"TPM as a tool for Competitive Advantage"

"Current state of manufacturing and TPM – Learning from TOYOTA KIRLOSKAR AUTO PARTS (TKAP) – INDIA"

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Japan Institute of Plant Maintenance (JIPM)

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Japan Institute of Plant Maintenance

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- 1961: The Japan Management Association establishes a Plant Maintenance Committee.
- 1964: A system of presenting PM awards is established.
- 1969: The Plant Maintenance Department is dissolved and the Japan Institute of Plant Engineers is established.
- 1971: The concept of plant maintenance with total participation (TPM) is put forward.

  Nippon Denso (currently known as Denso) implements TPM and wins a PM award.
- 1973: The "National Equipment Management Month" campaign begins.
- 1981: The Japan Institute of Plant Maintenance is launched with the approval of the Minister of International Trade and Industry (current Minister of Economy, Trade and Industry).
- 1994: The Chubu chapter hosts the First Karakuri Kaizen Kufu Exhibition.
- 2001: The Autonomous Maintenance Engineer license system is launched.
- 2008: Mr. Chisei Isogai (advisor at Toyoda Automatic Loom Works) becomes the ninth JIPM Chairman.
- 2008: The Planned Maintenance Engineer license system is launched.
- 2011: JIPM celebrates the 40th anniversary of its advocacy of TPM and 30th anniversary of its foundation (as a corporation).
- April 2012: JIPM is reorganized into the Japan Institute of Plant Maintenance as a public service corporation.
- June 2012: Mr. Osamu Nakatani (advisor at Toray) becomes the tenth JIPM Chairman.
- October 2015: The 20th Karakuri Kaizen Kufu Exhibition takes place.
- June 2016: Mr. Soujirou Tsuchiya (advisor at Denso) becomes the eleventh JIPM Chairman.
- September 2016: JIPM hosts the 21st Karakuri Kaizen Kufu Exhibition at Pacifico Yokohama.

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I - 1. What is TPM®?

TPM definition (company-wide TPM)

TPM（Total Productive Maintenance) aims at:

1. Establishing a corporate culture that will maximize production system effectiveness,
2. Organising a practical shop-floor system to prevent losses before they occur throughout the entire production system life cycle, with a view to achieving zero accidents, zero defects and zero breakdowns,
3. Involving all functions of an organization including production, development, sales and management,
4. Involving every employee, from top management down to front-line operators, and
5. Achieving zero losses through the activities of "overlapping small groups."

Ⅰ-2. What TPM aims at

To restructure corporate culture through improvement of human resources and plant equipment

Improving human resources	**① Operator: Ability to perform Autonomous maintenance** **② Maintenance: Ability to perform high-quality maintenance** **③ Production engineer: Ability to execute maintenance-free equipment plan**

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Improving plant equipment	**① Attain efficiency through revamping of the existing equipment** **② LCC-considered design of new equipment and minimizing start-up time**

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Improving the corporate culture

“ pursue maximum production efficiency”

I -3. 8 pillars of TPM deployment

Focused improvement	Improve efficiency through pursuing zero losses, and improve technical capabilities and Kaizen skills
Autonomous maintenance	Develop people who are skillful at equipment operation, and can manage and maintain good condition
Planned maintenance	Achieve zero equipment breakdown, and create planned maintenance structure to prevent breakdowns from occurring
Training and Education	Establish a structured system to develop human resource that are skillful with equipment operation, work and management
Health, Safety and Environment	Create a plant that is safe, secure and filled with energy
Quality maintenance	Establish zero defect condition to prevent quality defect and establish maintenance and management structure
Early management	Shorten development lead time for products and equipment, and establish a system that enables vertical start up production
Office TPM	Eliminate losses in the office and establish a supporting system for suppliers and supply chain

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I -4. TPM effects (example)

P Value added productivity
: 1.3 - 2 times

- Sporadic Failures: 1/5 - 1/290
- Equipment availability: 1.5 - 2 times

Q Process defect ratio: 1/10
Customer claim: 1/4 - 0

C Production cost: 20-50% down

D Product / WIP inventory: 50% down

S Lost time accident: Zero
Pollution: Zero

M No of Kaizen proposals: 5 - 10 times

① All-out autonomous management, i.e. People are charged to 'look after their own equipment' without being told

② Self confidence can be built up through "Zero breakdown" and "Zero defect" operation

③ Grease, chips and dust will be removed and a pleasant working environment can be created

④ Positive impression for visitors leads to success in receiving more orders

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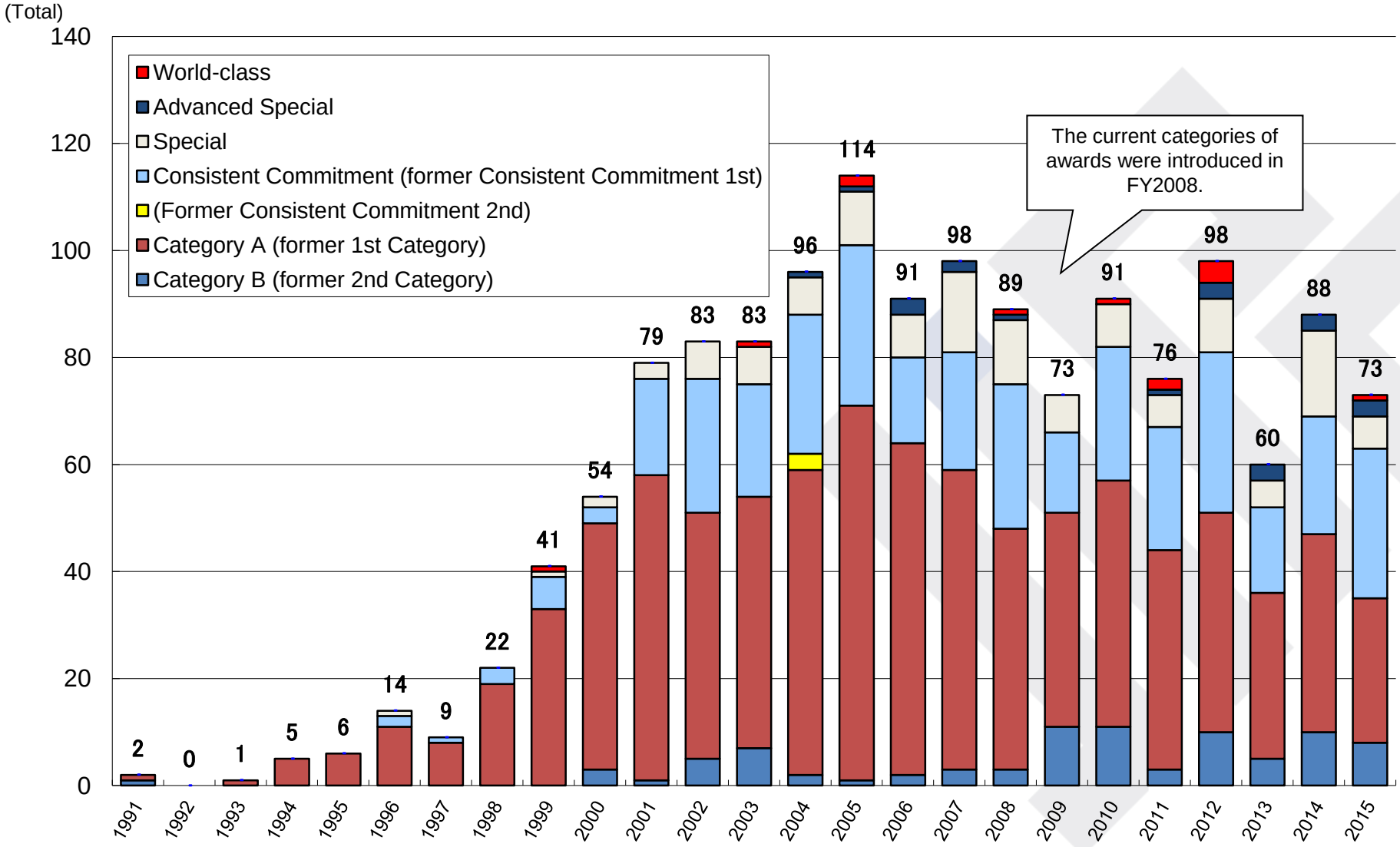
I-5. Trend in Overseas Winners of TPM Awards (1991–2015)



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III-1. The Present State of Manufacturing (1)

Fourth Industrial Revolution: "IoT" and "Industry 4.0"
—Creating new value to connect people with information—

- **First Industrial Revolution:** In the 18th century, the steam engine was invented, and light industries developed.
- **Second Industrial Revolution:** In the 19th century, electricity was used effectively, and heavy industries prospered.
- **Third Industrial Revolution:** In the second half of the 20th century, computers spread, and automatic production began.

■ **Fourth Industrial Revolution:**

IoT, Industry 4.0, artificial intelligence (AI), and automation technology such as robotics will be combined to create new businesses and services. The sophistication of industries will accelerate.

*** In April 2016, the Ministry of Economy, Trade and Industry estimated that "if Japan takes no action as technological innovation progresses, in FY2030 it would lose 7.35 million jobs, approximately 10% of the country's total."**

*** It is expected that industry and society will undergo rapid changes at a quick pace never experienced before. It is necessary to prepare for future changes while seeing the next 10 to 20 years as a yardstick for cycles of change and consider how to make the most of IoT and AI.**

III-2. The Present State of Manufacturing (2)

* AI will automatically produce schedules to meet all customer orders and delivery deadlines using data collected in real time and autonomously take necessary actions.

* AI will use data from sensors installed in each piece of equipment to detect signs of failure that are difficult for even experienced operators to find.
  → Unless the opinions of workers are heard, there is a risk that equipment will be covered with sensors.

* It will also become possible for manufacturers to reduce lead time based on the production department's instructions to zero and respond to orders through single-item production without having inventories.

* It could happen that much of previous production control such as manual plan changes and work instructions will become unnecessary. This will also become a solution to problems in Japan such as population decrease and lack of engineers.

III-3. The Present State of Manufacturing (3)

* Currently, AI requires huge amounts of data, but there is a plan in which, through joint research between businesses and research institutes, researchers will develop mission-critical technologies with the specific purpose of generating optimal solutions that cannot be found by human beings even if data is limited.

* Businesses will not be able to distinguish themselves if they introduce equipment from manufacturers as is.

  Equipment must arise from strong worksite skills.

* Competitiveness should be enhanced by combining a Japanese style of manufacturing and advanced technologies such as AI.

  Japanese-style smart factories: A bottom-up approach in which workers identify and solve problems is also important in the Fourth Industrial Revolution.

* The time will come in which "he who controls information, controls industry."

* Equipment management and TPM are important to realize IoT and 4.0.

IV-1. What Is Karakuri Kaizen®?

"The mechanism is simple."

"No money is spent."

"Improvements made by eliminating unreasonableness, waste, and unevenness"

The result is highly creative, happy improvements that set an example for others.

(as explained by Dr. Toyoharu Tsumura, Professor Emeritus at Shibaura Institute of Technology)

*** In March 1994, the First Karakuri Kaizen Kufu Exhibition was held in Nagoya.**

*** The Karakuri Kaizen Kufu Exhibition has also been held in Tokyo since 2000.**

*** FY2016 marks the 21st exhibition (Sept. 29–30).**

IV-2. Important Points in Karakuri Kaizen (1)

*** The starting point of Karakuri Kaizen is not to achieve greater efficiency but to make work easy.**

→ Workers improve jobs they have difficulty performing.

*** Workers use their creativity to solve problems that give them trouble in daily operations.**

(1) Analyze one's job and movements using videos and other tools effectively and decide what you want to improve. Close observation and devising systems makes the heretofore invisible world visible.

(2) Closely examine the shapes of workpieces to be processed and methods of conveyance.

(3) First consider methods that do not use a new form of power.

(4) See if the power currently being used can be employed or not. Make the most of neighbors' energy too.

(5) Decide on an energy to use.

(6) Try to make a miniature after ideas are developed.

→ It is also important to imitate predecessors' Karakuri Kaizen.

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IV-3. Important Points in Karakuri Kaizen (2)

* TPM activities and Karakuri Kaizen

- Interest in equipment and will to improve through autonomous maintenance activities

- Karakuri Kaizen is important to making well-conceived, well-designed equipment.

  → The operability and maintainability of equipment is improved.

- Low-cost automation (LCA) and Karakuri Kaizen

  → Karakuri Kaizen enables workers to perform their jobs more easily.

  → Reduce equipment cost: Improvements should not require that much money.

- Environmentally friendly Karakuri Kaizen that do not use new forms of power

  Example: Moving workpieces on the conveyor using the upward and downward movement of the press

Ⅳ-4. Conclusion

Up to now, Karakuri Kaizen has contributed to resolving the issues listed below.

(1) The need for improved worksite skills through human resource development

(2) The need to improve the reliability, operability, and maintainability of equipment while keeping investments low and enable overseas factories to share technology
→ In Japan, where goods do not sell, Karakuri Kaizen is important for reducing capital investments.

(3) Reduction of CO2 emissions and energy conservation measures
→ One example of reduction of CO2 emissions is Toyota Motor's "Toyota Environmental Challenge 2050" in which it cites Karakuri Kaizen—an effort to reduce factories' CO2 emissions to zero through daily improvements—as an effective means of achieving the initiative's goals.

(4) Make well-conceived, well-designed equipment, which brings together the design department's technology and worksites' information and know-how
→ Promotion of Karakuri Kaizen helps make equipment simple and slim, thus realizing low-cost equipment that is unlikely to break down.

(5) Support diversity by reducing workload (Example: responding to the aging of workers and making way for women to play an active role)

V-1. 8 Principles to Lead TPM Activities to Success

1. Implement TPM as an activity to achieve the company's management policy.
2. Urge senior managers (president, executives, and plant managers) to study TPM and participate in plants' activities personally.
   ⇒ The "T" of TPM also stands for the "T" of top management.
3. Plan the preparation for the introduction of TPM.
4. Train field managers and supervisors.
5. Draw up a budget for activity expenses.
6. Establish a thorough office to promote TPM.
   ⇒ The plant's No. 2 or equivalent person, a candidate for future senior management, is recommended.
7. Study other TPM activities mainly through outside seminars and visits to other companies.
8. Have TPM activities evaluated by external parties (Try to win TPM awards).
   ⇒ Without clear goals, TPM activities will stagnate and bring few results.