

Identifying an improvement method for Ecuadorian small companies

Denise Rodríguez^a

Marcos Buestán^b

Facultad de Ingeniería Mecánica y Ciencias de la Producción
Escuela Superior Politécnica del Litoral
Guayaquil-Ecuador

[a](mailto:mrodri@espol.edu.ec)mrodri@espol.edu.ec; [b](mailto:mbuestan@espol.edu.ec)mbuestan@espol.edu.ec

ABSTRACT

This article presents the improvement methodologies that fit the characteristics of Ecuadorian small and medium-sized enterprises (SMEs). First, these characteristics were collected through primary and secondary data. The secondary data was collected from previous studies performed by gubernamental and not gubernamental institutions. The primary data was collected through twelve in-depth interviews performed by the researches to key personnel from SMEs from the plastic industry of Ecuador. Lean Manufacturing and the SHEN model are the improvement methods that best suits the majority of the weaknesses identified in the Ecuadorian SMEs.

Keywords: small companies, SMEs, improvement methods

1. INTRODUCTION

Ecuador is a small Andean country located in north of the South American Continent. Ecuadorian companies are facing hard times because of the politic and economic issues that this country has being suffered for the last 2 decades. In Ecuador, the economic growth is supported in some extend, by the small and medium enterprises (SMEs). Inside the manufacturing industry, big companies represent the 16% of the business and SMEs represent the 84% of the business (INEC, 2007). Therefore, Ecuadorian SMEs have a great potential to generate employment, income and production (Barrera, 2001).

Due to the fact that productivity and efficiency improvements lead to a reduction in the productive costs and thus, make the enterprises more competitive (Niebel and Freivalds, 2009). There are many methodologies that help to increase the productivity levels through management as Lean Manufacturing, Kaizen, Total Quality Management, etc. Unfortunately, few research studies have been conducted in the arena of quality and productivity improvement for SME as the SHEN model for make to order SMEs (Muda and Hendry, 2003) and almost nothing have been done in SMEs from developing countries. I believe that it is time for the Ecuadorian SMEs to work in a formal way to improve their productivity; being productivity the ratio to measure how well an organization converts input resources (labor, materials, machines etc.) into goods and services. Thus, the principal aim of this research is to find a methodology that suits the characteristics of the Ecuadorian SMEs. This aim was reached by a carefull identification of the Ecuadorian SMEs characterics through the collection of primary and secondary data. Afterwards a review of the existing improvement methodologies and the techniques that overcome the different Ecuadorian SMEs characteristics.

2. SMEs IN ECUADOR

The definition of an SME in Ecuador is given in concordance with the Andean Community SME law, the Craft promotion law and the Small Enterprises promotion. This definition is presented in table 1:

Table 1: Definition of SMEs in Ecuador

Firm type	Headcount	Revenues (USD)
Micro	1 – 9	Till 100.000
Small	10 – 49	From 100.000 to 1'000.000
Medium	50 – 199	From 1'000.001 to 5'000.000
Large	200 or more	5'000.001 or more

Source: (INEC, 2007)

According to the Chamber of Small Industry of Guayas (CAPIG, 2007), the majority of the SMEs are in the service sector followed by the manufacturing sector. Inside the manufacturing sector: Chemical companies are the most numerous with 14%, Agriculture 12%, Plastic 10%, Wood 9%, Food 7% and Paper 6%. Among the SMEs, only 6% has implemented a quality system, 30% are interested in learning about quality systems, 49% are not interest in quality systems, 14% does not know and 0.5% knows about it. The main characteristics of the Ecuadorian SMEs are: the intensive use of labor, little technology development, low work division, low capital, low productivity, small saving capability and limited access to finance.

The National Manufacturing SMEs Survey that was performed in 2006 to a sample of 4000 Ecuadorian SMEs revealed that the majority of SMEs considered the economic situation, the long custom procedures, the diffulties to access to financial credits, and the tax system as the main constraints against the commerce. In addition, the four principal ways of support that the SMEs would accept from the government are: productive credit, training, productivity and process improvement and quality certification. Other important information gathered was the internet usage that in micro enterprises is 44.7%, in small enterprises is 49.2% and in medium enterprises is 47.9% (Ministerio de Industrias y Competitividad et al., 2007)

The most complete analysis of the Ecuadorian SMEs was the one performed by the government (INSOTEC, 2002). The survey was applied to 803 SMEs from the provinces of Azuay, Guayas, Manabí, Pichincha and Tungurahua. The SMEs surveyed belongs to the sectors of food, garment, leather, shoes, wood, furniture, paper, chemical, plastic, mineral and metallic products. The main findings were as follows:

- The family business are considered an important sector of the Ecuadorian SMEs
- In average a SME has 19 employees
- Seventeen percentage of the workforce is not qualified for the job, 30% is qualified for the job but does not have a formal education, 31% has finished the secondary school, 6% has a technical diploma, 15% of the employees have an university diploma and the 1% have a post graduate degree
- Only 27% of the SMEs offer training to their employees in a regular basis
- About the technology: 29% is manual, 44% is semiautomatic, 24% is automatic and the 4% is computerized.
- Thirty six percentage of the SMEs does not have computers, 35% has only one computer, 20% has between two and three computers and only the 9% has more than three computers. The 66% that has a computer states that also has internet access.
- The 66% of the production is make to order
- The most used method for quality control is the visual inspection by simple observation (57% of SMEs)
- In average and SMEs uses the 62% of the capacity; this is because of the market limitation.
- The inventories are managed by experience in the 28% of SMEs, kardex in 36%, and with help of a computer program in 36%
- Only 57% of SMEs has done a market research
- Fifty percent of the SMEs said that their first priority for the future is the improvement of products and processes and 44% for the new products design
- The needs for training are in the following topics: quality control, costs control, production techniques, production scheduling and control and design and development of products and processes.

Another relevant study is the one performed by Ortiz and Rodríguez (2008). They did a simple transversal descriptive research to collect the characteristics of the Ecuadorian SMEs. The sample size was calculated with a confidence level of 90%, a precision of 12% and an expected fulfillment rate of 70%. A sample of 196 SMEs were selected randomly from the Small Industry Chamber of Guayas (CAPIG) database which has 514 manufacturing SMEs: 18% Food, 17% Metal mechanic, 13% Chemical Products and 13% Plastic. Four persons were hired in order to apply the questionnaire directly to the companies. This form of gathering the information was preferred due to the low use of internet, the low reliability in the post mail, and the low response rates among the Ecuadorian SMEs (INSOTEC, 2002). After three months of work, 117 complete questionnaires were collected representing a response rate of 65%. The main findings are presented in the following lines:

- The majority of the SMEs from Guayaquil are older than 5 years old.
- The average working day is about 9 hours.
- In average there are 26 employees in an Ecuadorian SME.
- Only 43% of the companies have a training plan for their employees and this training is mainly for the employees from the managerial levels.
- Few employees participate in improvement teams
- Only 24% of SMEs has implemented an operations improvement program; ISO 9001 is the most common improvement program followed by Good Manufacturing Practices. The average time of implementation is between six months and one year and in the majority of the cases the leader of the implementation is an employee of the company, not an external consultant.
- 75% of the SMEs has the efficiency level upper than 70%
- 61% of the SMEs delivers less than 90% of the orders on time.
- The majority (55%) of the SMEs performs the quality control during the process, 41% of the SMEs make just an inspection of the final product and 4% do not make any quality control of their products.
- About the Industrial Safety System, around 67% of the SMEs assure to have implemented this kind of systems but the definition of Safety System is sometimes underrated. Some SMEs believe that an Industrial Safety System is just to provide personal safety equipments to their employees.

2.1 RESULTS OF THE IN-DEPTH INTERVIEWS

The in-depth interviews were performed to twelve plastic companies that are members of the Association of Ecuadorian Plastics Enterprises (ASEPLAS). The findings were grouped in six areas and presented in the following lines:

Customer Relationship

The sales agents are the only way of contact between the enterprise and the customers. The majority of the companies perform one customer satisfaction survey per year as a requisite of the ISO 9000:2000 certification. Few enterprises have classified their customers. The interactions with the customers are strictly for placing orders. Few enterprises make a formal tracking of the customers. Because of the high level of competence, the price is the principal factor for the buying decision. Despite of the pressure from the customers for shorter delivery dates, the common delivery time is greater than five days.

Interaction between the functions of production and sales

In the majority of the companies the communication is verbal. Few companies have a fully integrated information system. The communication is specifically for the managing of orders and the production planning. There are plenty of changes in the production planning. These changes sometimes produce friction between the people of sales and production. The changes also generate late deliveries and high levels of scrap. In the majority of the companies there is a weekly meeting for the production planning. The sales agent do not ask the production people for setting the delivery due date. In the majority of the companies, the sales department has the power of decision in the production planning.

Production

None company use visual control techniques for managing its production. After the 5S evaluation just four of 12 companies were rated as “Good”, three were rated as “Regular”, and five as “Very Bad”. None of the companies were rated as “Very Good”. Many companies show lack of order and cleanliness at the shop floor. 11 of 12 companies have excessive levels of work in process. It was evident the high level of inventory on the shop floor especially in the aisles and in the spaces next to the machines. Just one company has defined metrics using the Balance Scorecard method. Most of the companies just use the metrics kilograms produced and scrap. These metrics are just kept as historical information and they are not used for taking decisions. The production planning horizon is in average one week. In some cases long term schedules are elaborated, however in the most of the cases they are modified in agree with the market variations. In 80% of the companies the information about the equipments or machinery capacity is not considered in the production planning process. In the other 20%, the information employed is very rough. In none case it is used detailed capacity planning. The interaction among the equipments is never considered. All the companies interviewed have a functional layout. The scrap level is in average 3.5%. The minimum was 1% and the maximum 5.8%.

Quality

Fourty one percent of the companies has ISO 9000 certification. Eighteen percent of the companies develop quality control on finished products. Fifty five percent control quality during the production process. Twenty seven percent use control charts as part of its quality control system. None company use the seven basic quality tools. Just one company maintains and uses effectively quality performance measures. Companies are just reactive to the returns and complaints of the clients. Fifty five percent of the companies does not use any formal technique for solving quality problems, they just react as fire fighters. Thirty six percent of the companies develop informal meetings for solving quality problems; however they do not maintain any formal procedure for it. Just 9% keep planned meetings with formal procedures where quality problems are solved in a systematic way. Just 41% of the companies maintain one or two people exclusively aimed to the control quality process. Just 41% of the companies have laboratories equipment used to develop quality control.

Human Resources

There are many communication problems among the employees. There are low levels of motivation. Only one company has a monetary reward system. Only one has a non monetary reward system. Few companies perform some activities such as sport events or social acts for Christmas and New Year. The 25% of the companies does not have a training program. The 58% of the companies send to the employees to some occasional courses. Only the 17% of the companies have a formal training plan for the employees. Only in two of 12 companies all the employees has finished the high school.

3. REVIEW OF THE IMPROVEMENT METHODOLOGIES

In order to define the improvement methods that fits the Ecuadorian SMEs, a review of the some existing techniques from the most well known improvement methods such as: World Class Manufacturing (WCM), Lean Manufacturing, Total Quality Management, Kaizen, Training within Industry and the SHEN model was performed.

3.1 WORLD CLASS MANUFACTURING (WCM)

World Class Manufacturing is a state achieved by those enterprises that demonstrate to be better than their competitors. To be a world class manufacturer, the company should attempt to be best in the field at each of the competitive priorities (quality, price, delivery speed, delivery reliability, flexibility and innovation). Schonberger (1996) developed a guideline for evaluating the world class manufacturing level. The following principles are known as “customer-focused-principles” or “principles-based management”. For each of the principles, there is a five-point scale, with 5 being the highest level of attainment. Any firm that scores more than 67 points is in the stage of maturity.

1. Get to know the customer
2. Cut work in process

3. Cut flow times
4. Cut setup and changeover times
5. Cut flow distance and space
6. Increase make/deliver frequency for each required item
7. Cut number of suppliers down to a few good ones
8. Cut number of part numbers
9. Make it easy to manufacture the product without error
10. Arrange the work place to eliminate search time
11. Cross-train for mastery of more than one job
12. Record and retain production, quality, and problem data at the work place
13. Assure that line people get first crack at problem solving before staff experts
14. Maintain and improve existing equipment and human work before thinking about new equipment
15. Look for simple, cheap, movable equipment
16. Seek to have plural instead of singular work stations, machines, cells and lines for each product
17. Automate incrementally, when process variability cannot otherwise be reduced

3.2 LEAN MANUFACTURING

The term “lean” was coined by the International Motor Vehicle Program (IMVP) researcher John Krafcik due to the fact that lean uses less of everything which means less people, materials, machines, time, etc (Womack et al., 1990). Womack and his colleagues analyzed the way of manufacturing in the Japanese automotive industry (Toyota) and compared with the American automotive industry. The Toyota System based its activities in the 4P model. The four Ps are Philosophy, Process, People/Partners and Problem Solving. It is important to have a long term philosophy in order to improve processes through problem solving techniques applied by the employees. This 4P model is manifested in a group of principles that guide the implementation of the production change (Liker and Meier, 2006).

Henderson and Larco (2000) propose a different view, they suggested that Lean is based in six different principles: (a) workplace safety; (b) order and cleanliness; (c) JIT production; (d) Six Sigma quality; (e) Empowered teams; (f) Visual management and Pursuit of perfection. Womack et al. (1990) stated that the fundamental ideas of lean manufacturing are universal. In addition, Karlsson and Ahlström (1997) concluded from their application of the lean principles to a Swedish medium-sized enterprise that most of the principles of lean manufacturing suit the particularities of the SMEs. Furthermore, the results of the empirical study of Bonavia and Marin (2006) in 76 SMEs from the Spanish ceramic tile industry found that the least used lean practices are group technology, kanban, reduction of set up time, development of multi-function employees and visual factory and the most used practices are the standardization of operations, total productive maintenance and quality controls. In addition, the research of Forza (1996) in 43 plants belonging to the electronics, auto supplier, machinery and mechanical sectors suggest that lean production plants seem to use more teams for problem solving, to give important to employees’ suggestions and to document processes.

3.3 SHEN MODEL

The majority of the improvement methodologies are based on make- to- stock companies even though are recommended for universal applications. Muda and Henry (2002a) recognized the differences between make-to-stock and make-to-order companies and used the Schonberger (1986) WCM principles for developing a performance improvement method for the make to order SMEs from United Kingdom, the SHEN model. The initial SHEN model had 14 principles with five steps each one; these steps acted like a maturity scale where the company can assess and position itself in a maturity level according to its management practices (Muda and Hendry, 2002b). The authors applied the initial SHEN model in six UK companies from different business lines: (a) precision tools engineering; (b) furniture industry; (c) silos and feeding equipment for the agricultural industry; (d) high precision finished sheet metal components; (e) special doors; and (f) sheet metal and light metal fabrication products for diverse machines. In this application, the authors identified two principles that were not suitable to SMEs: The principle of “having systematic rewards, recognition and pay” was removed because the 6

companies support the fact that multi-skilling employees are not a priority for them thus the systematic rewards for cross-training has no sense. The second principle, “seek simple, flexible, movable, low cost equipment in multiples”, was removed because there is no need for movable equipment as the MTO SMEs are working well with a functional distribution and also it is possible that the SMEs needs a complex equipment due to its business line, finally the flexibility is considered implicit strategy of the company and not for a improvement model. Finally they proposed a model with 12 principles as follows (Muda and Hendry, 2003).

Generate enquiries/Sales

- Integrate the functions of production and marketing in all processes
- Design for products, processes and improved supplier relationships
- Collaborate with customers

Operations and capacity

- Simplify the shop floor
- Improve scheduling and workload control to cut flow times
- Cut the start up/changeover time and improve preventive maintenance
- Improve information flow

Human Resources

- Make essential improvements in skills and flexibility
- Everybody involved in change and strategic planning – to achieve a unified purpose

General continuous improvement

- Improve quality and implement appropriate performance measures
- Gather customer feedback and benchmarking
- Promote/market/sell every improvement

3.4 CONTINUOUS IMPROVEMENT (KAIZEN)

Massaki Imai (1986) introduced the term kaizen as the key to Japan’s competitive success. Kaizen means little improvements as result of continuous efforts. Kaizen based its improvement in the reduction of waste, and also make emphasis in aspects of human resources management such as: the communication, training, team work, job involvement and self discipline. Kaizen focus in common sense and low cost alternatives for improvement.

Many tools and techniques have been developed to support the continuous improvement quality route philosophy such as Just in Time, Total Productive Maintenance and Total Quality Management (Imai, 1998). Thus Kaizen could be applied in combination with other methodologies in order to tackle some of the problems presented in the Ecuadorian SMEs.

3.5 TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management is a process committed to continuous quality improvement. In order to succeed in the implementation of TQM, the management level should be committed to the change and the employees should be totally involved in the new way of working. Workers in TQM are organized in groups such as cross-functional teams and quality circles (Nicholas, 1998). Singh Soin (1997) focuses his analysis of Total Quality Control for different facets, such as: Client obsession, Planning, Improvement, Process daily management and employees’ participation. Furthermore, George and Weimerskirch (1994) suggest the following tasks to keep control of the system: (a) Know exactly what the customer requires; (b) Have well defined processes for translating those requirements into internal actions; (c) Align all of your tasks and processes along common goals and objectives; (d) Use key performance measures; (e) Involve everyone in continuous improvement; (f) Understand and improve all your critical processes; and (g) Satisfy your customers. In addition, Powell (1995) suggests that the major features of TQM are proposed by Deming, Juran and Crosby, and could be summarized in 12 factors:

1. Committed leadership
2. Adoption and communication of TQM
3. Closer customer relationships
4. Closer supplier relationships

5. Benchmarking
6. Increased training
7. Open organization
8. Employee empowerment
9. Zero-defects mentality
10. Flexible manufacturing
11. Process Improvement
12. Measurement

Many Chinese small manufacturing firms have implemented TQM programs following the view of Powell (1995) with the main problem of lack of resources and lack of bargaining power against suppliers. TQM allows the company to apply low cost solutions to tackle the problem of lack of resources (Lee, 2004).

3.6 TRAINING WITHIN INDUSTRY (TWI)

During the Second World War (WWII) the Training within Industry Service was created in the United States of America to speed up the training process of new workers for the weapon industry. Between 1940 and 1945, four training programs were launched: Job Instruction Training (JI), Job Relations Training (JR), Job Methods Training (JM) and Program Development (PD). TWI is considered as a foundation to sustain improvement programs (Dinero, 2005). Job Instruction Training teaches to the employees how to train others to perform a job efficiently; the steps of JI are: prepare the worker, present the operation, try-out performance and follow up. Job Relations Training teaches to the employees, especially supervisors, how to solve personal problems using an analytical method. The steps for JR are: get the facts, weigh and decide, take actions and check results. Job Methods Training teaches the employees how to improve their jobs in order to increase the productivity and quality levels. The steps for JM are: break down the job, question every detail, develop the new method, and apply the new method. These steps are very similar to the Kaizen Steps. Program Development teaches how to solve production problems. The steps for PD are: stop a production problem, develop a specific plan, get plan into action and check the results (Dinero, 2005; Graupp and Wrona, 2006)

4. THE IMPROVEMENT METHOD FOR ECUADORIAN SMES

After reviewing the most used operational improvement methodologies, it has been identified the strong points of the improvement methods in relation with the characteristics of the Ecuadorian SMEs presented in section 2. Table 2 shows in the first column a summary of the main characteristics of the SMEs and the other columns show the different improvement methods that overcome each of the weaknesses. Table 2 also shows the authors that propose the techniques that overcome the different SMEs weaknesses for each improvement method. As we can see, Lean Manufacturing followed by the SHEN model are the two improvement methods that overcome the majority of the SMEs weaknesses identified. This is an important finding because the SMEs can benefit from the direct application of Lean instead of searching for an improvement methodology that would not solve all their problems.

Lean Manufacturing involves plenty of techniques from diverse areas (i.e. quality, productivity, housekeeping). Therefore, Lean could overcome some weaknesses such as lack of housekeeping, low quality and productivity levels, low interaction with the customers, friction between production and sales, etc (see table 2). The application of Lean in Ecuadorian SMEs should follow a framework that considers these characteristics and prioritizes the use of the different Lean practices.

The Ecuadorian SMEs can benefit from the application of Lean Manufacturing. This benefit could be manifested in operational performance measured by quality and productivity indicators. The increment in productivity could also generate an increment in the competitiveness level of the SMEs and eventually the country.

Table 2: Improvement methods and SMEs characteristics

Ecuadorian SMEs' characteristics	WCM	Lean	SHEN	Kaizen	TQM	TWI
Low quality productivity levels	Schonberger 1996	Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003	Imai, 1998	Powell, 1995 Lee, 2004	Dinero, 2005 Graupp&Wrona, 2006
Low educational level		Liker&Meier 2006 Henderson&Larco 2000			Powell, 1995 Lee, 2004	Dinero, 2005 Graupp&Wrona, 2006
Approximately 66% of the SME is make to order			Muda&Hendry 2002 & 2003			
The most used method for quality control is the visual inspection by simple observation (57,4% of SMEs)		Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003		Powell, 1995 Lee, 2004	
Only 43% of the companies have a training plan for their employees	Schonberger, 1996	Liker&Meier 2006 Henderson&Larco 2000			Powell, 1995 Lee, 2004	Dinero, 2005 Graupp&Wrona, 2006
Only 39% of the SMEs deliver between 90 and 100% of its orders on time.	Schonberger, 1996	Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003			
80% of the SMEs has complaints and returns from 0 to 10% of its orders.	Schonberger, 1996	Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003	Imai, 1998	Powell, 1995 Lee, 2004	Dinero, 2005 Graupp&Wrona, 2006
Few enterprises has classified their customers. The interactions with the customers are strictly for placing orders.	Schonberger, 1996		Muda&Hendry 2002 & 2003		Powell, 1995 Lee, 2004	
There are plenty of changes in the production planning. These changes sometimes produce friction between the people of sales and production.		Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003			
Low housekeeping level and few visual communication signs in the workshops.		Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003			
Most of the companies just use the metrics Kg produced and scrap. These metrics are just maintained as historical information and not used for taking decisions.		Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003		Powell, 1995 Lee, 2004	
None company use the 7 basic quality tools and neither maintain groups for solving quality problems.		Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003	Liker&Meier 2006 Henderson& Larco 2000	Powell, 1995 Lee, 2004	
55% of the companies does not use any formal technique for solving quality problems.	Schonberger, 1996	Liker&Meier 2006 Henderson&Larco 2000	Muda&Hendry 2002 & 2003	Imai, 1998	Powell, 1995 Lee, 2004	Dinero, 2005 Graupp&Wrona, 2006

5. CONCLUSIONS

This paper presented the identification of Ecuadorian SMEs characteristics through the evaluation of primary and secondary data. These characteristics could be considered as weaknesses in some cases. These weaknesses could

be overcome by the implementation of improvement approaches that are proved to be effective for these situations. In addition, the paper presented a revision of some improvement methodologies with the aim of identify the methodology that fits the Ecuadorian SMEs characteristics. Finally, it has been identified that Lean Manufacturing and the SHEN model are the two methodologies that overcome the majority of the Ecuadorian SMEs weaknesses. The findings of this research are important for practitioners that could benefit from the implementation of the suggested methodologies in order to improve their quality and productivity levels.

6. RECOMMENDATIONS

Based on the findings of this study, it is recommended that the Ecuadorian industrial managers consider the Lean practices as a way of improving their productivity and competitiveness. The different tools that Lean manufacturing offers allow the company to perceived improvement in short, mid and long-term. Therefore, it motivates the employees and managers to stay attached to the methodology. It is also recommended that the Universities disseminates the Lean concepts among the industrial sector that sometimes ignore about the existences of these improvement techniques.

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