Lean Manufacturing Basics

Aza Badurdeen

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By Aza Badurdeen

Who am I?

I am a process engineer. I fell in love with lean manufacturing some years back when I did a thesis on lean manufacturing. I firmly believe that lean manufacturing is the best way to overcome most of the problems faced by manufacturing industry. It is my pleasure to see your thoughts on my e-book.

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For my parents

And teachers

Content

History of lean manufacturing

It is a popular fact that JIT system started in the initial years after the World War II in Japan for the Toyota automobile system. Toyoda family in Japan decided to change their automatic loom manufacturing business to the automobile business. But they had few problems to overcome. They could not compete with the giants like Ford in the foreign markets. Therefore Toyota had to depend upon the small local markets. They also had to bring down the raw materials from out side. Also they had to produce in small batches. They haven't had much of capital to work with. Therefore capital was very important. With these constrains Taiichi Ohno took over the challenge of achieving the impossible. With his right hand man Dr. Sheigo Shingo for next three decades he built the Toyota production system or the Just In Time system.

Although the concept was mastered in Japan for the Toyota production system, the roots of this concept goes into the sixteenth century. Eli Whitney's concept of interchangeable parts said to be the very initial beginning of this concept. But first or at least famous implementation of something similar to JIT happened a century later in manufacturing of Ford Model T (in 1910) automobile design. Manufacturing was based on line assembly. Every part

moved without interruptions to the next value adding point. Parts are manufactured and assembled in a continuous flow. Even Henry Ford may not have understood the basics behind his system. But it saved lots of money and made Henry Ford a richest on the planet at that time. Although very successful in the initial years, Ford system had it drawbacks. One of the major drawbacks was that it's inability to the change. This was due to the push strategy implemented in the Fords system. They relied on keeping machine busy without thinking about the final outcome. They had huge stocks in the form of finished goods and in the form of Work In Progress. This led to the inflexibility of the system. Also this wasted money unnoticed. Another major draw back of the system was the poor handling of the human resource. This led to have a less motivated set of people in the organization.

But in Japan, they studied the system very well and saw the problems that Ford system had. But the core concept of the Ford system was obeyed. This is the continuous flow of value system. Anything distracting it treated as a waste. Various pioneered work from people like Deming and Juran in the field of quality improvement was used in the system. This bought built in quality to the system. More importantly Ohno and Shingo understood the drawbacks in the push system and understood the role played by the inventory. This led to

Pull system rather than the push system, where the parts are produced only when they are pulled by the process before that. This is similar to the concepts in the super markets. When the shells are being emptied (that is when people buy the product), they are refilled with new ones.

This system developed in Toyota from 1949 to 1975 virtually unnoticed by the others even within Japan. But in the oil crisis in 1973 Japan economy suffered and most of the industries had losses. But Toyota overcame these problems. They stood out from the rest. This was the eye opener for other Japanese firms to implement this system. But this system got popular in the western world with the book “The machine that change the world” written by James Womack in 1990. This book was aimed to give the history of the automobile with the plant details of some of these manufacturers. He gave the name “Lean Manufacturing to this system”. This was the eye opener for the western world about this system. Thereafter the concepts were practiced allover the world. Experiences and knowledge vastly improved the system.

But there were many people who just tried to use the tools in lean manufacturing without understanding the meaning of them. They eventually failed. But there are number of places this system is working well. The

complete elimination waste is the target of the system. This concept is vitally important today since in today's highly competitive world there is nothing we can waste.

Even today this system adds to its history. Therefore there will be a lot to add to this chapter in the coming years.

Basic Lean Manufacturing Principles

We shall learn some of the basic lean manufacturing principles with some keywords used in lean manufacturing. By understanding these key words you will understand the basics of lean manufacturing, which is very important in success

Lean manufacturing defines the value of a product or a service with the customer point of view. Customers do not mind how hard you work or what is the technology you used to create the product or service you are selling to them. They will evaluate your product or the service by looking at how well this is going to fulfill their requirements.

Customers do not need to pay for the quality defects you have removed from your production lines. They also do not need to pay for the huge amounts of Over Head costs you have back in your facility. They will pay for the fulfillment of their requirements with the product or service you are providing to them. Simple isn't it.

With this I think why should be a good quality product always said to costly than a lower quality one. For me the good quality product should be cheaper.

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Why I am saying this. Because if any manufactures produce a good quality product it will cost them much low than producing a low quality one, since all the costs related to maintain the quality checks, replace the damages etc should be saved. But in the today's markets they refer to the better quality among the lower quality ones. The quality is not embedded from the manufacturing. Quality products are chosen among the average or bad quality products. Therefore it is obvious that the customers will define the value differently to the manufacturer. It does not matter much how valuable the product or service to the manufacturer. What does matter is how valuable they are for the customer. So put the glasses of the customer in defining value.

What do you see as a waste in your organization? Product with defects, bundle of waste papers, a light turned on unnecessarily or even a person taking a private call from the office Telephone. Yes of cause these are wastes. But do they account for the 70% - 95% of the resources wasted in your organization alone. No I am not mistaken, each and every organization wastes up to 95% of their resources, while most commonly this value exceeding 70%. Even the best lean manufacturers wastes up to 30% of their resources. So it is obvious that there are serious wastes that are hidden or yet to be discovered in your organization.

Knowing the scale of the wastes, it is worthy to know exactly a waste according to lean manufacturing. In lean manufacturing the wastes are defined as anything which does not add value to the end product. If customer sees the value with the end product, it is very much fair to define a waste in this way. Customers do not mind how much it costs you to repair damage, cost for your huge stocks and stores or other over heads.

Of cause there are wastes that can be avoided. But some are unavoidable to many reasons. For an example due to technical concerns. But let me tell you. Most of these wastes are avoidable. Even worst is that they are avoidable with very little effort, if you see them as wastes. Therefore think all over again with a refreshed mind. There will be many many wastes appearing in your organization. With that you will be finding many and many ways to get read of them. Keep in mind, every waste shows an opportunity for the improvement. We will cover more on this in a later topic.

When you identify the wastes and categorize them in to avoidable and unavoidable, you have to think about removing the wastes from the system. You must clearly understand that lean manufacturing always talks about removing, not minimizing. These two words have very different meanings. When ever you talk about minimizing, it implies that there are wastes in the

system in different quantity. But what lean manufacturing does is, it aims at removing the wastes from the system. Simply when there is a waste, simply get read of it.

Every problem in the system has a cause for it. Sometimes one or more root causes for a problem. One root cause even can contribute for more than one problem. For an example if you have frequent machine breakdowns, the root cause for this might be low skilled maintenance people. So how to overcome this problem. Should you dismiss the maintenance people? No, you should not get read of the people. You have to improve the skills of them with training and teaching. Of cause if you can not improve the skills of a person then you can think about giving him a transfer to another department or changing his job role. Lean manufacturing does not support dismissing people.

When you clearly understand the problems and their causes, then it is the time to find out the solutions. There are many ways that you can find solutions in lean manufacturing. Lean manufacturing solutions are more often very simple and very effective. This kind of problem solving requires people who can think differently or creatively. Sometimes simplest innovative thinking can change your world completely. In today's world where you want to be, is only a thought away.

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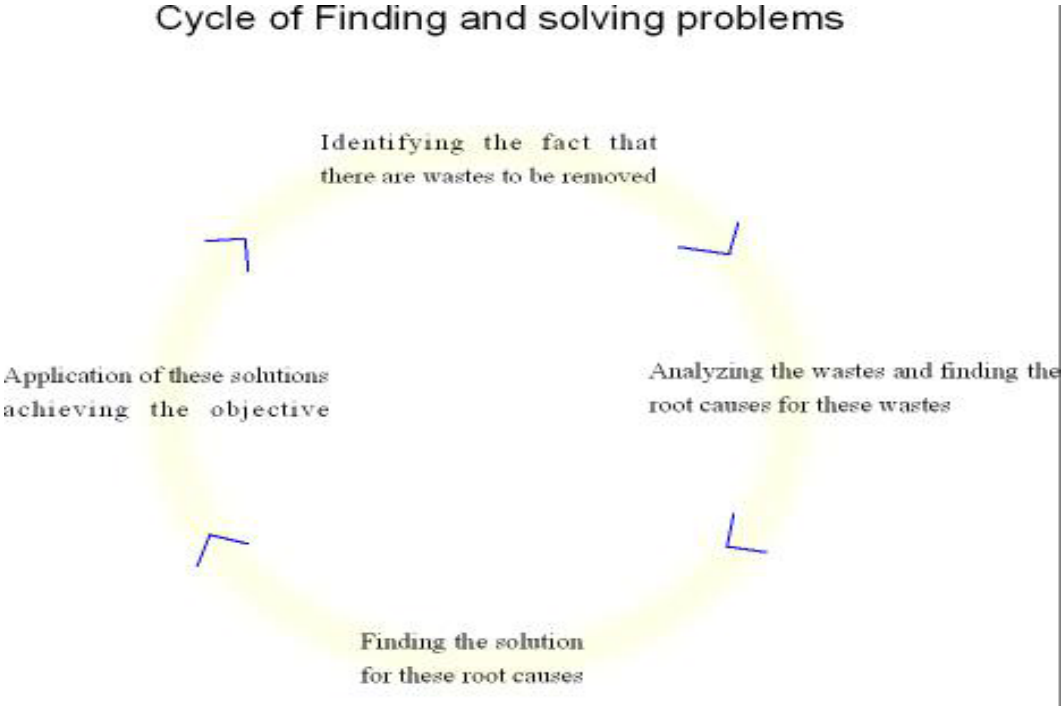
When you find the solution to the problem, then it is the time to implement the solution and to make sure that you achieve your objectives.

Problems are solved in this way over and over again. This is the cyclic concept of lean manufacturing. Lean manufacturing believes that each and every activity is interconnected. Therefore one advancement in one place will increase the system as a whole. Therefore this cycle of identifying, finding root causes, finding solutions and implementing will go on and on again and again. This process will continuous until there are wastes to be removed. Do not worry, for you this cycle will never end. Therefore you will have increments in your total productivity everyday. Remember even the best lean manufactures wastes 30% of their resources



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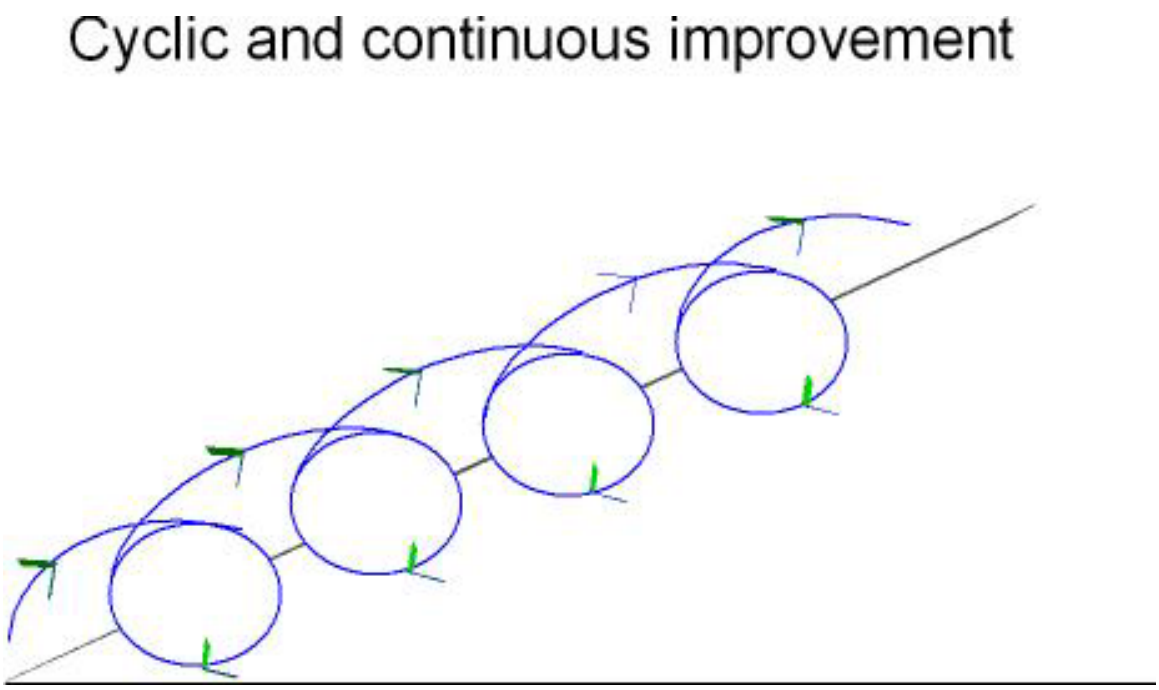
What are the solutions for your problems?. How to find them? Are you afraid? No need to. Lean manufacturing give priority to the simple, small, continuous improvement, rather than big innovations. Of cause there is enough room to absorb big advancements in the system. But the priority is set for the continuous improvement. These improvements might be very simple as adjusting the height of a seat or changing the position of the tools which you use frequently. Every simple improvement will improve the system as whole. Therefore final objective is one more step closer as an organization. Lean manufacturing is the way to never ending continuous improvement. This is also known as the Kaizen in lean manufacturing.



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Team building is one of the most important aspects of lean manufacturing. As I explained earlier lean manufacturing treat the organization as a single unit. Therefore departmental thinking will not be good in lean manufacturing. This is applicable to individuals working in the organization. They are lead to the ultimate objective of the organization, with various job functions. They are made into teams sometimes cross functional teams to accomplish the objectives of the organization.

Every job has to be supported by many other people. Therefore no organization can succeed if the workers are only concentrated about themselves, and play individually. This is why almost all the organizations around the glob are trying to build the team working culture in their organization. Good team means better future. So it is crucial to learn the art of team building to survive in today's tough, competitive world.

People will not change over night and will not become good team players. Top management must set the goals and must communicate these goals with their subordinates. Even setting the goals after talking to subordinates will help immensely in achieving them. After setting the goals you have to guide and lead people to achieve these goals and objectives. Therefore Leadership is immensely important in lean manufacturing. Lean manufacturing is something

much to do with hearts and minds of the people, rather than the equipments and capital. Therefore managing and leading the human resource has paramount importance.

When your organization is in the changing phase from conventional manufacturing to lean manufacturing, there will be a big resistance to change from the people. Not only floor level workers, but also the management will give you tons of negative inputs regarding the change. This is known as the resistance to change. This is the human nature. Therefore there is nothing to worry about. Simply manage this and you will be able to drive out the fear from the hearts of the people and will be able to get best out from the change.

When organization is changed from conventional to lean manufacturing, people tend to relax and go flat. So how to refresh them continuously and getting best out of them. You have to motivate them continuously. Understand the requirements of the people, and talk to their requirements and fulfill them. All the individuals love to be on their own and get direct credit for their work. In a team working environment there is a strong possibility of talented people get de motivated. So it is very necessary to give some attention to individuals with very high talents. Maslow's need hierarchy is one way to understand the requirement of the people better.

According to this hierarchy people have an order of requirements where only when the lower a level need is satisfied they will look into higher level needs. For an example they will not look to satisfy their esteem needs until their basic requirements like food, water and shelter is satisfied. Actually it is an art and a science not only to motivate others but also to motivate your self. So learn how to motivate yourself and people working with you.

After setting up the facility to fulfill the lean manufacturing requirements, how do you know whether your facility is working according to the way you intended? Of cause there are many ways. But one direct reflection of the effectiveness is the amount of inventory maintained. Every imperfection in the system creates the requirement for the inventory. For an example every

machine stoppage, not to stop whole manufacturing process must have a higher inventory. Although inventory itself a waste it a valuable reflection of the problems that the system has. No WIP means no problems. The relationship is very simple.

What really does matter is being productive. No waste means you are productive. But there are ways still to increase your productivity further. One important lesson that lean manufacturing teaches us is that is the fact “Being busy is not good enough”. But you have to be productive. Not productive individually, but being productive collectively as an organization. It doesn’t matter how productive you are as an individual or as a department, what counts at the end is how productive you are as an organization.

With no work in progress, with really productive work place you must always target to become the ideal factory described in the lean manufacturing.

Manufacturing wastes

Waste is defined as anything that does not add value to the final product. As I explained earlier, the wastes are everywhere in many different forms. Every organization wastes majority of their resources. Therefore it is worthier to have a closer look at these wastes. For the ease of understanding these and due to many other similarities, these wastes are categorized in to seven categories. In some instances one extra category is added to make the total of eight waste categories. Since I feel this eighth category is very important I will go by this categorization. Every waste you will come across in your organization or even in day-to-day life will fall into one of these categories.

Following are these waste categories.

- ✓ Over production
- ✓ Waiting
- ✓ Work In Progress (WIP)
- ✓ Transportation
- ✓ Inappropriate processing
- ✓ Excess motion or ergonomic problems
- ✓ Defected products
- ✓ Underutilization of employees

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Although in deferent groups, each one of these is interconnected. Therefore one change will affect the total system. You will see later in this chapter how closely these are interconnected to make the mesh of wastes in every organization.

Now we shall have a closer look on each of these categories.

Over Production

The word over production can be used to describe a type of waste which is in most of the places and we never think this as a waste. This is producing something before it is actually required. This can be applied to the bigger picture or in more localized sense.

In the bigger picture, this is equivalent to create a product or a service before it is actually required. Lean manufacturing always trust on the pulling rather than pushing. This means that every product or a service must be pulled from the process immediately after that. Therefore a product or a service must be pulled by the customer. In much more simpler way, customer must have the real requirement for the product or the service being produced. If you produce the goods without any stimulation from the market, then either you will have to

keep the product with you until there is a market for that product or you have to create the market stimulation with huge advertising campaigns etc. this is known as the push strategy. Still you will not have the guaranty that this will be able to sell the products without wastages.

In the much smaller picture, the word over production might mean producing a part of a product before it is required by the assembly line or the process after that. For an example there is no point of making more receivers than the phones intended to be produced. The extra amount will be a lost.

Over production accounts for many loses. One is the waste due to unnecessary parts. This also will make the WIP higher. Flow will not be smoother. This obviously leads to low quality products and defects as quality problems are hidden in the WIP maintained due to over production.

Waiting

In conventional batch processing, some studies show that 90% of the time goods are waiting to be processed. Some even say this is higher as 99%. Even a single minute lost in waiting can not be recovered in the process there after. Think carefully. Analyze how long the products are waiting against the time used for processing them. I am sure you will be shocked. This is one big contributory factor for the higher lead times. This simply means you take 100 hours or more to complete work which is worthier only 10 hours. Ninety hours or more is lost and added to the lead time. No waiting means you can deliver the goods within 10 days which actually took 100 days earlier. Think about the flexibility you will get with this. If you can do this, you are there to compete with the changing markets and react to the changes very fast, even before your competitors think about it. This will also reduce the WIP and tons of related problems. Also considerable savings on the production space and reduction in work in capital can be achieved. Among the cause of this problem is due to the high volume machinery, unawareness of the people, and conventional thinking of the people play leading roles.

Work In Progress

Work in progress or WIP is a direct result of over production and waiting. Every imperfection in the system will create a requirement for the WIP. Therefore WIP also known as the mirror of the wastes that system has. But WIP it self becomes a waste due to many consequences. It blocks money in the form of not finished products. It also reduces the flexibility of the production facility by increasing the change over time between different styles. It hides quality damages, and will only be revealed when a considerable damage is done. Higher WIP also requires larger floor space. This will also affect the appearance of the work place badly. Therefore if you want to be perfect, just target for a system where there is no requirement for WIP.

Transportation

No matter how well you do transporting. It does not add value to the end product. Therefore simply transportation is one of the wastes that have to be eliminated from the production system. This accounts for the quality defects, maintenance of a higher WIP, and additional cost of transporting the goods. Transportation often caused by poor work place organization.

Inflexibility of the layout plays a big role here. This can be avoided with careful re designing of the layouts.

Inappropriate processing

This is the using incorrect tools for the job. This does not mean that you should use complicated or expensive tools to do the job. It is about using the correct tool for the correct job. Low cost automation is one program where Toyota found to be really effective. Developing such tools can be done with the aid of workers, because they know the job they do more than anyone. Then this will become a very good way of motivating people as well. The enemy for this system is the mind set of the people who work in the organization. People naturally think like best equipment for the job is expensive and complex. So how to overcome this problem, which will not only save money for you but also motivate people immensely. Very simple. Change the mind set of the people by education and training. Also create a culture of continuous improvement. Then people will always look for the better ways of doing things, which creates opportunity for these kinds of innovations.

Excess motions

This waste is often overlooked. When performing a certain task people have to repeat their motions again and again. Although we do not realize, in many places people will have to move, bend or reach to collect some part or to reach a machine. If a time study can be done to check the percentage of the time for these unnecessary movements, you will see it is actually very high than you think. Even the other ergonomic conditions like correct lighting, tool arrangement, work process management is essential to achieve a good productivity from the people poor conditions are not good for the health of the worker obviously. Also this will waste large amounts of time. Workplaces will become very untidy. Workers will get tired easily. The reason for this is poor workplace organization. To overcome this problem, a detailed study has to be carried out about working conditions. Then they have to be re arranged to eliminate these problems. Even some simple equipment change like from normal chairs to movable and adjustable chairs will solve some problems. But some problems will need very good workplace engineering to overcome.

Defected products

All the above are wastes themselves. But they lead to another waste which is extremely costly. These are the defected product. In the case of services this is the poor quality of the service. Defects call for higher inspection and related costs. If you find a defect, you will have to remove it. The raw materials, time, effort and the money put in to this product will be wasted. Even worst, if this defected product goes to the customers hand you will loose the image for your organization. Also there is a risk of claims. In the long run this will be a big cost for the organization. Damage in a single dollar product can create millions of dollars of lost to your organization. As I mentioned earlier all the above wastes, poor raw material, mistakes from the workers, problems in the system, machinery problems and much more accounts for this problem. So removing this from the system is long time task. Making the system fool proofed, getting good quality raw material, educating people are among the solutions for this.

Underutilization of human resource

As I mentioned earlier in the chapter, the eighth waste for me the largest of the all. But most people do not think this as a waste. Think about Japan. They are not a nation blessed with natural resources as other countries. But they are in the top of the world today. How they managed to do this. Simply by using their human resource to its full potential.

Every worker, even the people do the most routine job in the organization will have something to contribute to the organization than their muscle power. Think about a floor cleaner. If you ask him, how to clean the floor much faster, I am sure they will come up with some fantastic ideas.

What lean manufacturing tries to do is to get ideas from all level of the people in the organization and to use them for the betterment of the organization. Therefore not making the full use of the human resource is a waste. Wasting this without using to fight against the wastes is the biggest loss for the organization.

Most of the times the human talents are deteriorated because they are not identified by the decision makers. Decision makers do not have the mind set

of managing human resource productively. Also most of the organizations do not have a proper system to use the talents of the people. They also do not have a good motivation and rewarding system for the talents. If people are not being rewarded, they will not come out with their full potential.

Overcoming this problem is a very long termed task. But even some simple techniques can give you good results. You can simply keep a suggestion box and ask people to put their ideas into it to regarding the productivity improvement. Motivate them with some cash or with recognition. See the results. You will have a potential of saving lot of money. More than that people will get motivated and will have a chain effect. Human brains and hearts are valuable even than the most expensive machinery in the world.

Can all the wastes be avoided?

If I am to give a more theoretical answer for the above question, the answer is yes. Yes you can avoid all the wastes in the system in theory. But in practical situations removing all the wastes might not be possible. Some might be not possible due to technical concerns; some are due to various obvious factors. For an example you have to transport the goods at least a little amount even within the working flow without adding any value to that. Anyway you will have

to get down the raw materials for the manufacturing of product from far places. These can not be avoided. If you try to avoid some of these wastes that will cost you much more in the bigger picture. Always remember the bigger picture is what that always matters.

Therefore it is very important to categorize the wastes according to availability of them. When you do that all the wastes in the organization will fall in to the one of the following two categories.

- ✓ wastes that are avoidable
- ✓ wastes that are unavoidable

Deciding what are the avoidable and what are unavoidable will require some good decision making. Lot of learning, experimenting and thinking has to go into this process. When you decide on this or at least have some idea about the wastes which are avoidable, then it is the time to understand the importance of removing each waste from the system. A tool like pareto curve will be an ideal tool to understand the problems according to their importance of removing them.

Always you have to give the importance to the bigger picture to stop creating a new waste in the system in the effort of removing one. Always an overall reduction should be there.

What about the other wastes which we thought un removable. Should they remain untouched? No, not at all. With the time there are new technologies, and many developments coming on. Also when you are removing some of the problems from the avoidable category, you fill find the ways to tackle some problems in this category as well. Therefore nothing is permanent. You will get tons of chances to overcome these problems. So stay focused.

Lean Manufacturing tools

Lean manufacturing is based on continuous finding and removal of the wastes. Value is defined from the customers point of view. Therefore all the tools in lean manufacturing aim to identify and remove wastes from the system continuously. There are four steps in implementing lean manufacturing. They are;

1. Identifying the fact that there are wastes to be removed
2. Analyzing the wastes and finding the root causes for these wastes
3. Finding the solution for these root causes
4. Application of these solutions and achieving the objective

When this is done go back to the stage 1 and continue this loop over and over again.

To become lean it is very necessary to understand the fact that wastes are there. You must also be able to find out where these wastes do exist. Then you will be able to find out the root causes for these problems and then come up with a way to solve it. To find out where in the process these wastes exist there is a very powerful and simple tool. This well known tool is process mapping.

Process map simply maps all the processes and the activities which are carried out in bringing a specific product or a service in to a reality. Irrelevant of the value they add to the final product or the service, the process map includes all the activities from the point of development or order inquiry to making and shipping the goods and up to the point where customer collects the goods.

By sticking to a single product or a service you will find it very easy to make the process map. This also makes it easy to understand the process when someone refers to the process map. Or another way you can create a map which is simpler and easy to understand is by creating a overall map with all the departments and their interconnectivity, and then map the processes within the departments separately. This way you will get a good map which is simpler to understand and much more conclusive. You can use the standard symbols used in the process mapping to create a process map which can be understand by all the people easily.

When you map the process, you will start to see the;

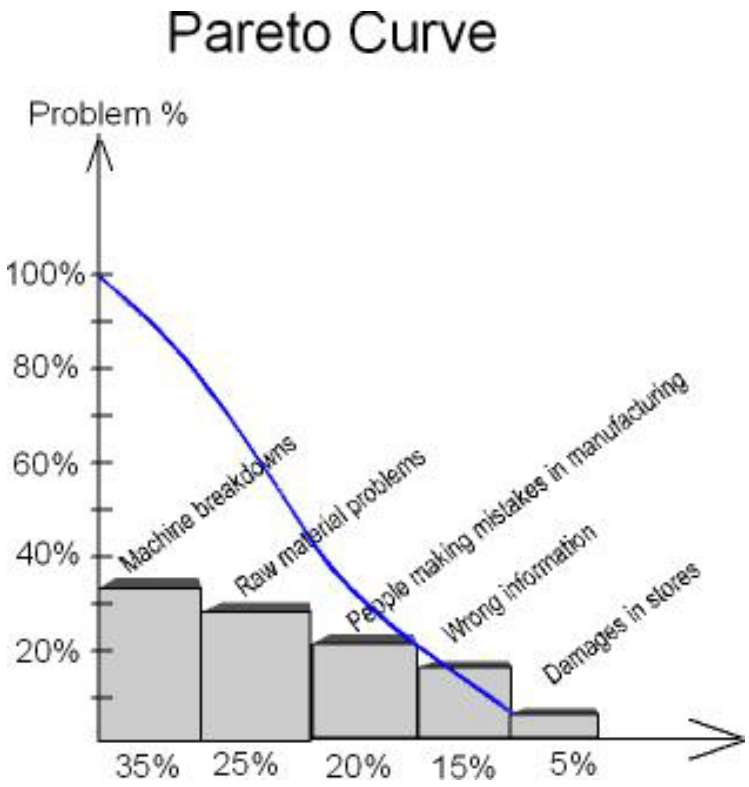
1. Value added and
2. Non value added activities

You will also have better idea of what are the avoidable, non value added activities and what are the non value added unavoidable activities.

After understanding these clearly, you have to create the process map for the future. This will include only the value added activities and the non value added but unavoidable activities. The process changes and the lay out changes etc are also possible in creating this ideal layout. This is so important since there after your aim is to get this ideal position. This will be the aim for your future.

By now you have clearly understand the wastes that you have to remove from the system. But what should be given the priority. Finding the order of the problems that should be according to the priority of talking is one of the very important issues to be addressed correctly.

One tool which is very important in this is the “Pareto Analysis” or the “Pareto Curve”. This will give you the importance of each problem to the system. Then you will be able to tackle the problems easily according to their importance. Refer to the chat below.



After finding out the order of talking of the problems, you have to find out the root causes for these problems in order to avoid these problems. For an example if you have frequent machine breakdowns, you will find the cause for this problem is untrained workers, poor maintenance, poor quality machinery used etc. then you will be able to analyze these causes again find out the causes for them as well. For an example why the staff is not trained properly is because most of them are new and have not had enough time to be trained. Then you will be able to come up with a way of training people when they just join in so that you will avoid this problem. It is generally advised that not to go than three steps down the line in finding root causes.

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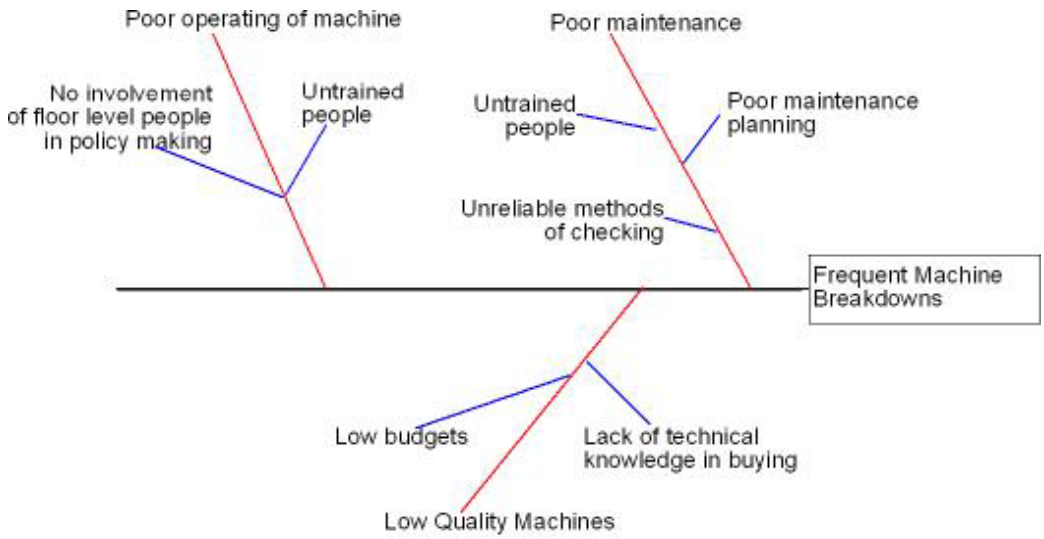
One tool which is extremely important in understanding the root causes of the problems is brain storming. Also various data collection techniques and analyzing techniques will help in finding out these root causes. Representing these root causes and their relevance to the immediate problem can be achieved with a cause effect diagram or a “Ishikawa Diagram”.



Ishikawa Diagram

Ok, now you know what are the wastes that your organization as and you also know what is the taking order for these problems. You also know the root causes for the selected problems. After knowing all these facts, now is the time to move to the problem solving process.

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Lean manufacturing offers few readymade and well proven solutions for any industry. But always you have to customize these solutions to suit your organization. Always keep in mind, lean manufacturing does not start with the tools, it starts with lean thinking.

OK. Now we shall have a look at few lean manufacturing solutions.

JIT (Just In Time)

Often this term JIT is used with JIT interchangeably. It is that much interconnected with lean manufacturing; in fact JIT is the backbone of the lean manufacturing. Actually the concept grew first with the Toyota system was the JIT. Then it developed to the lean manufacturing.

JIT is one key way to get read of most of the wastes which we have already discussed in the early chapters. JIT concepts are based on the pull demand model. Everything is done when they are actually needed. JIT has three main areas.

- JIT purchasing
- JIT Production
- JIT distribution

Purchasing is done when the goods are actually needed by the production. No large stocks are maintained. Often purchasing is done in small batches continuously. This allow production to run smoothly. This will also reduce the costs due to storage, and also will minimize the degrading of the goods. This way it is easy to monitor quality defects and correct them if there are any in the subsequent batches. Also this will help to achieve shorter lead-times in the production.

But achieving this has problems to overcome. First of all the supplier base of the organization should be manageable. Then they have to agree to produce in small batches and send them in the continuously. Minimum order quantity issues must be solved. The supplier must be able to adjust to the changes fast and also he must be able to keep the correct quality from batch to the other. And there may be much more problems to overcome. To overcome this corporate level involvement is very much required. When achieved this will mutually benefit both you and your supplier.

JIT manufacturing might be the most talked topic of all lean manufacturing techniques. This requires very good internal coordination and planning. All the tools we are going to discuss in this chapter will help achieving this objective. Even within the manufacturing area, pull demand concepts are used. The

items are produced only when they are required by the process following it. No stocks are maintained. This will reduce the costs due to WIP. This will also reduce the cycle time of the product, and therefore will improve the flexibility of the system immensely. This will also reduce the lead time considerably. Quality defects will be much lower since WIP is very low.

Achieving JIT manufacturing is again not an easy task. Most of the time this requires a radical change in the organization. Work will change from the conventional departmental thinking to the new team thinking. Manufacturing will change from the line system to the module or work cell based manufacturing. Every problem will cause the system to stop since there is no WIP to work with. All the problems hidden in the WIP will be revealed. Some people might not like the system. In short there will be tons of problems to be solved. This requires some courage and temperament.

It is true to say that most of the problems in achieving JIT manufacturing is has to deal with the human side of the problem. People do not like to change if there is no motivation to do so. People will fear about their jobs. They can bring lots of negative thoughts to this. Of cause negative thoughts are important. Why I am saying this is these negative thoughts might bring some real problems which we have never addressed before.

You will have to deal with these problems very carefully. One thing that you have to do first of all is driving out the fear with this change. Specially regarding their jobs. You have to take their participation in the process and let them to understand themselves that this is not something that should be feared about. You have to motivate people by continuous education about the new system. One smart idea may be to use the same names which they are familiar before for the new systems. For an example use the word bin card instead of a kanban card. People will feel immensely comfortable with the names they have been using before. You also will not loose anything, as far as you are applying the kanban techniques in your production.

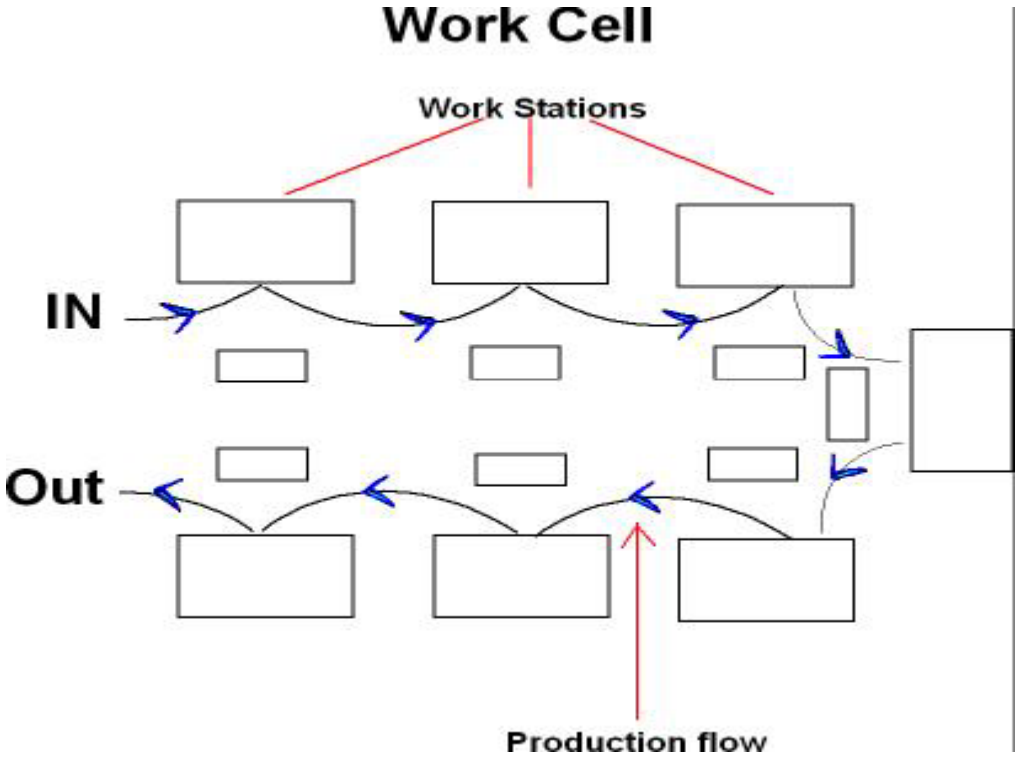
Apart from these problems there are very serious of problems which has to be dealt with transporting the goods. Since there will not be much of a stock to rely on, every load of goods is very important for smooth production run. Any delay will be very costly.

To achieve a smooth production without any delays in production and to distribute the goods in small batches to the buyers in continuous basis, it is very important to keep a good transportation management system. Generally this is known as the JIT distribution. Without this any of the lean objectives might not be possible. Most often this function is given to a third party logistic

company, who will take care of JIT distribution. On time, uninterrupted data exchange is very vital in this. Therefore it is advisable of using a electronic way of data interchange. It is also very much necessary to automate this data transfer function to avoid any delays and mistakes in duplication.

Work Cells

Work cell concept is another concept developed with the JIT. Work place is arranged in to a cell which is in the shape of English letter “U”. in a work cell there will be 3-12 people depending on the job task performed by this cell. There will be many cells which will complete the total product by working together. People who are in this cell are multi skilled and can perform multiple tasks according to the requirement. One of the main advantages of the work cell is the less movement and lesser transportation. Also this will reduce the over production considerably. This will also give very high flexibility to the entire production system since changing from one product to another is very easy. Sometimes it may require changing one work cell to produce a completely new product. Team working culture is very important in a process like this. Therefore good leadership is very much required. Every performance is measured in the team basis. Therefore motivation must be there for all the people working in the cell to work for a common objective.



Kanban tooling

Kanban is one of most popular tools in lean manufacturing. This is a simple concept, but very effective. Kanban mainly focus on the reduction of overproduction. There are mainly two types of kanbans. They are

Withdrawal kanban

Production kanban

Withdrawal kanban is the common type, which is actually a request from the process before that. This specifies the quantity that the succeeding process

should take from the process before that. On the other hand production kanban specifies the amount of products to be made in the next process with the goods created in the process before that.

This might take a form of a simple card which has the details of the product, qty and the storage location of that particular product. This even may be a sophisticated electronic data exchange process. No matter what, the final objective must be achieved and it should be an efficient process.

Various standardization techniques

One of the main problems will be faced by any lean manufacturer in the initial stage is preventing of line stoppages. One main reason for this is the system containing none standardizes work. Therefore any lean manufacturer has to make the processes standard and tooling and arrangements standard to achieve the goals of lean manufacturing. Instead of having many tools and many different adjustments, it is very useful to have narrow range of adjustments and tools which matches these precisely. Also there should be a good workplace arrangement so that it will be very easy to take and replace what exactly you need without even looking at that. This will save lot of time and prevent lots of silly problems.

One of the very important standardization tools used in lean manufacturing is the concept of 5S. This might be well known even to the people who are not even lean manufacturers. But I feel this has a much wider meaning than we normally think. We shall discuss this topic later in this chapter.

1. Seiri
2. Seiton
3. Seiso
4. Seiketsu
5. Shitsuke

Seiri refers to the sorting items according to their importance of use and discarding the items which are not useful. In the micro picture you can use this concept to clean the workplace and keeping only the necessary things on the workstation. But in broader picture you will see this as identification and removing all the unnecessary processes in the organization.

Seiton refers to the arranging of the selected items in a well organized and meaningful manner. This is like keeping the tools used frequently near to the worker. In the bigger picture this is equivalent to re arranging the work process so that work will be much more efficient. This will help in making a workplace which is fool proofed, that is there is very little or no room for silly mistakes to occur.

Seiso refers to keeping the workplace clean. In the bigger picture this might be equivalent of having a continuous process of identification and removal of wastes.

Seiketsu is continuously following the above three rules to achieve a good and organized work place.

Shitsuke is training and motivating the people to follow these good practices simply as a part of their day to day life. This is very much important for any organization since everyone should have the discipline to achieve the objective of the organization. It is also very important to make this process self driven so that there is no extra effort is required from the people.

Correct tooling for the job

It is not the most expensive or most sophisticated tool which will solve your problem. It is the most suitable tool and correct usage of that tool will solve the problem. Therefore it is very necessary to choose correct tools to complete the job. Often this will be a very low cost tool. And this might be made with the help of the people working in the organization. These suggestions also might come from the people actually does the job. Therefore

this is very good way to identify and solve the problems. Also this will motivate people to think about the new ways of doing things. This process will make the chain reaction of continuous improvement. End result will be a very low cost and highly effective way of doing things. But I am not saying that every problem can be solved like this. Some problems require experts to solve and sometimes new machinery to correct. But most of the problems are from the first kind.

Total Productive Maintenance (TPM)

Maintenance function is very important aspect which ensures smooth running of a production facility. In lean manufacturing one machine breakdown will not be just another breakdown since it can hold the entire production flow as there is no WIP to consume in the time of the machine breakdown. Therefore it is very important to have a correct maintenance process to become a lean manufacturer. TPM has three main areas. They are

Preventive maintenance

Corrective maintenance

Maintenance prevention

Preventive maintenance is to continuous checking and prevention of major maintenance. Regular checkups are planed and carried over. Each and every person who is working in a work station might be responsible for checking up and cleaning etc in order to prevent any problems from occurring.

Correction of the problems when they occur is very important to run the production units smoothly. These corrective maintenances can vary from very simple to very complex. People who are working with these machinery might be able to fix most of the simpler problems while a team of specially trained people might be required to do the complex jobs.

Maintenance prevention is one of the key aspects which makes the path to become lean. This is the process where the decisions are made in order to prevent maintenance. This process might include decisions like buying correct machinery for the job, training people to overcome most common problems etc.

Single Minute Die Exchange (SMDE)

As we have already discussed lean manufacturing born in the automobile industry. One of the most complicated problems this industry faced was overcoming the time taken to change the style in the production

line. This took days and therefore made the production lines inflexible. The idea was to reduce the setup time of the machinery. This is why SMDE born. With the aid of careful planning and coordination it was possible to reduce the time taken to change the line into minutes from days. This made an immense flexibility in the production line. Although started in automobile industry these concepts are very important since still for any organization one of the main problems is facing continuous changes styles in production.

Again how to do this changes from industry to industry. This might have something to do with strategic planning, choosing correct machinery, having correct layouts, having trained people and correct mindset of the people. Achieving SMDE require very good analysis and creative solution making.

Lean Manufacturing to Lean Enterprise

Manufacturing is only a single process in making a product or a service. In the bigger picture you have the customers and the suppliers in the main picture. The bigger picture also contains the environmental and social facts in the background. Therefore to be truly lean, not only the manufacturer, but also the other two main parties, customers and manufacturers must become lean.

If you find the system as a whole including the suppliers and customers, and analyze it for the wastes it generates, you will find most of the resources are wasted in these external systems. In most of the organizations raw material costs up to 50% of the finished product cost. Much more time is wasted in information exchange between you and supplier and also with the customers. This clearly states the requirement of the integrating the all the parties influence the system, in the process of becoming lean.

When the customers and the suppliers and all other parties involved in the process become lean, and operate for a single objective of waste elimination, this system is called lean enterprise.

Suppliers must be able to provide small quantities of raw materials in frequent intervals without interruptions to the manufacturer. They must be able to response to the changes required by the manufacturers. They must have shorter lead times and high quality products.

Customers or retailers must be able to communicate their requirements correctly to the manufacturers. They must response to the manufacturers quickly and efficiently.

The manufacturers must be able to produce in small batches and ship in small batches in frequent successions. They must be able to respond to the changes of the customer requirement quickly and efficiently.

There is one very important contributor in becoming a lean enterprise. These are distributors and the shipping agents. They must be able to bring in the raw materials without any delays and inconsistencies. They must be able to deliver the finished goods to the customer without any delays. Without this lean manufacturing or becoming a lean enterprise will not be possible.

Advantages of lean manufacturing

Lean Manufacturing is a buzzword. More often it is used with the terms like benefits, cost reduction, lead-time reduction etc. but if you have not started implementing lean manufacturing yet and if you have not started benefiting from lean manufacturing yet, you will need some numbers to be motivated.

We shall look into some quantified benefits of lean manufacturing where the principles of lean are implemented successfully. Lean manufacturing is normally known to reduce the;

- ✓ Lead time by 50% at least (some reports says stories where lead time is being reduced up to 90%)
- ✓ Reduced WIP up to 80%
- ✓ Floor space savings around 30 %(sometimes more than 50%)
- ✓ Increased productivity at least by 30%. (even more than 100% in some cases)
- ✓ Quality improvement by a factor of two
- ✓ Overall cost reduction

Above are only the quantified and most common advantages. But there are more and more other advantages come with lean manufacturing. Among them are

- ✓ Good team spirit which will drive your organization to the excellence
- ✓ Innovative culture in the organization
- ✓ Self driven people
- ✓ Pleasant working conditions
- ✓ Worker involvement and improved worker satisfaction
- ✓ Longer machine life
- ✓ Systematic approach to work
- ✓ Improved flexibility
- ✓ Environmentally friendly
- ✓ Built in quality

There are many other advantages which are not listed here. Even these advantages are not listed in any order. These will be more or less important to you according to your immediate requirements.

Some successful lean manufacturers claim that they have achieved some unexpected good result when they shifted to lean manufacturing. The reason for this is the chain effect created by the lean manufacturing implementation.

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One improvement always stimulates a better change in some other area. This will lead to a huge change in the organization, even in the areas where you not intended to have an improvement with the action you took. Therefore the synergy effect is very important advantage in lean manufacturing.

One more thing to remember in evaluating the advantages of lean manufacturing. You should never count the individual improvements, like how well a department performs or how well a particular team operates. All the advantages must be weighed in the bigger picture. All the advantages must be weighed according to their importance to the improvement of the total system. Therefore always remember to have the full picture in your mind.

Why Lean Is So Successful

Lean manufacturing talks about Optimizing and Eliminating wastes, rather than minimizing. When we are trying to minimize one type of waste another will go high. For an example if we are trying to minimize the machine idling time it can increase the Work In Progress as machines are on over production. At the end of the day the net out come on the organization will be negative. This is why Lean promotes Elimination and Optimization. This may be the Core Concept of Lean Manufacturing.

An Organization which applies Lean Manufacturing must understand clearly what is a waste? What is meant by improving? Etc. therefore it is very important to have a Clear cut definitions about the Key Words in Lean Manufacturing. This is clearly done in the Lean Manufacturing. It Answers the questions like, what is a waste?

One of the major concerns of the Lean Manufacturing is the WIP. But there are no techniques appear to eliminate WIP directly. This is a very important example to show the Lean Thinking of Treating the Cause Not The Effect. In Lean Manufacturing WIP has understood as an effect of imperfections in the system. It searches for the imperfections with the tools in Lean Manufacturing and fix these causes. Then the WIP will automatically go down.

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Lean Manufacturing believes in making the process of manufacturing correct, instead of expecting a good result. Generally the Asian way of management is process oriented unlike the western way of management which is result oriented.

Lean believes that a correct process of work will give correct results. This is quite a contradictory with the conventional way of thinking in management, which is always focused to produce results by any means.

Lean Manufacturing believes in continuous and steady improvement, rather than in Rapid improvements. This introduces the process sustainability and the involvement of all level of people. In Lean Manufacturing there is a role to be played by the workers in the improvement and innovation. This is not so in the conventional ways of management where the innovation and decision making are completely a responsibility of Managers.

Continuous improvements in the organization and involvement of the employees in the process of management decision making will motivate the employees. This will release the Organizational Synergy into work. This at the end will become the driving force of the organization.

Culture of team working is one of the major improvements Lean Manufacturing promotes for an organization. Two people can collectively give

more out puts than the sum of their individual out puts. This is the Asian way of thinking about work. This is promoted through team incentives and team recognition, unlike in the western way of management where individual performances are given more emphasis.

Participation of the all levels of employees in the process of decision making is one of the major improvements made by the Lean Manufacturing. This drive out the fear among the workers and made it easier to work with the decisions as they are a part of the process of making decisions.

People often have more to offer than their physical strength, to the organization. They have a brain and a heart as well. This philosophy really worked in the organizations where Lean Manufacturing was practiced.

Systematic approach to the reduction of wastes in every form is the base of lean manufacturing. Finding out the wastes and evaluating them and solving the problems that generates those wastes are working in a system it self. Within the bigger picture there are lots of smaller systems appear for the specific tasks. Some of them are quality circles, and set up teams etc.

Lean Manufacturing promotes simpler methods and tools to do the job. It often causes the low cost automation, very simpler methods of handling and even very simpler ways of managing the organizations. This can save larger

amounts of money as they are low cost them selves and they are effective in and efficient in the use. Having high value machinery promotes higher maintenance, higher level of training and fear of break downs. Therefore low cost automation is quite good from the workers point of view as well. On the other hand low cost applications are home made and therefore exactly meets the demands of the work stations. Toyota production system is very well known for these low cost automation processes, which gave them the flexible low cost solutions for their problems.

In Lean Manufacturing it believes people who does the work actually has the ability to find solutions for the problems in the work. Managers always play a supporting role. Therefore it is always better to say the workers what to do but not how to do. This requires better and thinking workforce unlike in an ordinary organization where the managers are suppose to do the thinking part and workers are supposed to work accordingly.

The single most Important Effect of Lean Manufacturing is the Cyclic Effect of All Its Interconnected Processes. They work in harmony and improvement in one place will improve the system as whole. Therefore with the time Processes quires Momentum and will start to Run On Their Own. Therefore they become self driven.

These are few of the identified advantages of lean manufacturing.

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There can be many more advantages which you will experience by implementing Lean Manufacturing in your

Lean Manufacturing for today's world

Most of the people think lean manufacturing is the best way to earn more profit. Yes it is true. Lean manufacturing will save you costs, increase the productivity, improve the quality and will shorten the lead time. All of these will save and money and obviously give you more profits. But I believe lean manufacturing can do much more than this to specially today's world. Let me explain why I believe this.

In this world there are more than six billion people. This population increases very rapidly. But the resources this world has is limited. Even these limited resources are consumed and degraded very rapidly. If you closely look at the problems the world is facing today like wars and environmental problems most of these problems are due to the limited availability and in appropriate use of the resources the world has.

Think how much of energy is wasted in an engine. Only 30% of the heat generated is used to generate mechanical energy. Even this energy is wasted in many forms. How much of raw materials are wasted in the process of a fiber becoming a finished garment. It is said that cost for the fiber in a finished garment is less than 1% of the value of the garment. Still much of the garment

weight is consist of the fiber. Where all other value additions have gone. Most of them are wasted in many forms. In some countries more than 25% of vegetables get wasted in transportation.

If car engine is made 60% efficient the gulf war might have been avoided. Do you agree? ☺. If the way of garment manufacturing can be changed, most of the environmental problems in the manufacturing countries will end. If we transport the vegetables carefully, war for the land and hunger in many countries will end.

I have only given you few examples. Think deeply you will find millions of examples. One day I started thinking about this, actually I felt very sad. Can we waste these precious resources. I do not think so.

This is why I believe lean manufacturing is a system that must be practiced worldwide. At least the core concept of waste elimination must be obeyed in each and every organization in this world. Waste is a common enemy regardless of the nationality, race or religion. It creates pressure among the societies. It makes the deference between the rich and poor much wider. It creates global warming. It creates war. Find out, there are millions of problems resulted from wastes in many forms.

Therefore wasting of the resources has to be stopped. There are no resources can be wasted for any reason. But how to achieve a world without waste. Lean manufacturing concepts will show you the way.

OK. Think and make the moves now.