DEVELOPMENT OF LEAN CULTURE ASSESSMENT FOR LEAN MANUFACTURING IMPLEMENTATION

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ABSTRACT

Many companies are looking at lean manufacturing for helping them to remain competitive; Lean manufacturing is however more than just a set of tools and techniques as it also requires a change in the organizational culture of the company involved to be a lean culture. The relationship between an organization's culture and its ability to implement lean six sigma technique is a long-term effort. As a first step, the purpose of this paper is to offer the results of a survey conducted to measure the lean cultures criteria in the manufacturing company which is conducive for successful implementation of lean six sigma methodologies. The method used for this paper study was the questionnaire method using a lean culture assessment questionnaire that has been designed by the researcher that was aligned to the important principles based on Toyota Way model. This study indicates that the existing organizational culture of radiator Production Company is relatively conducive to the implementation of lean principles within the company.

KEY WORDS

Lean manufacturing, organizational culture, lean culture assessment, questionnaire.

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INTRODUCTION

Continuous improvement has become one of the most important processes in organizations today. Whatever the specific approach TQM, Six Sigma, Lean, Process Management and Improvement or Kaizen, the culture of the organization must support that approach. If the culture does not foster the approach, support the behavior and activities, reinforce the discipline, motivate and reward the actions and results, then the continuous improvement process will fail. Culture can be defined, measured, and changed. It can be changed to support the type of continuous improvement process the organization wants to implement. However, it is hard work and takes time to make the change. The change can be well worth the effort, but must have the commitment, involvement and patience of the senior leadership team (Charles Aubrey [1]). It is essential that management understands the culture of the organization both in analyzing the organization's strategic position and in the implementation of strategy. When the culture is in conflict with some aspect of the company's direction, performance targets, or strategy, the culture becomes a stumbling block. Therefore grounding the organizational culture in core values and ethical principles has a significantly positive impact on performance (Xavier Jantjies [2]). The importance of the role of organizational culture in the success or failure of a company's ability to successfully implement a new philosophy such as lean manufacturing should not be underestimated.

This paper is intended to discuss and evaluate the organizational culture that presently exist at manufacturing company and compare it with the true lean culture criteria which are based on Toyota culture and improve the gap for successfully implementation of lean manufacturing methodologies.

LITERATURE REVIEW

Definition of Organizational Culture

The importance of organizational culture gained high attention in the 1980s. The recognition of its importance was enhanced by the superior performance of Japanese firms over their American counterparts, and the rapid development of knowledge-intensive technologies which highlighted the importance of humans. These factors led to the revelation of the linkages between organization culture and organization performance. Thus it became accepted that organization culture is not just a soft business issue, but based on its influence on performance and effectiveness, it is rather a strategic competiveness factor (Cameron et. al. [3]). Corporate culture is an organizational way of life that creates employee attitudes, beliefs, behaviors and actions through the accepted, routinely demonstrated management norms, practices, traditions, and symbols that are institutionalized through continuous communication, reward and recognition. Leaders need to focus on the core of the organization (basic underlying assumptions), and without addressing them; the organization is unlikely to change or maintain their culture. Organizational development are organization culture, values, and norms; employee personality and behavior; motivation, group interactions, performance measurement, education and learning, skills, pay systems, reward systems, and change management (Charles Aubrey [1]).

Definition of Toyota Culture

Liker and J.K. [4] explains that the underlying assumption of Toyota's culture is reliant upon two parts: external which starts with customers; and internal that starts with respecting people and a continuous improvement in internal culture. Liker and J.K. [4] highlights Toyota's endeavors to make their people feel part of Toyota and Toyota part of them (ownership) by mixing and socializing them into the different departments from early stage. Liker and J.K. [4] describes that Toyota's leaders believe and have trust in their people and understand that investing in people is the key to success of Toyota. Marksberry et. al [5] explained why Toyota is a successful firm by stating that Toyota's culture offers long-term vision, incentives and rewards to help mangers in encouraging people to participate greatly in ongoing activities undertaken in the organization. Marksberry et. al [5] add that the firm also accepts people's mistakes particularly in experiments as such belief leads to continuous improvement. Liker et. al [6] described that the trust in Toyota's culture is distinctive and has not come through words; rather through policy and daily interaction among members, which eventually encouraged them to feel a part of Toyota's family.

Toyota believes the suppliers are the cornerstone of their production system and without a strong relationship with suppliers, lean is unlikely to happen (Vaghefi et. al [7]). The strong relationships with the suppliers means involving them in the process and there is an institutionalized set of practice between both parties to help transfer knowledge and to learn faster in engineering, designing and manufacturing.

Culture Criteria for Lean Transformation

The most common element of Toyota culture is continuous improvement or scientific experiment. The other most common elements are the long term thinking and the emphasis on people (respect, involvement). Within these three main features there are several others to mention. Liker et. al [8] provides the most complete picture of the Toyota culture, as shown in Table 1. Portia Tung [9] introduced the importance of the employee development and problem solving in the lean culture that Toyota has achieved can also been seen in the 4P Model of the Toyota. It can be seen from figure 1 that the 4P model takes the form of a pyramid and as Liker [4] where the foundation of the pyramid is the long term philosophy that looks to add value to both customers and society. The Toyota management system has been described by fourteen principles which can be categorized into four broad categories, as discussed by Liker [4] that form the 4P's of the 4P model of Toyota Way.

Lean Culture

David Mann [10] state that the culture in a work organization is defined by the sum of its individual's work habits and added that the culture is the knowledge of how things are done to stay out of trouble by a member of a group. David Mann [10] added that the culture for group members is invisible; it is the things that are given, or the way we do things around here. Integris [11] defined the lean culture as an organizational environment in which the values and behaviors are aligned with the guiding principles of lean management. Integris [11] added that competitive advantage depend on many factors that helps organizations differentiate themselves like "cost,

Table 1. Features of the Toyota culture (Liker et. al [8]).

| No	Toyota Culture	No	Toyota Culture	No	Toyota Culture
1	Continuous attention toward the external environment	13	Process-thinking in decision making and problem solving	25	Searching for development opportunities
2	Two ways, open communication channels	14	Employee involvement	26	Regular information and knowledge sharing
3	Learning from experience	15	Personal involvement	27	Employee development
4	Treating employees as partners	16	Employee suggestions	28	Constructive critique
5	Cooperation	17	Support	29	Discussions
6	Human focus	18	Responsibility	30	Rights to feedback
7	Tidiness	19	Trainer leaders	31	Visual management
8	Conflict acceptance	20	Forwarding goals	32	Finding root causes
9	Commitment, loyalty	21	Respect	33	Long term thinking
10	Customer focus	22	Consistency	34	Self critique
11	Innovative spirit	23	Rewarding guidance	35	Minimizing losses
12	Trust, sincerity	24	Tolerating failures		
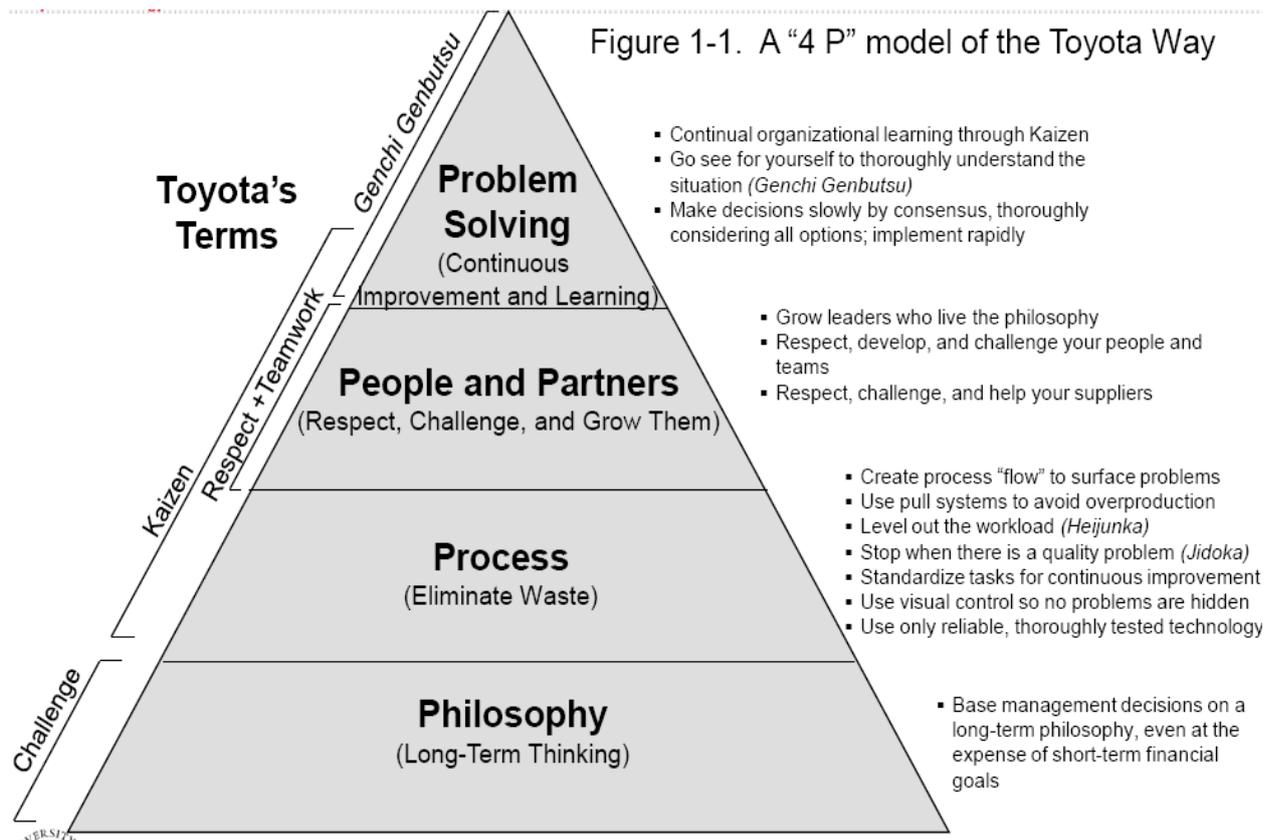
Fig. 1. The 4P Model of Toyota Way (Liker [4]).

quality, technology, customer service, logistics chain, talent, and brand". However, there is a much less obvious and less tangible factor that also can be a determining source of competitive advantage, that factor is organizational culture.

Convis and Gray [12] stated that senior managers have to be willing to be involved in day-today improvements in operations. This needs the basic tenet that people in the TPS are the most important asset and not the TPS tools. Tempel et. al [13] added that top management presence and availability on the shop floor is one of the most critical points during the lean rollout, therefore a lean culture is characterized by emphasis on people first, trust, strong customer orientation and the joint shop floor.

Organizational Culture Assessment for Lean Transformations

Badurdeen [14] classified the tools available for evaluating organizational culture into two methods; one method to identify a group/organization's culture is called the typological approach like organization ideology questionnaire. The second method that assign a quantitative rating, for example, based on a Likert- like scale and therefore use a dimensional approach. All tools have been used widely to perform organizational culture evaluations; including (organizational culture inventory; Organizational culture survey, Hofstede's organizational culture questionnaire).

The importance of the organizational culture in the success or failure of a company is not in question but there have been a differing of options on how the organizational culture of a company should be measured. The types of methods that are used in the study of organizational culture can be divided into two main type's quantitative and qualitative methods. The qualitative method is an interactive one that enables the company to get an insight to the experiences and perceptions methods that may not be able to be ascertained by quantitative methods (Smith [15]).

The organizational culture of a company is unique and cannot be defined correctly using a standardized form of measurement. Kaplan et. al [16] develop a questionnaire that is more aligned to be able to measure the company's culture. The other main method used for measuring the organization culture is the quantitative methods; this method mainly takes the form of questionnaires, surveys and interviews. These quantitative methods help to give the company and its managers the advantage of having structured data to work with in order to perform analysis and track over time. The type of method that is selected by the company depends on the practical problem or the research type of the company being studied and the research problem resulting from it. The method that is chosen will have an impact on the picture of culture that will be obtained needs to be obtained (Smith [15]).

RESEARCH DESIGN AND METHODOLOGY

This study will use quantitative method for the data collection by using a questionnaire in order to measure the current lean culture that exists at manufacturing companies and drew a true picture about it.

Developing the True Lean Culture Questionnaire

Since organizational culture is a complex phenomenon, it is impossible to develop a

questionnaire that would capture all of the possible cultural dimensions (Cameron et. al. [3]). Therefore any questionnaire must be tailored according to the research aims. Thus a questionnaire is likely to capture only some selected features of the organizational culture Fischer et al. [17].

As our aim here is to evaluate the degree to which an organizational culture matches with "true lean culture" a questionnaire is needed to focuses on dimensions related to lean management that are seen as special in Toyota's culture. It is difficult to find this kind of questionnaire in the related literature. This study developed a questionnaire to measure the lean culture in the manufacturing organization. This questionnaire depends on the special cultural features of Toyota which are described in the literature of this work. This work grouped the culture criteria into seven main culture criteria which describing the characteristics of lean culture, and also developed a number of sub-culture criteria for each main culture criterion. Each sub-culture criteria contains a number of questions that can reflect the related content. These sub-culture criteria were clearly defined in groups on the questionnaire as shown in appendix A. Respondents must indicate their agreement or disagreement of these statements using a five-grade scale according to Likert- scale.

Questionnaire Construction

Questionnaire is constructed such that each main principle is divided into numerous sub-principles criteria. For example, continuous improvement encompasses six sub-principles criteria; root cause problem solving, Standardization, leaders go to Gemba walk, daily accountability process visual controls, and level out the work load. The number of sub-principles criteria varies for each main principle, but we believe that all important lean culture criteria (for construction) are included in this questionnaire.

Each sub-principle criteria is, in turn, divided into a number of questions. Each question is designed to measure a firm's conformance to the sub-principle. The number of questions associated with each sub-principle criteria is variable and all questions carry the same weight or importance. Each question is answered along a continuum that ranges from "lean" behavior to un-lean behavior. Thus, by answering each question one evaluates conformance to a lean sub-principle criteria. By combining performance on sub-principles criteria, one assesses conformance to the main principles.

Format of Questionnaire

The method of data collection is the questionnaire method. The questionnaire was designed by the researcher with the aim of ensuring the format of the questionnaire was aligned to the desired output of addressing the main problem statement of how conducive the present organizational culture at radiators manufacturing company is to successful implementation of lean manufacturing concepts and tools. The method of the questionnaire was chosen with the aim of obtaining data in order to assess the organizational culture of radiators manufacturing company through analyzing the results of the specific questions asked.

The individual sections of the questionnaire have questions that are asked in relevance to the specific section in order to ascertain a measurement of those

specific principle criteria when the employees answer the questions. The sections of the questionnaire as already discussed were developed in alignment with the Toyota Way model and structured in a way to categorize the main core principles criteria of the Toyota Way culture that is incorporated in their people value stream. The different sections of the questionnaire are shown in Table 2.

RESULTS AND DISCUSSION

The results of the survey are shown in Fig. 2. Along the radar chart there can be seen the average values of the main principle of lean culture criteria for Radiator Production Company. The inner line on the chart clearly indicates that, according to the opinion of the respondents the culture of the Radiator Production Company is not yet at the level of the true lean organization culture of the Toyota which represent the outer line on the chart. This result is expected, knowing that this company is at the beginning of its lean journey. There are however specific three areas of the company's culture criteria are recommended to focus on such as mission, process focused and mutual respect and trust. Then the company leaders and the management were well recognizing the gap and the real weakness of the company. They focused on the weakness and provide training and awareness according to Toyota culture. These tasks took four month, and after that the same evaluation of lean culture questionnaire had been repeated. The results of data collection from questionnaire were represented by second measure lean culture in column chart as shown in Fig. 3. The middle column on the chart represents the first measure and the third column on the chart clearly indicates that the lean culture of the Radiator Production Company has improved more than the first measure especially in the area of weakness.

Table 2. The different sections of the questionnaire.

No	Main principle of lean culture criteria	Sub- principle of lean culture criteria
1	Continuous improvement	Root cause problem solving. Standardization. Leaders go to Gemba walk. Daily accountability process. Visual controls. Level out the work load.
2	Process focused	Waste reduction. Kaizen training.
3	Mutual respect and trust	Mutual trust. Mutual respect.
4	Employees Involvement	Training learning. Empowerment. Motivation.
5	Consistency	Team work. Communications.
6	Mission	Visionary leadership. Clear goals.
7	Adaptability	Customer focus. Supplier relationships.
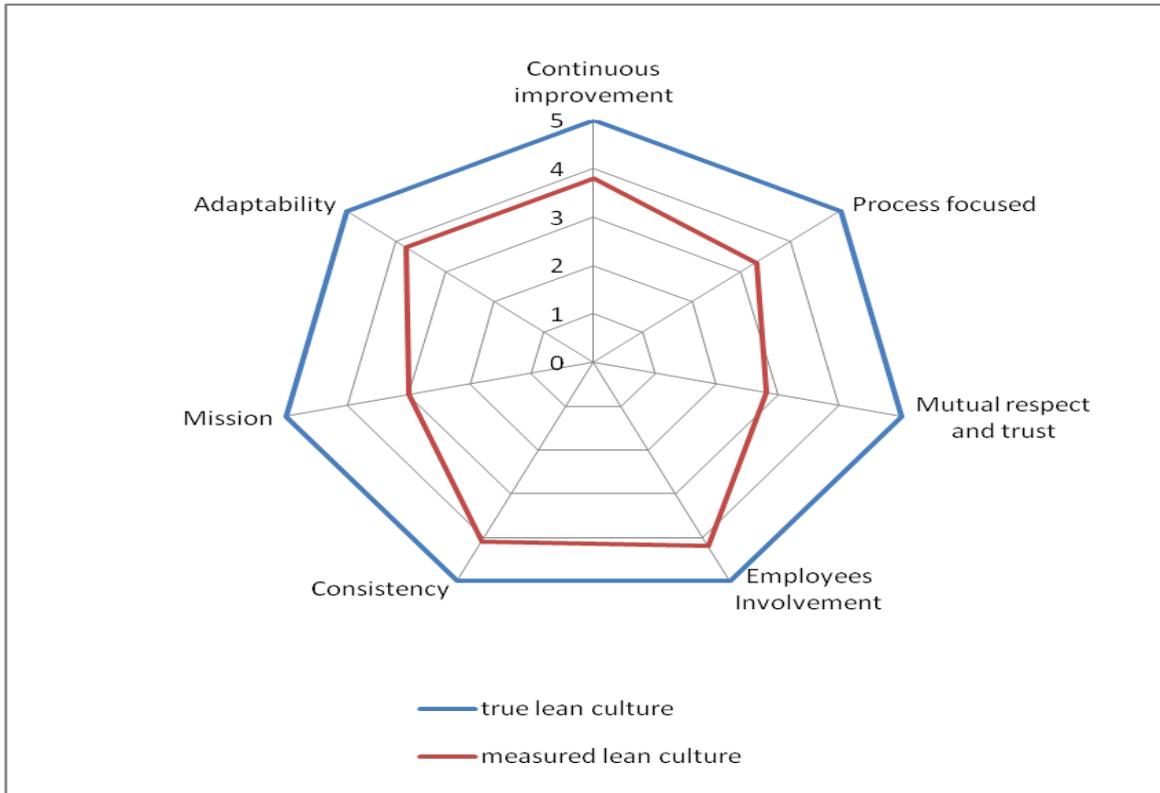
Fig. 2. Lean culture assessment averages for first measure.
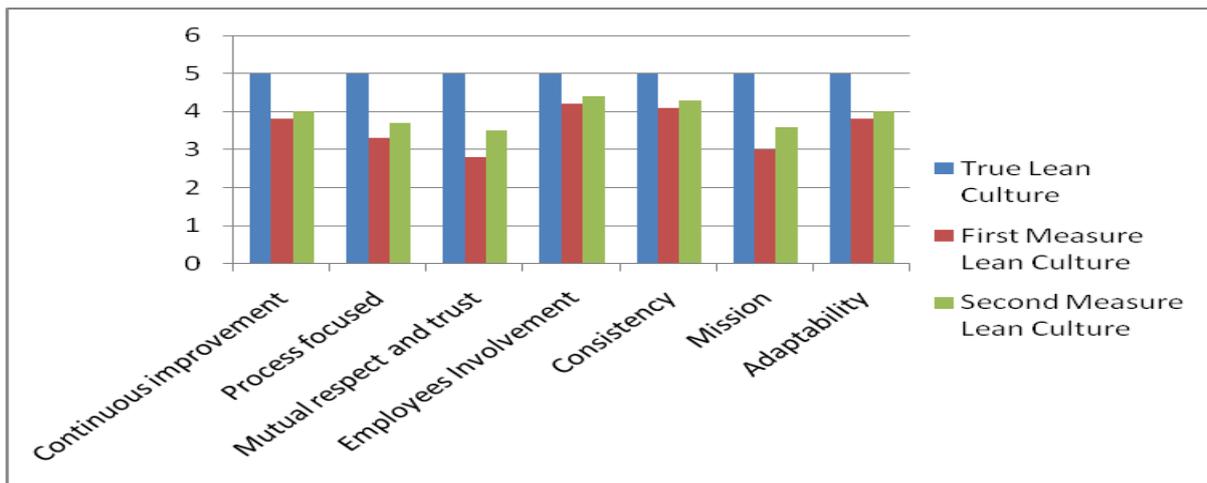
Fig. 3. Lean culture assessment averages for second measure**.**

CONCLUSION

This paper presented a way of how to develop and evaluate lean organizational culture. The organizational culture of Radiator Production Company contains elements of its culture that will provide an initial base that is conducive to the implementation of lean manufacturing principles within the company. This is apparent in the results achieved from the questionnaire designed for this research study, also indicates that it was a reliable and valid method for the research study

and for manufacturing sectors. The successful implementation of lean six sigma techniques and principles will enable the Radiator Production Company to continuously improve that will lead to benefits for the company thus enabling it to remain competitive while also providing benefits for its internal and external customers.

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Appendix A

Lean Culture Assessment questionnaire

COMPANY	
DATE	
DEPARTMENT	

Please note the following:

Please answer all questions openly and honestly to ensure accurate results by placing X on the scale rating which feel that happened in your organization.

Please indicate your level of agreement to the following statements using this scale and take your time for accurate responses:

Please click on a number from 1 to 5 for each statement below:

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

		Lean Culture Criteria	scale				
			1	2	3	4	5
A		**Continuous improvement**					
A1		Root Cause Problem Solving					
	1	Leaders regularly expect cause analysis (5 why analysis) and pursuit of root causes for problems large and small.					
	2	Routine, systematic use of problem solving tools to seek root cause solutions.					
	3	The process is redesigned to avoid occurring of problems.					
	4	I constantly look to identify problems or concerns when performing my job function.					
	5	Solutions and corrective actions are implemented effectively and timeously.					
	6	Develop continuous improvement in the organization through identifying and solving problems.					
	7	I would stop the production process if it was discovered that something was wrong with process or the product.					
A2		Leader Standard Work					
	1	All leaders carry and follow standard work.					
	2	Daily and weekly review by next level.					
	3	Completed documents visually displayed by day of week for each leader.					
	4	Transitions between leaders eased by hand-off of leader standard work.					
	5	Most leaders can identify how standard work benefits.					
	6	I am allowed to contribute to improving procedures and work instructions.					
	7	There are clear procedures and work instructions available in your work area.					
	8	I am allowed to contribute to improving procedures and work instructions.					
	9	My team regularly comes up with possible ideas to improve procedures or works instructions.					

	10	The organization has specific housekeeping standards and targets i.e. 5S's.					
	11	The practice of working safely is important to my everyday work function.					
	12	The organization has clear rules and practices which are important.					
A3	Leaders go to Gemba walk. (walk to the site of problem)						
	1	Daily reviews of a production and related processes.					
	2	Weekly perform audits on processes (i.e., 5S, pull systems, TPM, g).					
	3	Many senior leaders teaching gemba walk to junior leaders.					
	4	Gemba walks regularly held with feedback and assignments.					
	5	Process mistakes beyond production tracking produce task assignments for improvement.					
	6	Paretos of top three misses across many processes drive improvements.					
A4	Daily Accountability Process						
	1	Accountability is routine; boards used effectively for long and short assignments.					
	2	Supervisors use basic project management skills.					
	3	Supervisors support groups integrated into value stream improvement activities.					
	4	There are measuring systems for process performance.					
	5	Leaders focus on comparison of expected and actual performance.					
A5	Visual Controls						
	1	Visuals in regular use for all tasks throughout.					
	2	Tracking data regularly analyzed for trends to spot problems.					
	3	Identified problems followed up for root cause solutions					
	4	Team leader use 5S in work place.					
	5	Team leader visual identifies problems in work place.					
A6	Level out the workload						
	1	Team leader keep the work load is the same for all employees in the team.					
	2	Leader looks for innovative ways to improve and ready to take risks.					
	3	Leader accepts mistakes as learning opportunities.					
	4	Leaders develop sessions focused on applying lean principles and learning Kaizen events which actually redesign processes and deliver results.					
B	**Process focused**						
B1	Waste reduction						
	1	Managers in this organization work to eliminate waste from their own processes average.					
	2	Leader defines all kind of waste for us.					
	3	There is continuous system to decrease the waste.					
	4	I contribute with my team members to decrease the waste from the processes.					
	5	Leaders use the statistic to analysis the process variation and try to decrease it.					
	6	Leader define value stream mapping for all processes.					

	7	Effectiveness and efficiency of any process are improved.					
B2	Kaizen training.						
	1	Daily task assignments from daily tier two and three meetings drive small and large improvements.					
	2	Employee suggestion system established and sustained with steady input of ideas, output of implemented improvements.					
	3	Line leaders identifying and leading improvement activities in their areas.					
	4	Improvement plans and targets visibly displayed at value stream and department boards.					
	5	Many leaders are kaizen facilitators.					
	6	Plants have kaizen and lean resource teams to support local improvement activities.					
	7	Expected performance for all processes defined and documented.					
	8	Process documentation revised as processes change.					
	9	Documented processes match actual processes.					
	10	Managers are actively engaged in process improvement for the process for which they are responsible.					
	11	Managers focus on improving the process rather than blaming people.					
C	**Mutual respect and trust**						
C1	Mutual respect						
	1	Leader's willingness to seek input and look at people when they talk, give them undivided attention; ask follow-on questions during the conversation.					
	2	Respect become deep felt for and by every person in the organization and give freely of their creative abilities.					
	3	Leaders acknowledge the accomplishments of others then give away the credit if things go well, and take the fall if things go poorly.					
	4	I am committed to the main goals of our organization.					
	5	The organization treats all its employees equally with regards to respect, performance and recognition.					
	6	My team leader and manager treat me with respect and dignity.					
	7	My team leader and manager allow me to learn and grow from my mistakes.					
C2	Mutual trust						
	1	There are an atmosphere of trust and respect.					
	2	Employees report failure without fear of blame.					
	3	I am respected and trusted by my fellow employees.					
	4	There is high trust between employees and managers.					
	5	The performance appraisal is true for all process and employees.					
D	**Employees Involvement**						
D1	Learning and training						
	1	Leaders grooming talent for all employees and ensure that the innovation of team members has success to match or even surpass the organization goals.					
	2	Each employee is involved in running the business and helping the organization to meet its goals.					
	3	Organization focuses on upgrading workers' skills and					

		knowledge to improve efficiency and customer service.					
	4	Employees are well informed of the current company development policies.					
	5	Leaders insist to encourage employees to build knowledge in problem solving thinking and countermeasures.					
	6	Employees have appropriate training related to his work.					
	7	There is an annual assessment of my training needs.					
	8	The training repeated every period of time.					
D2	Empowerment						
	1	Number of ideas generated per week from employees for problems solving equal to the number of employees.					
	2	Monthly "Share the Gain" meetings with all employees.					
	3	All employees have the ability to stop the assembly line when they recognize a significant product defect.					
	4	The company is employing competent people for the right positions within the organization.					
	5	The company has an effective induction program when a new employee joins the company.					
	6	There is an annual assessment of my training needs.					
	7	There are documented competencies that are required in my current position and other positions.					
	8	The company assesses employee's competency with regards to their current positions.					
	9	Management provides employees with the tools and authority required to continuously improve their performance.					
	10	All employees feel that they have the responsibility and authority to participate in decision making and problem solving in their appropriate operating levels.					
D3	Motivation						
	1	I feel part of my company and I am proud to tell people were I work.					
	2	I achieve satisfaction when my team and myself achieve our targets or solve problems.					
	3	I feel responsible for my work place and equipment.					
	4	The organization values have a positive impact on my family and myself.					
	5	The leaders of the organization lead by example in maintaining values and the code of conduct.					
	6	I look forward to coming to work in the morning.					
	7	Managers are well trained and competent at motivating and developing employees.					
E	**Consistency**						
E1	Team work						
	1	Managers cooperate with employees.					
	2	People show loyalty toward the organization.					
	3	Team goals dominate individual goals.					
	4	In their work employees try to learn from each other.					
	5	My team has regular team meetings every day.					
	6	My current team members are aware of their roles and responsibilities with the team.					
	7	My team has clear goals and targets that are aligned to the organizational goals and targets.					

	8	My Team leader facilitates problem solving sessions when problems have been identified.					
	9	My team regularly identifies and solves problems as a team					
	10	The organizations various teams are aligned and work together towards a common goal.					
	11	I feel happy and content as a member of my team.					
	12	The company provides team-based recognition and rewards.					
	13	My Team Leader provides a good coaching role and allows me to grow in my current position.					
	14	The training performed by team leader is satisfactory to my job requirements.					
	15	Each team of employees has defined their customers and seeks feedback.					
E2	Communication						
	1	There is a clear communication channel that effectively communicates the company's objectives and performance.					
	2	I am informed of formal and in-formal events happening within the company.					
	3	I am able to openly communicate on issues with my team leader, manager or HR department.					
	4	I receive feedback on ideas and issues that i have raised.					
	5	I feel comfortable that I can discuss problems with my team leader or manager.					
	6	Employees are regularly given feedback on safety incidents and their corrective actions.					
	7	Employees receive regular feedback on quality issues from customers.					
F	**Mission**						
F1	Visionary leadership						
	1	Leaders communicate the organization's vision for the future and focuses on the leadership team.					
	2	Leaders changed the way we interacted with employees.					
	3	Leaders identify for the major barriers that need to be overcome in order to achieve the organization vision.					
	4	Employees share their views and ideas on how to reduce waste and improve processes.					
	5	Leaders clarify vision, mission and values of organization.					
	6	Supervisors understand standard work.					
	7	Management commit with time and resources.					
F2	Clear goals						
	1	Leaders clarify the organization's goals for every level.					
	2	Leaders develop a transparent metrics understands by individual levels.					
	3	Every employee knows what the organization is looking to accomplish.					
	4	Every employee knows how their individual role contributes to the achievement of organization vision.					
G	**Adaptability**						
G1	Customer focus						
	1	Leaders focus in defining the customer requirements to provide the customer exactly the right product, on time and without flaws.					

	2	There is a file for customers' ideas and requirements.					
	3	Team leaders organize a regular meeting with customer monthly.					
	4	Leaders focus in updating the customer satisfaction index.					
	5	Management develops metrics for measurements of success from the voice of the customer.					
	6	Team leaders focus in decreases the waste.					
	7	We have the ability to access information quickly and easily about the customers.					
	8	Customer requirements are clearly understood by everyone in the organization.					
	9	Presence of effective website to collecting feedback from the customers.					
	10	Leaders provide training for employees in how to change to meet customer requirements in minimum time available.					
	11	Presence a system to predict the customer requirements.					
G2	Supplier relationships						
	1	Presence a system to collects Periodic feedback from partners and suppliers.					
	2	Team leaders organize a regular meeting with partners and suppliers monthly.					
	3	Leaders foster regular communication channel within and between work cells and also outside your department					
	4	All material provided by supplier are accepted every time.					
	5	We have minimum number of suppliers.					