

# RECOMMENDED STRATEGIES IN IMPLEMENTING SIX SIGMA IN INDONESIAN'S SMALL MEDIUM ENTERPRISES

Daddy Budiman<sup>(1)</sup>

<sup>(1)</sup>Lecturer of Mechanical Engineering Department, Padang State Polytechnics

## ABSTRACT

*Small Medium Enterprises got very strategic position in economics of every nations. But now, SME has a big challenge to stay survive and grow up in the competitive market now. To solve the problem, SME must produce the high quality product with the lower cost. To achieve that goal, SME must be performing a high efficient and effective operation. To achieve the good performance of operation and produce the high quality product, SME need to find the method which to be applied in their production time. Many new methodologies for improvement are available such as Total Quality Management, Total Quality Control, Six Sigma, and Design for Six Sigma. SME in Indonesia still confuse which methodologies have optimum result with the small amount of budgets. This paper suggest that Six Sigma can improve the performance of SME in Indonesia based on the implementation in other countries in some way.*

**Keywords:** Six Sigma, Small Medium Enterprises, Quality

## 1. INTRODUCTION.

### 1.1. Six Sigma Methodology

Six sigma is a good method to identify and reduce number of defect in business process or system by care much intention to performance characteristic which really important to costumer. There are strategy, method, tools and technique to achieve a costumer satisfaction. Large companies already applied six sigma and get big benefit.

There are four aspects in six sigma which did not appear in other business improvement analysis and total quality control. First, The Six sigma focuses on the bottom line impact in saving. Project leader only approved the project which aimed the dollar saving. Second, the six sigma is useful in integrating human aspect including culture change, training, and customer focus. Third, DMAIC links the tools and technique in sequential manner. Finally, six sigma creates the good infrastructure in for training, from champion, black belt, until yellow belt.

Many SME still did not use six sigma, even thought the market trend tent to be more competitive. The costumer tends to have high quality product with the lower cost. SME must consider six sigma to keep survive in business. The information that are really important is to find that how long manufacturing company has get involved with six sigma, how the success and the failure of the six sigma applied, whether Six Sigma CSF for large companies differ than CFS for SME.

### 1.2. Small Medium Enterprises

Breaking down the SME definition, Industry Canada defines a small business as one that has fewer than 100 employees (if the business is a goods-producing business) or fewer than 50 employees (if the business is a service-based business) (de Guinea et al., 2005). A firm that has more employees than these cut-offs but fewer than 500 employees is classified as a medium-sized business.

In the EU, a similar system is used to define Small to Medium Enterprises. A business with a headcount of fewer than 250 is classified as medium-sized; a business with a headcount of fewer than 50 is classified as small, and a business with a headcount of fewer than 10 is considered a micro-business (Antony et al., 2005). The European system also takes into account a business's turnover rate and its balance sheet.

Wiltshire Committee provided the first clearly stated Australian definition of small business. The Committee was established to explore ways of 'providing guidance to small business management and help improve efficiency, with attention primarily on small manufacturing business'(Everett and Watson, 1996). Consequently, the Committee addressed the question of definition and proposed the following:

A business in which one or two persons are required to make all the critical management decisions: finance, accounting, personnel, purchasing, processing or servicing, marketing, selling, without the aid of an internal specialist and with specific

knowledge in only one or two functional areas (Everett and Watson, 1996 ).

SME position is as a supplier for large companies. They form the foundation for nation economy. Because that position, it is very important to keep SME survive in the global competition. SME should provide high quality product with low cost. From the table below we can see the strength and the weakness of SME.

Table 1 The strength of SME<sup>[1]</sup>

No	Strengths
1	Flexible
2	Flat with few layer of management
3	Top management highly visible and hence provide leadership by example
4	Absence of bureaucracy in management teams
5	Culture of learning and chance rather than control.
6	More innovative in their ability to meets costumer demand.

Table 2 The Weakness of SME<sup>[1]</sup>

No	Weakness
1	Low degree of standardization.
2	Focus in operational matter rather than planning.
3	Lack of strategic planning and inspiring vision.
4	No incentive or reward program in many cases due to budget and resource constraint.
5	Not system oriented
6	Lack of skill, time and resources; no specified training budget.

**1.3. Key characteristics of SME**

The key characteristics relate to the inherent nature of small firms and although any such a list can never be complete, include the following key factors:

1. Management and ownership is rarely separate.
2. Control over business operations and decisions reside with one or two persons, who are usually family members.
3. The equity in the business is not publicly traded.
4. The personal security of the owners is required to secure business debt. Limited liability is rarely present.
5. The level and number of formal contractual relations are kept at a minimum level.
6. Personal objectives of owners will guide and directly influence business decisions.

The contribution of SME for percentage can be seen in the table below:

Table 3 Contribution of SME on employee using percentage<sup>[9]. [16]</sup>

Region	Very Small	Small	Medium	Large
Austria	25	19	21	35
Belgium	48	14	11	27
Denmark	30	22	18	30
Finland	23	16	17	44
France	32	19	15	34
Germany	24	20	14	43
Greece	47	18	14	21
Ireland	18	16	14	51
Italy	48	21	11	20
Luxemburg	19	26	29	29
Netherland	26	19	15	40
Norway	32	21	18	29
Portugal	38	23	18	21
Spain	47	19	12	21
Sweden	25	17	16	41
Uk	31	16	12	41
EU	33	19	14	34

**2. SIX SIGMA IN SME**

**2.1 Expert opinion about implementing six sigma in SME**

The special requirement for applying six sigma in the SME in some Countries. They also explain how to be modified six sigma in SME. That comment also support by Rowland 2004 who argues that the traditional approach to black belt training is not desirable for SME.

The top management team need to be really support for every aspect of six sigma. Adam et al 2003 said that it is much easier to implement six sigma in SME if the owner of the business believed the advantages of implementing Six Sigma.

There are four main prerequisite in effectively implementing six sigma. The prerequisite are management team buy-in and support, education and training, resource commitment, link to the compensation.

Six Sigma can be an effective methodology for SME to built the continues improvement based on ISO 9001:2000 requirements. There is an example of using green belt approach during the continues improvement can tackle their business problem.

The element factor to success in launch the six sigma are visible management commitment, clear definition of customer requirement, shared understanding of

core business process and their critical characteristic, rewarding and recognizing the team member, communicating the success and failure stories, selecting the right people and the right project.

**2.2 The reasons for not implementing six sigma in SME in some Countries**

Antony, J, Kumar, M & Madu explained that the reasons for not implementing six sigma is because 35 percent of SME thought that six sigma is not important. 26 percent of SME have insufficient resources about Six Sigma. 20% of SME said that the existing quality system is sufficient. 11 percent SME said that Six Sigma is not required by the costumers. 8 percent said that they perceived no benefit for implementing Six Sigma.

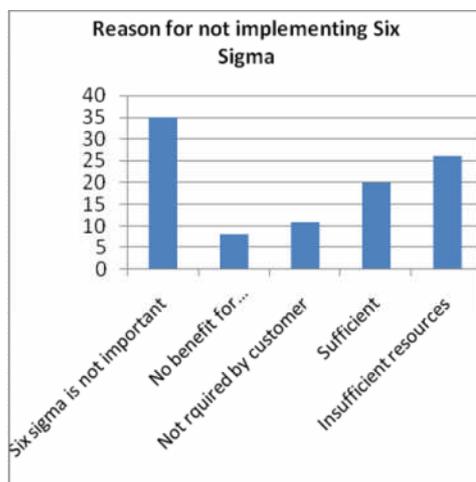


Figure 1, Reasons for not implementing Six Sigma by SME.<sup>[1]</sup>

It was found that 70 percent of SME operate their companies in 2.8 to 4.0 sigma level. In addition 23 percent of them are operating above 4.0 sigma level.

In SME, 35 of them did not have a Six Sigma project champion. 45 percent of SME used black belt to lead the Six Sigma project. Some of the company used green belt. Only less than 10 percent of the company used yellow belt in deploy Six Sigma project. The highest number of green belt and black belt are in automotive company and the lowest number of that is found in Textile Company.

**2.3 Six sigma methodologies used by manufacturing SME**

Antony, J, Kumar, M & Madu said that since the result of research is compute, the biggest methodology used is DMAIC (69 percents). Then, the next popular technique is DFSS (19 percents). The next is Lean sigma and the combinations of DMAIC and DFSS (each 6 percents).

The result of Antony et all research said that 69 percent of the company did one to five Six Sigma

project. About 25 percent of the companies did five to ten Six Sigma project. One company did more than 20 Six Sigma projects. 62 percent of the company got benefit up to 250000 pound sterling per annum. 13 percent of the company got benefit between 250000 pound sterling and 500,000 pound sterling. But 25 percent of the company did not measure the financial affect from using Six Sigma project.

**2.4 Critical success factor for implementing six sigma in SME**

The Critical success factor is the element that important to success implementing six sigma in SME. There are some major factors which are important for successful applied six sigma. They are Management involvement and participation, Linking six sigma to customers, Linking six sigma to business strategy, Understanding of six sigma methodology, Project prioritization and selection [1].

Antony, J, Kumar, M & Madu said that the key metrics of six sigma implementation in SME. The most popular used were number of complaints and percentage scrap. The unpopular metrics were First Time Yield (FTY) and Trough Put Yield, even though these metrics were essential metrics of Six Sigma.

Table 2. 4 Six sigma metric popular used by SME<sup>[1]</sup>

No	Six Sigma measuring Variable	Percentage of companies using the metrics
1	Number of complaint	94
2	Percentage scrap	81
3	Cost of poor quality	75
4	Defect rate	75

**2.5 Benefits of six sigma to SME**

Table III show us that the key benefit from implementing Six Sigma is reduction in process variability. The next benefit is increasing the profitability. Than followed by reduction of operational cost and reduction in the cost of poor quality. All companies agreed that they got benefit from the implementation of Six Sigma. The key benefit which also got from implementing six sigma are reduction cycle of time, reduction customer client, improved sales, and reduced sales.

Table 3. 5 Key benefits of six sigma to SME<sup>[1]</sup>

No	Benefits to bussines
1	Reduction in process variability
2	Increase in profitability
3	Reduction of operational costs
4	Reduction in COPQ
5	Increase in productivity

**2.7 Six sigma tools and techniques within SME**

The kind of tool which are used in Six Sigma project in SME can be shown from the table IV below. The tolls that more acceptable in SME to built the Six Sigma project are process mapping, cause and effect and histogram, run chart, control chart, FMEA, process capability analysis, and Poka-yoke. All of the tools mentioned are explained on simple graphical drawing.

The more sophisticated and complex like affinity diagram, project charter, SIPOC model, quality costing analysis, run charts, measurement system analysis and QFD were not used very much in SME Six Sigma project. QFD is important to detect the requirement of the customer. It is better for SME to develop more experience on every tool in six sigma.

Table 4. The five Tools and technique used popularly by SME utilizing Six Sigma.<sup>[1]</sup>

No	Tools	Familiar (%)
1	Process mapping	100
2	Cause and effect analysis	100
3	Histogram	100
4	Control charts	94
5	Run Chart	56

**3. RECOMMENDED STRATEGY IN IMPLEMENTING SIX SIGMA IN INDONESIAN'S SME**

**1. Implementing DMAIC**

SME implement six sigma by follow the DMAIC method. DMAIC is a step for define, measure, analyze, improve in six sigma project. Every step has it own tools that also have a questioner to guide the SME in process improvement (Neagu & Hoerl 2005). Since the result that 69 percents of the company around the world is familiar with the DMAIC approach, this could be the first recommendation to use in Indonesian's SME.

**a. Define**

Define in SME is usually to determine the CTQ, goal of the problem, business case, business objective, project scope, role and responsibilities. The team leader should be integrated whole people who involved in the six sigma project. In SME the define step are more specific to define:

1. The criteria for choosing six sigma projects
2. The costumer expectation
3. The key process (SIPOC)
4. The training activities for group members
5. The job and task of people who involved in six sigma project

6. the goal of six sigma project

**b. Measure**

The second step to measure six sigma project is measure. First SME should clarify the CTQ characteristic, planning for collecting data, performance base-line in out-put and out-come level, and measurement checklist. The key point for measurement activities is to convert the fact into the quantitative data.

**c. Analyze**

The third phase in six sigma project is analyzing the data. In this step the data which already collected are measured using statistical tools. The specific jobs in this phase are find the characteristic of CTQ, the quality of process capability, find the root of the problem, and convert all defects into the amount of cost.

**d. Improve**

The next step after analyze is the improvement phase. In this phase the problem which found in the analyzing phase should be solved. The solving of the problem should cover the long term goal and take the preventive for the defect in the future. In other word, the SME must select the fire prevention method, not the fire fighter method.

**e. Control**

The control phase is important to make the system improvement in SME is running continuously and stable. This six sigma project needs consistency in implement the program which planned in improvement phase.

**2. Management involvement and participation**

Management should focus on empowering all aspect in company. First step is build the project team which consists of a diversity of skills that range from technical analysis, creative solution development, and implementation

Six sigma team are comprised of several types of individuals:

**a. Champions:** senior level managers who promote and lead the deployment of Six Sigma in an important spot.

**b. Master Black Belts:** full time Six Sigma experts who are responsible for Six Sigma strategy, training, mentoring, deployment, and results. They work across the organization to develop training and lead change.

**c. Black Belts:** Fully trained Six Sigma expert with up to 160 hours of training who perform technical analysis.

**d. Green Belts:** Functional employees who trained in

introductory Six Sigma tools

**e. Team Members:** persons from a range of functional sectors who support specific projects

3. Number of complaint

Number of complaints are some aspects that not cover by the company. The company should answers some question to focus in customers. Some fundamental questions which explained by Evans JR and Lindsay WM are;

- a. What products or services are produced?
- b. Who uses these products and services?
- c. Who do employees call, write to, or answers questions for?
- d. Who supplies the inputs to these processes?

4. **USES THE POPULAR METHOD PROCESS MAPPING, CAUSE AND EFFECT ANALYSIS HISTOGRAM, SCATTER PLOT, RUN CHARTS, CONTROL CHARTS**

**a. Process mapping**

Process mapping which famous as flow charts is an effective tool that we can use to analyze our performance. The process mapping represents an algorithm or process, the steps as boxes of various kinds, ordering steps by connecting these with arrows. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields<sup>[10]</sup>.

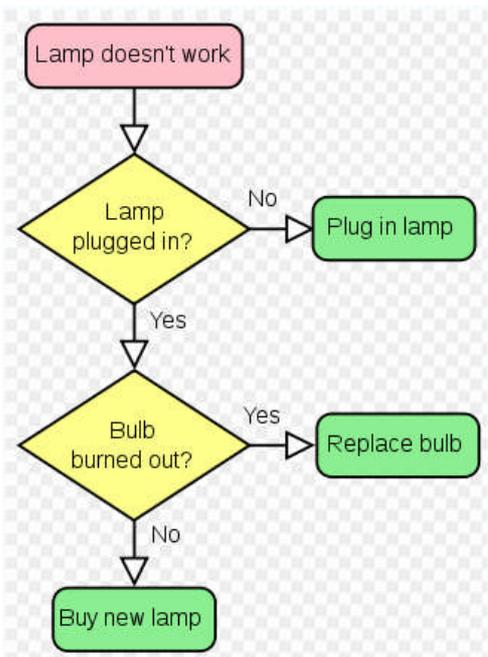


Figure 2 Flow Chart Diagram [14]

**b. Cause and effect analysis**

Cause-and-effect diagrams which are known as Ishikawa Diagram are diagrams that show the causes of a certain event. Common uses of the Ishikawa diagram are product design and quality defect prevention, to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation.

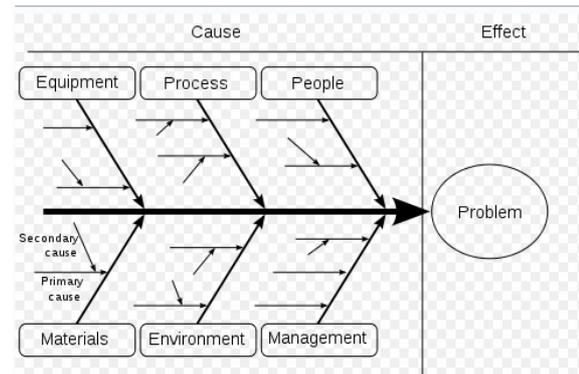


Figure 2 Cause and Effect Diagram<sup>[8]</sup>

**c. Histogram**

Histogram is a graphical display of tabulated frequencies, shown as bars. It shows what proportion of cases fall into each of several categories: it is a form of data binning. The categories are usually specified as non-overlapping intervals of some variable. The categories (bars) must be adjacent. The intervals (or bands, or bins) are generally of the same size.<sup>(11)</sup>

Histograms are used to plot density of data, and often for density estimation: estimating the probability density function of the underlying variable. The total area of a histogram used for probability density is always normalized to 1. If the lengths of the intervals on the x-axis are all 1, then a histogram is identical to a relative frequency plot.

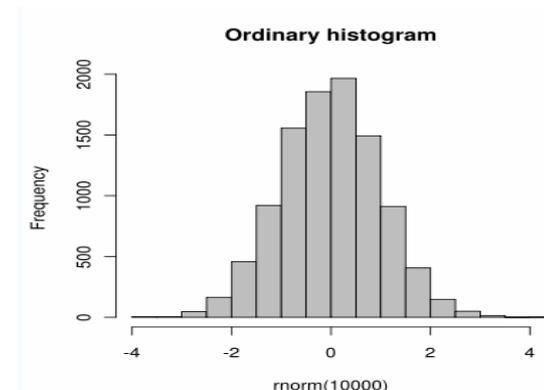


Figure 4 Histogram<sup>[12]</sup>

**d. Run Charts**

Run Chart is a graph that displays observed data in a

time sequence. Often, the data displayed represent some aspect of the output or performance of a manufacturing or other business process

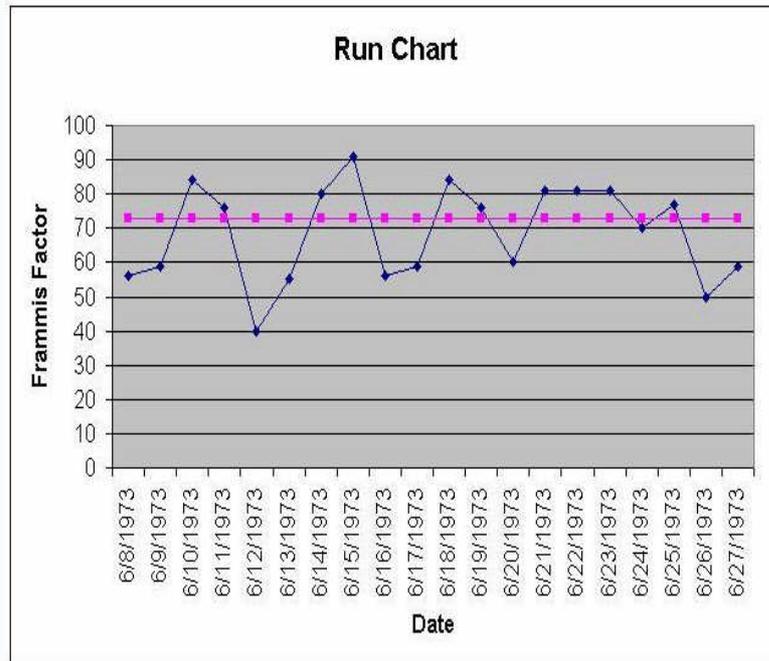


Figure 5 Run Chart Diagram<sup>[13]</sup>

**e. Control Charts**

Control Chart are tools used to determine whether a manufacturing or business process is in a state of statistical control or not. If the chart indicates that the process is currently under control then it can be used with confidence to predict the future performance of

the process. If the chart indicates that the process being monitored is not in control, the pattern it reveals can help determine the source of variation to be eliminated to bring the process back into control. A control chart is a specific kind of run chart that allows significant change to be differentiated from the natural variability of the process.

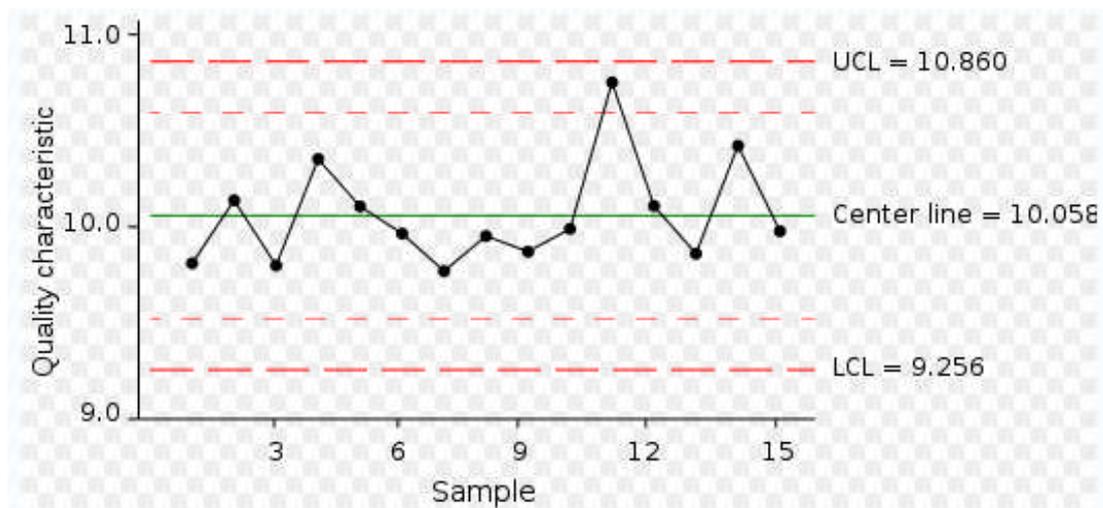


Figure 6 Run diagram<sup>[17]</sup>

**5. REDUCTION IN PROCESS VARIABILITY**

Demming W said that variation is major factors that make a problem in quality. In example,

inconsistencies in human behavior could frustrate the customer and hurts companies' reputation. The variation can be measured by using the area under the curve like in "Figure (7)".

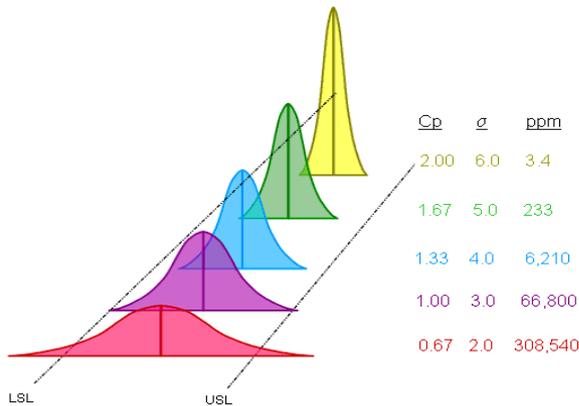


Figure 7 Process variability<sup>[15]</sup>

## 6. CONCLUSION

SME realize that six sigma is a good tool for improve the performance the SME them selves. It is not easy to implement the six sigma because it integrated the process improvement and product improvement. For applied six sigma the SME need to be familiar with the statistic tool and other tool in six sigma. Communication among six sigma user also needs to establish to make a quick progress of implementation.

Define, Measure, Analyze, Improve, Control are the effective steps that guide the SME achieve the continues improvement. The SME is more specific in applied DMAIC because the managers who also sometime are also the owner of the company have to be realize first the benefit of implementing six sigma. After that, the SME need to make a group who also help each other in implementing DMAIC. It take several time and a lot of focus while do the DMAIC.

Indonesia can start improve the quality by using Six Sigma from the DMAIC and ordinary tools. The Government should create the policy that push SME listen to the customer complaint and facilitate the communication among them.

## REFERENCES

1. Neagu, R & Hoerl, R, *A six sigma approach to predicting corporate defaults*, Quality and Reliability Engineering International, vol. 21, no. 3, pp. 293-309., 2005
2. ANTONY, J., KUMAR, M. & MADU, C. N. *Six sigma in small- and medium-sized UK manufacturing enterprises: Some empirical observations*. International Journal of Quality Reliability Management, 22, 860-74., 2005
3. CARTER, J., *Strategic Planning for a Small Company*. [http://www.ndtma.org/typ\\_html\\_nav.asp?ObjectID=6391](http://www.ndtma.org/typ_html_nav.asp?ObjectID=6391)., 2006

4. DE GUINEA, A. O., KELLEY, H. & HUNTER, M. G., *Information systems effectiveness in small businesses: extending a Singaporean model in Canada*. Journal of Global Information Management, 13, 55-79., 2005.
5. EVERETT, J. E. & WATSON, J. *Do Small Businesses Have High Failure Rates? Evidence from Australian Retailers*. Journal of Small Business Management, 34., 1996.
6. FU, H.-P., CHANG, T.-H. & WU, M.-J. *A case study of the SMEs' organizational restructuring in Taiwan*. Industrial Management and Data Systems, 101, 492-501., 2001.
7. PETER J REA & KERZNER., H. *Strategic planning : a practical guide*, New York, Wiley., 1997.
8. [http://en.wikipedia.org/wiki/File:Ishikawa\\_Fishbone\\_Diagram.svg](http://en.wikipedia.org/wiki/File:Ishikawa_Fishbone_Diagram.svg)
9. *Regional Innovation Technology for Small Medium Enterprises Asheim Bjorn T , et all* Edward Elgar Publishig, Inc ,USA 2003
10. SEVOCAB: Software and Systems Engineering Vocabulary. Term: *Flow chart*. retrieved 31 July 2008.
11. Howitt, D. and Cramer, D. *Statistics in Psychology*. Prentice Hall, 2008.
12. Evans JR and Lindsay WM, *The Management and Control of Quality*.Thomsons South Westen 6<sup>th</sup> edition 2005
13. [http://en.wikipedia.org/wiki/File:Cumulative\\_vs\\_normal\\_histogram.svg#file](http://en.wikipedia.org/wiki/File:Cumulative_vs_normal_histogram.svg#file)
14. <http://en.wikipedia.org/wiki/File:SimpleRunChart.jpg>
15. <http://en.wikipedia.org/wiki/File:LampFlowchart.svg>
16. <http://sixsigmatutorial.com/Six-Sigma/Six-Sigma-Capability-Improvement.aspx>
17. EIM., *the European Obsevatory for SMEs: Fifth Annual Report* ,table A2,p.305, 1997.
18. <http://en.wikipedia.org/wiki/File:ControlChart.svg>

