

Making stream of production

Introduction

Recently I have got the questions about the method of the introduction and stability of TPS from my Spanish friend. On the other hand I have seen many failure cases of the introduction.

And in this opportunity I wish to describe the way of introduction and stabilize TPS from the point of view of the “Making Stream of Production”.

As first description, I write the essential factor for beginning the activity.

By the way (this is my personnel opinion but) I believe that it is quite difficult or almost impossible to introduce the TPS by the company himself and is reasonable to get the professional coach like as the consultant.

And I am also a consultant of this field. Then I write some points for the success of the introduction.

1. Organization of the project.

As a method of TPS introduction, it is quite general to make the project and is reasonable. I write the detail of project management in the chapter of factory management and here write just the points.

For the success of the project, I describe following points.

-1. Company wide project: Good and preferable idea is to make the company wide project. Then for the success, “Large ship is harder to sink than small” and the range of the activity should be the company wide which involving all of the managers. And the general manager of this project should be the company’s president.

For establishing the firm project organization following preparation are made.

Making policy and declaration.

Study session for all classes.

Decide the organization.

Target items and figures. And rough estimate of investment.

Making action plan.

Review system; Monthly, weekly.

-Study session for all class.

This session is quite important and essential.

After the 2 days senior management class session, I implement this study session for departmental managers and supervisors & foremen of the gemba. Also the

information is displayed in the notice board for all employees.

By the way the problem to be faced firstly is to establish the firm project organization.

When beginning and the first day of [study session for senior managers](#), I require to attend all members of managers including the president.

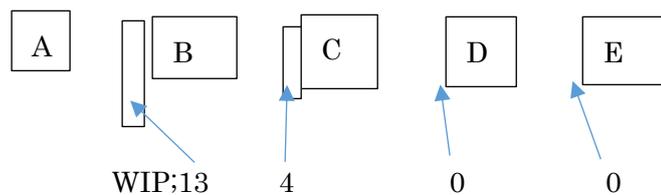
And in the [session](#), I demonstrate a kaizen in the gemba and require the obedience of the “Quick Kaizen”.

For involving the managers, one of good idea is to demonstrate the Kaizen example in a gemba (working place) and show the “necessary kaizen speed and the effect”.

I use this method quite often.

For instance Example-1.

The assembly line had 5 processes (A, B, C, D and E) with 5 workers.



As of the start of observation, B had 13 WIP (work-in-progress) supplied from A in the side.

Also C had 4. D and E had 0 WIP.

As you aware the problem of this line is the lack of line-balance.

Then I suggested to mark the space identification with white tape for the stock of just 2 WIP and make rule.

A doesn't make and supply the parts if the stock yard of B has 2.

And A should start making the parts when B starts to use 1 of 2.

B shouldn't make the assembly job until C starts to use 1 of 2.

And I taught that we could reduce the WIP 13 to 2 and 4 to 2 without the sacrifices of labour efficiency at this time

Secondly I questioned.

Who is the best worker who knows all process?

Then I could confirm that D can work all processes in well skill.

I suggest to eliminate D from the line and adjust the line-balance. And also I asked D to watch the situation of the flow of production and asked to help if somebody delay.

After the 2 cycles of production, the line flue smoothly in keeping the necessary quantity.

Next, I required to reduce the individual stock yard 2 to 1.

And finally 1 to 0 to establish the one piece flow with 4 workers.

In fact, it is very easy to improve 10 ~ 30% efficiency improvement and the reduction of WIP in the assembly line which does not implement “flowing production”.

Example-2.

The game of “Looking for the wrong points.



In the gemba, look at one area (for instance above photo).

And I require the senior managers to find wrong points and the reasons.

(The answer of number of wrong points and reason are in the documents of 5Ss.)

In fact, I use this game quite often.

Example-3.

Quick Kaizen in maintenance.

I have got the request of the introduction of TPM by an European company. And when starting the coaching in the company, at the first day and in front of the

machine, I discussed with the managers and required the immediate action of one machine maintenance which the contents were the clean-up, oiling, correction of v-belts, solving noise, lubricant nozzle & quantity, anti-scattering cover, change of hydraulic pressure oil & mesh, re-tighten up of the volts and nuts with yellow mark and visual control which are marking & identification of oil point & kind of oil, visual board of maintenance timing of previous and next, graphs of out-put and DPU, scrap, format of maintenance record. This “Quick Kaizen” was implemented within 2.5 hours by 3 technicians (including the creation of ideas of the anti-scattering cover).

These actions are never difficult and are very basic condition for TPM.

The purposes of this quick activity are

To show the effect (immediate effect) of TPM.

To show the velocity of “Quick Kaizen”.

TPS requires this quick kaizen which is essential condition.

To establish the basic condition of TPM (which is one of essential condition of TPS).

(Then I required this Kaizen expansion to all main machines within one week.)

In such demonstration (I call “ceremony”) the activity is recognized as company’s wide. Also it is one of my basic concept that I don’t spend the cost and time for the natural answer. The case of TPS coaching also same. I require the participation of senior management in the first education and training (for clarifying the position of this activity). The Top management should have the understanding of the concept of JIT (lean) production and the firm belief.

With through the study session, I intend to confirm the firm belief.

-Firm belief.

(Can you continue the TPS in any case?)

Recently when making the education to the managers I use next episode which is the case of line stop in Toyota to confirm their hard belief.

At 16th of July. 2007, the earthquake namely ‘Niigata-ken Chuetsu-oki Earthquake’ which was M6.6 and Shindo 6 (Very severe earthquake directly above its epicentre) was occurred. And this earthquake gave the serious damage to these area. Fortunately the nuclear power station had no damage. But the infrastructure and manufacturing factories were damaged seriously. In those, there was a manufacturing company namely Riken Corporation who makes and supplies the “Piston Ring” which is used in any car and is supplied to Toyota, Honda, Nissan ----. After the disaster, and 7hours later Toyota, Daihatsu lines were stopped. And

Nissan, Honda --- were partially stopped. The recovery was made and, at the July 23rd, Riken could re-start the supply to the clients.

As you understand Toyota and his group utilize the Kanban system in TPS. Then the stock is just the line side and in the truck (Parts in the transportation also one of stock in TPS). When making the telephone conversation with a Toyota person, he told me that in JIT and the Kanban system it is possible to occur such trouble in inevitable reason, however Toyota never gives up to continue the TPS”.

Now 2 things.

One is TPS also never almighty. It might be easy to occur the situation of supply stop. Secondly, your top management should keep the definite mind of the introduction and keeping TPS.

-2. Review meeting

When starting the project, review system should be decided.

Grand review meeting: Monthly. The chairperson is the president.

Project teams review meeting: Weekly and timely.

-3. The role of the secretary

The full-time person in charge of secretariat should be nominated.

His mission is as follow.

a) Coordinate of the range and theme of TPS activity.

What is the purpose to introduce TPS?

b) Coordinate the meetings including the grand review meeting.

c) Progress control of each activity and advice.

This person is one of key for success. Therefore he requires not only the Knowledge of TPS, but also the human nature characteristic of Leadership, Capacity of decision making balanced, Perseverance, Negotiating power.

Probably there is no such person in the company from the first. Then one of idea is to work with a consultant.

-Empower (giving the authority)

Here I explain one successful example.

In HONDA when developing new car, he takes the project system which is independent from the normal managerial organization. And the project organization is very flat and hasn't so many ranks, but has 3 ranks for decision making and is constituted of the experts of Sales, R&D, Engineering, QA, Production, Procurement, Accounting---- (from all departments).

First of all, the LL (Leader of leaders) who is in charge of the project leader and given the authority of the level of a director and also is full time is nominated. When

nominating a LL, the very drastic appointment is made from the competent engineers. Toyota also has similar system for developing new car.

There may be some resistances to give the absolute authority of the project management to a subordinate employee. However it is necessary to avoid the sinking in long voyage.

2. Making policy and declaration.

What is the purpose to introduce TPS?

The purpose is the continuous benefit and continuous growth in the CS, ES, SS.

And TPS is not the final purpose, but one of means.

For getting benefits, it is necessary to improve the “Lead Time, Cash-flow and Throughput” in the concept of JIT “Producing necessary products in necessary quantity and at necessary timing”. The purpose of the introduction is to cultivate and fix the concept of JIT.

CS: Customer’s satisfaction.

ES: Employee’s satisfaction.

SS: Society’s satisfaction.

Anyway the purpose and goal should be cleared and shared to all employees.

3. The range of the activity.

As the concept of JIT (Lean), the range of supply chain which includes supplier to customer is ideal. However it is not realistic from the first. The companies who can implement all range TPS are just large ability companies like as Toyota, Nissan, GM---, and smaller and medium companies should target just internal deployment firstly.

I saw a case which the large company forced to his suppliers to have the stocks for timely delivery in the name of JIT. It is very clear that it is never be called as TPS. And I recommend to limit just internal TPS as the first step.

4. Goal and milestone.

When teaching TPS (also for instance TPM, TQM), first of all I make the action plan based upon the deep survey and diagnosis of the client company. Sometimes the term of survey to make up the action plan is more than 6 months.

Then create the action plan which describe the Policy, Goal and Target figures, Range of the activity, Necessary techniques, KPI and achievement scheduled, Man-power and organization, Investment, Review system and Milestone.

Then my recommendation is to make up the certain action plan. (I saw many cases of lack of action plan. The action plan is never as “Que Será Será”.)

-Quality of action plan.

When comparing the ratio of achievement in the action planes of Japanese excellent companies and foreign companies which I have seen in the world,

Excellent companies; 89%.

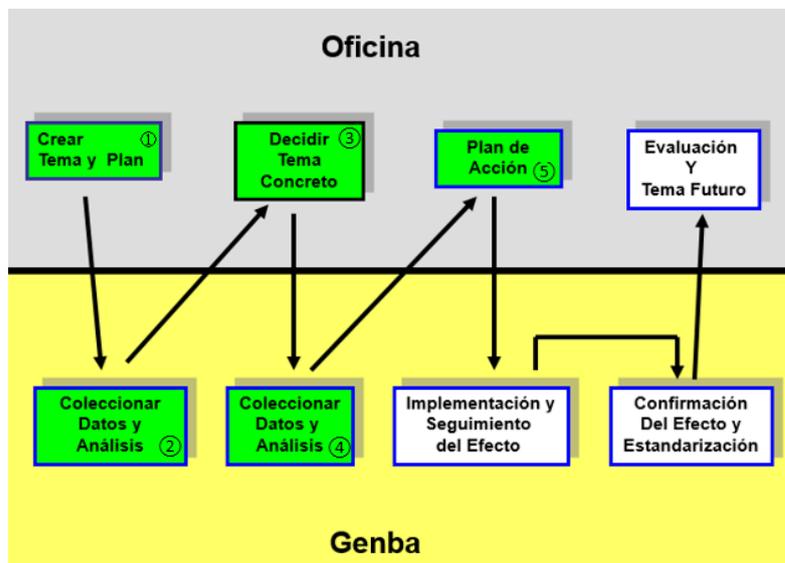
Other foreign companies; less than 40%.

The causes of the lack planning are

The action plans are just the “List of ideas (on the whims)”.

And there are no consideration of

Contribution to the target figures, Prioritization, Certain and Concrete method.



Jump from ①;
Creation of ideas to ⑤;
Making up the action
plan.
And missing the steps
of ② ③ and ④

I describe the way of action plan in the column of “factory management” but shortly following 5 steps are required.

For making an action plan, it is also important to follow the PDCA (Deming cycle).

However “P; plan” has 5 steps as above picture.

- ① Create the ideas to achieve the target figures.
- ② Gathering data and analysis to confirm the possibility of ideas.
- ③ Decide the themes of action and ideas to meet the goal.
- ④ Gathering data and analysis and creating additional ideas and confirm the effect.
- ⑤ Confirming the effect and to estimated investment and making up.

This process is for making the business plan but is same to the plan of TPS introduction.

The process of making action plan is quite important for success of the introduction. The first essential consultancy job is to help of making action plan.

And also one of key factor of success is the visibility.

-Necessary activity.

Now I describe the necessary activity themes as follow.

SMED, KANBAN system, Change from Push to Pull, Education of the concept, Heijunka System, Production Control & YAMAKUZUSHI, MIZUSUMASHI, One Piece Flow Production, Mixed Production system, Working Standard & Standard Time, Standard work & Work Combination Diagram, 100% inspection and Poka-Yoke, Autonomous inspection, Junji inspection, TPM, TQM (include 6Sigma), QRQC, Flow (Stream) Production, Flow Production by Product Function, Layout with compact machine, Flexible machine (Possible to displace easily), Cellular & Modular production, Study of Work element, Creation of Multi-skill-Operator & Job rotation and Skill training and control system, Andon, Kaizen Team in gemba, Kaizen team in office (for developing the current work style including engineering and R/D), QC Circle, VSM or QC Process Chart and Product Function Deployment, One Peace Flow in office work (including design engineering) and Basic Factory Management (if the company's managerial level is less than 75 points in my Factory Management Check List).

Heijunka: Hei = Flat. 2 Heijunka: One is Heijunka of Quantity.

One is Heijunka of Various kinds (of products or parts).

Therefore Heijunka is to produce various kinds of products or parts evenly in Tack Time.

YAMAKUZUSHI: Flatten the daily work load of order for Heijunka of Quantity.

MIZUSUMASHI: Material handler. Regular time & Regular round trip in the line and gathering finished products, parts and delivering parts, materials, die & tools and collecting & delivering kanban.

TPM: Total Preventive Maintenance for improving the machine reliability.

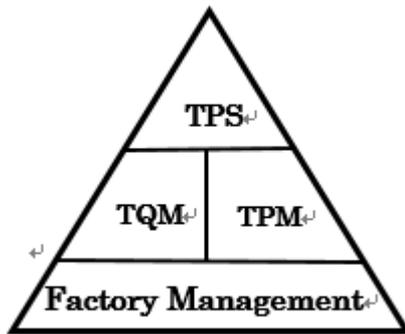
Junji inspection: Inspected by the next process worker.

TQM: For improving the quality reliability.

QRQC: Quick Response Quality Control; Quality improvement is proportional to the speed of Response.

If there is no base of these, even though introducing (for instance) Kanban System, the stock level is rather increased.

VSM: Value Stream Mapping.



When teaching TPS, I tell you that Factory Management, TPM and TQM are essential.

And for the success of the introduction and stabilizing, the back ground should be prepared.

And the contents of basic factory management are

Policy Control, Target Control, Visual Control, Daily Control, Cost Control (Individual Cost, Functional Cost, Expected Cost, Actual Cost), Safety Control, Meeting System, Efficiency Control, 5S, 4R, Gemba Organization, Budget Control, Action Plan, Project Management, KPI, Data gathering System, QC, Inspection system, Rule and Standard (Safety rule, Division of duties, Working rule, Standard Time, Working Standard), Irregularity (Abnormality)Control, Production Control (Production Planning, Progress Control and Production Control), PM (Preventive Maintenance), POP (Point of Production system), Project Management, Shipping and Delivery Control, Purchasing Management, Inventory Control, Lay-Out, Material Handling, Skill evaluation System.

As the base of TPS these conditions are essential. When starting the project and in his action plan, these themes also planned in the milestone if necessary (less than 75%).

Misunderstanding-1: 5S.

Now sometimes I saw the misunderstandings regarding the base of TPS and says that 5S is the base of JIT (lean concept) in TPS.

As I wrote in my 5S documents, 5S is not the base of JIT concept, but just one of essential condition of the factory management. If allegorize it, 5S is one piece brock in the foundation of a house. 5S is important. However if it is allowed the word which “5S is the base of TPS”, it is easy to occur the misunderstanding that 5S is sufficient condition for Lean manufacturing.

And always I say that 5S is one of essential condition but never sufficient condition for management.

Misunderstanding-2: Bottom-up?

Is TPS (or other Japanese origin technique) supported by just bottom-up?

Quite often I saw and heard that TPS is supported in Bottom-up and is effected to the “Partial Optimum”, therefor TPS has the luck of “Entire Optimum”.

This comment is ridiculous.

As I wrote before the essential base for TPS is the certain level of “Factory Management”. And the issue of “Partial or Entire Optimum” is not the range of TPS, but the factory management. I saw this ridiculous comment in the comparison of TQM and 6 Sigma. In the first place TQM is not a system, but is a thought like as JIT (Lean). On the other hand 6 Sigma is a project management system in the training of statistical methods giving heavy importance to create BB (Black Belt), GB. The comparison its self is ridiculous. And if saying “Supported by Bottom Up”, the activity of QC circle which is one of tool of TQM and has the QC story which is the process of problem solving and is the original form of DMAIC corresponds to it.

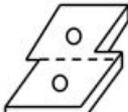
Misunderstanding-3: -Production Schedule

In the “pull” and Kanban system, the production order is given to just the final process and not given to individual process (just pulled with Kanban, in the case of automobile industry). This thing is misunderstood as that it is no necessary to give the production schedule to the individual processes and the suppliers.

Even though TPS, production schedule based upon the sales information is necessary internally and externally (for suppliers) because it should be used for the calculation of manning level, preparing materials by suppliers. (But the production schedule is not the purchase order. The purchase order is just Kanban.) Toyota gives the production forecast of next month and 2 & 3 months. And actual “pull” is made with Kanban.

Misunderstanding-4: -Production schedule-2.

For making a production schedule, MRP is used. The task of MRP is to make the schedule and order of individual process, stock and purchasing control, ordering to suppliers. However after the Kanban system which is the system of realizing JIT the roles of MRP are above for scheduling manning level and preparation of materials in suppliers also to calculate the number of Kanban.

Foto de pieza 	Su Proceso		Proceso delantero	
	Galvanización		Prensa	
	Número	123456		
	Nombre	Soporte		
	Cantidad	5	Contenedor	4A

Number of Kanban ↕

The number of the Kanban is changed based on the sales information and the actual situation in MRP.

-The amount of investment

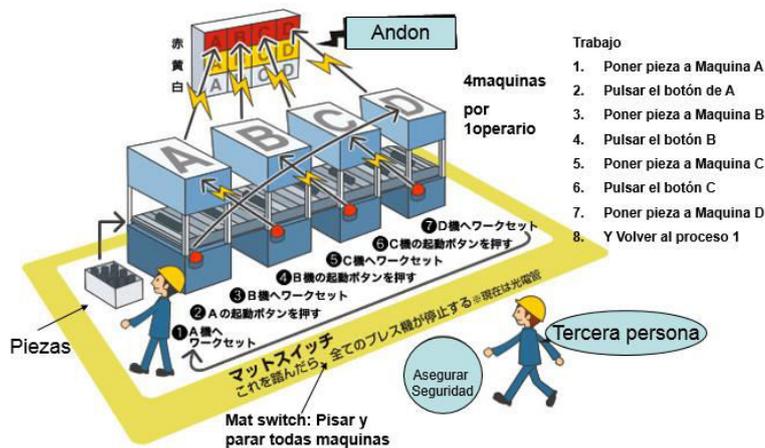
Now there is a common question regarding the amount of investment for the introduction activity.

Not so much investment is required and the contents are.

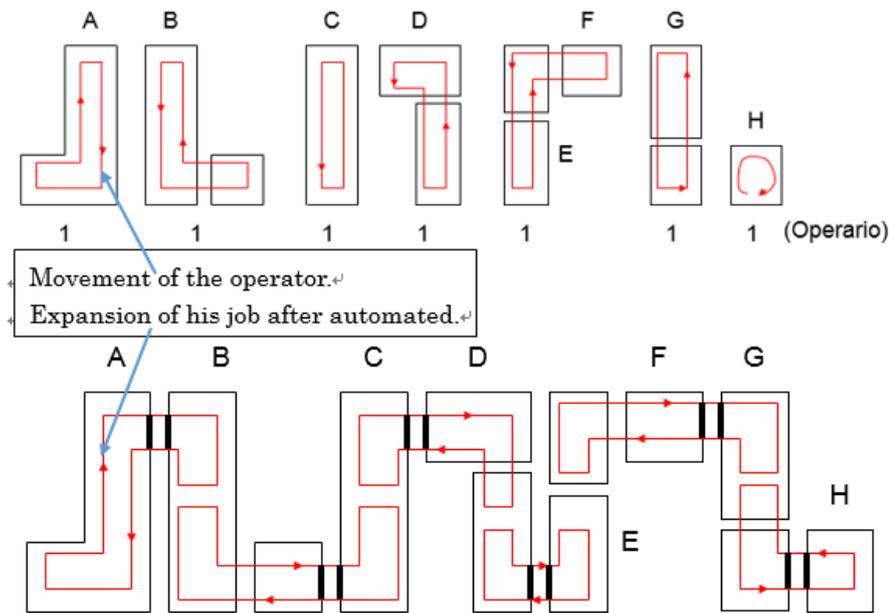
Labour investment: One full-time secretariat. Project Team members (not full time, but make the activity in his one part of job). Consultant: If hire a consultant, it is necessary to pay the fee. But my recommendation is the activity of your own. It is necessary to invest the cost of QC Circle, small group activity in gemba.

Machine: Modification of machine to install in the production flow and the automatic stop device in the machine.

Machine modification: For instance Toyota doesn't like to use a high speed machine because it is not possible to sell the products like as the speed of the high speed machine. Produce just the products (in the tack time) which to be possible to sell.



Also Toyota doesn't like automatic fully functional machine and likes to make his hand made machine because the complicated machine is costly for the maintenance and support by engineers. Above picture. For making one parts, Toyota doesn't use a full functional machine, but use single process machines with the combination of the operator. After this Kaizen, the process and if there is an opportunity of following picture, then considers the making full-automatic machine of this parts.



Toyota is very stingy company who doesn't like to buy new machine and likes to make his own handmade machine and handmade automatic stop device. Therefore when visiting Toyota factory, you can find very old but very well maintained machines. Old machines are of course finished the depreciation already and just contributing to profit. Therefore it is no necessary to invest the large investment for machine.

Easy displacement: Without the large machine like as large press, firing painting process, most of all machines are not fixed and displaceable for easy lay-out change. Toyota doesn't like a large machine which is very expensive and very difficult to displace, but likes smaller machine which is easy to incorporate in the cellular line.

-Difficulty job which I have had in my consultancy.

When making the consultancy job, sometimes I have had the resistances which influence to the success.

- 1) The Kaizen velocity: One day one kaizen. When visiting the factory I taught the importance of flowing process. And (for instance) I require the displacement of a machine for making the cellular production. But the resistance is very tough. They have the fixed thought which machines should be used in fixed location. But this thought should be changed. And the machines should be displaceable as much as possible for the flexibility of the factory, ideas and development.
- 2) Organization Change: A big obstacle is the departmental wall. The project suggests to eliminate the barrier of business flow in the Value Stream Map, QC Process Chart or Process Flow Diagram in IE. (And eventually the proposal was accepted.) However the resistance was very tough and I needed to threaten the

president to draw my hand from this project. Then I needed to confirm their gravitas.

- 3) Union: When attempting the introduction of TPS (Lean), the Top Management should promise that the company doesn't dismiss any employees in the process of the Kaizen. When starting this activity, first of all it is necessary to explain to all employees including the union who is most nervous to a dismissal.

For the success of this project and also continuous improvement, it is essential to gain the cooperation of employees. And if they think that TPS introduction effects to reduce current employees, nobody wants to cooperate and participate to Kaizen. Therefore it is necessary to declare that no one else is dismissed in the process of Kaizen.

How to maintain the employment after getting the surplus workers?

For keeping the jobs and avoiding dismissal: reduction of overtime, adjustment the capacity in total, cross training (investment for future), establishment of Kaizen team (investment for future), taking the outsourcing work in, business expansion in sales dept. and new products development.

And if you can't make decision of non-dismissal, you never challenge TPS.

Also the company needs to negotiate the possibility of following issues.

Cross training and Multi-skilled operator, Job rotation, Supporting in group system, Plural machines with one operator, No chair in work place (standing work and no sitting work), No boundary between office and gemba (including working ware),

Supporting in group system; in the cross training, operator can support and recover the delay as the group.

No boundary between office and gemba; Engineers, Production planners, Trainers, Maintenance technicians also the members of the production in gemba.

5. KPI and project visibility.

Recently I have got the opportunity to listen the talk of Mr. Masamoto Amezawa who was the vice-president of TMMK (Toyota Motor Manufacturing Kentucky Inc.). And he emphasized the importance of "Policy Control, Target Control and Daily Control" which are the items of (my saying) Factory Management for TPS.

And for the project management, the visibility in KPI is essential.

As I wrote the importance of the action plan, the follow up of the activity in the review meeting is important.

If the progress is not possible to see in the figures or indexes, it is not possible to

continue. Indexes & figures which I call KPI (Key Performance Index) are essential.

What are the necessary KPI?

General KPI of Factory Management plus CS, ES and SS.

I describe the typical KPI in factory management.

- a) Safety: Number of days continued of 0 accident. Number of accident occurred (in absence). Number of accident (no absence). Number of suggestions for safety kaizen. Number of suggestions of Hiyari-Hatto.

Hiyari-Hatto: Experience of sweat with fear and to be startled (before accident)

- b) Throughput: Sales amount of the month – Variable cost.

In TOC (Theory of Constraint) and Lean, the word of “Throughput” is used. But simply, it is the Marginal Profit in accounting terminology.

- c) KMH: Production and sales KMH.

$KMH = \sum \text{Each Standard Hours} \times \text{Number of products}$.

Quality Performance: Defect ratio. Defect per unit index (DPU).

Direct Advance Index (DAI). Quality Cost.

-DPU: for example same products A, B, C, D and E total 5.

A has 1 defect.

B has no defect.

C has 3 defects.

D has 2 defects.

E has 0 defect.

The defect ratio is $(3 \text{ defectives} / 5 \text{ products}) \times 100 = 60\%$.

$DPU = (6 \text{ defects} / 5 \text{ products}) \times 100 = 120 \text{ index}$.

The production line should be controlled in both.

-DAI: For instance a line has A, B, C, D and E total 5 processes. And the each defect ratio is

A: 1%, B: 0%, C: 3%, D: 2% and E: 0%.

$-DAI = 0.99 \times 1.0 \times 0.97 \times 0.98 \times 1.0 \times 100 = 94.1$

Incidentally, if this index is such lower Cp, the company shouldn't intend to introduce TPS.

-Quality Cost: (Visible Costs) Costs of Inspection, Repair, Additional material, Scrap, Inspection tool and equipment, Compensation. (Un-visible Costs) Costs of Design instruction, Machine and Labour Efficiency down, Poor reputation and Lost of sales opportunity, Delivery delay and special transportation, Increase of stock, Cp down and Stock increase, Cash flow down.

In 6Sigma it is said that if the Cp (Process Capability) is less than 3sigma (7% of DPU), the quality cost should be more than 20% of total sales amount. Such company also shouldn't intend to introduce 6Sigma and **should improve** the basic factory management level.

- d) Labour efficiency: $(\sum ST \times \text{out-put}) \times 100 / \text{Total Working Hours}$
 Total out-put: Each process out-put which contributes to Sales (Not includes the work-in-progress, inventory in warehouse). Therefore total company efficiency is
 $(\sum ST \times \text{Sales units of the month}) \times 100 / \text{Total working hours}.$
- e) Material efficiency: Scrap ratio, Inventory turnover ratio. Yield ratio.
 Scrap ratio: $(\text{Total scrap weight} \times 100) / \text{Total in-put weight (Roughly)}.$
 $(\sum \text{Each kind of scrap weight} \times \text{unit budget cost}) \times 100 / \text{Total material budget cost (Exactly)}.$
 Inventory turnover ratio: $\text{Total Stock} / \text{Sales of the month}$
 Total stock: Inventory in warehouse plus work-in-progress.
 Or Production Turnover Ratio: $\text{Sales of the month} / \text{Monthly stock}.$
- f) Money efficiency: Cash-Flow.
- g) Machine efficiency: Machine Performance Ratio, Machine Operation Ratio, Machine Operation Ratio with Velocity, Machine Down Ratio, Machine Down Frequency Index.
 Machine Performance Ratio:
 $(\sum \text{Machine operation hours}) \times 100 / 20 \text{ days} \times 8 \text{ hours} \times 2 \text{ shifts}.$
 Machine Operation Ratio:
 $(\sum \text{Operation hours} \times 100) / \text{Total Working Hours planned}.$
 Machine Operation Ratio with Velocity:
 $(\sum MSST \times \text{Out-put} \times 100) / \text{Total Working Hours planned}.$
 MSST: Machine Standard Speed Time (Out-put/Hour).
 Machine Down Ratio:
 $(\sum \text{Break down and Stop hours} \times 100) / \text{Total Working Hours planned}.$
 Machine Down Frequency Index:
 $(\text{Number of times of machine down}) / \text{Total Working Hours planned}.$
 Example of the standard of Machine Down and Machine Down Frequency
 Machine Down; More than 15minute stop with machine breakdown.
 Down Frequency; Less than 15minutes stop with machine trouble.
- h) LT and LT Efficiency: Lead Time; The term from Receiving Order to Delivery.
 Lead Time Efficiency (LTE);
 $(\sum \text{Standard LT of each process}) \times 100 / \text{Actual LT}.$
 Each Process; Order Processing, Preparation of material, Production,

Preparation of shipment.

I give the importance to this percentage because all activity and the result such Making stream of production, JIT, One piece production, Heijunka and for supporting these, SMED, Improvement of Cp, Inspection system in 100% inspection with Poka-Yoke are appeared in the result of this LTE (and the inventory performance).

Standard LT of each process; Substantial and theoretical hour for dealing with the job and not include waiting term.

The ultimate goal of TPS is to seek 100% in the standard LT. The standard LT also should be improved in the Kaizen Activity.

- i) CSI (Customer satisfaction Index): Customer's Claim Ratio, Delivery Delay Ratio, Delivery Delay Index, Internal Delivery Delay Ratio.

Customer's Claim Ratio:

$(\text{Number of products claimed} \times \text{One million}) / \sum \text{Products shipped.}$

Delivery Delay Ratio:

$(\sum \text{Number of lots delayed} \times \text{One million}) / \sum \text{Lots shipped.}$

Delivery Delay Index:

$(\sum \text{Number of dais delayed} \times \text{One million}) / \sum \text{Lots shipped.}$

Internal Delivery Delay Ratio:

$(\sum \text{Number of lots delayed} \times \text{One million}) / \sum \text{Lots delivered to production process.}$

- j) ESI (Employee Satisfaction Index): Absenteeism Ratio, Labour turnover Ratio, Number of suggestions in Suggestion Scheme, Number of QC Circles.

I wrote the necessary KPI a little exactly because one of key point for the success of the introduction and fixing TPS is the visibility in the figures. Depending upon the manufacturing company the KPI required is different, but at least these KPI are required in common. And if there is no milestone in KPI, the project should be failed.

I listed up the necessary KPI for normal factory management. And if you intend to introduce Lean Manufacturing with TPS, at least next KPI are essential.

- 1) LT (Lead Time) index
- 2) Cash-flow (in gemba, Inventory Turnover ratio)
- 3) Performance index (Labour, Machine and Material)

(Regarding the KPI, I shall describe more exact and the usage in the column of "factory management".)

6. The role of top management.

The role of (for instance) the president is

-1. Policy Maker: He needs to declare his decision (the introduction of TPS) in his words. Policy is the banner of the change for entire velocity.

-2. General Manager of the project: Introduction of TPS for establishing the lean concept is an innovation. Therefore he himself needs to exert his responsibility which follows the progress in certain review system and cascades down the authority.

-3. Vision holder: What is the ideal feature of the products?

What is the core competence? What are the products? What is the future vision? And what is the purpose to introduce TPS?

For instance. Occurring strange phenomenon in the financial statements:

When practicing TPS, the inventory is dropped dramatically (and increasing the cash-flow). This thing gives the phenomenon that the total production costs in TPS becomes bigger than the total cost in the conventional system and reducing profit in the financial statements. The cash-flow is very much improved. But the profit looks as decreased.

Now even though profitable in the financial statements, a company goes bankrupt if the cash-flow is bad. And cash-flow is more important for business. The president requires the temporary patience and explanation to the shareholders.

I had the bitter experience which **this phenomenon** gave the excuse to stop **TPS introduction** activity.

It is the typical means that beginning the project from the production gemba. And after the innovation of gemba, the activity should be expanded to the office and design development (R/D and engineering).

After finishing the internal TPS, the activity should be expanded to the suppliers. This vision also required.

-4. Organization Maker: Certain organization, Delegation of authority.

-5. Enforcer: When introducing the concept of JIT (lean) in TPS, firstly all managers need to study the meaning of JIT and the method of TPS. But when realizing in the company, the managers who take and have the negative mind and activity always appear. Then the president requires the resolute treatment including the dismissal. He requires to eliminate the obstacles.

Obstacle.

After the demonstration of “Quick Kaizen” **in the study session** we make the action plan. And during the making action plan the Kaizen activity in gemba is continued.

When making the introduction of TPS, TPM ---, I use the usual means which introduce the Kaizen Committee and its mind in both gemba and office.

And in the Kaizen Committee, I establish the groups of 5Ss, QC circle and Safety.

And as the first stage I establish the 5S groups in gemba for bringing up the leaders (including from office). The team members make the weekly inspection and the suggestions which should be chosen easier theme and resolved within one week. At the initial stage the themes are easy to resolve by themselves. However after the several week more difficult themes remain and are required the help of the managers.

(Training of Quick Kaizen)

But managers don't want and hate the help and the troublesome.

Such managers should be eliminated. I know it is difficult but is necessary.

In fact it takes several years to introduce and fixing the concept of JIT in a company. (Depending upon the scale of the company and the firm intention, it is different, but)

Most of the term, it is necessary to concentrate to change the mind and intention of managers to Lean concept.

As the first step I teach the factory management, and from the first I intend to bring the "seeds of lean" up in the managers.

From next I describe the TPS from the point of view of "Making Stream of Production".