



TPM³ and Six Sigma: Similarities and Differences

By Ross Kennedy – President & Managing Director

TPM³ / Australasian Lean is a structured, yet flexible and practical, phased journey that unleashes the full potential of your people, equipment & processes as you strive for World Class Performance. It is a proven company wide improvement strategy that initially focuses on equipment performance to provide the foundation for a true Lean implementation of FLOW with the flexibility and capability to allow management to expand the methodology throughout the supply chain, ultimately involving all employees, suppliers and customers.

Six Sigma is a comprehensive and flexible system for achieving, sustaining and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data and statistical analysis, and diligent attention to managing, improving, and reinventing business processes. (Pande, Neuman, Cavanagh, 2000)

Research for this paper highlighted several high level similarities between TPM³ / Australasian Lean and Six Sigma

6 Themes of Six Sigma (Pande, Neuman, Cavanagh, 2000)	6 Themes of TPM ³ / Australasian Lean
Genuine focus on customer	Maximise Customer Value
Data & fact driven management	Focus on the Holistic improvement ‘drivers’ of Overall Equipment Effectiveness (OEE), Lead Time Reduction of Processes, Life Cycle Cost of New Equipment / Products, and Time Lost by Maintenance supported by site wide goal aligned performance measures, baselines, and dashboards incorporating Input, Process & Output monitoring
Process focus - Management & Improvement	People, Equipment & Process focus – Management & Improvement
Pro-active Management	Pro-active through engaging all employees to support an Innovation and Learning Organisation
Boundary-less collaboration	Everyone involved in Cross-functional Team and Area Based Team improvement activities
Drive for Perfection, Tolerance for failure	Innovation & Learning Organisation striving for Perfection / World Class Performance

For example both focus on the customer; however Six Sigma does this through a project focus with limited employee involvement where as TPM³ / Australasian Lean achieves it through engaging all employees especially those who are doing the value-added activities (workers).

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Motorola and others have announced that their quality goal is Six Sigma... What is the obstacle? It's your machines. You must have a perfect machine to produce a perfect product. (Hartmann, 1992) If the equipment is not working perfectly employees become frustrated and the company cannot service their customers competitively.

The two methodologies are data driven, believe in preventing problems from happening, encourage cross-functional collaboration and use learnings in the drive to perfection.

Some other similarities include:

Six Sigma (Pande, Neuman, Cavanagh, 2000)	TPM³ / Australasian Lean
Which inputs have the biggest influence on the results	Bottleneck / problem area analysis
Variation in product	Variation in equipment component life, variation in equipment performance, variation in product and variation in flow / delivery
A defect is any instance or event in which the product or process fails to meet a customer requirement	An equipment defect is any imperfection with the equipment, a product defect is any imperfection in specification, a flow defect is any imperfection in the production plan.
Process Improvement	People, Equipment & Process Improvement
Process design / redesign	Engage employees, improve equipment performance, improve equipment & product design weaknesses, enhance processes and flow, ensure new Equipment / Products / Processes are TPM ³ Friendly
Black Belter, Green Belter	TPM ³ Co-ordinator, TPM ³ Champions (Production Managers), TPM ³ Co-Champions (Maintenance Managers)
Training for above: 2-3 weeks	Training for above: 2 weeks with 6-12 months hands-on support plus a continuing development program.
Six Sigma Coach	TPM ³ Navigator
Pilot areas	Strategically selected pilot areas
Project Charter	Team Mandate & Boundaries
Leadership support (Leadership Group / Sponsors / Champions)	Leadership support (Leadership Team / Sponsor / Champions)

They both use analysis to ensure efforts are focused on bottlenecks / key areas of influence (Theory of Constraints), support Dr Edwards Deming's concepts that variation must be reduced, and address the concept of defects.

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Well-trained facilitators are vital, as is upper management support. The methods both suggest trialling in pilot areas, and insist that teams have very clear guidelines (mandates and boundaries). Similar tools are used for data analysis and root cause analysis.

However comparing some of the Key Features of Six Sigma and TPM³ / Australasian Lean starts to highlight the important subtle differences:

Key features of Six Sigma	Key features of TPM ³ / Australasian Lean
Strategically Driven by Management	Strategically Driven by Management
Quality Performance as 'driver'	Equipment Performance as initial 'driver' to provide stability to allow Flow to enhance Customer Satisfaction (Best Quality, Best Service, Lowest Cost, Shortest Delivery Time)
Data analysis based on existing records	Data analysis based on observation, local knowledge and records
Project driven by selected employees	Behaviour driven engaging all employees especially those who add the value (workers)
Little, if any, Area Based Team development focus	Promotes and supports synergistic Area Based Teams to address problems at the source
High Technical Content	Not 'rocket science'

3 Quotes Worth Considering

In order for a company to create the culture required to implement Six Sigma, deployment leaders must deal with the potential schism that can occur with the development of a cast system of 'have' (i.e. "The Black Belts") and 'have-nots' (i.e. the rest of the employees). While 'The Belts' may be fully engaged, they typically represent a small portion of the employee population. If the non-Belts are not equal contributors to the desired culture change, they will feel even less engaged than before...People get engaged in improvement efforts when they believe their participation is actually making a difference for themselves. (Kowalski)

IF there is a chink to be found in Six Sigma's armour, the survey identifies non-Belt participation and ownership. This problem, however, rarely surfaces in the first 12 to 18 months of Six Sigma Deployment. In fact, we've observed that, initially, many Six Sigma Deployment Leaders experience a false sense of security about results. Why? Because most of the projects taken on by newly trained Black and Green Belts rarely require high levels of frontline support, and for the most part, don't challenge top managements' ingrained cultural biases... more tools are required to deal with the change management aspects of Six Sigma". (Kowalski)

Many people are surprised when I give talks and tell them that Toyota does not have a Six Sigma program. Six Sigma is based on complex statistical analysis tools. People want to know how Toyota achieves such high levels of quality without the quality tools of Six Sigma. You can find an example of every Six Sigma tool in use somewhere in Toyota at some time. Yet most problems do not call for complex statistical analysis, but instead require painstaking, detailed problem solving. This requires a level of detailed thinking and analysis that is all too absent from most companies in day-to-day activity. It is a matter of discipline, attitude, and culture. (Liker 2004)

Data Analysis

Six Sigma make extensive use of existing records. Due to the inherent weaknesses in a lot of front line data eg downtime reports, TPM³ / Australasian Lean also relies heavily on observations and local knowledge to complement the data. These observations and the local knowledge provide valuable information on what is happening and possible root cause.

Many times what gets recorded into measurement systems is where the problem was noticed, not where it originated. One company spent many dollars on the equipment in the exit area (as the system noted the problem there) only to discover through observations and surveys that the problem was with the conveyor feeding the exit area.

The use of observation and local knowledge also supports the engagement of people, as everyone in the area knows they have had input into the information being analysed.

Speed of Results

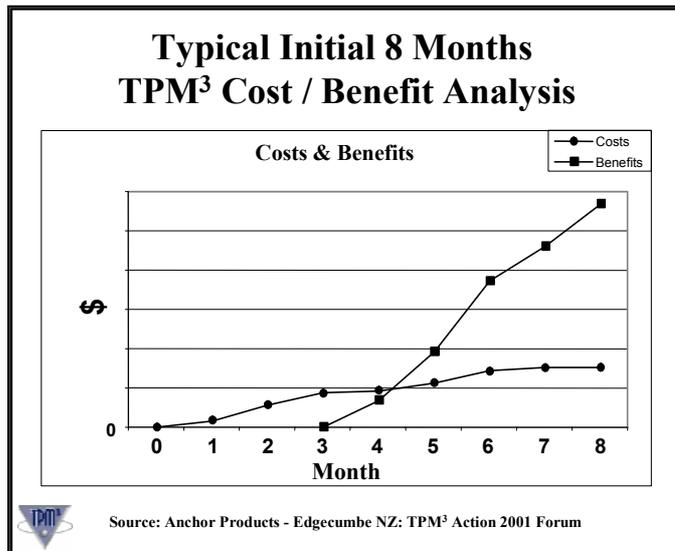
Six Sigma often has a long Leadtime before significant benefits start to flow.

And what we can see from the GE deployment is that a company shouldn't expect more than a breakeven the first year of implementation. Six Sigma is not a "get rich quick" methodology (Waxer)

"Success with Six Sigma is a five-year trip at least." (Dave Amos, Ford) For the first two years, people had to keep telling Jack Welch, 'You're not going to see bottom-line results right away'"

From an initial year or so of break-even efforts, the payoff has accelerated (at GE) (Kowalski)

On the other hand, due to the relatively small initial outlay, after the first 3 months of the introduction of TPM³ / Australasian Lean, significant returns can often be generated.



The mandate for most TPM³ teams in the first 3-month cycle of improvement activity is at least a 25% improvement in Overall Equipment Effectiveness (increase in first pass good output though improvement in planned or unplanned downtime, performance rate or speed, and quality performance including yield, rejects & rework). Generally companies will spend \$50,000 to \$100,000 in the first 6 months and get an annualised return of \$200,000 to \$400,000.

At the 2005 TPM³ Forum in Melbourne **ai Automotive – Adelaide (SA)** reported how their first cycle of TPM³ involved 4 Macro Focused Equipment & Process Improvement teams, which delivered annualised savings of over \$400,000. One of the teams in an assembly cell improved OEE from 47% to 63% (34%) and improved first pass Quality from 93% to 99%.

At the 2003 TPM³ Forum in Sydney **ACI Plastics Packaging – Kirrawee (NSW)** reported how one team over 12 weeks reduced material losses resulting in an annualised savings of \$178,788.

Also at the 2003 TPM³ Forum in Sydney, **Zinifex (formally Pasmenco) Rosebery Mine – Rosebery (TAS)** reported how over their first 12 months they reduced Crusher Roll change-outs saving \$160,000 per annum; improved capability in mine development from 100 to 125 metres / week; and improved metal recovery in their conversion plant by 3% giving a revenue increase of \$1.6m per annum.

Reported Long-term Achievements from TPM³ / Australasian Lean (Source: TPM³ Forums in Aust & NZ)

Hynds Pipe Systems – East Tamaki Site in New Zealand

Commenced their TPM³ Journey in September 2001. On March 2006, the East Tamaki site was the first New Zealand site awarded Level 1 of the 5 Level Milestone TPM³ Excellence Award. They are currently progressing Cycle 13 with some 80% of their employees involved in TPM³ improvement teams.

They have achieved a 90% increase in output from the plant since commencing their TPM³ Journey

Other publicly reported achievements at the site include:

2003: Reported that one section of the plant had been able to increase capacity 62% allowing the introduction of ongoing Area Based Team improvement, which has more than sustained the gains.

2004: Operations Manager reported their TPM³ activities had resulted in a 12% reduction in operating costs and a 20% increase in output from the site compared to last year, with little to no capital expenditure.

2006: A team focusing on improving the yard layout, storage and traffic flows at their site produced impressive results including a 30% increase in storage space, a reduction in loading time, a 23% increase in productivity and an increase of 4% in truck fill.

Juken NZ – Northland Mill at Kiatia in New Zealand

Commenced their TPM³ Journey in January 2005 and over the first 12 months completed 3 cycles of TPM³ team activity engaging 28% of their workforce in their Sawmill and Veneer Plant. Achievements in their Sawmill, which was a major focus of their pilot activities, included:

- *87% reduction in Lost Time Injury Frequency*
- *34% increase in Capacity (OEE)*
- *375% increase in Productivity*
- *93% increase in Yield*
- *67% reduction in Maintenance Costs*
- *29% reduction in Electricity Costs*
- *67% reduction in Labour Costs*

all contributing to a **50% reduction in Total Costs**. Supporting this was zero customer complaints. Currently the site is progressing Cycle 6 with 98% of their employees involved in TPM³ Activities

Simplot Australia

Commenced their TPM³ journey in September 2003 at 3 of their sites (Kelso NSW, Echuca VIC and Ulverstone TAS). In November 2004 they expanded their TPM³ journey to their remaining sites (Bathurst NSW, Devonport TAS and Agricultural Services TAS). To date 2 sites have been awarded Level 1 of the 5 Level Milestone TPM³ Excellence Award (Kelso Sept 05, Devonport Aug 06) with the other sites aiming to achieve similar by the end of 2006. Some of their publicly reported achievements include:

2005 Simplot Australia – Kelso (NSW): Reduced product spillage by 87% and increase OEE by 4.5% equating to a annual saving of \$182,000 on one product line. Total Plant OEE has improved from 64% to 83% in 12 months (Sep 04 to Aug 05)

2006 Simplot Australia – Bathurst (NSW): A New Equipment Management Team for Capsicum Processing reported a \$19,165 savings due to early commissioning of the new line and an annualised saving of \$156,578 due to increased throughput and recovery along with two new commercial opportunities due to improved quality results. They also reported improved safety, communication and morale along with better understanding of quality requirements by the process workers.

Synergies between Six Sigma and TPM³ / Australasian Lean

Due to both the similarities and the differences, TPM³ / Australasian Lean can enhance any existing Six Sigma program by:

- Engaging all employees
- Using local knowledge to verify / challenge data
- Creating opportunities for quick, low cost improvements

TPM³ / Australasian Lean is now being seen as a necessary component of a Six Sigma program whether it be in manufacturing, processing, mining, utilities or service companies.

References

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About The Centre for TPM (Australasia)

The Centre for TPM (Australasia) or CTPM was created as an outcome of the first conference dedicated to TPM in Australasia held in Sydney in 1995. During the conference, which was chaired by Ross Kennedy, there was a call from the delegates to establish a much-needed Institute for TPM to support industry, academia and government similar to those already present in Japan, USA and Europe. Responding to this call, Ross with several colleagues, established CTPM in January 1996 with its head office located in Wollongong. CTPM is a membership-based organisation established to develop, promote and advance the knowledge and practice of TPM³ / Australasian Lean.

TPM³ / Australasian Lean is an enhanced and expanded version of the internationally recognised TPM methodology that was originally developed in 1970 as an integral part of the now famous Toyota Production System and kept secret by the Japanese for some 20 years. Enhancements include being specifically redesigned for the non-Japanese workplace culture and expanded to embrace the entire Toyota Production System rather than just equipment focused.

Several of our clients now describe **TPM³ as Australasian Lean** as it is a structured, yet flexible and practical, phased *journey* to Lean Production initially focusing on equipment performance as a driver to rapidly bring benefits to shareholders, customers and employees. Others see it as a proven company wide improvement strategy that initially focuses on equipment performance with the flexibility and capability to allow management to expand the methodology throughout the entire supply chain, ultimately involving everyone.

Our Quest is to assist companies to unleash the full potential of their People, Equipment and Processes as they strive to achieve World Class Performance by providing the best value and most innovative training, navigation, research and networking in TPM³ / Australasian Lean

CTPM and its membership have grown rapidly. There are now over 30 sites covering some 12 Industry Groups from Manufacturing, Mining & Processing, Utilities and Service companies that are currently progressing their TPM³ journey to World Class Performance. Over 10,000 employees are covered by CTPM membership and our research group has links with the University of Wollongong and the Australian National University.

The CTPM is very mindful of the need for companies to establish their own in-house capabilities to lead, manage and facilitate their TPM³ / Lean journey in order to achieve sustained success. However we also acknowledge that TPM³ / Lean has been developed based on over more than 30 years of practical experience and research, and as such, establishing or developing internal capabilities is not achieved just by attending one or two training courses. Proper training from a recognised authority is critical (such as the TPM³ Leadership / Instructor's Program which was developed in November 1997 and to date, some 20 courses later, has over 250 graduates from some 30 companies), however most of the learning comes from doing. There are very few short cuts to experience.

For this reason, CTPM has developed a proven flexible methodology covering a range of educational training courses, introduction and pre-cycle planning workshops, team kick-off workshops supported by comprehensive step-by-step Team Member Manuals, a site wide assessment & planning process, the 5 Level Milestone TPM³ Excellence Award supported by our Milestone Assessment Process, and most importantly, a full-time team of experienced TPM³ Navigators to provide facilitation and training support who are located throughout Australia, New Zealand and Indonesia.

About Relogica Indonesia

In Indonesia CTPM deliver these services in partnership with PT Relogica Indonesia. Relogica are a asset management consulting company who specialise in assisting Indonesian clients achieve world class performance through optimising their physical assets.

About the Author

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The Centre for TPM (Australasia) or CTPM: www.ctpm.org.au

A fitter and turner by trade, Ross has a Mechanical Engineering degree from the University of New South Wales and a Management degree from the University of Wollongong.

He has more than 20 years of hands-on manufacturing and operational experience covering maintenance, production, operations and executive roles followed by 5 years of international Lean consulting experience with the Manufacturing and Operations Group of Coopers & Lybrand's International Management Consulting Practice, where he first came across TPM in 1990 when he lead one of the first implementations of TPM in Australasia.

In August 1994 Ross established his own practice specialising in TPM. He organised and chaired Australasia's first TPM conference in 1995 and, as an outcome of that conference; Ross founded The Centre for TPM (Australasia) or CTPM with several colleagues in January 1996.

After extensive research including a trip to Paris in 1997 to attend Europe's first World-Class Manufacturing & JIPM-TPM Conference and associated workshops with leading TPM practitioners from throughout the world, CTPM launched its TPM³ methodology in January 1998, which is an enhanced and expanded Australasian version of 3rd Generation TPM embracing the Toyota Production System and spanning the entire Supply Chain.

Ross has been actively involved with TPM and TPM³ / Australasian Lean since 1990 and has delivered publicly over 200 papers and workshops on the subject both within Australia and overseas. CTPM, under the direction of Ross and his team of experienced full-time TPM³ Navigators is presently assisting over 30 sites spanning some 12 different industry groups located in Australia, New Zealand, Thailand and Indonesia, on their TPM³ / Australasian Lean journeys to World Class Performance.