



Policy Deployment Case Examples¹

Case 1: Chemico

This is a plant belonging to a major chemical company which was set up in 1962 and produces a range of around 100 adhesive tapes and packaging foams with a staff of nearly 300 people.

They have a strong foundation in high-involvement innovation, having won the coveted Deming Prize and numerous other awards for high-performance achievements in fields like total productive maintenance. They make use of such national competitive award schemes as a means of focusing attention on the key strategic goals of the business.

Their strategic level 3 process is driven by a three-year 'mid-term plan' (MTP), which translates broad corporate objectives into focused missions at a plant level. The MTP for the plant is further devolved into broad aims for achieving this; here these are '... production which is flexible, trouble-free and stockless ...'. And in turn these devolve into the specific objectives for the TPM programme. This policy deployment process can be seen in the recent history of MTPs at the plant:

MTP & Date	Key Objectives	Key Elements
1986 TPM 1	'Increase competitiveness through FTS'. Develop 'Muda' (waste)-less plant - mainly worked on facilities and on developing a visual control 'open workshop' concept. 'Sprint target' was winning the 'Excellent plant award'	Building up foundations for TPM by working on equipment ('eliminate Muda') and people ('form active groups')
1990 TPM 2	Increase customer satisfaction' through market-focused cellular production, aiming at speed and quality delivery. Develop a "good showing' FTS plant, with the aim of producing a showpiece factory. Sprint target was the 'TPM award'	Innovation in products and organization structure, and moving to a 'focused factory' approach
1994 TPM 3	10% expansion of business and improved customer satisfaction. Develop I-TPM (ideas and innovation) programme, aiming to complete the FTS factory. Sprint target is the 'Special award' for TPM	25% reduction in direct labour input, 23% cost reduction in products, zero accidents and other stretch goals set

¹ from John Bessant, *High-Involvement Innovation* (Chichester: John Wiley and Sons, 2003)



Characteristic of this and many other mid-term plans for TPM is the use of the metaphor of 'pillars' supporting the construction of their success. In this case nine pillars are seen as contributing to the stretch goals of cost reduction etc. These include things like 'no adjustment production', 'no supervision system' and so on. Each of these is in turn a target but relevant for each production area and is used to drive a systematic process of problem-finding and solving. For example, achieving a 'no supervision system' requires equipment that is 100% available and reliable, and this can only happen if the causes of breakdown are carefully analysed and preventive measures taken to ensure that type of breakdown does not happen. It uses simple techniques like fishbone analysis but applies them with great discipline and system to create a series of linked projects, each of which is suitable for individual or small group kaizen activity.

This approach is backed up by extensive use of visual imagery and display – in part reflecting the pictographic nature of the language but also to get away from words and down towards the underlying concepts in such 'mission' statements. One of the main charts shown was a pictorial representation of the MTP with a 'rich picture' capturing the key features, targets and challenges. Language is also developed around the programme so that there is a vocabulary of key words and phrases which people use in working on the programme.

An example of the operation of this approach was given. One of the nine pillars is 'no adjustment equipment'; in other words, in the ideal case, equipment that needs no adjustment. In practice the argument is that on a large piece of process plant, 4–60m in length, they do not want to have operators constantly running up and down to make adjustments since this represents wasted time and energy. More important, such monitoring and adjustment adds no value – their picture to represent this stage was of a man standing with arms folded in front of a machine. The challenge is how to eliminate the need for supervision and checking of equipment without compromising safety. This provided the focus for small group discussion and the use of simple *kaizen* tools. It led to a detailed seven-step programme for gradually chipping away at the problem via a series of small *kaizen* projects². These were:

1. Initial cleaning-up of machines and area.
2. Measures against contamination sources and difficult areas.
3. Preparation of a cleaning and lubrication manual and procedures.
4. Development of *jishu-hozen* – thorough self-inspection of plant by the operators themselves rather than maintenance staff. This involves a five-stage training programme.
5. Voluntary inspection by operators.
6. Thorough quality inspection.
7. Adjustment-free operation.

Working up through this agenda becomes the operator-level contribution to building one of the pillars. The first task was essentially cleaning up the floor – not a simple task since the production of adhesive meant that spills were often hard to remove and attracted other dirt.

²

It is important to note the similarity between this and other step-by-step programmes for the same purpose. This shows the influence of JPIM in diffusing standardized approaches to good practice.



Importantly the process of cleaning up involved all staff, led by the section manager who, symbolically, picked up the first brush and took on the dirtiest of jobs. Photographs shown indicated just how filthy some of this plant was, inside and out. One effect of this 'spring cleaning' was a very visual change in the way the plant looked – important as a motivator and also as an enabler of subsequent work.

Next came the process of identifying problem areas where contaminants arrived or where inspection was difficult to achieve. Amongst the simple *kaizen* ideas extensively deployed in response to this was the idea of 'museum cases' – putting a glass or plastic cover over key parts of the machine so that it was easy to see it in operation and, more important, to see where there was leakage. This meant that an operator could see where there was a problem at a glance – rather than having to wait for a maintenance craftsman to inspect the machine. In some cases this principle of making it visible and accessible meant minor redesign or rearrangement of machines. This is a key feature of TPM – amongst examples are simple U-tubes to show lubricant levels, the use of children's windmills to indicate motor function and painting alignment marks on bolts to ensure they are tightened to the correct tolerances.

The third step involved the thinking through and preparation of simple standard checksheets to define and capture learning about what has to be cleaned and lubricated. An important component of these sheets (which are displayed prominently next to each machine) is that they include not only what has to be done but an explanation of why doing it is important. The sheets are written by the operators themselves and make extensive use of photographs, diagrams and other visual images to help simplify and standardize the process.

Step 4 involves the development of self-inspection skills amongst operators and this is achieved by a systematic training programme accompanying further checksheets to institutionalize a procedure. Significantly, operators have to attain 94% pass marks or repeat the training!

Step 5 involves implementing the self-inspection approach, using the procedure checksheets but also encouraging their systematic revision and updating.

Step 6 is a more systematic approach to improving quality, by building in measurements for what would have to be under control in a perfect system. This involves constructing a large matrix which lists criteria down one side and desired values along the other axis. The list of potential criteria is huge, so this is simplified into key categories – for example, ease of set-up or stability level. The measurement scale is based on simple scales – for example, gauging ease of set up on a notional 1 – 5 scale, where 1 is 'a set-up needing full support' and 5 is 'a touchless set-up'. The purpose of this is to set up in the cells of the matrix a series of projects which can first be addressed and then systematically improved. Using red and green dots provides a quick visual display – where there is a red dot, there is a potential improvement project. Importantly this builds in a driver for *continuous* improvement, rather than a one-off fix of the problem.

Importantly the categories, scales and the subsequent projects are all discussed and developed by the small group responsible for the area.

CI operates in the following fashion. Direct employees are grouped into teams of around eight and are expected to work on CI directly and also to suggest projects which can be taken up by the engineers. There are daily meetings of each work team, together with occasional meetings for specific CI projects of the larger variety. All employees are required to contribute suggestions as part of their contract (the underlying theme being that their



success is bound up with that of the company, so this is their duty). The current target is ten ideas per employee per month, but they are only counted if actually implemented. The team leader (with reference to others if necessary) evaluates and grades the suggestions according to a simple scale:

- A-grade suggestions are simple improvements which are rewarded with a payment of ¥300 (equivalent to the price of a pint of beer).
- B-grade suggestions are larger scale and rewarded with a percentage of savings.

In addition employees who make their quota of suggestions per month receive a book token.

With roughly 150 direct employees out of a total of 300 this equates to around 1500 suggestions per month in production. Clearly there are problems in managing this volume of ideas, but it is simplified by using a single sheet of paper for each team on which each individuals' contributions can be recorded by the team leader. If there is a high-earning suggestion then the team leader evaluates it and puts it forward to the site committee, which only looks at significant suggestions.



Case 2: Carco Vehicles

This car plant produces around 900 vehicles per day with a staff of around 2000 usually working two shifts. As with many Japanese firms the high value of the Yen has hit exports hard, to the point that the company made a loss in 1990. They have responded to this crisis by systematic deployment of continuous targeted improvement, with three core themes:

- development of new, attractive products;
- maintaining productivity levels;
- reconstruction of the company from within.

Workforce involvement has been critical to this development, especially as there has been a continuing reduction in labour with a consequent loss of production knowledge. Their efforts at TPM began in 1992, partly as a way of increasing utilization and efficiency of the existing plant instead of introducing new capital investment. The long-term programme includes simultaneous attacks on quality improvement, cost-reduction employee motivation and increased education and training, and the specific 'stretch' targets are:

- zero defects;
- zero accidents;
- zero breakdown;
- 20% increase in labour productivity.

The pillars on which these are to be achieved are:

- *jishu hozen* – voluntary operator inspection and maintenance;
- *kaizen teian* – individual improvement activities;
- education and training;
- planned maintenance;
- development management;
- quality maintenance activities, including ISO 9000;
- tool/mould/die maintenance management aimed at zero defects and breakdowns.

They began by setting up separate task forces to deal with each area, and developed a formal structure aimed at promoting TPM. The results undoubtedly helped in their recovery from losses by the end of 1995; examples of gains include:

- 96% cut in breakdowns per month across the site (from 5252 in May 1992 to 194 in November 1996 – and this level has been sustained). Their plans for Phase 2 of TPM are to cut this still further, by another 30% to around 60/month within three years.
- Reduction in warranty claims of 50% in the domestic market between 1992 and 1994.
- Accident rates cut – some areas have zero accident recorded for the past two years.
- Increases in total plant efficiency (calculated as designed operating rate x hourly rate x good product rate) of various lines and units running at 55-80%.
- Reduction in overall machine losses – damage due to machine problems are down from an index value of 100 to 60%.
- Inventory is down by 50%.
- Working-hours per vehicle has gone down from 14 to 11 (for the Impieza saloon).

These have not been due solely to TPM but the company believes it has made a major strategic contribution. Their view is that the biggest single impact of TPM was the speeding up and smooth introduction of the new model 'Legacy', which meant high levels of



production performance were attained from day 1 and maintained.

In financial terms they estimate a saving of ¥17.9bn (based on an exercise similar to cost of quality accounting) over the period 1992-1994.

As with other companies, the three-year mid-term plan is the key mechanism for focusing and refocusing attention in CI. In Fuji's case the plans have involved three main themes over the past decade:

- TQM aimed at increasing productivity and quality.
- TPS (Toyota Production System) aimed at waste reduction.

TPM aimed at obtaining high machine efficiency and availability and at increasing production rates through a more reliable plant.

Visualization of this is important; the dominant image is one of 'equipment and operator upgrading'. There are story- and displayboards throughout the factory, including a master chart which is a giant Gantt chart tracking progress to date and plans for the future. Each work group meets daily and this takes place around their own storyboard.

The implementation of TPM includes a number of components:

- daily review and improvement cycle – i.e. high frequency of small innovations;
- small and regular inputs of training – 'one point lesson system';
- motivation events;
- individual *kaizen teian* activities;
- small group *kaizen* (successors to quality circles);
- 5-S activities to ensure workplace cleanliness and order;
- preventive maintenance analysis;
- design for maintenance;
- 'zero orientation' – no tolerance for waste, defects, stoppages, etc. as the target;
- step-by-step approach;
- voluntary participation and high commitment.

The implementation of TPM involve a five-year programme spanning two mid-term planning periods. Part 1 ran from 1992-1995 and was designed to introduce the basic TPM mechanisms; activities included awareness and training and practice to embed the behavioural routines. Part 2 – the current phase – involves aiming for the JPIM's Special Award for TPM. Significantly the company is using very clear behaviour modelling approaches, articulating the desired behaviours and systematically reinforcing them to the point where they become routines.

Policy deployment is the link between these broad objectives and the specific improvement activities at shop floor level. For each of the eight pillars of TPM there are specific targets which can be decomposed into improvement projects. For example, 'maintain your machine by yourself', 'increase efficiency of machine to the limit' or 'reduce start-up times'. These vague signposts are quantified and analysed in terms of how they can be achieved and the problems which would have to be solved to make that happen, using simple tools such as 5-whys and fishbone charts. Diagnosis is top-down in terms of setting the actual numerical targets or the extent to which operators can maintain their own machines; a team of specialist engineers carries this out.

As with other plants there is a step-by-step process for increasing capability in TPM, and this



is linked to training inputs. For example:

- Step 1 = clean up your machine.
- Step 2 = learn to detect different sensitive points.
- Step 3 = develop a procedure for lubrication and cleaning work.
- Step 4 = total inspection and check of different key points.
- Step 5 = autonomous inspection.
- Step 6 = adjustment and ordering.
- Step 7 = execution of this in self-management (unsupervised) mode.

The company places strong emphasis on mechanisms for embedding these behaviours in the culture so that they become the way things are done and taught to others. An important aspect of Phase 2 – the current mid-term plan – is to find mechanisms for doing this. These include extensive use of training and development – for example, each employee receives ten hours' initial training in TPM and then three hours per month additional training on the job. They are also allocated 30 minutes per day to carry out their individual maintenance and to learn and improve this.

In addition to this operator development and individual improvement there are also CI projects in particular areas on which groups work in team mode – for example, projects on sputterless welding or cleaning engine coolant, which involve consistent attack on problem areas over a period of weeks or months. Activities of this kind have led to, for example, major set-up time reductions; the Komatsu 1000-tonne presses take less than ten minutes to change and are changed four or five times per shift. Projects of this kind tend to take around three months.

There are some 30 odd groups working – 10-15 in trim, 12 in body and assembly and 6-8 in the press shop. Group leaders spend half their time with the groups, facilitating, training etc., and the remainder acting as a floating resource to cover sickness, holidays, etc.

The evolution of *kaizen* has been through early team activities going back 20 or more years. Individual *kaizen teian* ideas did not come through at first so a campaign was launched with the theme of 'what makes your job easier?'; prior to that the focus was outside the individual operator's own job area. The evolution of suggestions can be seen in data collected by the JHRMA which suggest that on the site there is now 100% participation of the 'eligible employees' (around 85% of the total workforce). Of their suggestions around 88% are implemented giving a 1995-6 saving of around ¥3.2bn.

At present they are receiving around 20 suggestions per employee per month. One of the difficulties raised by the generation of some 40,000 suggestions per month is how to process them; this is primarily the responsibility of the group leader. Many of the ideas are minor changes to standard operating procedures and foremen/team leaders are authorized to make these. Ideas are judged against four levels:



Level	Reward	Volume
1 = High level, considerable potential benefits, judged by senior management team	¥150,000+	only 4-5 per year
2 = Again, reviewed by senior team	¥10,000+	20 per year
3 = Basic, handled by team leader	¥300	
4 = Minor, recognized to encourage continuous improvement activity	¥50	

The importance of recognizing and rewarding the low-level simple ideas was expressed by one manager: 'If we don't encourage fertile soil at the bottom, we'll never get the high-grade ideas later'. Motivation is also secured by strong top-level commitment. When the TPM programme was launched, the first stage was built on 5S principles and involved cleaning up machinery and the plant. The plant director held a site briefing explaining his concern and the ideas behind TPM and then led the setting up of a 'section chief's model line' which was a line cleaned up and improved by all the senior managers as a demonstration. Symbolically the plant director was the first to pick up a broom and begin the process. The line was followed by an 'assistant chiefs model line', again to reinforce the commitment top down.



Case 3: Electro Products

This plant employs around 1700 full time staff, plus 250 part-time, plus 550 sub-contractors; and unlike the preceding cases has not yet implemented a TPM approach - partly because their products still involve a high proportion of complex manual assembly. Once again the approach of 'policy deployment' is central; the company first decides on business priorities and then identifies key broad themes which form the targets for 3 year mid-term plans (MTPs). These MTPs are then systematically broken down into specific activities linked to stretching targets for each area of the plant, and these targets are in turn broken down into projects and targets for small group and individual improvement work. So in the case of this company, the 7th MTP expressed its overall objective as "...to strengthen quality assurance based on customer satisfaction..." and this has led to a set of specific activities around building a customer-focused quality system which identifies responsibilities for quality improvement projects within this structure. (A significant feature of this is the extent to which sales and marketing are now extensively involved in QA).

In terms of the mechanisms for quality improvement, each strategic business unit within the corporation holds monthly quality meetings and these in turn make a 3 monthly meeting with the central QA staff at company headquarters. There is also an annual quality conference at which all quality staff meets. Within the plant there is a monthly review of quality-related data - complaints, defect rates, etc. - and a report on the improvement activities going on within the various work groups. In addition there are several special efforts to promote and maintain attention on quality matters - such as the 'President's tour' and the Quality Innovation Contest.

The quality system is driven by a 'cost of quality' approach which is used to monitor quality and drive improvement activities. They estimate that this cost was around 1-2% of turnover when they began the present campaign in the MTP.

Improvement activities take several forms; first, there are individual activities based around the operators personal responsibility for quality. There is then a system of small-group activities where time is allocated to problem-finding and solving using various tools and approaches in which all operators receive training. In 1996 there were 75 such groups, each meeting for about 1-2 hour/week, focusing on quality-issues related to their area. These groups are given targets for improvement expressed in terms of a points system, and progress towards achieving these targets is displayed on the notice-boards in their area by means of green dots. In the first 6 months of 1996 they received 4873 suggestions in this fashion, which, when annualized, contributed an effect estimated by the company's panel, of 262m yen - equivalent to around 53,000 yen per employee. The company pay for such suggestions based on the points system - for example, if a team achieved the (high) target of 500 points they could receive as much as 2m yen; these suggestions are all recorded and assessed by a committee and points awarded according to their judgement. Using this system the company paid the equivalent (again annualized) of 7.6m yen to the 75 groups for 1996.

Data from the Japan Human Relations Management Association suggests that for 1996 the company implemented 6.9 suggestions per employee per year (but this figure is low because of the high levels of employment) Participation rates in kaizen teian activity was 100% and 96.7% of suggested ideas were implemented. This contributed an economic benefit of 15.5bn yen.



Case 4: Airco Machinery

This plant employs around 1800 people making a wide range of industrial equipment. Their approach is driven by a sequence of Mid-Term Plans with particular focus. In 1987, partly as a response to the *endaka* (problems of the high yen) they targeted TPM and in 1990 received the national TPM award. Prior to this their target had been the development of their version of flexible JIT for high variety production which is still being used to drive a move towards mass customization. The period 1990 to 1994 was characterized by the acquisition of ISO 9001 and the current mid-term plan is to achieve the TPM Excellence Award and ISO 14001 certification.

The motives for TPM relate to an increasing emphasis on automation and the preoccupation with ensuring minimal breakdown and machine attendance requirement. The five pillars supporting their TPM programme are:

- autonomous maintenance;
- small group improvement activities;
- early equipment management;
- planned maintenance;
- upgrading of employees via education and training.

Each of these has a step-by-step sequence associated - as with other plants. For example, developing autonomous maintenance involves:

- Step 1 Initial cleaning
- Step 2 Countermeasures at the source of problems
- Step 3 Cleaning and lubrication standards and procedures
- Step 4 General inspection by operator
- Step 5 Autonomous inspection
- Step 6 Organization and tidiness
- Step 7 Full autonomous maintenance

For each of these there is a check sheet, with details of what has to be checked for and a column for evaluation as below:

Item	Checks and Actions (PDCA)	Key Check Points	Evaluation 0=Bad -10=Good
Initial cleaning			
Sources	Check	Did you find evidence of oil leaks, air leaks, etc?	
	Plan	Do you really understand the trouble?	
	Carry out measures to avoid troubles	Are these measured being carried out as you planned?	
etc.	etc.	etc.	etc.



Evaluation is carried out by section managers, each auditing an area other than their own. All operators are required to participate in this process.

Small group improvement activities take place in addition to the individual operator work. These are made up of work groups (average size is 7-8 people but in some areas larger groups, up to 30 strong operate) responsible for identifying and solving problems in their areas, towards the general target of 'no trouble' manufacturing. There are 41 work groups across the site. Typical kaizen projects include development of simple turntables to improve access for assembly, moving tool storage racks which accompany operators as they move with the moving assembly line, and an assembly table which tilts and has a transparent cover to permit easier inspection. These groups make extensive use of storyboards and other tools in their rest areas, which are integrated with the line. Storyboards use 'before and after' photographs and descriptions to remind existing workers and to training new ones in the rationale behind changes and to encourage further ideas.

Groups meet formally for 30 minutes twice per month but there is extensive informal activity, including the daily briefings and team meetings. The working day runs from 0800 until 1700, with a 10 minute daily meeting at the start of each day or shift.

They receive around 1000 suggestions per month, and these are evaluated through a hierarchical system, with the first cut taking place at work group level. High grade ideas (or which there are around 3300 per year, equivalent to 10 per person per year) move up to the company committee responsible for evaluation and these are rewarded with larger sums. An important feature of their idea management system is that changes are captured and incorporated into the standard operating procedures such that ISO 9001 is not compromised; they have a documented process for assuring this.

TPM is supported by a dedicated organization structure with several staff seconded to manage the promotion and implementation. The approach is simultaneously top-down and bottom up, with policy deployment as the key tool for ensuring linkage. The broad objectives of TPM are broken down into specific projects and target activities towards which continuous improvement can be focused. The specific targets for TPM 2 - the current mid-term plan - are again stretching and include two overall objectives - productivity increase of 50% and an achievement of break-even point of 80% or less³. These in turn set up other targets:

- 1.5 times increase in new product introductions
- productivity increase by 40%
- cost of after-sales service reduction of 50%
- improvement in method productivity of 10%
- percentage of malfunctions down to 300ppm (*product defects) in process
- enhanced maintenance competence to equivalent of 1 licensed person per group minimum

³ This is based on the ratio of fixed costs to added value. If this is 1:1 there is no profit, but at 0.8:1 or less the profitability is significant. To achieve this requires significant efforts at fixed cost reduction which they see as achievable through TPM

⁴ They calculate MTBT on the basis of a moving average over 10 shifts



We can see this deployment through the plan to achieve one of these targets - the 'Perfect No-Stop Line PNS' which will have less than 300ppm process malfunctions and a mean time between touches (i.e. operator intervention) of more than 4 hours. ⁴ In order to achieve this ambitious target they need to work on several sub-projects, covering both ergonomics and man-machine interfaces and also the level and type of plant and equipment.

In turn this translates to a detailed series of tasks which have to be dealt with in step-by-step fashion - as below:

Step	Title	Aims
1	Total inspection on facility and product	No malfunctions No accidents No faults
2	Model plan	Prepare for no touch 100% good product No stopping No adjusting
3	Trial practice	Model of no touch operation MTBT of 4h
4	First and subsequent development	Expansion and fixing of no touch system
5	Full autonomous maintenance	MTBT of 8 hours or more

In turn each of these ambitious targets becomes a set of projects for training, experimentation and problem-solving. Importantly the actual achievement is less important than the journey itself, with all it implies for building a deep understanding of the key barriers to TPM. Significantly they report that the momentum within this project dropped off during the step 3-4 transition and they re-energized the project with major training inputs .

Training is a key feature of this company, with a systematic progression plan for upgrading all employees aimed at levelling up and increasing skills in various maintenance and related skills. Significantly these training inputs include a component of 'know why' as well as know how, and cover issues outside the work group context - for example, the overall functioning of the PDS approach. Their approach is to use operators for most activities, supported by specialists - so that in maintenance there are only 10 formal specialists, but a further 100 plus with qualifications in basic maintenance skills. This equates to the target of at least one licensed maintenance worker in each work group.





Case 5: Industrial trucks Ltd.

This is a major producer of fork lift trucks and related machinery and at this particular plant they employ around 900 staff producing three main product lines - industrial trucks, construction equipment and other new products.

Strategy is now focused on the 'Aggressive 30' programme, reflecting the 30 years since the plant was set up, and TPM and indirect cost reduction are the key themes. Previous mid-term plans have focused on TQC (1975-92) but TPM has dominated since 1992. Current targets within the plan are:

- 1.5 times increase in overall productivity
- Breakdown reduced to 10% of current levels
- Streamline production flow by 30%
- Reduction in NPD introduction time of 50%

To deliver these they have a 9 pillar structure to the programme which is deployed as in the other examples. Results from the first phase were encouraging; during 1993-96 they reduced the costs of waste from an estimated Y7.8bn (= 26% of total production value) to Y4.2bn; they plan to cut this down further in the current plan. The total cost of waste is calculated and broken down into 46 areas, each of which becomes the target for improvement activity.

Kaizen operates in both top down and bottom up modes. Each work group studies its 'waste map' and identifies a series of projects which are led by section managers. Each section has specific targets to achieve - for example, increase machine availability from 49% to 86%, or cut work in progress from 100 to 20 vehicles.

The number of themes has grown, both for individual kaizen teian and for small group activities as shown below:

	No of themes for small group projects	No. for individual actions
1993	14	136
1994	28	230
1995	40	290
1996	46	360

Each waste theme is plotted on a matrix, with the other axis being a detailed description of the types and nature of waste arising. This matrix gives a picture of the project targets which are then indicated by a red (= unsolved) or a green (=solved) dot. Importantly projects completed in one year can be revisited and the targets increased in subsequent years to drive through continuous improvement. For example, in the case of set-up time for changeover to new products:

	Number of changeovers	Time to effect each changeover in seconds
1993	255	2903
1994	285	3216
1995	298	2824
1996	304	1716
1997 plan	650	1100



or in reducing the number of short (less than 5 minute) stoppages on a welding robot line :

Year	Number of Stoppages
1993	7133
1994	10179
1995	7494
1996	2671
1997 pan	700

The tools and mechanisms used for this are classic SMED - video analysis, group discussion on waste identification and potential solutions, etc. (Shingo 1983).

In another area machining of units increased from 206 per shift in 1994 to 221 in 95, 238 in 96 with a planned 255 in 97. Much of this was a result of projects designed to increase the length of time which machines could operate unmanned, moving from 40 minutes in 1994 to 420 in 1996.

Overall results of the first phase TPM include:

- plant lead time average 11 days down to 4
- WIP from 340 units to 90
- number of short stoppages reduced from 8160 to 1706
- total productivity increased to 154% of the 1994 level

A significant element in the new MTP is the focus on administrative productivity. Targets here focus on two areas - material reduction (through better purchasing, etc) and human efficiency improvement. The latter makes use of a Work Breakdown Structure approach, and analysis of this kind identified 160 kaizen project areas which have contributed a 28.8% improvement in indirect labour productivity. The development of work on these themes is indicated below:

Year	Number of themes worked on
1992	28
1993	21
1994	41
1995	38
1996	32

The basic model involves a kind of business process re-engineering (BPR) approach in listing the ideal and actual ways in which work could be carried out and then addressing projects to close the gap. For example, in one area the staff required reduced from 7 to 2 via elimination of unnecessary work and increases in autonomy.

Much of the 'technology' for effecting such improvement has come from transferring concepts used in production - e.g. focus on high value added work, make contribution visible. A version of cellular manufacturing is also in use in the main office where a kind of 'hot desking' approach (called 'free location') is in use. This has the advantage of reducing space requirements but also of breaking down many of the barriers between functional areas on the administrative side; the use of multiple copies of documents is also dramatically reduced. It is being backed up by training to develop multi-skilled workers able to move freely between jobs.



CI activities are grouped into small group and kaizen teian activities. Where a kaizen target is identified a label is stuck on and when the project is complete the label is removed. Over the past 2 years 6000 labels have been removed. Small groups meet for an average of 10 hours/month approximately 4 times per month. There are roughly 14 groups of 7-12 people.

Reward and recognition for ideas varies with the level of suggestion. For small kaizen it is assumed to be part of the job but additional rewards can be given. There is a bimonthly boardroom presentation for the most effective suggestions. For simple teian suggestion they use the standard suggestion scheme and pay for these on a scale ranging from Y100 to Y20,000; some employees contribute over 200 suggestions per year. They are ranked in terms of their potential contribution to profit and a big idea would need to contribute Y1m upwards. The ranking is carried out by a panel and is generally perceived to be fair; in part this may result from the differences in overall payment systems (based on seniority) in which workers become accustomed to different level of pay for the same basic work. There also a re-deployment programme so that staff are not worried about losing their jobs as a result of suggestions; for example in the administrative area overall staff has been cut from 217 to 139 but these have been re deployed into sales, new business ventures or to headquarters.

Once again much is done to reinforce the behavioural messages and to lead by example. In the training workshop where all workers go for repeated injections of training, there is a display of completed improvement projects, with some good ideas which can be applied to other equipment. For example, the use of little windmills on all outlets gives a simple visual indicator of whether or not a cooling fan is running. Another gauge mounted a simple needle on a bearing with a piece of white card behind it. This gave a clear visual representation of whether or not there was heavy vibration in the bearing - an idea which could be widely distributed.

Making things visible is a key theme - the use of the matrix charts with their red and green dots everywhere is a constant reminder of the overall CI programme. Also each project, as it is completed is painted a shocking pink colour so that it is clear on walking through the factory where and what has been done - often sparking interest and application elsewhere but at least reminding on a continuing basis.

It's not just Japan

Before we leave the case examples it will be worth emphasising that the experience described in detail here is not confined to Japanese firms. There are widespread examples from around the world which demonstrate the significant potential of sustained level 3 capability. A number of writers have reported such cases in detail, including (Kaplinsky 1994; Gallagher and Austin 1997; Witcher and Butterworth 1997; Humphrey, Kaplinsky et al. 1998; Owen and Morgan 2000; De Jager, Welgemoed et al. 2002). Here are a few which highlight both the benefits and also the considerable efforts needed to build and retain such capability.





Case 6: Better Boilers Ltd

This company, an old family business, specializes in the manufacture of domestic heating systems for the UK market. It employs around 700 people and has a tradition for enlightened human resource policies with an emphasis on participation. However it was a period of turbulent environmental change which pushed their thinking towards an emphasis on high involvement innovation – in particular:

- Slow down in growth as markets became saturated
- Consolidation of players in the sector led to an increase in price competition
- Changes among customers/distribution channels: as builder's merchants restructured from regional to national companies, this led to an increase in their purchasing power which put pressure on
- Environmental pressures: increasing demands for more energy-efficient boilers put more pressure on R&D expenditure
- A rise in the company's cost base in both direct and indirect areas
- Expansion in the product range in terms of both volume and mix led to pressures on becoming more flexible. (There were up to two dozen variants of some products)
- Failure to meet customer demand for specific models despite high overall stocks (stock turn was around nine) an indication of problems in production layout and management
- Quality problems: although the company had a reputation for high quality and was well respected, this was achieved only by high inspection and rework costs

The management recognized the need for fundamental change if the company was to survive and maintain its competitive position. The outcome was the formulation of a Company Improvement Plan (CIP), based on the introduction of Just-in-Time techniques. The plan aimed incorporated the following aims:

- Support business growth plans
- Improve customer service and market opportunity
- Reduce business operating costs of: stock, cost of quality and space requirements
- Reduce lead times
- Enable quicker response for new product introductions
- Strengthen competitive position

It identified seven specific areas on which improvement activities would focus:

- Quality improvement
- Balanced production
- Lead-time reduction
- Set-up reduction
- Pull systems
- Supplier networks
- Housekeeping

Four task groups were set up to managing change in key areas. The first was tasked with setting up a pilot production cell; the second focused on planning and the implementation of a revised approach to planning and scheduling; the third was based around human resource issues and communication, education and training to support CIP; the fourth task group was charged with the implementation of a Quality Improvement Programme.



Pilot cell

One of the first activities under the new CIP was to pilot the JIT principles by setting up a new production cell for boiler production, which ran ten different models. This ran for four months on a pilot basis and proved to be a tremendous success, generating significant improvements in a range of areas:

- Product cycle time reduced from average of seven weeks to one day.
- Throughput reduced from days or weeks to two hours.
- Some set-ups reduced from 30mins to few seconds.
- 50% saving in floor space (30,000 to 15,000 sq ft).
- 60% reduction in distance travelled (2,200 to under 1,000 ft).
- Significant reduction in scrap and rework.
- All ten models could be made in a day.

The improvement was also reflected by higher levels of morale. Although some employees were wary that it was still early days, comments from workers indicated clear signs of improvement:

“Anything we don’t like or doesn’t seem practical they are modifying for us. We have had some say in what we’re doing. The commitment throughout and the attitude of management has been good. We have seen a different attitude. It’s been better than before.”

Everything is a lot more compact, it’s a cleaner and neater area and everyone knows what everyone else is doing. I think it is a friendlier atmosphere. The new job has made the job easier and there is not as much carrying to do around the place.”

Due to the success of the pilot, the changes were adopted across the company.

Developing continuous improvement capability

The next stage in developing capability came after a restructuring into focused business units (SBUs) and involved group-based voluntary teams called CITs – continuous improvement teams. These differed from SBU work teams in that they were voluntary and sometimes operated cross-SBU and cross-company. All teams were formally registered so participation could be monitored and appropriate support/facilitation made available.

Before teams set up, team leaders and team members were trained. All members participated in one day awareness sessions (over a period of two years). Managers at all levels, from directors to team leaders attended a two week team leader training programme (spread over 6 months) covering team leading, problem solving, enabling and coaching skills.

Everyone was given CIP handbooks explaining principles of continuous improvement (CI), its role in the company, the mission statement, CIP principles, the problem solving process and tools.

Recognition was addressed in a number of ways. For example, there were lunchtime recognition sessions at which each team had to make a presentation of their progress twice a year in front of an invited audience and attended by at least one director, other managers and guests.

A target was set of 25% participation by end of first 12months of operation (was actually 28%). In second year, the target of 57% was reached by mid-year and by end of that 12 month period 75% of workforce had participated.



During this period the teams were given the authority to spend any amount if they could show a return in improved performance.

20 Keys Programme

Later as the CIT activities appeared to be plateauing, the **'20 Keys' initiative** was introduced. 20 corporate wide objectives were identified, covering things such as housekeeping, stock control, etc. and each was described at five levels of achievement. CITs assess current status of each key and set targets for improvement.

The keys act as a prompt for ideas for improvement and provide supporting measurement system to monitor progress. The company's annual report highlighted the importance of this approach:

"This new system for measuring process performance against world class standards offers team members a valuable opportunity to progressive assessment. The package, which is applied to every aspect of the working environment, is proving invaluable in the identification and weeding out of methods which do not make a contribution to quality and profitability. This incremental approach not only creates a sense of shared control over the company's processes but also enables unnecessary costs to be traced and eliminated."

This policy deployment approach operates in the following way. The team reaches consensus as to what the current performance is in each of the keys. They then construct the radar chart and formulate an action plan. Targets are set between Team Leaders and General Managers. Team leader then discuss with team and reaches consensus on improvement targets. Identify which keys are most in need of improvement (high profile keys). Establish work programme and monitor. Since targets set through team consensus, team has ownership of targets. Team Leader will monitor general progress. Teams meet regularly to discuss improvement opportunities. These opportunities listed and prioritized through team discussion and consensus. CIT Improvement Ideas Sheet used to record the identified opportunity and progress it through to actioning the solution.

Following the success of the continuous improvement programme the company embarked on a number of complementary activities including an inter-firm CI programme with its suppliers, based on vendor rating and analysis of strategic challenges for policy deployment.