143	96.6
$B2.8_{A.1}$	Strength of training from other agency	2.55	1.738	1	7	148	22	126	85.1
$B2.8_{A.2}$	Strength of consultation from other agency	2.92	2.253	1	7	148	13	135	91.2
$B2.8_{A.3}$	Strength other supports from other agency	3.26	1.284	2	6	148	21	127	85.8
$B2.8_{B.1}$	Importance of training from other agency	4.71	2.348	1	7	148	21	127	85.8
$B2.8_{B.2}$	Importance of consultation from other agency	3.55	2.505	1	7	148	11	137	92.6
$B2.8_{B.3}$	Importance of other supports from other agency	4.86	2.054	1	7	148	21	127	85.8
$C1_A$	Understanding of fishbone diagram	1.47	1.297	1	7	148	145	3	2.0
$C1_B$	Use of fishbone diagram	1.31	0.964	1	6	148	147	1	0.7
$C2_A$	Understanding of check sheet	1.71	1.597	1	7	148	147	1	0.7
$C2_B$	Use of check sheet	1.59	1.384	1	7	148	147	1	0.7
$C3_A$	Understanding of control chart	1.59	1.465	1	7	148	147	1	0.7
$C3_B$	Use of control chart	1.42	1.125	1	6	148	146	2	1.4

$C4_A$	Understanding of graphic	1.62	1.536	1	7	148	147	1	0.7
$C4_B$	Use of graphic	1.37	1.129	1	7	148	147	1	0.7
$C5_A$	Understanding of histogram	1.52	1.421	1	7	148	147	1	0.7
$C5_B$	Use of histogram	1.29	0.993	1	7	148	147	1	0.7
$C6_A$	Understanding of pareto diagram	1.52	1.377	1	7	148	147	1	0.7
$C6_B$	Use of pareto diagram	1.24	0.873	1	7	148	147	1	0.7
$C7_A$	Understanding of scatter diagram	1.44	1.277	1	6	148	147	1	0.7
$C7_B$	Use of scatter diagram	1.23	0.845	1	6	148	147	1	0.7
$C8_A$	Understanding of scatter diagram	1.44	1.277	1	7	148	147	1	0.7
$C8_B$	Use of scatter diagram	1.23	0.845	1	6	148	147	1	0.7
$C9_A$	Understanding of affinity diagram	1.30	1.021	1	7	148	145	3	2.0
$C9_B$	Use of affinity diagram	1.16	0.743	1	6	148	146	2	1.4
$C10_A$	Understanding of arrow diagram	1.35	1.115	1	7	148	147	1	0.7
$C10_B$	Use of arrow diagram	1.21	0.821	1	6	148	147	1	0.7
$C11_A$	Understanding of prioritization matrix	1.34	1.095	1	7	148	147	1	0.7
$C11_B$	Use of prioritization matrix	1.19	0.788	1	6	148	147	1	0.7
$C12_A$	Understanding of matrix diagram	1.35	1.163	1	7	148	147	1	0.7
$C12_B$	Use of matrix diagram	1.22	0.882	1	6	148	147	1	0.7
$C13_A$	Understanding of interrelationship diagram	1.37	1.177	1	7	148	147	1	0.7
$C13_B$	Use of interrelationship diagram	1.21	0.813	1	6	148	147	1	0.7
$C14_A$	Understanding of systematic diagram	1.39	1.196	1	7	148	147	1	0.7
$C14_B$	Use of systematic diagram	1.26	0.966	1	6	148	147	1	0.7
$C15_A$	Understanding of FMEA	1.35	1.172	1	7	148	146	2	1.4
$C15_B$	Use of FMEA	1.21	0.909	1	7	148	146	2	1.4
$C16_A$	Understanding of SPC	1.46	1.324	1	7	148	146	2	1.4

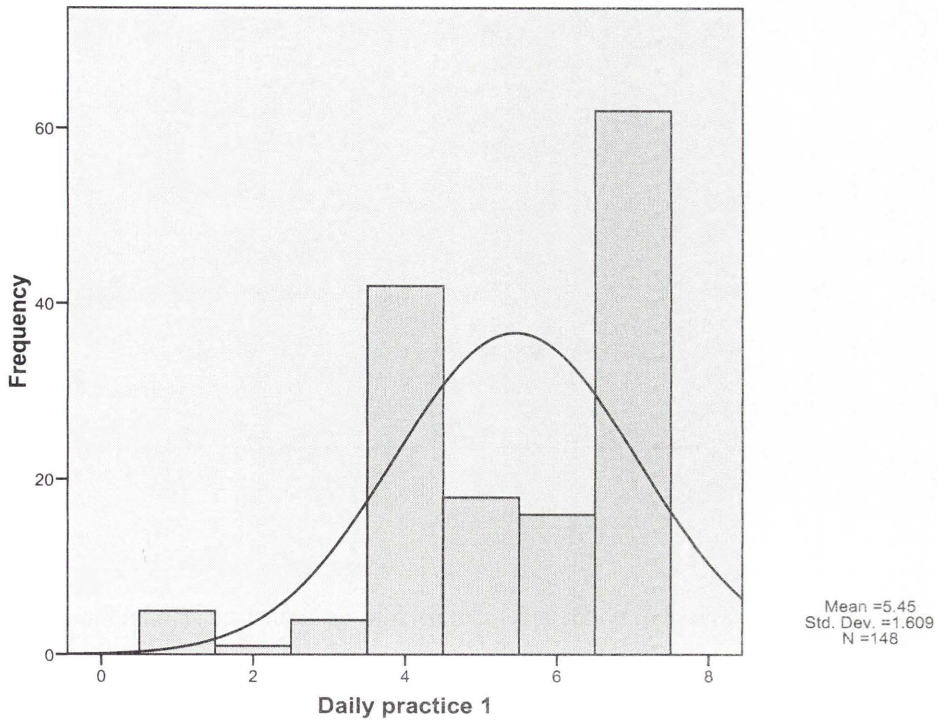
$C16_B$	Use of SPC	1.32	1.155	1	7	148	146	2	1.4
$C17_A$	Understanding of QFD	1.40	1.253	1	7	148	147	1	0.7
$C17_B$	Use of QFD	1.32	1.164	1	7	148	147	1	0.7
$C18_A$	Understanding of DOE	1.47	1.321	1	7	148	147	1	0.7
$C18_B$	Use of DOE	1.37	1.218	1	7	148	147	1	0.7
$C19_A$	Understanding of 5S	2.13	1.949	1	7	148	147	1	0.7
$C19_B$	Use of 5S	1.84	1.630	1	7	148	147	1	0.7
$C20_A$	Understanding of SMED	1.34	1.060	1	6	148	146	2	1.4
$C20_B$	Use of SMED	1.34	1.117	1	7	148	146	2	1.4
$C21_A$	Understanding of one piece flow	1.20	0.767	1	6	148	146	2	1.4
$C21_B$	Use of one piece flow	1.17	0.706	1	6	148	147	1	0.7
$C22_A$	Understanding of pull system	1.26	0.969	1	7	148	146	2	1.4
$C22_B$	Use of pull system	1.23	0.884	1	6	148	147	1	0.7
$C23_A$	Understanding of value stream	1.18	0.743	1	6	148	146	2	1.4
$C23_B$	Use of value stream	1.18	0.740	1	6	148	147	1	0.7
$C24_A$	Understanding of visual workplace	1.27	0.981	1	7	148	145	3	2.0
$C24_B$	Use of visual workplace	1.26	0.976	1	6	148	146	2	1.4
$C25_A$	Understanding of cell manufacturing	1.26	0.888	1	6	148	145	3	2.0
$C25_B$	Use of cell manufacturing	1.30	1.033	1	7	148	146	2	1.4
$C26_A$	Understanding of other tools/techniques	-	-	-	-	148	-	148	100
$C26_B$	Use of other tools/techniques	-	-	-	-	148	-	148	100
$D1_1$	Daily practice 1	5.45	1.609	1	7	148	148	0	0
$D1_2$	Daily practice 2	6.11	1.424	1	7	148	148	0	0
$D1_3$	Daily practice 3	2.80	2.037	1	7	148	147	1	0.7
$D1_4$	Daily practice 4	2.32	2.031	1	7	148	148	0	0
$D1_5$	Daily practice 5	2.22	1.911	1	7	148	148	0	0
$D1_6$	Daily practice 6	2.12	1.819	1	7	148	147	1	0.7
$D1_7$	Daily practice 7	5.29	1.685	1	7	148	147	1	0.7
$D1_8$	Daily practice 8	4.25	2.096	1	7	148	148	0	0
$D2_1$	Resource 1	4.43	1.868	1	7	148	146	2	1.4
$D2_2$	Resource 2	4.68	1.955	1	7	148	148	0	0

$D2_3$	Resource 3	3.17	2.104	1	7	148	148	0	0
$D2_4$	Resource 4	5.24	1.919	1	7	148	148	0	0
$D2_5$	Resource 5	4.32	2.041	1	7	148	148	0	0
$D3_1$	Owner characteristic 1	5.70	1.700	1	7	148	148	0	0
$D3_2$	Owner characteristic 2	5.66	1.589	1	7	148	148	0	0
$D3_3$	Owner characteristic 3	5.22	1.883	1	7	148	148	0	0
$D3_4$	Owner characteristic 4	5.34	1.887	1	7	148	148	0	0
$D3_5$	Owner characteristic 5	5.76	1.712	1	7	148	148	0	0
$D4_1$	Employee characteristic 1	5.47	1.639	1	7	148	148	0	0
$D4_2$	Employee characteristic 2	5.36	1.634	1	7	148	148	0	0
$D4_3$	Employee characteristic 3	4.85	1.657	1	7	148	147	1	0.7
$D4_4$	Employee characteristic 4	4.92	1.426	1	7	148	147	1	0.7
$D4_5$	Employee characteristic 5	2.79	1.853	1	7	148	148	0	0
$D5_1$	Training 1	4.65	1.995	1	7	148	146	2	1.4
$D5_2$	Training 2	4.38	2.014	1	7	148	146	2	1.4
$D5_3$	Training 3	4.51	1.984	1	7	148	146	2	1.4
$E1_1$	SME	5.35	1.887	1	7	148	147	1	0.7
$E1_2$	Government	4.22	2.241	1	7	148	147	1	0.7
$E1_3$	Main customer	5.83	1.657	1	7	148	147	1	0.7
$E1_4$	Main supplier	4.60	2.306	1	7	148	146	2	1.4
$E1_5$	University	4.52	2.323	1	7	148	148	0	0
$E1_6$	BDS	4.48	2.275	1	7	148	148	0	0
$E1_7$	Others	3.00	-	3	3	148	1	147	99.3
$E2_1$	Belief on the new program	4.42	1.498	1	7	148	146	2	1.4

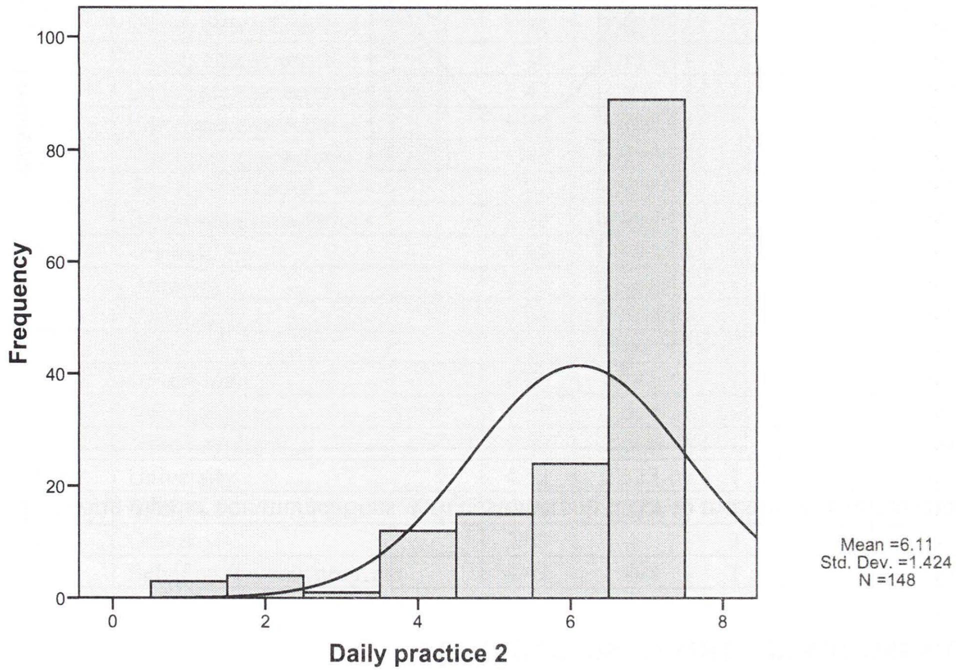
Appendix J

Histograms of data responses of readiness variables

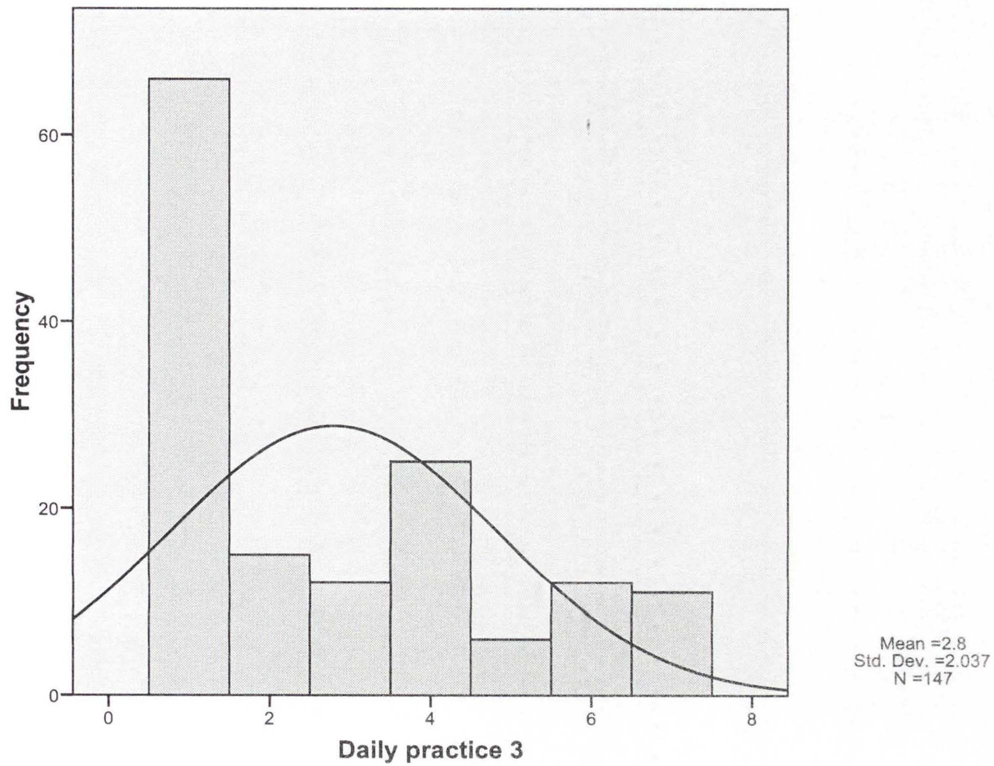
D1.1 Having regular communications with customers in order to meet their requirements



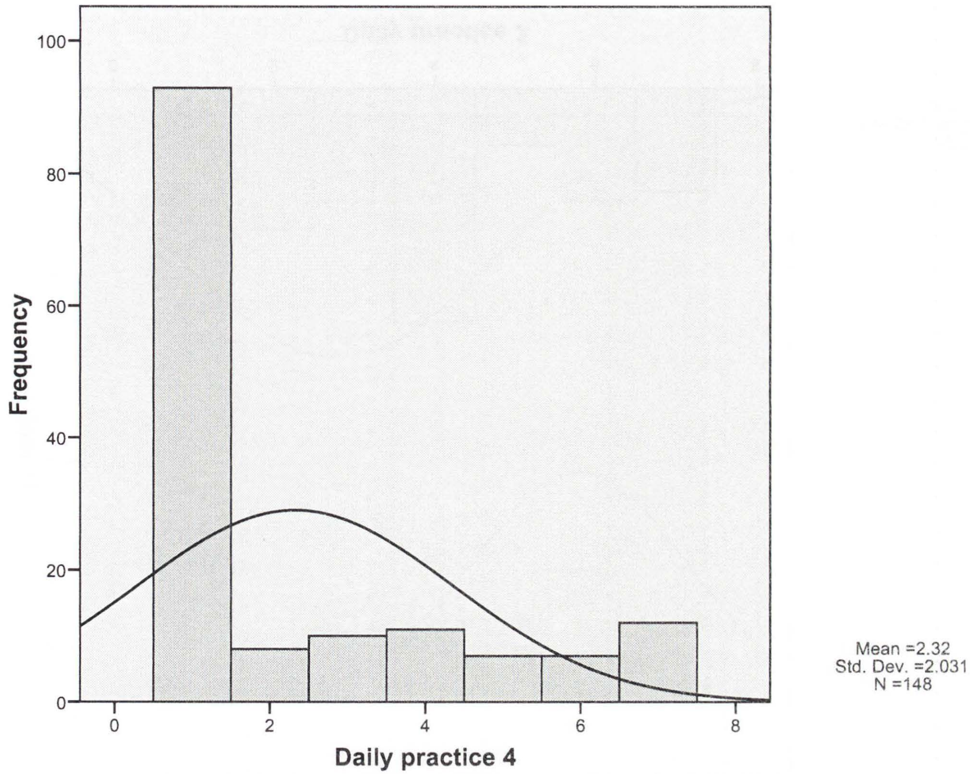
D1.2 Having regular measurement of customer satisfaction (e.g. number of complaints, etc.) and acting on the results of measurement



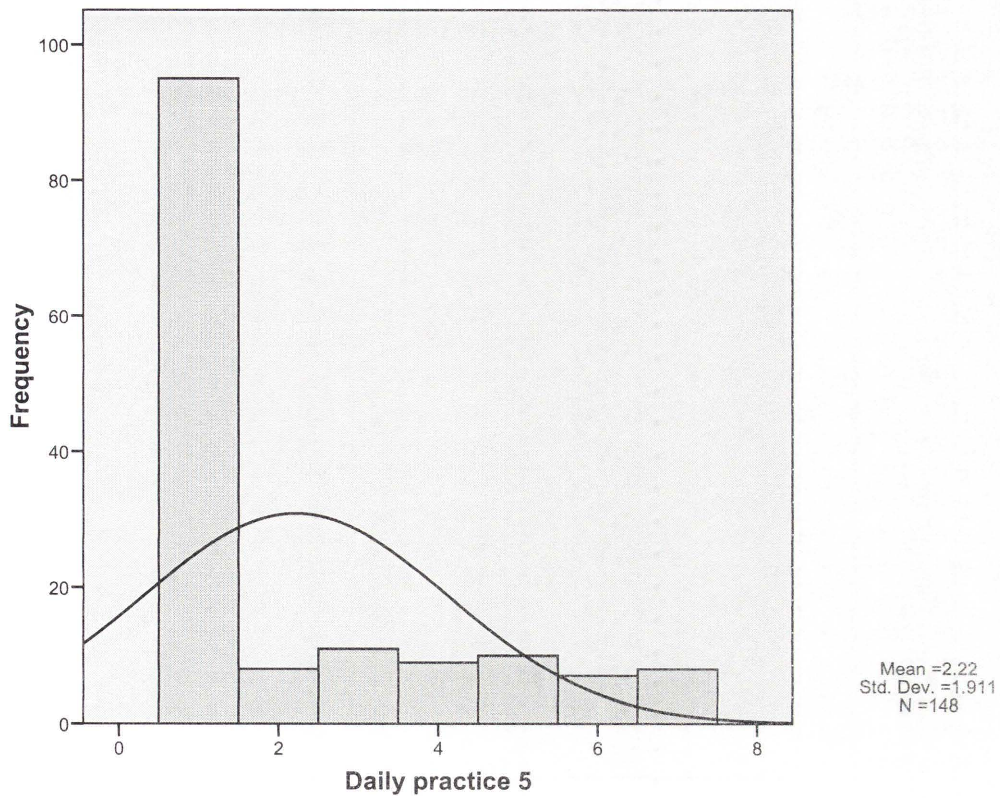
D1.3 Decision making and action taking based on data rather than gut feel or guesswork



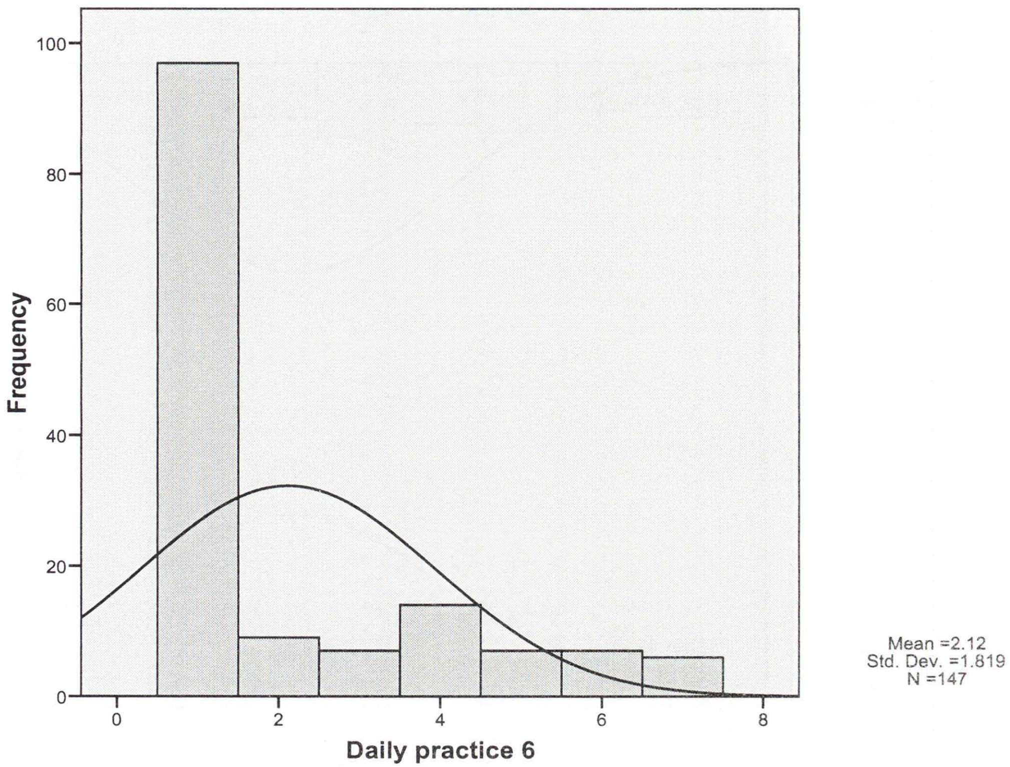
D1.4 Using improvement tools/techniques to improve quality of product



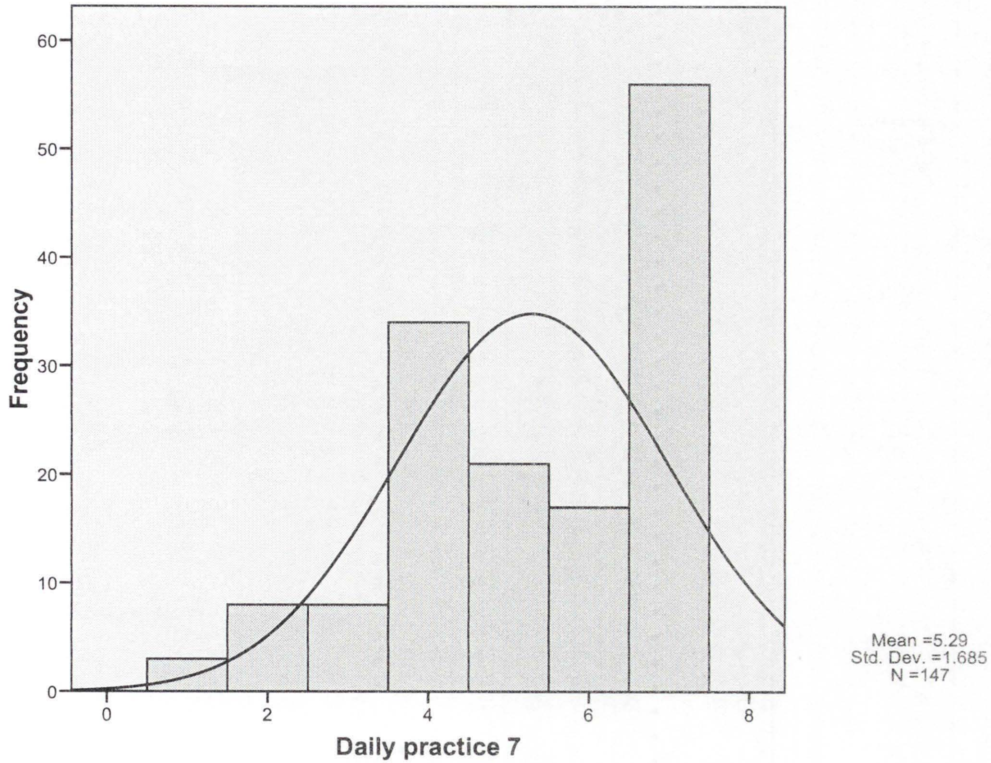
D1.5 Using improvement tools/techniques to reduce cost



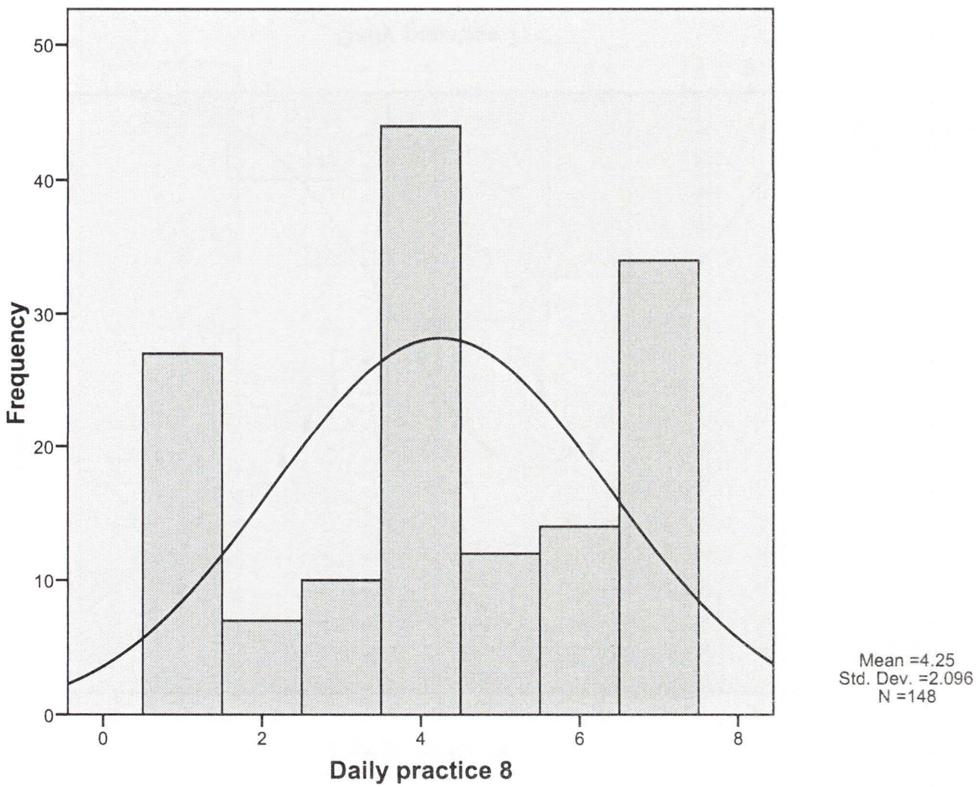
D1.6 Using improvement tools/techniques to reduce time of production



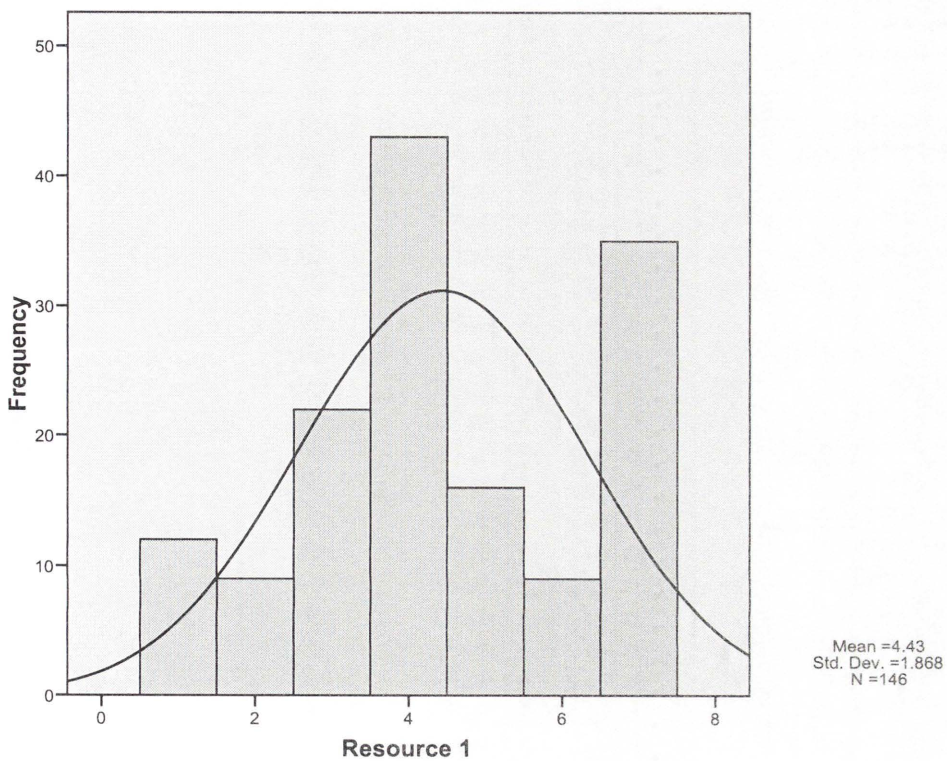
D1.7 Having a culture in which people are not blamed for new ideas that do not work



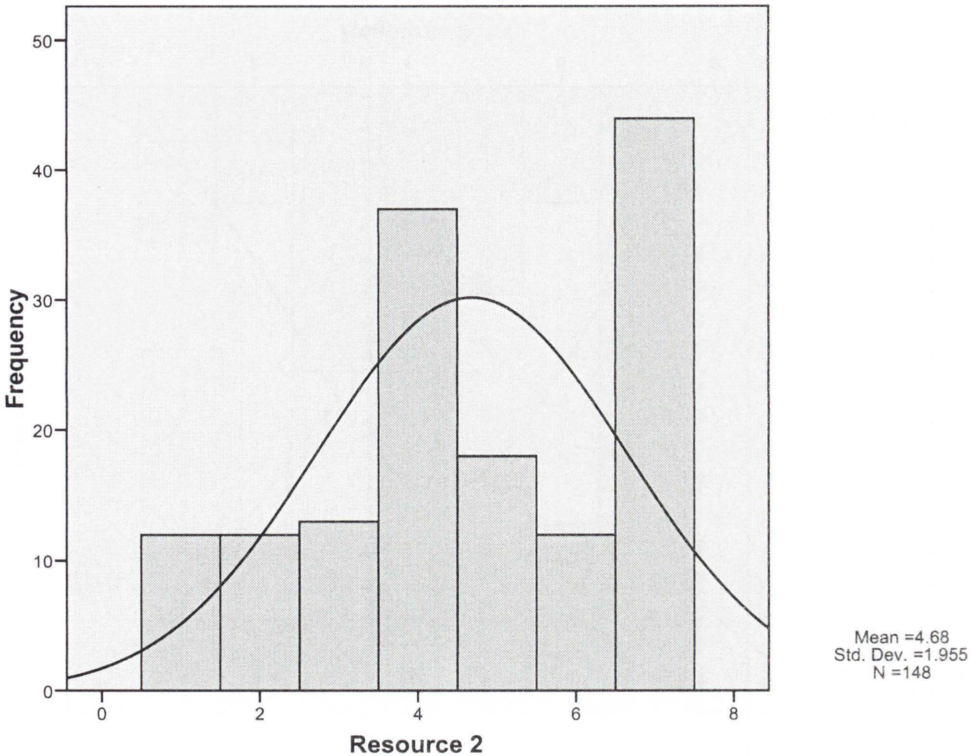
D1.8 Acknowledging and rewarding employees who make significant contribution to the company



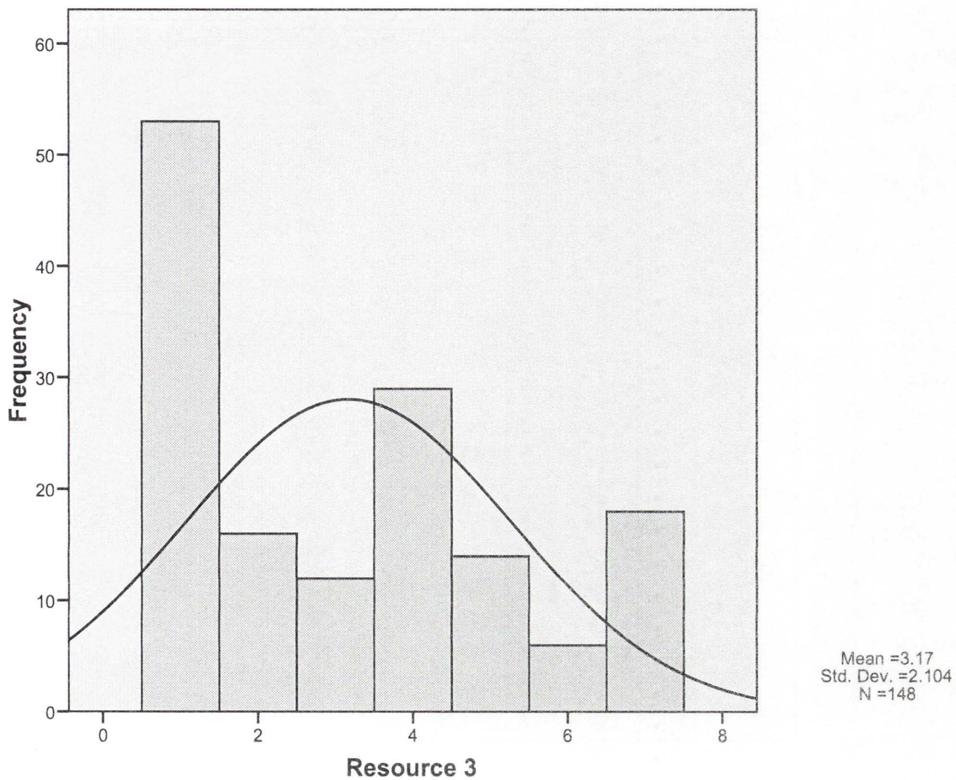
D2.1 Financial resources to support a new program/approach



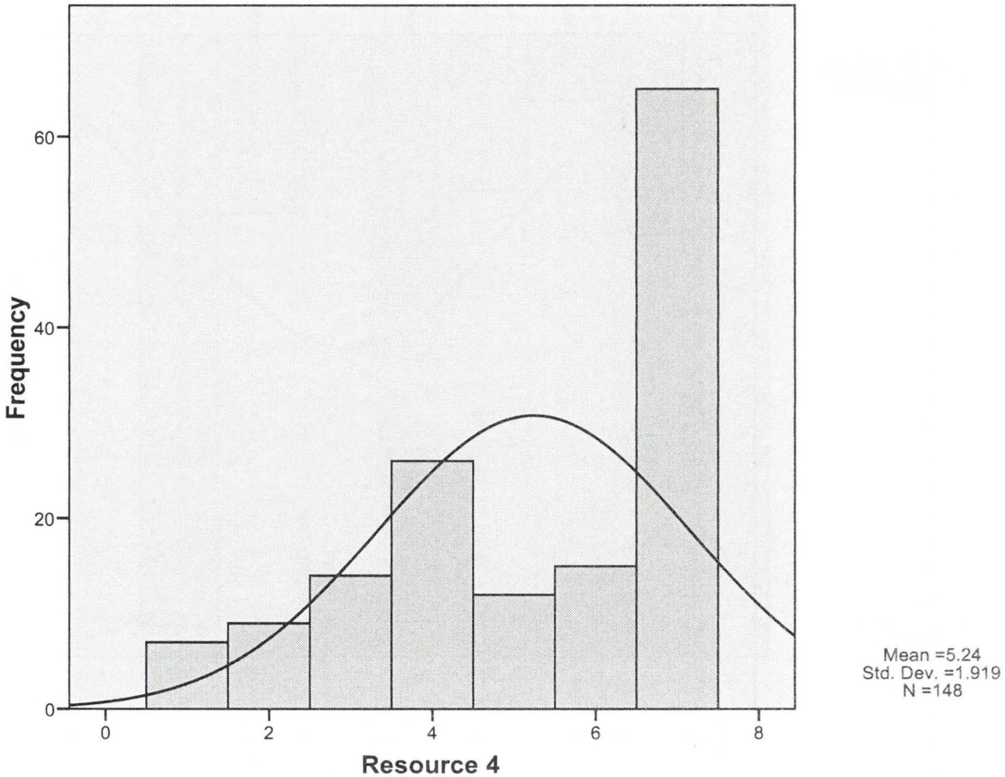
D2.2 Technical resources i.e. software, equipment



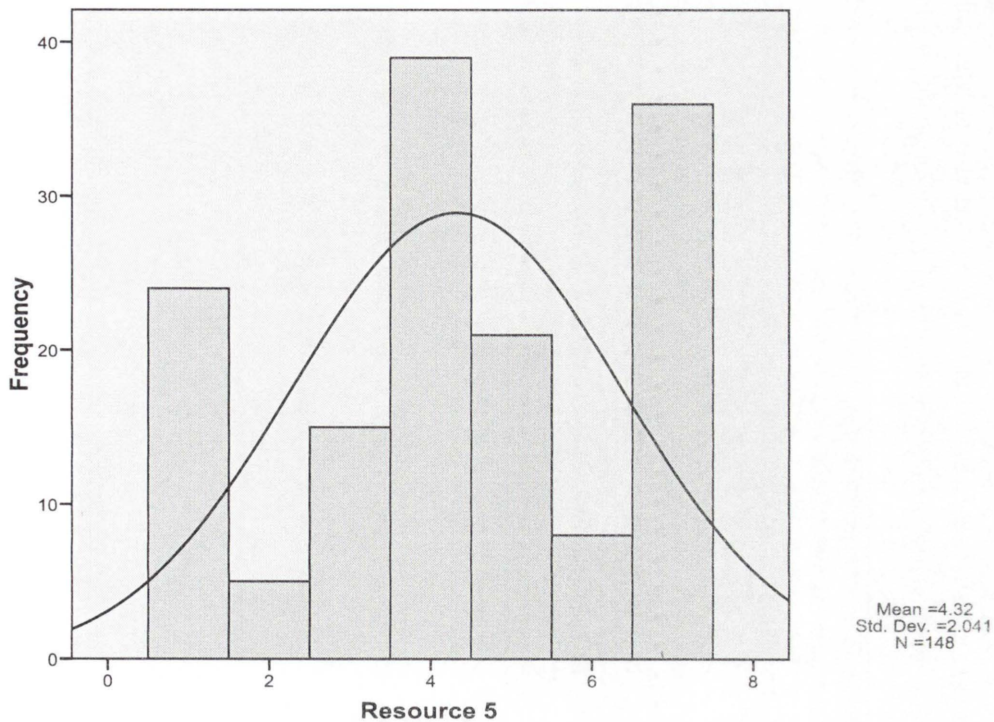
D2.3 Consultant hiring to help implementing of a new program/approach



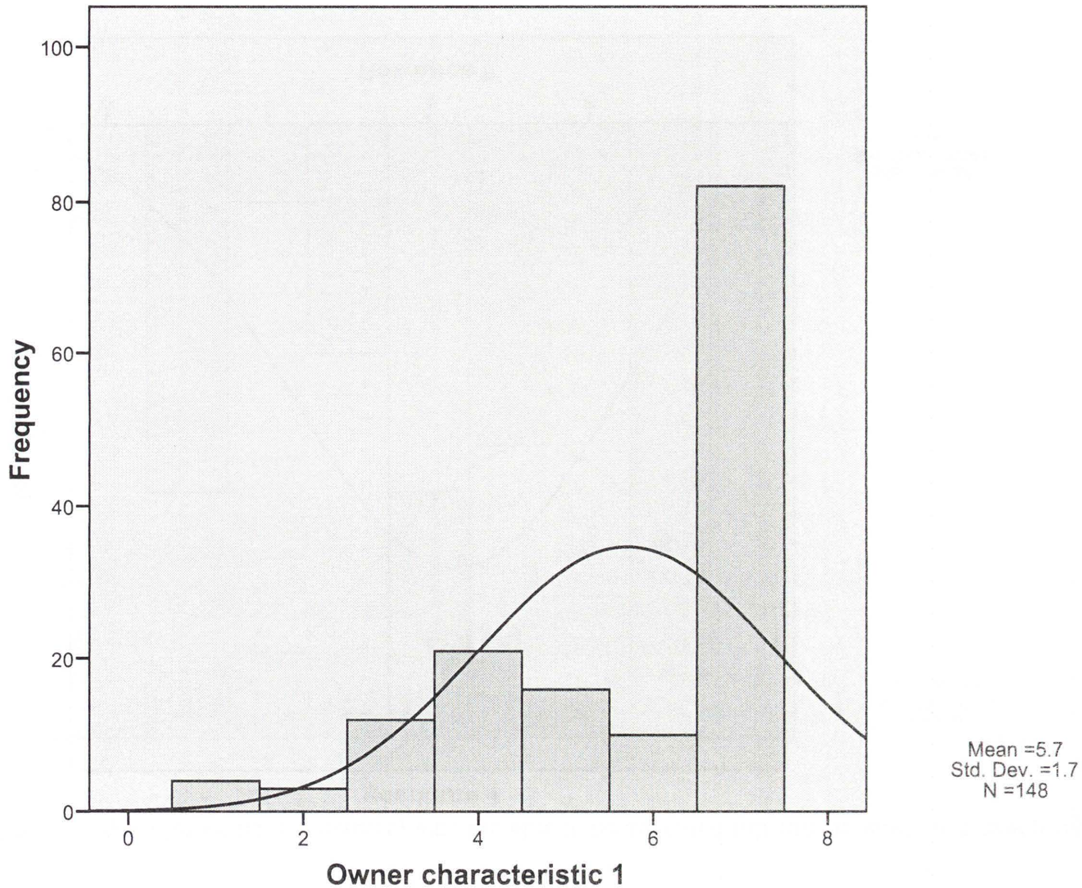
D2.4 A work environment that enables employees to work together as a team on a new program/approach



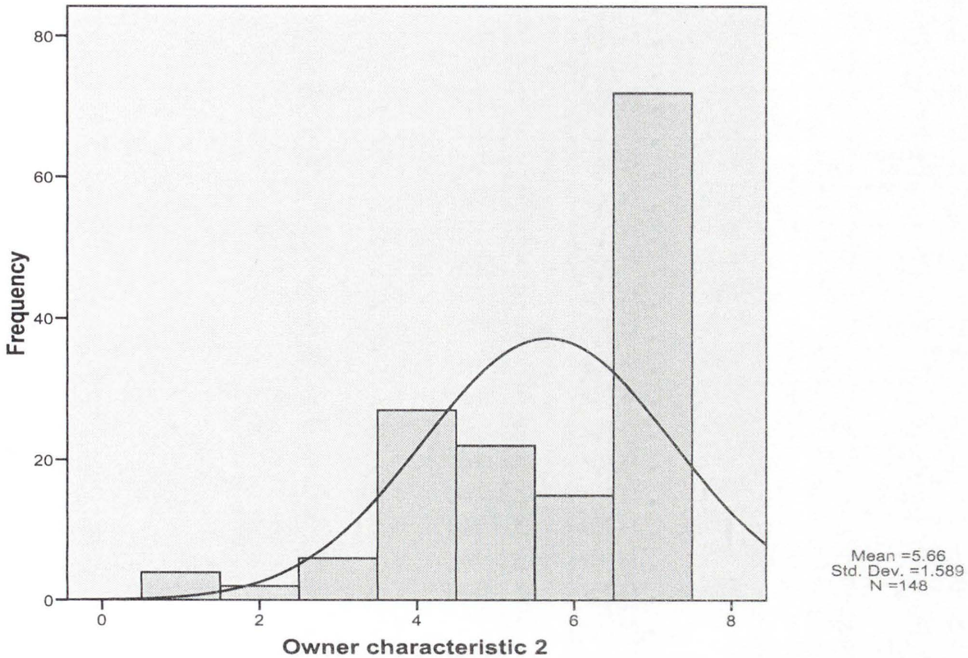
D2.5 Employees (other than managers) who are able to be allocated full-time to work on a new program/approach



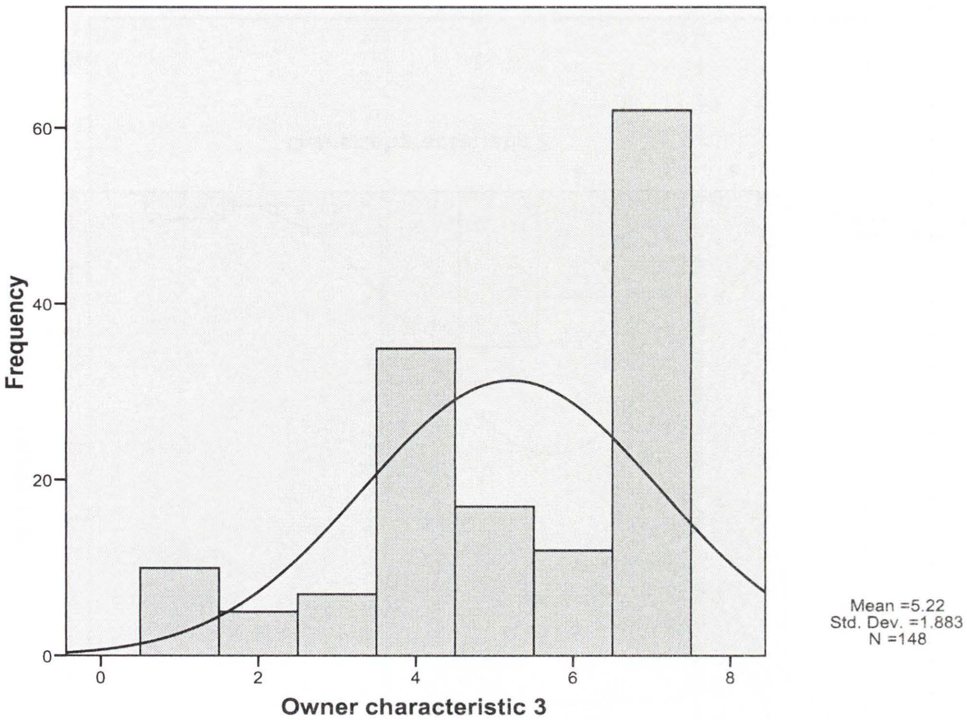
D3.1 I am willing to be actively involved in a new program/approach that is adopted



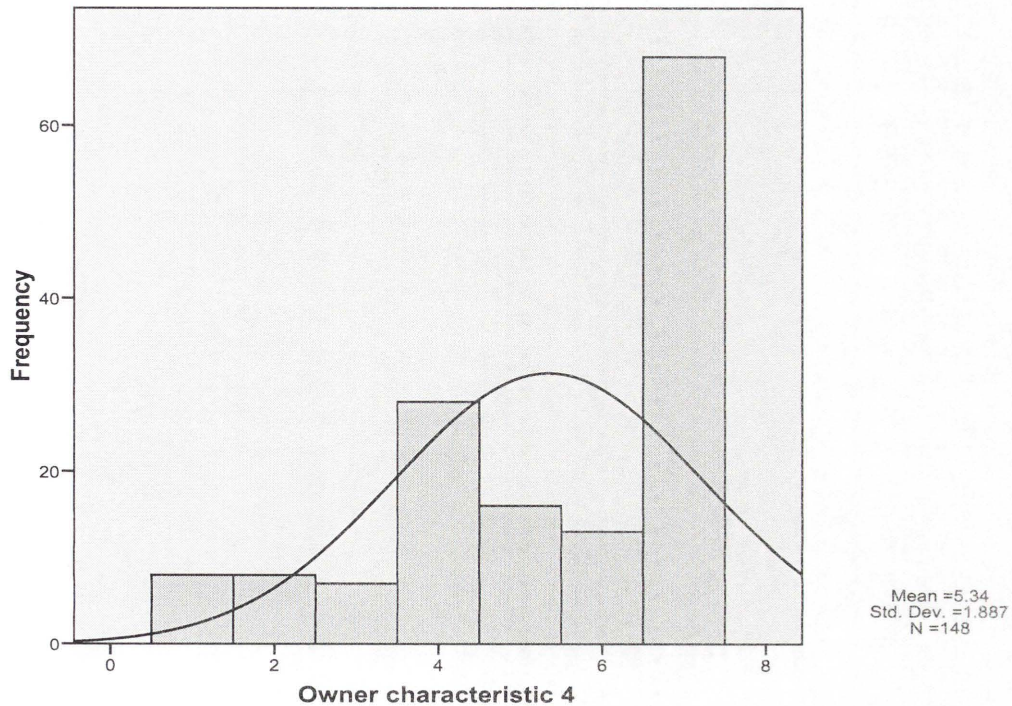
D.3.2 I am willing to change the thinking in our company to support a new program/approach



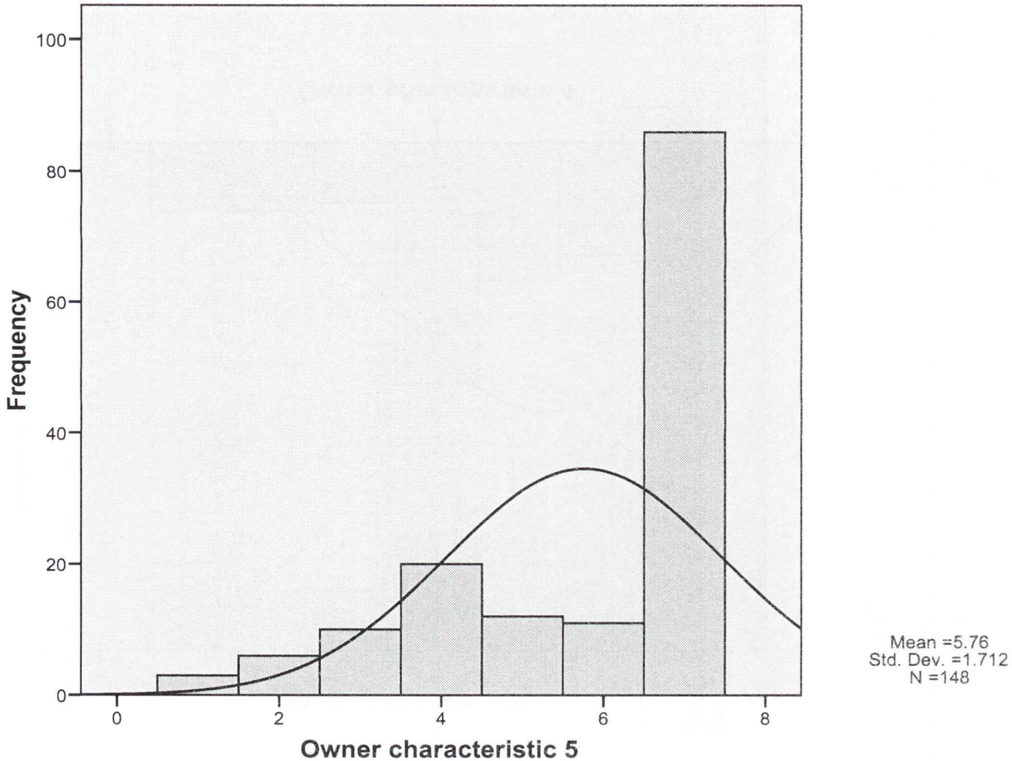
D3.3 I am willing to change policies in this company to support a new program/approach



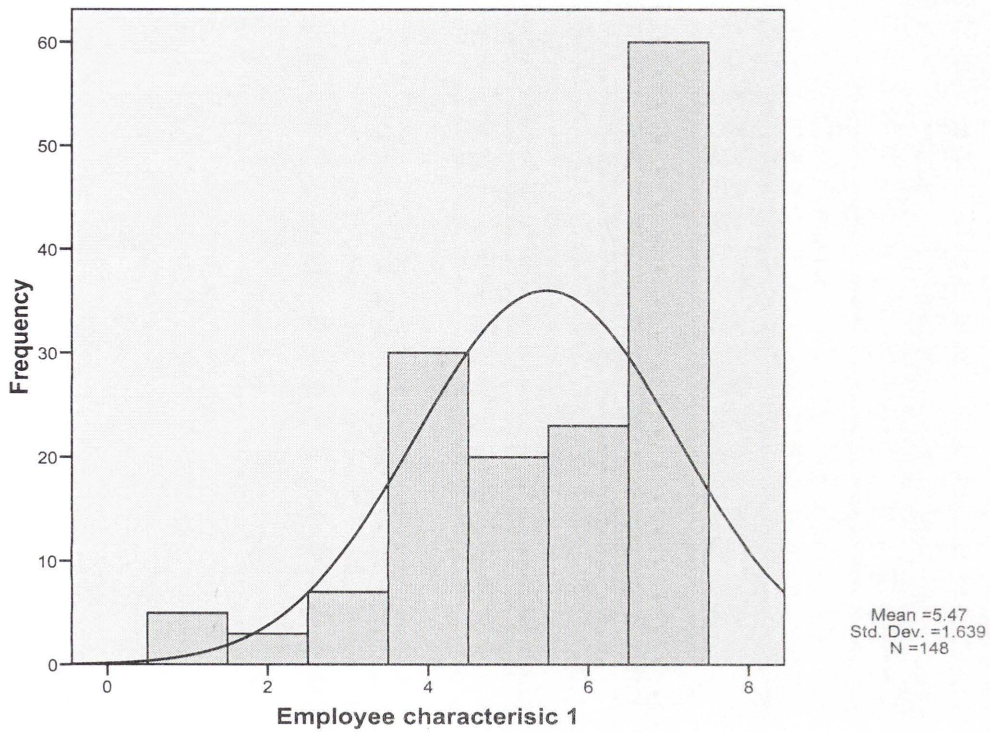
D3.4 I am willing to attend training in order to improve my knowledge and ability to lead the implementation of a new program/approach in my company



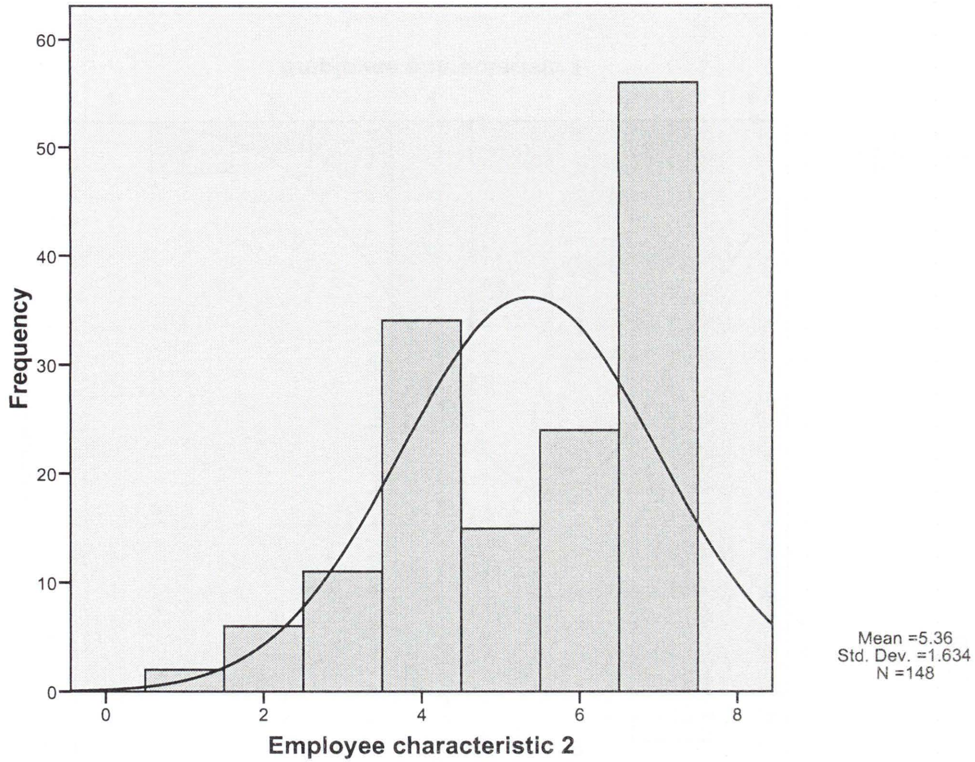
D 3.5 I am willing to support a new program/approach with adequate resources



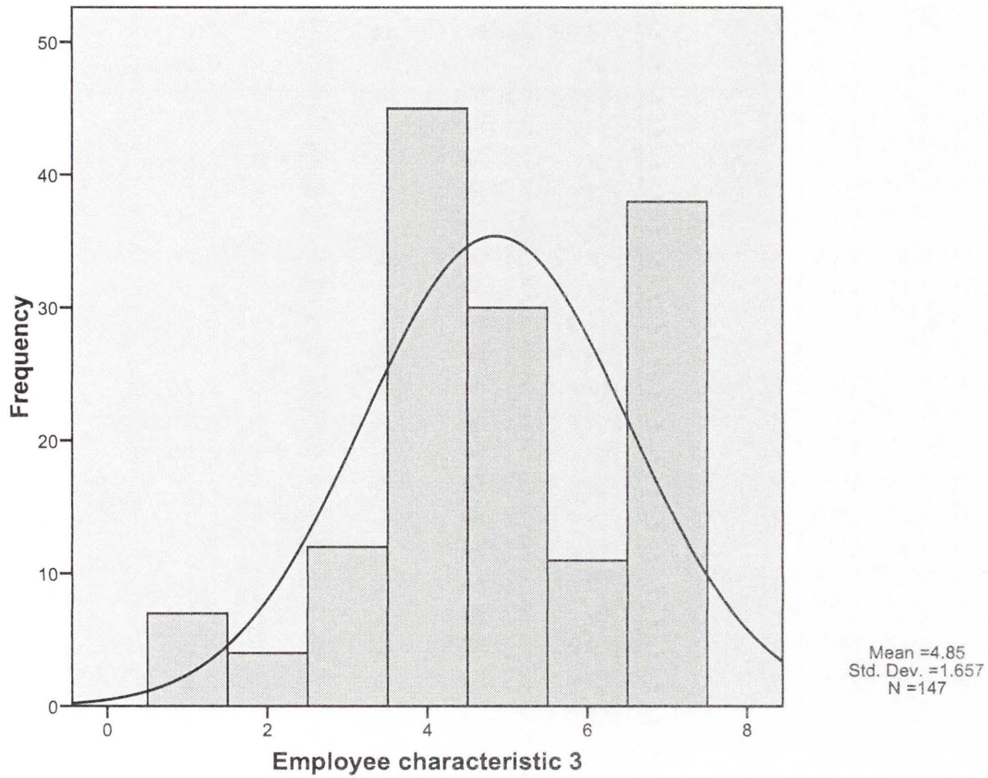
D 4.1 Employees' willingness to work as a team



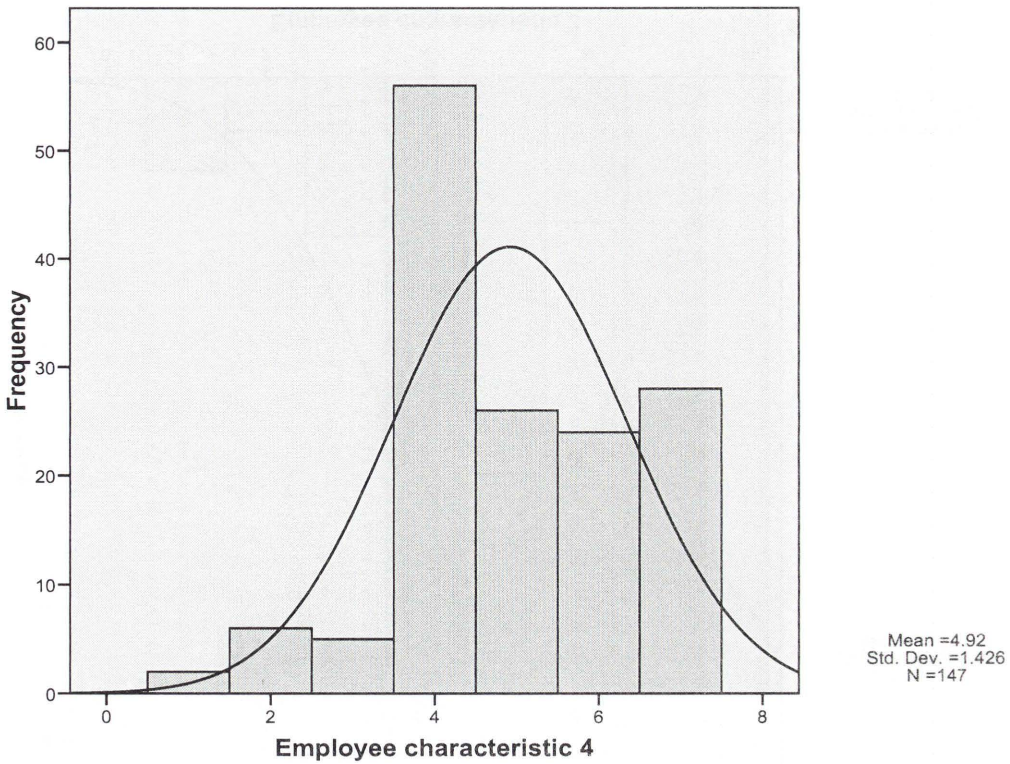
D 4.2 Employees' willingness to learn new things



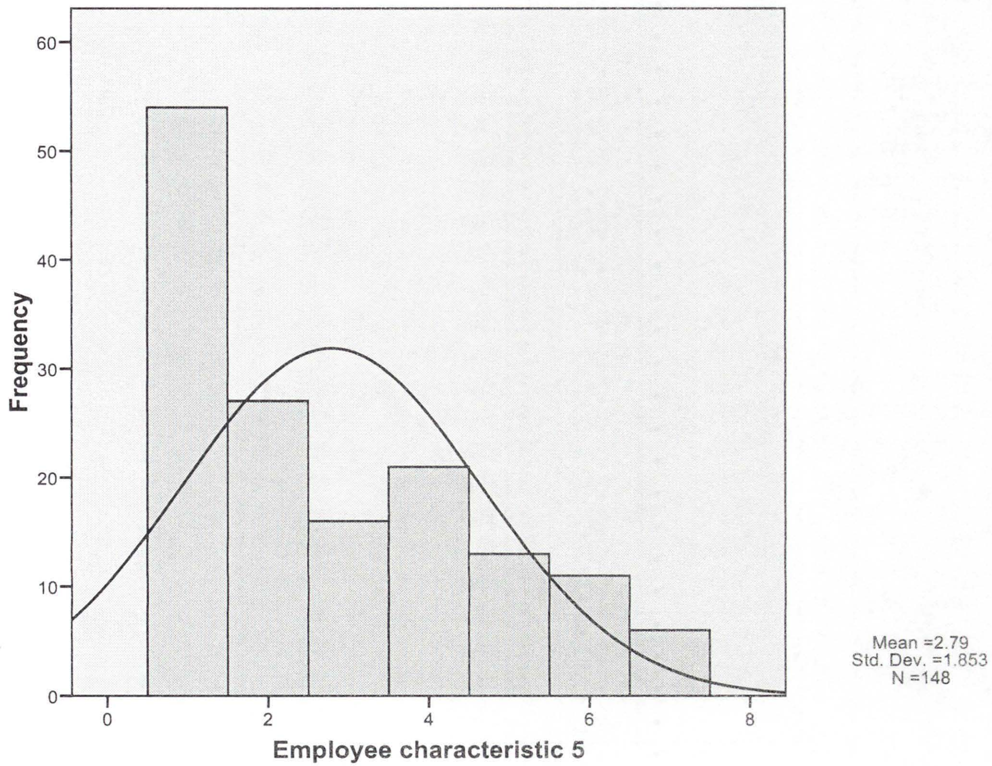
D 4.3 Employees' ability to solve problem in their workplace



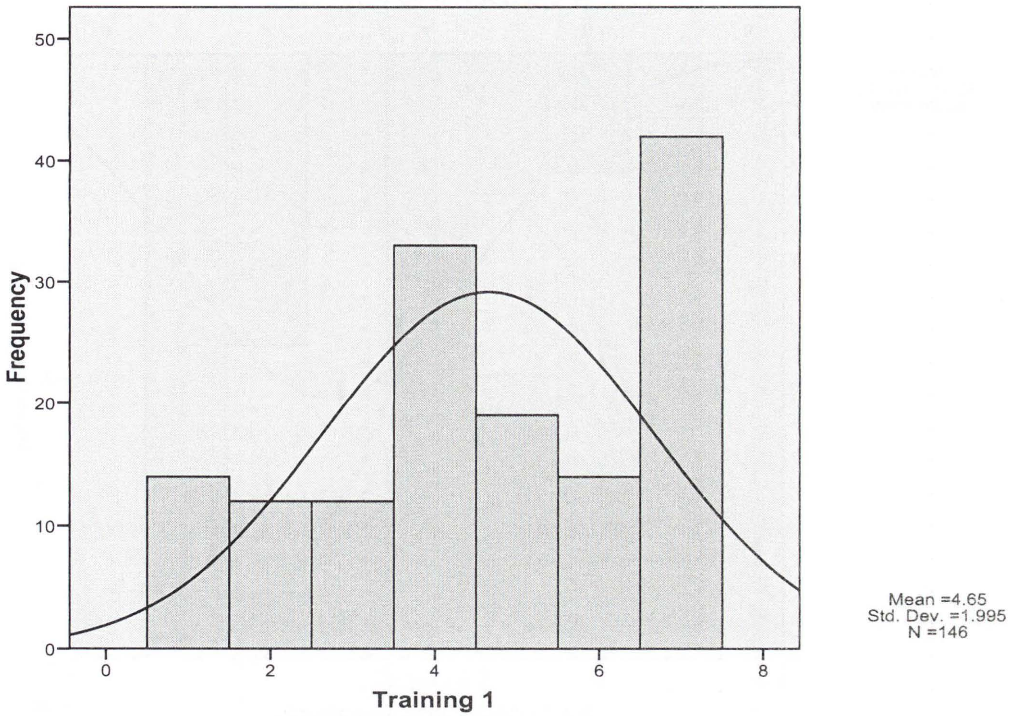
D 4.4 Employees' skill with regard on their job



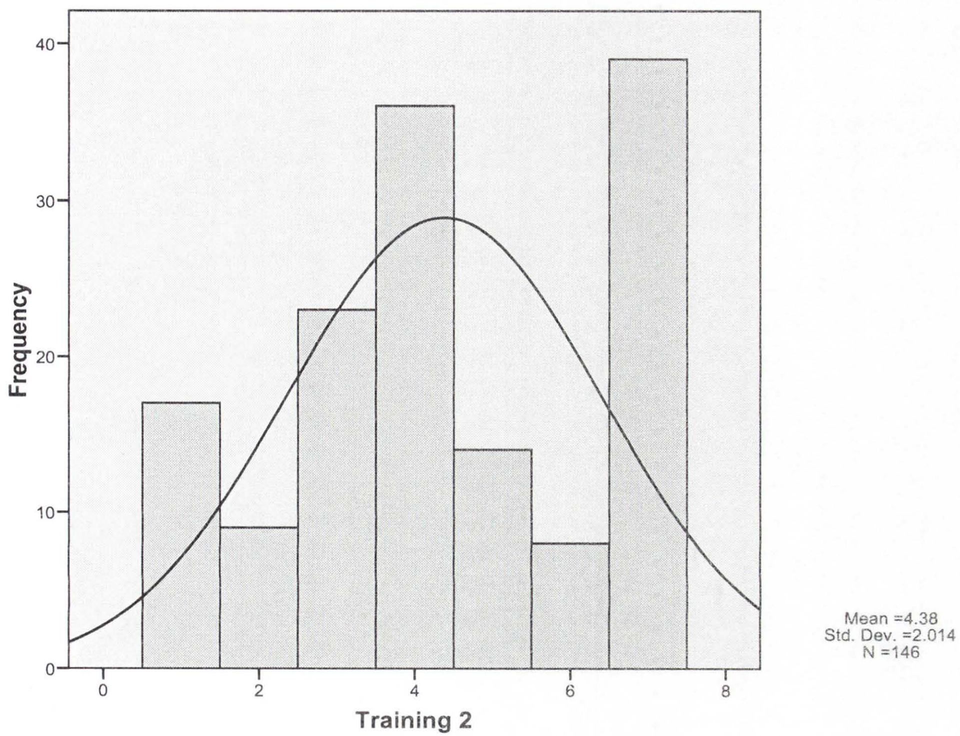
D 4.5 Employees' educational background that enables them to analyse operational problems i.e. use of statistics or statistics software, etc.



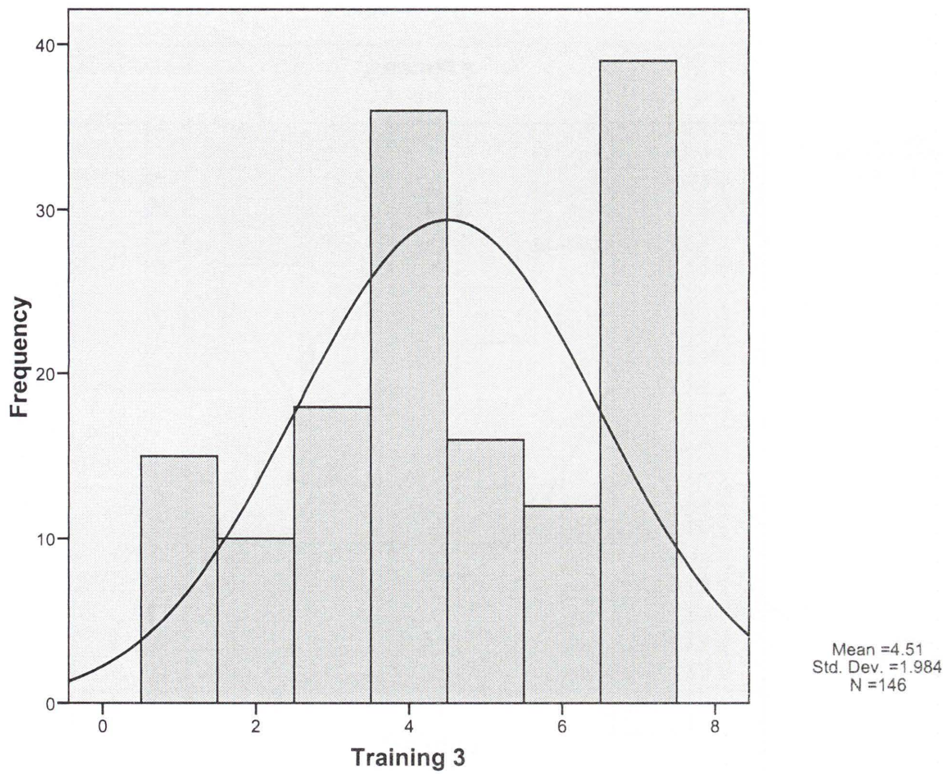
D 5.1 To train selected people at management level in key aspects related to a new program/approach adopted



D 5.2 To train selected employees in key aspects related to a new program/approach



D 5.3 Provide training time to employees who have training opportunities outside the company related to a new program/approach



Appendix K

Paired T test result for means difference of influence from external entities

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from other SME towards innovation adoption	5,34	146	1,888	,156
	Influence from Govt towards innovation adoption	4,21	146	2,244	,186

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from other SME towards innovation adoption & Influence from Govt towards innovation adoption	146	,428	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Influence from other SME towards innovation adoption - Influence from Govt towards innovation adoption	1,137	2,230	,185	,772	1,502	6,160	145	,000

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from other SME towards innovation adoption	5,37	146	1,883	,156
	Influence from main customer towards innovation adoption	5,84	146	1,661	,137

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from other SME towards innovation adoption & Influence from main customer towards innovation adoption	146	,335	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Influence from other SME towards innovation adoption - Influence from main customer towards innovation adoption	-,466	2,052	,170	-,801	-,130	-2,743	145	,007

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from other SME towards innovation adoption	5,34	146	1,888	,156
	Influence from supplier towards innovation adoption	4,60	146	2,306	,191

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from other SME towards innovation adoption & Influence from supplier towards innovation adoption	146	,191	,021

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper			
Pair 1	Influence from other SME towards innovation adoption - Influence from supplier towards innovation adoption	,740	2,686	,222	,300	1,179	3,328	145	,001

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from other SME towards innovation adoption	5,35	147	1,887	,156
	Influence from university towards innovation adoption	4,54	147	2,312	,191

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from other SME towards innovation adoption & Influence from university towards innovation adoption	147	,522	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Influence from other SME towards innovation adoption - Influence from university towards innovation adoption	,810	2,085	,172	,470	1,149	4,708	146	,000

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from other SME towards innovation adoption	5,35	147	1,887	,156
	Influence from BDS towards innovation adoption	4,48	147	2,283	,188

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from other SME towards innovation adoption & Influence from BDS towards innovation adoption	147	,528	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Influence from other SME towards innovation adoption - Influence from BDS towards innovation adoption	,878	2,054	,169	,543	1,212	5,181	146	,000

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from Govt towards innovation adoption	4,23	146	2,246	,186
	Influence from main customer towards innovation adoption	5,82	146	1,660	,137

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from Govt towards innovation adoption & Influence from main customer towards innovation adoption	146	,188	,023

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Influence from Govt towards innovation adoption - Influence from main customer towards innovation adoption	-1,596	2,529	,209	-2,010	-1,182	-7,626	145	,000

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from main customer towards innovation adoption	5,83	145	1,664	,138
	Influence from supplier towards innovation adoption	4,62	145	2,304	,191

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from main customer towards innovation adoption & Influence from supplier towards innovation adoption	145	,456	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Influence from main customer towards innovation adoption - Influence from supplier towards innovation adoption	1,207	2,141	,178	,856	1,558	6,789	144	,000

T-Test

[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from main customer towards innovation adoption	5,83	147	1,657	,137
	Influence from university towards innovation adoption	4,53	147	2,327	,192

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from main customer towards innovation adoption & Influence from university towards innovation adoption	147	,297	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Influence from main customer towards innovation adoption - Influence from university towards innovation adoption	1,299	2,423	,200	,904	1,694	6,503	146	,000

T-Test

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[DataSet1] C:\Users\user\Documents\THESIS\survey data.sav
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Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Influence from main customer towards innovation adoption	5,83	147	1,657	,137
	Influence from BDS towards innovation adoption	4,49	147	2,280	,188

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Influence from main customer towards innovation adoption & Influence from BDS towards innovation adoption	147	,331	,000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Influence from main customer towards innovation adoption - Influence from BDS towards innovation adoption	1,340	2,333	,192	,960	1,721	6,963	146	,000

Appendix L

T test result for means difference of expectation between sample groups

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Strength of believe in success of new program	Sidoarjo	69	4,23	1,506	,181
	Pasuruan	69	4,72	1,413	,170

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Strength of believe in success of new program	Equal variances assumed	,004	,948	-1,982	136	,050	-,493	,249	-,984	-,001
	Equal variances not assumed			-1,982	135,448	,050	-,493	,249	-,984	-,001

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Strength of believe in success of new program	1-10 years	48	4,08	1,397	,202
	more than 10 years	95	4,57	1,541	,158

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Strength of believe in success of new program	Equal variances assumed	3,367	,069	-1,833	141	,069	-,485	,265	-1,008	,038
	Equal variances not assumed			-1,893	103,122	,061	-,485	,256	-,993	,023

Appendix M

T test result for means difference of readiness variables between sample groups

Summary of T tests for means of readiness variables between Sidoarjo and Pasuruan

Variable	Mean (Sidoarjo)	Mean (Pasuruan)	Test results
Use of improvement tools	3.0870	1.5072	***
Communication with customers	5.4783	5.5072	Not significant
Resource availability	3.9884	4.8638	**
Management support	5.0986	6.1217	***
Employee commitment and ability	4.4899	4.9391	*
Provision of training	4.1062	5.0239	**

* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

Summary of T tests for means of readiness variables between company with less than 10 years and more than 10 years in business

Variable	Mean (1-10 years)	Mean (more than 10 years)	Test results
Use of improvement tools	2.1354	2.4691	Not significant
Communication with customers	5.7917	5.2990	Not significant
Resource availability	4.5625	4.2804	Not significant
Management support	5.7292	5.4598	Not significant
Employee commitment and ability	4.7375	4.6392	Not significant
Provision of training	4.6244	4.3849	Not significant

* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

T-Test

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[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav
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Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean use of improvement tools	Sidoarjo	69	3,0870	1,99900	,24065
	Pasuruan	69	1,5072	,86811	,10451

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean use of improvement tools	Equal variances assumed	81,842	,000	6,021	136	,000	1,57971	,26236	1,06087	2,09855
	Equal variances not assumed			6,021	92,768	,000	1,57971	,26236	1,05869	2,10073

T-Test

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[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav
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Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean communication with customers	Sidoarjo	69	5,4783	1,53975	,18536
	Pasuruan	69	5,5072	1,70314	,20503

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean communication with customers	Equal variances assumed	1,465	,228	-,105	136	,917	-,02899	,27640	-,57559	,51762
	Equal variances not assumed			-,105	134,640	,917	-,02899	,27640	-,57564	,51767

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean resource availability	Sidoarjo	69	3,9884	1,51031	,18182
	Pasuruan	69	4,8638	1,41275	,17008

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean resource availability	Equal variances assumed	,441	,508	-3,516	136	,001	-,87536	,24897	-1,36771	-,38302
	Equal variances not assumed			-3,516	135,398	,001	-,87536	,24897	-1,36773	-,38300

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean management support	Sidoarjo	69	5,0986	1,60023	,19264
	Pasuruan	69	6,1217	1,00424	,12090

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean management support	Equal variances assumed	23,828	,000	-4,499	136	,000	-1,02319	,22744	-1,47296	-,57342
	Equal variances not assumed			-4,499	114,369	,000	-1,02319	,22744	-1,47373	-,57265

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean employee commitment & ability	Sidoarjo	69	4,4899	1,28911	,15519
	Pasuruan	69	4,9391	1,02228	,12307

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean employee commitment & ability	Equal variances assumed	5,454	,021	-2,268	136	,025	-,44928	,19807	-,84096	-,05759
	Equal variances not assumed			-2,268	129,288	,025	-,44928	,19807	-,84114	-,05741

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Location of the company	N	Mean	Std. Deviation	Std. Error Mean
Mean training	Sidoarjo	69	4,1062	1,87991	,22632
	Pasuruan	69	5,0239	1,71709	,20671

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean training	Equal variances assumed	,453	,502	-2,994	136	,003	-,91768	,30651	-1,52383	-,31154
	Equal variances not assumed			-2,994	134,899	,003	-,91768	,30651	-1,52387	-,31149

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean use of improvement tools	1-10 years	48	2,1354	1,65507	,23889
	more than 10 years	97	2,4691	1,74712	,17739

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean use of improvement tools	Equal variances assumed	,426	,515	-1,101	143	,273	-,33366	,30308	-,93274	,26543
	Equal variances not assumed			-1,121	98,466	,265	-,33366	,29755	-,92410	,25679

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean communication with customers	1-10 years	48	5,7917	1,50118	,21668
	more than 10 years	97	5,2990	1,64675	,16720

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean communication with customers	Equal variances assumed	,344	,559	1,745	143	,083	,49270	,28242	-,06556	1,05096
	Equal variances not assumed			1,800	101,942	,075	,49270	,27369	-,05017	1,03556

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean resource availability	1-10 years	48	4,5625	1,45670	,21026
	more than 10 years	97	4,2804	1,57656	,16008

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean resource availability	Equal variances assumed	1,120	,292	1,039	143	,300	,28209	,27145	-,25449	,81866
	Equal variances not assumed			1,067	100,711	,288	,28209	,26426	-,24215	,80632

T-Test

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[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav
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Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean management support	1-10 years	48	5,7292	1,31989	,19051
	more than 10 years	97	5,4598	1,52101	,15444

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean management support	Equal variances assumed	4,590	,034	1,047	143	,297	,26937	,25729	-,23921	,77796
	Equal variances not assumed			1,098	106,542	,275	,26937	,24524	-,21682	,75556

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean employee commitment and ability	1-10 years	48	4,7375	1,22120	,17627
	more than 10 years	97	4,6392	1,17886	,11969

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean employee commitment and ability	Equal variances assumed	,432	,512	,467	143	,641	,09832	,21052	-,31781	,51446
	Equal variances not assumed			,461	90,879	,646	,09832	,21306	-,32491	,52156

T-Test

[DataSet1] D:\documents\DATA THESIS S3\DATA 18 FEB 2008\Survey Data.sav

Group Statistics

	Lengthinbusiness	N	Mean	Std. Deviation	Std. Error Mean
Mean training	1-10 years	48	4,6244	1,81598	,26211
	more than 10 years	97	4,3849	1,94141	,19712

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean training	Equal variances assumed	,125	,725	,714	143	,477	,23943	,33549	-,42374	,90259
	Equal variances not assumed			,730	99,599	,467	,23943	,32796	-,41128	,89013

Appendix N

Factor analysis result

Factor Analysis

Correlation Matrix[a]

a. Determinant = .006

Communalities

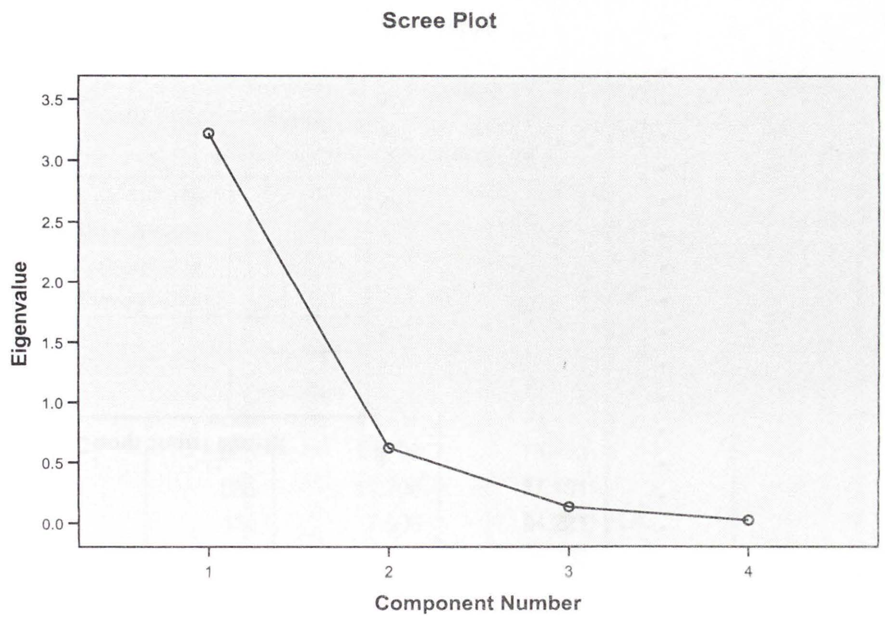
	Initial	Extraction
Useimprovetoolst3	1.000	.480
Useimprovetools4	1.000	.898
Useimprovetools5	1.000	.930
Useimprovetools6	1.000	.913

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.222	80.538	80.538	3.222	80.538	80.538
2	.620	15.500	96.038			
3	.135	3.369	99.406			
4	.024	.594	100.000			

Extraction Method: Principal Component Analysis.



Component Matrix[a]

	Component
	1
Useimprovetoolst3	.693
Useimprovetools4	.948
Useimprovetools5	.965
Useimprovetools6	.956

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Correlation Matrix[a]

a. Determinant = .127

Communalities

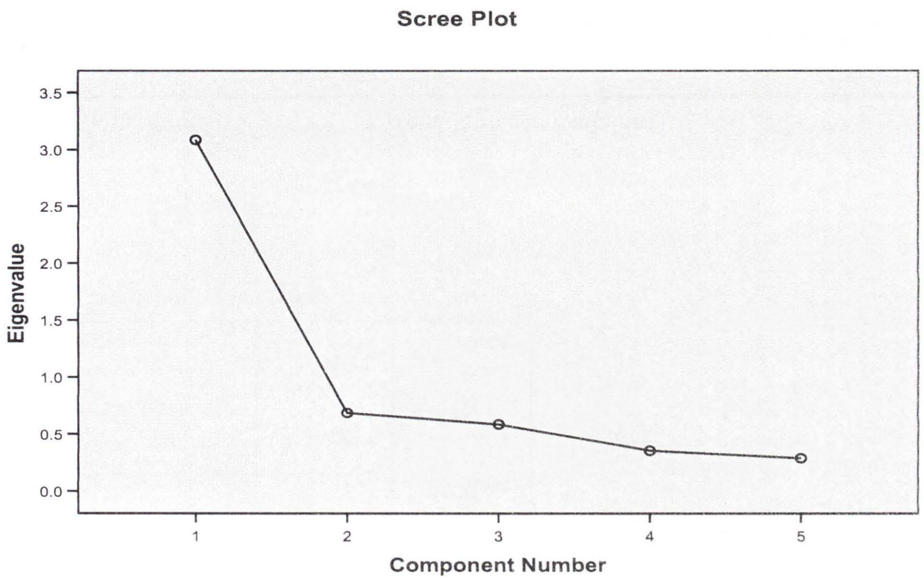
	Initial	Extraction
Resourceavailability1	1.000	.648
Resourceavailability2	1.000	.751
Resourceavailability3	1.000	.465
Resourceavailability4	1.000	.667
Resourceavailability5	1.000	.555

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.086	61.717	61.717	3.086	61.717	61.717
2	.685	13.708	75.425			
3	.585	11.706	87.131			
4	.354	7.090	94.221			
5	.289	5.779	100.000			

Extraction Method: Principal Component Analysis.


Scree Plot
Eigenvalue
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
Component Number

Component Matrix[a]

	Component
	1
Resourceavailability1	.805
Resourceavailability2	.866
Resourceavailability3	.682
Resourceavailability4	.817
Resourceavailability5	.745

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Correlation Matrix[a]

a. Determinant = .068

Communalities

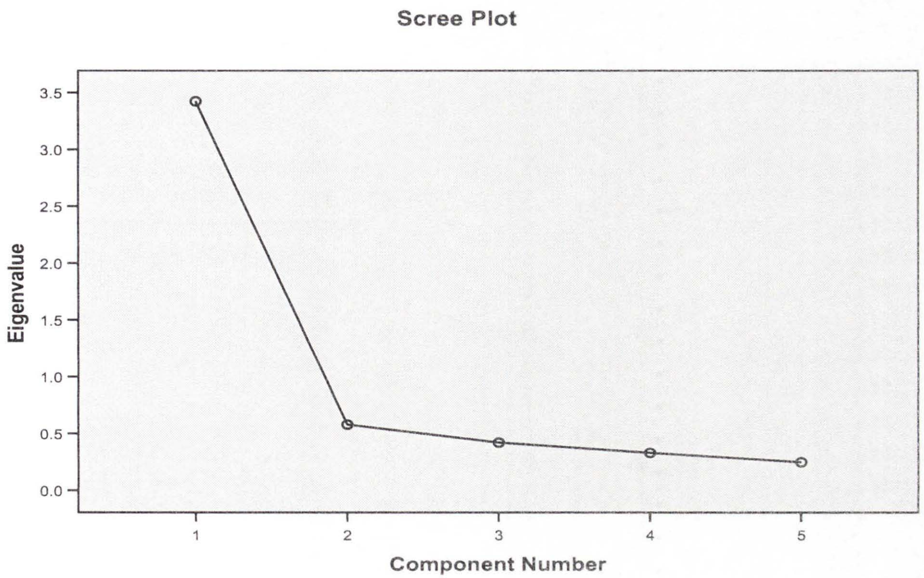
	Initial	Extraction
Managementcommit1	1.000	.790
Managementcommit2	1.000	.730
Managementcommit3	1.000	.543
Managementcommit4	1.000	.681
Managementcommit5	1.000	.680

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.424	68.475	68.475	3.424	68.475	68.475
2	.580	11.593	80.068			
3	.420	8.404	88.471			
4	.330	6.596	95.067			
5	.247	4.933	100.000			

Extraction Method: Principal Component Analysis.


Scree Plot
Eigenvalue
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
Component Number

Component Matrix[a]

	Component 1
Managementcommit1	.889
Managementcommit2	.855
Managementcommit3	.737
Managementcommit4	.825
Managementcommit5	.824

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Correlation Matrix[a]

a. Determinant = .162

Communalities

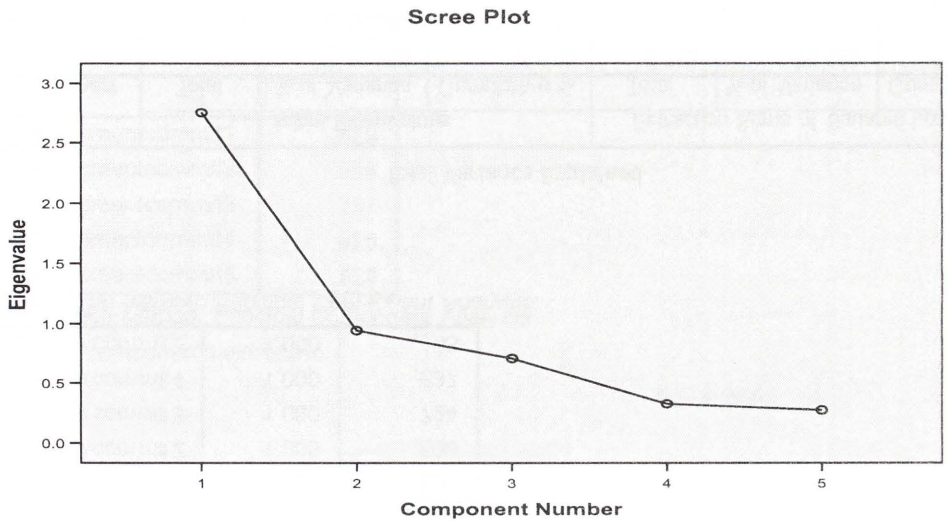
	Initial	Extraction
Employ commit1	1.000	.691
Employ commit2	1.000	.698
Employ commit3	1.000	.724
Employ commit4	1.000	.537
Employ commit5	1.000	.103

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.753	55.056	55.056	2.753	55.056	55.056
2	.944	18.882	73.938			
3	.707	14.149	88.087			
4	.325	6.500	94.587			
5	.271	5.413	100.000			

Extraction Method: Principal Component Analysis.



Component Matrix[a]

	Component
	1
Employ commit 1	.831
Employ commit 2	.835
Employ commit 3	.851
Employ commit 4	.733
Employ commit 5	.322

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Correlation Matrix[a]

a. Determinant = .162

Communalities

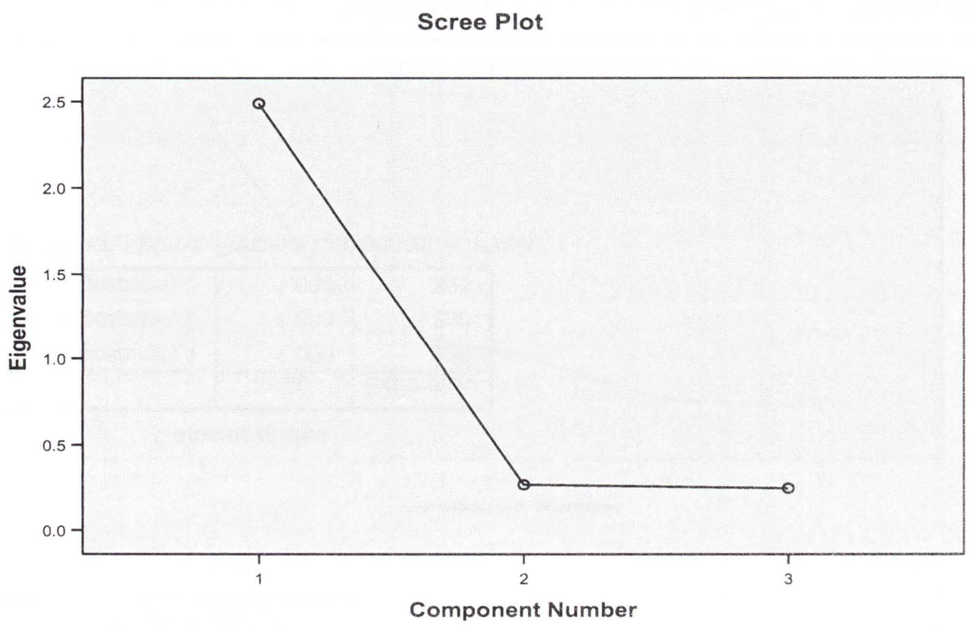
	Initial	Extraction
Trainingcapacity 1	1.000	.836
Trainingcapacity 2	1.000	.830
Trainingcapacity 3	1.000	.823

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.489	82.960	82.960	2.489	82.960	82.960
2	.266	8.870	91.830			
3	.245	8.170	100.000			

Extraction Method: Principal Component Analysis.


Scree Plot
Eigenvalue
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
Component Number

Component Matrix[a]

	Component
	1
Trainingcapacity 1	.914
Trainingcapacity 2	.911
Trainingcapacity 3	.907

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Appendix O

Multiple regression results

Regression

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[DataSet1] F:\DATA 18 FEB 2008\Survey Data.sav
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Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Manager and lower level[a]	.	Enter
2	Company size - 10 to 25 employees, Company size - 26 to 99 employees[a]	.	Enter

3	Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years[a]	.	Enter
4	Mean employee characteristics, Mean culture data tools, Mean customer, Mean resource, Mean training, Mean owner characteristics[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Strength of believe in success of new program

Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.092[a]	.009	.002	1.506	.009	1.216	1	141	.272	
2	.122[b]	.015	-.006	1.512	.006	.448	2	139	.640	
3	.208[c]	.043	.001	1.506	.028	1.337	3	136	.265	
4	.537[d]	.288	.222	1.329	.245	7.447	6	130	.000	1.817

a. Predictors: (Constant), Manager and lower level

b. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees

c. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees, Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years

d. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees, Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years, Mean employee characteristics, Mean culture data tools, Mean customer, Mean resource, Mean training, Mean owner characteristics

e. Dependent Variable: Strength of believe in success of new program

ANOVA[e]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.757	1	2.757	1.216	.272[a]
	Residual	319.719	141	2.268		
	Total	322.476	142			
2	Regression	4.802	3	1.601	.700	.553[b]
	Residual	317.673	139	2.285		
	Total	322.476	142			
3	Regression	13.901	6	2.317	1.021	.414[c]
	Residual	308.574	136	2.269		
	Total	322.476	142			
4	Regression	92.828	12	7.736	4.379	.000[d]
	Residual	229.648	130	1.767		
	Total	322.476	142			

a. Predictors: (Constant), Manager and lower level

b. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees

c. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees, Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years

d. Predictors: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees, Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years, Mean employee characteristics, Mean culture data tools, Mean customer, Mean resource, Mean training, Mean owner characteristics

e. Dependent Variable: Strength of believe in success of new program

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	4.453	.133		33.458	.000		
	Manager and lower level	-.453	.411	-.092	-1.103	.272	1.000	1.000
2	(Constant)	4.498	.173		26.038	.000		
	Manager and lower level	-.189	.498	-.039	-.380	.704	.686	1.459
	Company size - 10 to 25 employees	-.049	.279	-.015	-.176	.860	.923	1.083
	Company size - 26 to 99 employees	-.449	.476	-.099	-.943	.347	.642	1.558
3	(Constant)	4.615	.230		20.089	.000		
	Manager and lower level	-.334	.505	-.068	-.662	.509	.662	1.510

	Company size - 10 to 25 employees	-.048	.282	-.015	-.172	.864	.894	1.118
	Company size - 26 to 99 employees	-.415	.477	-.092	-.870	.386	.634	1.576
	Length in business - 1 to 5 years	-.368	.367	-.090	-1.004	.317	.874	1.145
	Length in business - 6 to 10 years	-.514	.363	-.130	-1.416	.159	.835	1.198
	Length in business - 11 to 15 years	.198	.338	.054	.584	.561	.816	1.226
4	(Constant)	1.357	.613		2.215	.029		
	Manager and lower level	-.126	.457	-.026	-.276	.783	.631	1.586
	Company size - 10 to 25 employees	-.163	.250	-.051	-.651	.516	.888	1.126
	Company size - 26 to 99 employees	-.279	.443	-.062	-.629	.530	.572	1.750
	Length in business - 1 to 5 years	-.339	.331	-.083	-1.024	.308	.837	1.195
	Length in business - 6 to 10 years	-.669	.328	-.169	-2.041	.043	.796	1.256
	Length in business - 11 to 15 years	.130	.305	.036	.427	.670	.782	1.278
	Mean culture data tools	.071	.075	.081	.947	.346	.753	1.327

Mean customer	-.086	.082	-.092	-1.047	.297	.706	1.416
Mean resource	.174	.100	.176	1.742	.084	.536	1.865
Mean owner characteristics	.201	.119	.190	1.685	.094	.432	2.315
Mean employee characteristics	.278	.114	.217	2.441	.016	.695	1.439
Mean training	.091	.083	.112	1.090	.278	.515	1.942

a. Dependent Variable: Strength of believe in success of new program

Excluded Variables[d]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Company size - 10 to 25 employees	.006[a]	.072	.943	.006	.990	1.010	.990
	Company size - 26 to 99 employees	-.094[a]	-.933	.353	-.079	.689	1.452	.689
	Length in business - 1 to 5 years	-.077[a]	-.917	.361	-.077	.999	1.001	.999

	Length in business - 6 to 10 years	-.130[a]	-1.537	.127	-.129	.975	1.025	.975
	Length in business - 11 to 15 years	.100[a]	1.184	.238	.100	.977	1.024	.977
	Mean culture data tools	-.020[a]	-.225	.822	-.019	.923	1.083	.923
	Mean customer	.136[a]	1.634	.104	.137	1.000	1.000	1.000
	Mean resource	.382[a]	4.835	.000	.378	.974	1.027	.974
	Mean owner characteristics	.402[a]	5.128	.000	.398	.971	1.030	.971
	Mean employee characteristics	.367[a]	4.678	.000	.368	.995	1.005	.995
	Mean training	.358[a]	4.530	.000	.358	.987	1.013	.987
2	Length in business - 1 to 5 years	-.078[b]	-.921	.359	-.078	.996	1.004	.642
	Length in business - 6 to 10 years	-.126[b]	-1.467	.145	-.124	.958	1.044	.639
	Length in business - 11 to 15 years	.108[b]	1.257	.211	.106	.953	1.049	.640
	Mean culture data tools	-.004[b]	-.048	.962	-.004	.887	1.127	.620
	Mean customer	.132[b]	1.574	.118	.133	.997	1.003	.640
	Mean resource	.387[b]	4.884	.000	.384	.970	1.031	.640
	Mean owner characteristics	.400[b]	5.013	.000	.392	.948	1.055	.630

	Mean employee characteristics	.366[b]	4.627	.000	.366	.989	1.011	.641
	Mean training	.355[b]	4.406	.000	.351	.966	1.035	.630
3	Mean culture data tools	-.020[c]	-.223	.824	-.019	.880	1.136	.613
	Mean customer	.158[c]	1.872	.063	.159	.972	1.029	.631
	Mean resource	.398[c]	5.073	.000	.400	.967	1.035	.633
	Mean owner characteristics	.415[c]	5.199	.000	.408	.926	1.080	.620
	Mean employee characteristics	.374[c]	4.761	.000	.379	.985	1.015	.633
	Mean training	.382[c]	4.716	.000	.376	.929	1.077	.620

a. Predictors in the Model: (Constant), Manager and lower level

b. Predictors in the Model: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees

c. Predictors in the Model: (Constant), Manager and lower level, Company size - 10 to 25 employees, Company size - 26 to 99 employees, Length in business - 1 to 5 years, Length in business - 6 to 10 years, Length in business - 11 to 15 years

d. Dependent Variable: Strength of believe in success of new program