New Engineer
JOURNAL

Servicing Manufacturing, Industrial Engineering and Engineering Societies

In this Issue

- Principle based model for best practice in operations
- Manufacturing in the post GFC world
- Velocity…using lean thinking and digital data
- Value for money and value management
- Performance mapping and the utility-productivity performance equation

ENGINEERS AUSTRALIA

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Upcoming Conferences & Exhibitions

IAHR 34th Biennial Congress

26 June – 1 July 2011
Brisbane Convention Centre, Brisbane, QLD
www.iahr2011.org

Including the 33rd Hydrology and Water Resources Symposium – 10th Hydraulics in Water Engineering. The Congress theme 'Balance and Uncertainty: Hydraulic Engineering in a Changing World' focuses on the central roles of hydraulic engineering, hydrology, and water resources for our changing world, and how these roles link to the broader issues. A balance is continually being sought between competing values in water engineering, including the environment, the economy, tourism, social and indigenous values, health aspects, aesthetics, and the needs of current and future generations. Careful management and innovative solutions are required to balance these competing values, and these solutions must be able to deal with the uncertainty in the natural world as well as the changing human world.

Engineers Australia and its National Committee on Water Engineering (NCWE) are collaborating with IAHR to organise the 34th IAHR Biennial Congress together with 33rd National Hydrology and Water Resources Symposium and the 10th National Conference on Hydraulics in Water Engineering.

ASEAN Australian Engineering Congress 2011

25-27 July 2011
Kuching, Sarawak, Malaysia

Engineering for Sustainability

The ASEAN Australian Engineering Congress 2011 (AAEC 2011) is hosted by Engineers Australia, Malaysia Chapter and Swinburne University of Technology, Sarawak Campus with support from Sarawak Development Institute. The ASEAN Australian Engineering Congress 2011 (AAEC 2011) aims to foster excellence in the practice of 'Engineering for Sustainability'.

This Congress presents an opportunity to consulting engineers, researchers, designers, contractors, local councils, implementing government agencies and suppliers to discuss sustainable engineering solutions for the advancement of economic growth while preserving the fragile environment. It provides a forum to review knowledge, disseminate information, promote awareness, facilitate collaboration, and make recommendations on the role of engineering in responding to delivering sustainable solutions. Innovative engineering projects and potential solutions will be presented in the form of technical presentations to encourage constructive discussions and to also provide a networking opportunity amongst university lecturers, students, staff of government implementing agencies and practicing consulting engineers. There will be an outstanding program of international and local speakers to present solutions to some of our most pressing problems on 'Engineering for Sustainability'.

The Conference Program will focus on six themes to be presented by reputable speakers: Planning & Policy; Climate Change; Sustainable Buildings & Infrastructures; Green Technology; Sustainable Waste and Water Management; Community and the Environment.

AAEC2011 – ASEAN Australian Engineering Congress 11

25-27 July 2011
Riverside Majestic Hotel, Kuching, Sarawak, Malaysia
www.aaec2011.com

AAEC 2011 is hosted by Engineers Australia, Malaysia Chapter and Swinburne University of Technology, Sarawak Campus with support from Sarawak Development Institute.

The Congress aims to foster excellence in the practice of "Engineering For Sustainability". It presents an opportunity for consulting engineers, researchers, designers, contractors, local councils, implementing government agencies and suppliers to discuss sustainable engineering solutions for the advancement of economic growth while preserving the fragile environment.

ICWES15 – International Conference for Women Engineers and Scientists

19-22 July 2011
Adelaide Convention Centre
www.icwes15.org

ICWES15 is jointly hosted by Engineers Australia's National Committee for Women in Engineering and the International Network for Women Engineers and Scientists (INWES).

The Manufacturing Show Asia 2011

26 June – 29 June 2011
Raffles City Convention Centre, Singapore
www.terrapinn.com/2011/mfgshow

The Manufacturing Show Asia 2011 is a senior level strategic event that brings together manufacturing leaders across 7 key vertical industries to uncover and innovate tomorrow's strategies and models to enhance capacity and optimize resource allocations, drive costs, speed to market, competitive advantage and streamline processes to achieve profitability and market share.

At this event, you will: • Learn flexible and agile manufacturing strategies that will enable you to respond to the changing market environment; • Benchmark your organisation with other leading manufacturing companies - share your challenges and learn best practice strategies; • Learn strategies how to navigate in emerging markets such as China, India and Vietnam; • Establish and implement a practical framework to mitigate risk and ensure manufacturing compliance; • Be able to evaluate available technology to drive manufacturing process; • Find out what are the key manufacturing excellence techniques – GMPs, lean manufacturing, Total Productive Systems - in a complex Asian environment

For more information, contact Gwen Goh on +65 6322 2760 or at gwen.goh@terrapinn.com.

Eighth International Conference on Technology, Knowledge and Society

16-18 January 2012
University of California, Los Angeles USA
http://www.Technology-Conference.com

This conference will focus on a range of critically important themes in the various fields that address the complex and subtle relationships between technology, knowledge an society. The conference is cross-disciplinary in scope, a meeting point for technologist with a concern for the social and social scientists with a concern for the technological. The focus is primarily, but not exclusively, on information and communications technologies.

The conference includes plenary presentations by accomplished researchers, scholars and practitioners, as well as numerous paper, workshop and colloquium presentations. Presenters may choose to submit written papers for publication in the fully refereed International Journal of Technology, Knowledge and Society. If you are unable to attend the conference in person, virtual registrations are also available which allow you to submit a paper for refereeing and possible publication in this fully refereed academic Journal.

Whether you are a virtual or in-person at this conference, we also encourage you to present on the Conference YouTube Channel. Please select the Online Sessions link on the conference website for further details. We also invite you to subscribe to our monthly email newsletter, and subscribe to our Facebook, RSS, or Twitter feeds at http://www.Technology-Conference.com.

The deadline for the next round in the call for papers (a title and short abstract) is 14 June 2011. Future deadlines will be announced on the conference website after this date. Proposals are reviewed within two weeks of submission. Full details of the conference, including online proposal submission form, are to be found at the conference website http://www.Technology-Conference.com.

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Contents

Front Cover: Cochlear Australia New Zealand's cleanroom environment featuring a production cell.

FORMAL PAPER REVIEWS
Leading papers published in this Journal are fully refereed. This service is available through the **New Engineer JOURNAL**. Papers which are to be fully refereed for formal publication may be submitted at any time.

A Look into the Future...

This edition's front cover photo is somewhat symbolic of what this edition of **New Engineer** is all about – a reflection of what the immediate past has been, and what the future may hold. The photo comes courtesy of Rod Lopez, Industrial Engineer and Head of Manufacturing, Cochlear Australia – *an Australian company that leads the world in best practice product development and manufacturing*. Rod is special invited author of one of the feature articles that appear in this edition of **New Engineer** (more below…).

Federal President, Daniel Kulawiec , reports on activities undertaken on behalf of IIE members in the first few months of this year, and raises questions about the uniqueness or otherwise of industrial engineering. He asks if IEs (and hence the IIE) should see themselves as holders of a unique set of knowledge and skills and, if so, how we should best protect this, or IE as a more ubiquitous set of knowledge and skills that should be much more widely promoted – but again, how to do this?

Rod Lopez's feature article "Principle based model for best practice in operations" reflects somewhat Daniel Kulawiec's observation that industrial engineering can contribute to the on-going development of most enterprises. Rod brings his IE knowledge and skills not only to the fore at Cochlear Australia but also at Macquarie University and the University of New South Wales. His article well reflects his training as a professional IE that can contribute to the ongoing development of training programs applicable not only to the future development of Cochlear Australia, but all organisations.

Bill Ferme's article "Manufacturing in the post GFC world" provides a timely reflection of what has transpired from the Global Financial Crisis (GFC) and what impact the GFC has had on consumer behaviour and, hence on the future demands of manufacturing worldwide. Bill's article also reports on the growing new trends of 'fracturing', 're-shoring' and 'frugal innovation' and what these might mean to manufacturing in Australia.

John Blakemore contributes to this edition with a brief article on his new, upcoming book titled "Velocity". The article "Velocity…using lean thinking and digital data to innovate a fast future to satisfy customers" reflects John's belief that the digital world not only offers opportunities to do the things IEs have always done (boost quality, reduce costs, have on-time, in-full delivery, etc.), but to do so much more cheaply and quickly.

Lex Clark also contributes with a timely update on 'value engineering'. His article "Value for money and value management" informs readers of the latest developments in this area, and provides numerous and informative examples to best illustrate techniques.

The final feature article "Performance mapping and the utility-productivity performance equation" is the third in a series on performance theory. This article compliments articles previously published by the author in **New Engineer** (2009), and aims to inform readers of the latest developments in this growing area of research. A mini case study is again referenced to best illustrate basic theory and subsequent, possible future development of new IE tools and techniques.

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YOUR CONTRIBUTIONS ARE WELCOME

Some Suggestions are:

- Ask the speaker at your regular member meeting for a copy or notes of his or her talk and send the draft to us to provide wider readership.
- Ask your colleagues for a written statement – long or short – which will inform or interest your fellow readers. Send some of your publicly available brochures and information kits to our editor for the information of your fellow members and to increase interest in your firm's products and services. Pictures are welcome: personalities, processes, plant and offices to show you are a positive developing unit within your industry
- Dash off an Email to us about your view of areas you would like us to include in **New Engineer** to stimulate industry improvement and innovation.
- See that someone is delegated at each plant visit to report on the visit for the benefit of fellow members in other states.
- Tell of success stories and policy statements of wider implication for our readership.
- Provide your personal observations from overseas visits and conferences, apart of course from your organisation's confidential data, to help readers keep up with the global economy

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Institute of Industrial Engineers Federal President's Report

In 2011 the Institute of Industrial Engineers will continue to deliver on the key business objectives of promoting Industrial and Manufacturing Engineering, and serving the needs of all its members. I have had the opportunity in the first two months of this year to meet some of our members who reside in cities outside my home town of Melbourne for the first time. It is always advantageous to hear first-hand from members on what the status of Industrial / Manufacturing Engineering is in their local markets and industries, what challenges they see, and what ideas they have for the future. Please continue to share these ideas with me by email for further exploration over our membership base.

These types of meetings further demonstrate the unique nature of our profession. When you look at the organisations in which our members are currently employed, you will find practitioners right across the Australian industrial landscape – Defence, Consulting, Academe, Manufacturing, Service Industries, Mining, Transportation, Government, Construction, and Banking to name but a few. How many other branches of Engineering can claim such a wide spread of engagement?

If this is in fact the case, we can conclude that Industrial Engineering (and hence the IIE) represents a collection of core skills and tools and philosophies that can benefit any organisation that relies on utilising resources for a specific outcome in the most productive way possible (which describes every business and organisation I am aware of). So is Industrial Engineering a 'discipline' in its own right, or an "applied" arm of engineering? Does Industrial Engineering represent a unique branch of the Engineering family tree, or should it be covered as a specialist area of Mechanical Engineering?

I raise these questions not only to promote discussion, but if the answer is 'yes' that IE and the IIE, represents a unique body of knowledge and skills, then to examine how well we as a profession and as a insitute meet the expectations of people in representing this unique body of knowledge and skills.

I had the opportunity recently to attend Engineers Australia Engineering Practices Advisory Committee. One of the areas of discussion was the role of Colleges and Societies. Colleges were defined as areas where there were sufficient professional engineers to form a credible peer group to define an area of practice, and a unique body of engineering knowledge related to that area.

I don't want to suggest that Industrial Engineering take on the role of a college. However if we do define Industrial Engineering as a standalone discipline with a core set of industry skills, we can possibly use the role of Colleges to examine some of the areas that the IIE should focus on.

David Hood, National Deputy President of Engineers Australia, prepared a paper to discuss the role of Colleges within Engineers Australia. From this paper I can distil 9 key roles of relevance:

1. Primary definer of the area of practice and 'keeper' of the specific body of engineering knowledge
2. Setting practice standards and formulating policy
3. Advancing the area of practice
4. Accrediting education and training
5. Provision of Continuing Professional Development (CPD)
6. Assessing competencies
7. Assessment and terms for Chartered Status
8. Advisor to EA, the government and community
9. Promoter of the knowledge, practice and profession of Engineering in their discipline

The members of IIE represent our sum of knowledge and skills in the areas that we operate. Due to resource and financial limitations, we have only basic frameworks in place today, and we rely on members to bridge the gap. Are we focussing on the right areas?

I won't provide my interpretation against these nine elements at this time – our members and readers of this article can make their own assessment. But I can report that there is a high level of interest amongst the Board members for a number of these items. For example

- Over the last two Board meetings there has been substantial debate on IIE's role in accrediting education and training courses for varying levels of Engineering practice. Proposals have also been presented to the Board for IIE to become a formal accreditation body. This discussion will no doubt continue.
- Some Board members are interested in the procedures for assessing competencies for IIE membership and practice. This is particularly relevant for Engineers immigrating to Australia from across the globe. How do you assess international qualifications against local standards?
- Another area of interest is in IIE's role as a Provider of Continuing Professional Development. Our past President has been an advocate for this role for the Institute for a number of years, and is exploring ways in which more experienced members are able to pass their knowledge onto engineers operating in the industry today.

Individual members are encouraged to explore areas of interest to themselves, and where appropriate, to prepare a submission for consideration by the Federal Board. New ideas will create new opportunities and a brighter future for the profession as a whole.

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Principle based model for best practice in operations

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The topic of best practice is of great interest to businesses in all industries and regions. The literature on this topic is extensive and the approaches to implement best practice across businesses and business functions quite varied. A principle based approach forms the basis to lay the building blocks of best practice and achieve short and long term operational excellence.

For most businesses, defining best practice is difficult in practical terms. Best practice in the retail sector and best practice in manufacturing can be defined in very different ways despite the underlying similarity in the fundamental dynamics that drive both sectors towards ever lasting productivity improvements. Best practice within an industry sector can also be defined in different terms depending on the type, size and structure of the organisation. In most cases, best practice is defined in terms of outcomes and characteristics of a desirable future state and while this is often appropriate, obtaining the understanding and support from employees is a critical factor as is the elaboration and ongoing review of a clear path with milestones, challenges, responses and key events along the way.

In this article, we discuss a principle based approach which can be used by any business to aid the definition and implementation of best practice. We also discuss the role that Industrial Engineers can play in this process. In some instances, we feature examples from Cochlear's lean implementation and describe the connection to the proposed approach.

The Approach

The proposed approach requires the upfront selection of overriding operational principles intended to guide the business through the implementation journey. These principles, once selected and agreed upon by senior management, become the underlying tenets and the foundation upon which practices in all business functions evolve. These practices take the form of an intertwined system of tools and methods acting as the building blocks of best practice.

The journey to best practice is a matter of implementation and mastering of these tools and methods in a way consistent with the principles selected up front and in a sequence which is appropriate to the business maturity and supply chain characteristics.

The selection of the right principles and practices is key to a good start in the journey as is the order, sequence and pace of the implementation effort. This will also ensure the journey to best practice becomes an energising, exciting and stimulating activity for all the people involved.

Figure 1 illustrates a typical example of a high level best practice model. The base of the pyramid consists of 5 principles: Built in Quality, Rapid Response, Every day Improvement, Standard Work and People Involvement.

In this model, these principles are considered essential towards the achievement of the business objectives which sit at the top of the pyramid. Practices and tools are in the core section of the pyramid and represent the way in which the principles manifest in the day to day running of the business.

Getting the principles right at the onset of the implementation journey is a key step. This is where the 'buy-in' is obtained at all levels in the organisation. As people in the business agree to and begin to internalise these fundamental principles of operation, the implementation of practices and tools becomes easier and more effective. When confusion arises, and it will at times, going back to the principles and testing for 'compliance and adherence' is quite useful. This 'recalibration' process helps and guides people through ambiguous situations.

Principles

The word 'principle' in this context can be defined as a fundamental proposition or truth which serves as a foundation for a system of accepted practices and behaviours within an organisation.

In Figure 1, the five proposed principles represent the foundation upon which a best practice model of specific practices and tools can be constructed.

People Involvement

The principle of '**People Involvement**' refers to the need to create and maintain an environment which fosters a spirit of pride, teamwork and collaboration. Some of the elements required to put this principle in practice include:

- The elaboration and communication of a clear vision and mission as well as the determination of the values and cultural priorities which are required in order to support the achievement of business objectives.
- The establishment of Occupational, Health and Safety priorities and processes which ensure an environment where employees can perform at their best.
- The introduction and ongoing operation of employee life-cycle processes, from search, selection and induction through to professional development, upskilling, performance appraisal, recognition and even redeployment and discharge.

- The establishment and ongoing support to processes and systems which encourage collaboration and teamwork and open communication with robust feedback and feedforward mechanisms.
- True and genuine empowerment of employees so that they, themselves, can determine, prioritise and implement improvements in the way they go about doing their day to day job.

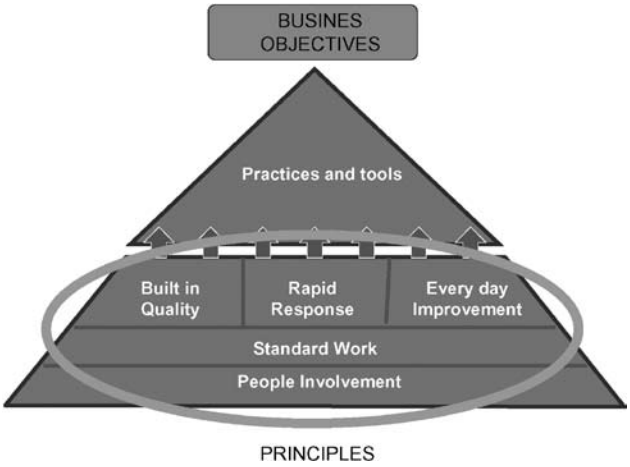

Figure 1. Best Practice Model

Standard Work

The principle of '**Standard Work**' is quite important and it refers to the need to create a repeatable process which in turn leads to repeatable levels of quality and throughput. Without a standardised process, the output of a process varies and it is this variation which defies the effectiveness of the entire system. Of course, change is constant and the business must be able to adapt and respond to varying and often challenging requirements. It must do this though, in a planned and well thought through manner. This is only possible when the business is able to standardise activities upon which improvements and changes can be made. Some of the key elements required to put this principle in practice include:

- The set up and maintenance of a clean environment where all things have a place and everything is in its place. This applies to all areas in the business and it goes beyond the physical systems (e.g. office, workshop, facilities) to electronic systems of data storage and retrieval (e.g. shared drives, documentation portals, etc.).
- The estimation and ongoing assessment of customer volume and mix requirements and the set up of the most appropriate flow and rhythm (i.e. TAKT) which maximise customer service and minimise inventory holding costs.
- The determination, documentation and implementation of the 'current best method' in order to safely and efficiently perform work that meets the necessary level of quality. Once a standard it set, through the continuous improvement process, the current standard might in fact change. The documentation of standardised work is subject to change through the controlled process of continuous improvement and it is therefore "fixed" but not static. Importantly, standard work applies to all activities and jobs in the organisation and to some extent to those activities and jobs which are typically considered as non-repeatable (e.g. design, repair and troubleshoot, etc.).
- The implementation of visual management as a powerful, proactive management tool, which makes standards and actual conditions highly visible in the workplace for an immediate grasp of the situation. Visual management allows 'effective communication without words' and it is used for setting standards, showing abnormalities, displaying actual to target and often to instruct, explain and communicate information.

Built in Quality

The principle of '**Built in Quality**' refers to the need to build quality into the product or service so that defects are prevented or at least detected before the customer receives it.

This principle is critical in ensuring products and services are designed with an error free, error prevention approach from the onset, that is, from the time customer requirements are interpreted by the organisation and transformed into a design or a specification. Some of the elements required to put this principle into practice include:

- The determination of adequate product quality standards which reflect the voice of the customer and which can be consistently produced to the required level of quality by the processes existent within the business. This also includes the process to develop, revise, approve and communicate the quality standards across the organisation.
- The method by which processes are prepared and validated before they are put in use by the business to produce and deliver products or services in line with required quality standards.
- The system of building quality in every step of the process through prevention, detection and containment of abnormalities with the purpose of minimising process variation and reducing waste associated with defects.
- The process for two-way communication of quality expectations and results between customers and suppliers through standardised communication pathways.
- The set up of common documentation, practices, procedures, and organisational structures in a quality system designed to support best practice and institute flexibility and agility in the organisation.

Rapid Response

The principle of '**Rapid Response**' refers to the need to continually reduce the elapsed time taken by each and every activity or process in the business. This principle relates to the notion of 'expediting at all times' in the following way: Given the right and often 'pressing' circumstances, most businesses are able to find ways to expedite the delivery of products and services and all associated processes in a controlled and well coordinated manner.

The key with rapid response is to make this practice a standard feature of all processes while keeping costs down and creating a culture where waste is relentlessly identified and eliminated in every step of every process. This principle can be put into practice by instituting some of the following elements:

- A constant drive to design and put in place a simple sequential process flow of material and information that ensures the appropriate management of work in progress, allows traceability, is visual and transparent, reduces lead time and easily detects problems while optimising cost, reducing inventory and maximising customer service levels.
- The selection and implementation of user-friendly lot sizes that facilitate damage-free and economical handling during shipment, storage and delivery. In its broadest definition, lot sizes apply to all processes and represent the amount processed or converted at once between sequential steps, whether they are steps in a production line or steps in a design, accounting, marketing, selling, distribution process, etc.
- Scheduled logistics pipeline with established controls and managed to predetermined schedules for reliably ordering, receiving, consuming and delivering products, services and information in a way that maximises and levels flow throughout the pipeline.
- A replenishment system where the user initiates the manufacture and / or delivery of a product at a specific time, place and quantity based on actual consumption. This is effectively a 'pull' system where actual demand sequentially drives all preceding steps in the supply chain, from customers' customers to suppliers' suppliers.
- An overall supply chain management system which manages and provides visibility to the end to end value stream, ensures compliance and fosters improvement in the performance of all supply chain stakeholders at lowest total supply chain cost.

Every day Improvement

The principle of '**Every day Improvement**' refers to the need to ensure there is a process for ongoing implementation of improvements by everyone, everywhere and every day. Sometimes referred to as 'Continuous Improvement', the principle of 'Every day Improvement' implies a more discrete process which delivers improvements every day the business runs.

This is an important mindset with great cultural implications. Even when processes seem to be stable, the business should ensure there is a drive and a process for employees to look for and implement improvements. Some of the elements required to put this principle in practices include:

- A structured process that identifies, analyses, and eliminates the discrepancy between the current situation and an existing standard or expectation, and prevents recurrence of the root cause.
- A process that enables the total organisation to set targets and performance standards, integrate plans and remain focused to achieve company-wide goals and manage change.
- A process to align and integrate all employees to work together, to take action and to develop a culture of continuous improvement.
- Continuous improvement of the design of facilities, equipment, tooling and layouts utilising a variety of inputs, internal and external, including functional benchmarking.
- An operational process control system that enables rapid communication of the need for assistance when abnormal conditions occur. This process is also used to communicate relevant information in order to prioritise and initiate the problem solving process and drive management and support groups to go and see the problem.
- Combined input from design and development and manufacturing operations in the earliest stages of product and process development in order to build upon current and past experiences and assure the simplest possible processing and delivery of products and services.
- A total asset management system which maximises the productivity of facilities, equipment, tooling and machines.
- An improvement process that creates and utilises talent and ability to recognise the need for change and manage the implementation of change. This will ensure new business objectives are met in the face of changing business conditions.

Practices and tools

As discussed earlier, practices and tools include all those activities or initiatives which form part of the best practice implementation program and require specific 'know-how' and expertise in lean thinking and operations management.

Figure 2 provides a more detailed view of the best practice model presented in Figure 1. This sub model summarises in a 'pantheon' schematic the tools and practices referred to in the previous section. This format aims to put in perspective the relative importance of the most critical practices and the building blocks required to ultimately eliminate waste and achieve business objectives.

It can be noted that the foundation practice of 'leadership and change management' in this sub model is the foundation to support the implementation of all other practices. This means that the capability of the organisation's leaders, at all different levels, to lead and manage change effectively and the impact they can have, whether positive or negative, on the best practice implementation process cannot be underestimated. Every practice in this sub model requires the leadership team to motivate, inspire, participate, role model and adequately manage the introduction of change in the business. After all, the journey to best practice is mostly about change and change is the only constant.

Figure 2. Practices and Tools

Industrial Engineering

Industrial Engineers (IEs) have a key role to play as businesses embark on the journey to best practice.

Cochlear Ltd is the world leader in the design and manufacture of implantable hearing solutions. In this company, the journey to best practice is well underway and the IEs work across a variety of projects and initiatives intended to bring about productivity improvements. Interestingly, many of these initiatives are related to human processes rather than machine processes per se. For example, an important activity performed every day, at the start of the shift, by the Production Team Leaders is the '5-minute team meeting'. The objective of this meeting is to gather the team in a designated location nearby the team's envelope of operation, review safety, attendance and performance issues from the previous shift as well as outstanding and closed issues. The meeting concludes by deploying team members to their workstations and providing them with objectives and 'inspiration' for the day. All this in exactly 5 minutes.

The role of the IE in this process cannot be underestimated. They are responsible for working with the production team to streamline this important communication process, standardise it while allowing for individual team leader competency levels and measuring its effectiveness. This process has resulted in significant productivity gains, morale and workplace improvements besides a shared understanding of daily requirements.

This simple yet critical communication process is in effect one of the many tools entrenched in a broad and comprehensive framework of tools and methods used within the organisation: The Cochlear Lean System (CLS).

In line with the previous discussion about the principle based approach to best practice, the CLS combines various operational principles which are put in practice through the implementation of tools like the 5-minute meeting and many others, including:

- Value stream mapping and waste elimination
- Cellular layouts and pillar (cycle time) charts
- Workplace organisation and layout optimisation
- Kanban control and one piece flow manufacturing
- Total Productive Manufacturing (TPM) including preventive, predictive, reactive and autonomous maintenance
- Quick change over techniques
- Problem solving and design of experiments
- Error proofing, visual controls and visual management

The IEs play an important role in the governance and ongoing evolution of the CLS. In fact, the IEs are responsible for benchmarking and creating the content of the CLS, providing relevant training in its use and monitoring its performance.

Cochlear's cleanroom environment featuring a production cell

Conclusion

Through the implementation of a principle based approach and the practices that evolve from high level buy-in at all levels in the organisation, Cochlear has been able to achieve significant improvements in manufacturing, warehousing, internal and external logistics, procurement and manufacturing process design.

These improvements range from substantial reductions in manufacturing and supply lead time, reductions in work in progress and finished goods, increases in capacity, flexibility, quality and customer satisfaction. Overall productivity gains have been experienced year on year. At the same time, employee involvement and engagement continue to deliver small step improvements day by day.

Like Cochlear, organisations in general, irrespective of industry and size, can adopt a principle based approach to best practice. Importantly, the implementation effort is most effective when focus is placed equally on the intangible aspects of the implementation, that is, the 'minds and hearts', as it is placed on the tangible or infrastructural aspects.

Rod Lopez is the Head of Manufacturing at Cochlear Ltd and a post graduate Lecturer at various Universities in Sydney. Rod graduated from Monash University with a bachelor of Industrial Engineering and Computing, and later completed an MBA at the same University. With close to 20 years in industry, Rod is a dedicated professional and expert in lean thinking and operational improvement.

Manufacturing in the post GFC world

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The collapse of trade in the recent GFC was more extreme because the crisis meant the market for trade finance seized up. The GFC also means the economic recovery in the advanced economies will be unusually slow as banks repair their balance sheets and households rebuild their savings.

Consumer habits

The GFC has changed people's shopping habits and made them more cautious. People are shopping less and with more purpose. Many have traded down from name brands to store-brand products. People are becoming more Eco-Savvy and are demanding to know the carbon footprint of retailers and manufacturers before they buy. Sustainability is already a feature in some furnishing; we have cushions made of soya, fabrics in bamboo of unbleached cotton. Dyes that are natural, water-based and often reusable. Businesses will be scrutinised for their attitudes to responsible practices, manufacturers will be quizzed on their shipping, on the products they buy or produce and how and where[1]. Also, Australian consumers have discovered that the same goods in Australian retailers are now available online for about half the price and are not subject to the GST if the value of the goods is under $1,000! The sudden recent demise of Borders, Angus & Robertson bookstores in Australia is a recent example of this new phenomenon.

Emerging economies catching up to the west

After a brief fall following the GFC of 2008, the number and size of cross-border acquisitions by the emerging economies rebounded strongly in 2010. In the past decade 60% of the foreign purchases by these developing – country multinationals have been of companies in the rich world; in the past two years the proportion was 70%. In part, this may reflect the fact that the emerging economies recovered more quickly after the GFC, allowing their corporate champions to return more quickly to the acquisition trail. The Boston Consulting group (BCG) has analysed 100 leading firms from emerging economies. The BRICS (Brazil, Russia, India and China) dominate: BCG looks at 13 companies from Brazil, six from Russia, 20 from India and 33 from China, with the rest spread widely. The list includes the world's largest baker (Group Bimbo of Mexico), meat producer (JBS of Brazil) and aluminium manufacturer (United Company RUSAL of Russia), as well as the second and fifth biggest telecoms-equipment firms (Huawei Technologies and ZTE, both from China). These 100 companies are looking lively. In the past decade they have seen their revenues grow by 18% a year on average, three times faster than non-financial firms in the S & P 500. And they have managed to expand fast without sacrificing profit margins, which at 18% were six percentage points higher than those of their (non-financial) peers in the S & P 500[2]. In effect, it would appear that in 2011, for the first time in two centuries, Europe and America face being out-produced, out exported and out-invested by China and the emerging economies! By 2020, Asia's domestic markets will be twice the size of America's. The world's middle class will have swelled from 1 billion consumers to 3 billion. The countries and companies that will flourish in Asia's new markets will be those that can provide technology-driven, custom-built, value-added goods and services to Asia's 2 billion consumers[3]. The question is why are the emerging economies companies giving the west a hard time? The answer could be: these companies growing reliance on partnerships. More and more, they are hooking up not with established multinationals but with other emerging-market companies, to share knowledge, penetrate new markets and spread the risk of especially hair-curling investments. Also, they know how to service the new up and coming Asian middle class.

Increasing complexity

Today's business environment is very complex and competitive. To succeed, you have to be the best, which means having the highest quality and lowest cost. To be the best, you have to concentrate on one thing. You cannot be all things to all people and be the best. This is called a 'fracturing' of business[4]. When one company can make a better product by relying on others to perform functions the business used to do itself, it creates a complex network of companies that serve and support each other. This has been accelerating over the past 10 years. Even small businesses can have a pyramid of corporate entities that perform many of its important functions. One aspect of this trend is that companies end up with fewer employees and more independent contractors. In Australia, people who used to be employees are now independent contractors launching their own businesses. This means that companies are getting smaller and more efficient, revenues are going down but profits are going up. This means that we are at the end of the age of the employer and employee. With all this fracturing of businesses, employers cannot guarantee jobs anymore because they do not know what their companies will look like next year. This means that the new contractors

work when they can but handle their own insurance, benefits, health care etc.. Is this the new 21st Century model economy?

A recent world-wide study of over 700 small and medium sized enterprises in the discrete manufacturing industry across four sectors and in eight countries by IDC Manufacturing Insights found that for Europeans and North American manufacturers achieving operational excellence has become more complex, the pressure to reduce costs and improve productivity as ever top priorities and perfecting the customer experience from bid to fulfilment a critical business need[5]. The study showed these companies are struggling with increasing complexity, global competition, rapidly changing business environments and volatile raw material prices. Complexity in the industry also arises from a number of new factors such as low visibility into demand forecasting, the challenge of properly bidding for a project and project profitability. Most importantly discrete manufacturers struggle to insure customer fulfilment because of complex and global supply chains making control over the customer experience very challenging. Lack of clear visibility into market demand coupled with global competition makes developing profitable new products a guessing game. Manufacturing companies must also work harder to meet their customers increasingly diverse requirements; e.g., mobile phone makers introduced 900 more varieties of handsets in 2009 than they did in 2000[6].

Commoditisation of manufacturing

A recent study by Deloitte & Touche LLP found that in many industrial markets, manufacturing customers are increasingly interested in one thing: price. And they are more willing than ever to switch suppliers to get lower prices and better supplier performance in the form of things like on-time delivery.

According to the study[7], one third of manufacturing customers said they are more willing to switch suppliers than they were before the GFC. And 43% said they had switched suppliers recently, with lower prices and better supplier performance being the top reasons. Very few are looking for things like better post-sales service or tech support, the study indicated. And growing numbers are willing to **compromise** on design specifications to get lower prices.

So, why the big focus on prices and the willingness to switch suppliers? The GFC has prompted many manufacturing customers to focus first and foremost on reducing costs and preserving cash. The rush to lower costs is undercutting any loyalty customers may have once felt towards suppliers.

An Australian example of this [8] could be Frigrite, a 60 year old commercial refrigeration and air conditioning business, has called in Voluntary Administrators, which had 75% of its business with two grocery giants, Coles and Woolworths. Frigrite recently lost its contracts with these grocery giants which could be due to the vicious battle between the grocery giants themselves to cut prices and win market share for years to come.

Innovation issues

The business mode of the innovators is to create amazing technology, outsource the software to India and the manufacturing to China where they can find lower cost suppliers and manufacturers, avoid US labour and environmental regulations and then bring the work back to the USA at virtually no import tariff. Wall Street makes a boatload of money on the deal- good for them. But job creation? Not hardly[9].

In January 2011, President Obama called for more innovation in his State of the Union address. He wants it to come from business. Most businesses do not have a clue how to be innovative, as Forbes pointed out in its November 2009 edition 'Why the pursuit of Innovation Usually Fails'[10]. Businesses by and large are not designed or managed to be innovative. For the last decade businesses have reacted to global competition by seeking additional efficiency – such as by off shoring information technology and manufacturing- eliminating millions of American jobs. Most executives would rather see a plan to cut costs, saving 'hard dollars' in the supply chain, sale or marketing, than a plan for new product introduction into new markets where the executive has to deal with 'unknowns'. The article concluded that to increase innovation Mr.Obama must introduce incentives such as; Increase tax credits for R & D etc..

Andy Grove, former CEO of Intel asks in a recent article[11] "what kind of a society are we going to have if it consists of highly paid people doing high-value-added work – and masses of unemployed?" Friedman, the economist recently said the USA should do more "Start-ups, not Bailouts". Grove said this is wrong, start-ups are wonderful but they cannot by themselves increase tech employment as technology goes from prototype to mass production. This is the phase where companies scale up. They work out design details, figure out how to make things affordably, build factories and hire people by the thousands. Scaling is hard work but necessary to make innovation matter. The scaling process is no longer happening in the USA. Today, manufacturing employment in the USA in the computing industry is about 166,000, meanwhile a very effective computer-manufacturing industry has emerged in Asia, employing about 1.5m workers-factory employees, engineers and managers. This situation is happening in other industries like photovoltaics. There is more at stake than exportable jobs. With some technologies, both scaling and innovation takes place overseas. Such is the case with advanced batteries. We are now entering the age of mass-produced electric cars and trucks. They all rely on lithium-ion batteries and the USA's share of these products' production is tiny. The USA lost its lead in batteries 30 years ago when it stopped making consumer-electrics devices. Whoever made batteries then gained exposure and relationships needed

to learn to supply batteries for the more demanding auto market? USA companies did not participate in the first phase and consequently were not in the running for all that followed. Grove believes that the above situation has to do with a general undervaluing of manufacturing – the idea that as long as 'knowledge work' stays in the US, it does not matter what happens to factory jobs.

Even though the US continues to be the leading manufacturing economy in the world, we have seen (the US) running a trade deficit in advanced technology products since 2002, said Douglas K. Woods, President of AMT.

Emerging countries are no longer content to be sources of cheap hands and low cost brains[12]. Instead they too are becoming hotbeds of innovation, producing breakthroughs in everything from telecoms to car making to health care. They are redesigning products by taking a 'clean sheet' approach to reduce costs not by just 10%, but by up to 90%. They are redesigning entire business processes like having separate design teams; finding new suppliers to do things better and faster than their rivals in the West plus getting commitment from the top management[13]. The rich world is losing its leadership in the sort of breakthrough ideas that transform industries. This is partly due to emerging-market firms and consumers moving up market. Huawei, a Chinese telecoms giant, applied for more international patents than any other firm in 2008. Even more striking is the emerging world's growing ability to make established products for dramatically lower costs: no frill $3,000 cars and $300 laptops may not seem as exciting as a new iPad but they promise to change far more people's lives. This sort of advance-dubbed 'frugal innovation' by some – is not just a matter of exploiting cheap labour (though cheap labour helps). It is a matter of redesigning products and processes to cut out unnecessary costs. Emerging economies are not merely challenging the West's lead in innovation. They are unleashing a wave of low-cost, disruptive innovations that will, as they spread to the rich world, shake many industries to their foundations.

Supply chain issues

The long run increase in and volatility of oil prices, the rising raw material costs and transportation costs may have a significant impact over the next year. These will favour making and stocking products closer to consumers, in contrast to upstream suppliers[14].

Many USA companies are Re-Shoring (returning work to the USA) Manufacturing[15] because of:

1. Increases in the cost of ocean transportation back to North America which has increased by 150% since 2008 lows;
2. Longer product delivery cycles that make domestic manufacturers less responsive to consumer trends;
3. Poor production quality standards that have resulted in the delivery of defective goods.
4. China's industrial wages are rising inexorably by the year.
5. Supply-chain risk (costs up, non-availability of product and trade-union problems).
6. Companies concerned about the seepage of their products' IP.

Companies are reassessing supply chains as China's on-again, off-again embargo of rare earth exports in 2010, in which it withheld materials that are critical for sophisticated electronics and electrical equipment, demonstrated that the risk of over-reliance for supplies on any single country[16]. Fully 68% of global executives responding to a recent McKinsey survey said that supply chain risk will increase in the coming five years[6].

Australian manufacturing

The Australian market is small, fragmented and essentially unattractive for world companies. The Australian economy is broad in scope, reflecting distance from historically important markets but equally shallow, reflecting the small size of the economy. This means that manufacturing plants have small volumes (even flow-line volumes) and high variety; a difficult combination to make money. However, this is one of Australia's manufacturing strengths! But, industry costs will be further increased by the coming carbon tax which has many companies, such as Bluescope Steel, already threatening mass layoffs!

Let us examine the Australian Government promotion of Lean Manufacturing improvement methodology. According to an ARC Advisory Group's strategy report, 36% of USA manufacturers are using Lean as their primary improvement methodology. Those numbers are likely to be representative of how many companies in Australia are applying lean principles in even a limited way and in at least one specific rather than actually using lean principles throughout the organisation. The challenge with the concept of Lean is that it can mean different things to different people. A common question is whether it is the tools and processes, or the people that make Lean work. In reality it is both. Applying Lean tools, new technology and new business processes to a traditional silo-oriented culture will not work. Lean at its core, is a cultural and people-oriented initiative. Key to making the transition to a Lean organisation is the fundamental change in the corporate culture that must be made. This is easier said than done! Academics are still struggling with the concept of 'cultural change'. With regards to Australian manufacturing industry where about 95% are small companies, Lean has not been too popular as most small manufacturing companies are already operating in a lean manner, have little extra management people to implement Lean principles and definitely cannot afford a value-stream manager nor expensive consultants. A recent article[17] commented that over the last 20 years, Lean enterprise has been used as an effective tool for improving manufacturing competitiveness through reducing costs.

However, in a globalised market, cost reduction is reaching its limits. In many cases the labour cost advantage of low cost countries is simply too great to be bridged. As a result many of the best Lean companies in Australia particularly in the automotive sector have faced poor financial performance and closure. The writer was involved in the recent government C21 scheme to improve the performance of second and third tier automotive suppliers and found that they were stuck in a difficult situation and many did not have any IP and when they went overseas to find business they were only able to offer spare manufacturing capacity. These companies will need a lot of government help to obtain new products and new management! The answer is more innovation and less Lean manufacturing. Again, this is easier said than done. The writer believes Australia's manufacturing future is in the hands of young engineers, however, they must be trained to set-up new businesses, how to innovate and manage export businesses. These skills should be obtained from the country's business schools. Already, the writer is coming across a few MBA/Engineers setting up new businesses. The governments must look at subsidising the extra training of engineers to MBA level; this would be cheaper, for example, than subsidising the declining automotive industry by billions of dollars.

Australia's car industry faces a drop in demand, however it is trying to change itself with Toyota building hybrid cars and GMH launching its new small car: the Cruze. Three areas could cause this: 1. rise in petrol price, 2. rise in electric cars and 3. cheap cars from India and China. This will have big implications for Australia's three main car makers. The upward trend in electric vehicles production and demand-which will increase along with oil prices-is the key to future-proofing the Australian car industry. The first Chevy Volt electric vehicles rolled off GM assembly lines in Michigan last month. The US car maker has made the electric vehicle (EV) a key plank in renewing its brand. Renault/Nissan has followed suit. The Leaf, its first pure electric car, and new EV models will be mass-produced at 500,000 units a year within 3 years. China's electric car maker BYD is already there, with an estimated 500,000 electric vehicles sold this year. According to an IBIS World Report from 2009, only about 150,000 of the million cars sold in Australia are supplied from our local plants. The above output figure for three plants is absurdly uneconomic where an economic output of 250,000 is required to make a car plant profitable. The above is a gloomy scenario for Australia's three car makers[18]. On top of the above, the Federal Government has scrapped the Green car Innovation fund[19] which was a central pillar of its industrial policy. Is the end of the Australian car industry in sight?

Overseas manufacturing

Despite an increasingly global marketplace for their products and a sense of cautious optimism as they emerge from the GFC-induced recession, US high tech manufacturers see little chance of meeting President Obama's goal of doubling US exports in the next five years. Sixty percent of high-tech companies said it was 'very unlikely' or 'not likely at all' that the President's goal would be achieved. The overwhelming reason, cited by 60% of the companies surveyed, was the belief that the US is too expensive for high tech manufacturing[20].

Capital-intensive producers of durable goods around the world face a long struggle for survival as they contend with weak customer demand, under-utilised production lines, but continuing fixed costs such as finance. Part of the solution will be a rationalisation of manufacturing capacity. And part will be price cutting, as companies try to buy sales in order to cover as much as they can of their fixed costs. The flood of cheap imports and the threat of unemployment from plant closures inevitably will put pressure on politicians to protect their industries[21].

In the UK, manufacturing has been neglected by policy makers for too long. This means that schools and Further Education colleges have a tendency to emphasise knowledge-based or service careers over manufacturing employment. Manufacturing has become largely invisible in schools and is now less visible in apparently 'post-industrial' societies, except as 'inventory in transit' on road systems. Many UK companies have experienced 'hard – to-fill' vacancies. Many companies were recruiting individuals over 65 and over 70. Some companies are even considering closing the business due to difficulties with too-hard-to-fill vacancies[22].

How did Germany and China ride through the GFC in a relatively good position? What sets them apart is manufacturing. Their predominantly industrial economies meet their own needs and those of other nations. China has the infrastructure, the expertise and the labour force to be the world's leader in manufacturing. Germany competes against cheap Chinese labour with a unionised workforce that receives better pay than American workers. One secret to Germany's success is that their financial system is designed to support manufacturing business. A guide to Germany's manufacturing pre-eminence is BMW's recent commitment of $550m to their electric car where they will build Germany's first factory to mass produce battery-powered cars to (as yet) as yet an untested market[23].

Conclusion

Western economies are still suffering a hangover from the GFC. Consumer habits around the world have changed to lowest price and frugality in purchasing. The emerging economies are the latest competitive wave to hit western economies with innovative frugal designed products and clever acquisitions. Increasing complexity is also hitting manufacturing companies, lower costs, tighter lead-times, rising fuel costs and convoluted and risky supply chains. The commoditisation of manufacturing is now happening where low cost products are pre-eminent and where there is no loyalty to suppliers. Innovation experience in the USA has shown that it does not automatically create jobs. To

create jobs, innovation must go through the whole cycle to manufacturing. What is happening is that R & D, design, prototype manufacturer and manufacturing is being done in lower cost countries. Australian industry is being hit by all these trends and the automotive industry is becoming a cause for real concern for both OEM's and the suppliers. With regards to Lean manufacturing it is reaching its limits in cost reduction as this is just not enough in these desperately competitive times. The complex subject of innovation must be addressed by all sizes of Australian manufacturing companies. Australia's manufacturing industry is not well equipped to deal with the above situation with its poor Innovation record and silver-bullet chasing management[24]. Finally, there is a raft of new technologies coming up like nano-technology, robotics, emphasis on green technology, smart materials and systems etc. These technologies will need MBA/Engineers to commercialise them and consequently create a new more scientific manufacturing industry.

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Velocity…using lean thinking and digital data to innovate a fast future to satisfy customers

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The following is a précis of the new book "Velocity", the digital lean fast future of business. This will be printed and bound by the new Canon fully integrated machine from digital flash drive to bound paper cover book. Velocity will be launched at the National Manufacturing week in Melbourne on the 24th May 2011.

Background

Business is about people, process and precision. Businesses of the future will produce to demand with small batch sizes and maybe to a batch size of one. Precision of process in all business functions at "six sigma" tightness of control, creates a strong competitive advantage. Technology and process improvements are advancing at an increasing rate. As a result, new pressures are placed on management and leadership if the enterprise is to be competitive and grow. Global supply chains with networks of suppliers feeding strategically placed assembly plants near the market they serve are commonplace, especially in big business. A key question is how do small businesses, both in manufacturing and the service industries, take advantage of the new and efficient cooperative ways of satisfying customers, with higher expectations, faster than before.

The Author and the Book

This book offers the solution to this familiar challenge to management…faster innovation and product and service delivery at a higher degree of precision…six sigma processes using lean thinking and digital data from the source.

The author's PhD taught him to be mentally agile. As a result of this and the co-operation of over 400 clients both in Australia and overseas and a career dedicated to learning from the best, he has developed 26 rules to analyse and implement Lean systems and 22 creative ideas to aid innovation of process and product. These have been applied with considerable success and some programs are discussed in Chapter 9 of the book.

Fundamental Characteristics of Good Business Practice

The first three fundamental characteristics of good business practice are quality, cost and delivery aimed at exceeding customer expectations. Add to this innovation and speed with a special focus on continuous improvement. Continuous research and development of both process and product is fundamental. It is clear that to achieve best practice, we should have total cooperation in all of the supply chain to achieve maximum benefit for all participants.

Cooperating to Compete is a Strong Competitive Advantage

Digital connections to suppliers and customers will assist in making companies more agile. Some innovative companies have clearly demonstrated how the new rules can work very effectively.

With the new digital cooperative lean approach, value adding by decreasing waste in planning, process and expenses continuously increases as we innovate. Digital connections allow companies to move and use information anywhere along the supply chain. This allows any enterprise in the chain to more accurately forecast, or ultimately, make to order only.

Such ideas will not work to advantage if the processes are not operating at a high degree of precision, a level which is now regarded as processes at such a level of reduced variation that the defect rate outside the range of acceptability for the customer is only 3 parts per million. Variation in process is a major enemy of speed.

To achieve maximum benefit, the five functions of business; people, operations, marketing and sales, innovation and finance need to be integrated. This requires the judicious use of people, technology and information, and the continuous training and upgrading of people skills and knowledge. Concentration on the technical aspects of these factors alone will not yield the desired results. The reason is that the most important part of all business is people; whether they are customers, employees, employers or investors. Introducing new technology and techniques is much easier than changing culture and behaviour, but they must go together.

In the early stages of a business transformation, use of simple management tools can lead to significant productivity gains in bottleneck areas of the system and these can be used as a guide to assist in culture change and further innovations.

This is clearly practiced at the plants of Japanese clients the author has worked with over the years; companies like

Panasonic, Matsushita, Canon, Honda, Toyota and Kawai. Special mention is made in this book of the work of Honda and their BP (Best Position, Productivity, Product, Price, Partners) program. Honda has a very special place in my heart and mind because of the supremely high standard of their engine integrity and the fast innovation they apply to linking process and product innovation. They had none of the earlier financial support that Toyota had, and yet have excelled.

Physical process improvement is singularly not enough

When we come to the actual process of changing a bad enterprise into a good one, it is important to realise that you can only go so far in improving culture if all that is changed is the physical environment. If the culture is poor, then physical improvements may result in substantial improvement that can be quickly eroded by a poor management team.

This book's core message has developed around 30 years of consulting to management. It takes the latest principles relating to what is commonly called lean manufacturing and total quality management with the latest management principles, and focuses on compressing supply chains, and on identifying an improved competitive advantage, the *velocity* of the processes and systems.

It is important to understand that the methods described are proven, scientific and logical, but their successful implementation will not work without the support and leadership of a good management team. The culture and vision of this team and the company is set by the chief executive officer, senior management and the board.

The basic thesis is that western-style management has recognised the superior performance of many Japanese companies, such as Toyota, Honda, Panasonic and Canon, and has attempted to duplicate their formula, with in many cases, a high degree of failure, particularly for American auto manufacturers. Why? In almost all cases in the literature, the reason is associated with the people function, leadership and culture, not the technology or technical techniques.

Velocity

Successful modern management involves a sharp customer focus, and the rapid use of high quality information via digital computer systems that are conveyed through a network of teams in a compressed hierarchical structure. The organisational structure must allow creativity, communication, improvement and innovation of all processes and functions. Companies must plan for the long-term and plans should be continually updated. People must be rewarded for creativity, communication skills and continuous improvement and innovation. The focus is on precision, speed, and quality in the entire supply chain.

Cross-functionality, innovation and fast financial management with a short time period must be core elements of production and serving customers. The enterprise now must be an integrated structure of people driving innovation to satisfy and exceed customers needs and wants. Measurements of processes and systems must be at the source of the activity, and the financial outcomes must be available quickly. Digital data can satisfy this need. Financial data should be available quickly, but looked upon as real time output.

It is vital that modern managers understand reporting as well as communication, budgeting and the full implications of profit and loss accounts, balance sheets and cash-flow. They must also understand the concept of continuous research and development, training, education, and never-ending improvement. The board sets the strategy, direction and philosophy that will drive the mindset of managers in the future where innovation, a sharp customer focus, flexibility and speed are urgently needed for all people, processes and systems.

New tools and techniques, such as the 26 tools for process improvement and for innovation of process, the 22 creative ideas will assist management in championing the new approach.

Conclusion

It is the intention of this book to enunciate a new interpretation of the management processes and systems to facilitate a more caring and successful human side to work. This book aims to release the intellect and power of the people and realise the potential of producing to demand with a batch size of one. It is about high velocity integrated systems driven by innovative caring management.

Value for money and value management

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The following article is based on presentations made by the author (Lex Clark, FIEAust CPEng, FIIE, FIVMA) at the Institute of Value Management Australia (IVMA) Conference held in the Sydney Olympic Centre on 28 and 29 May 2010. This Conference discussed the new Australian Value Management Standard AS4183:2007 (replacing AS/NZS 4183:1994) and the associated Value Management Handbook presently in preparation by IVMA.

A focus of this Conference was on the fundamental importance of the concept of Value for Money (VfM) in Australian management at all levels. The fact that in practice the concept is widely discussed but poorly understood and inadequately practiced or not practiced at all is seen as problem for Australian Management and an opportunity for Value Management.

However, the question can be asked, isn't this what Value Management VM (including Value Analysis VA and Value Engineering VE) has been doing all along around the world since its development over 60 years ago. The answer, not very helpfully, is yes and no. Yes, in that it has aspired to evaluate Value and then achieve it at the lowest Cost. No, in that the understanding and evaluation of Value is commonly poorly done or not done at all, and the lowering of associated Costs is consequently underutilised.

The race to be competitive!

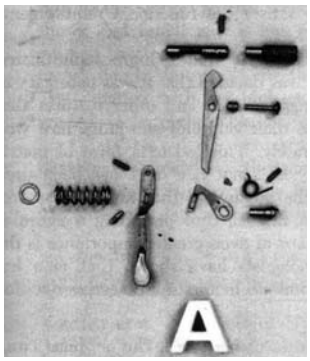
In some respects, we are now starting a new race to improve the application of Value Management in Australian after 50 years of development. The new Australian Value Management aims to do just that.

Some Australian background history

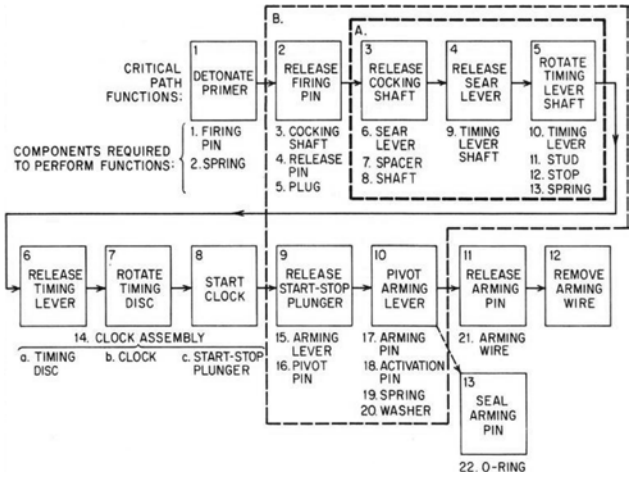
- Value Analysis was introduced into Australia first around 1966 through a visiting Value Analyst, Dusty Folkes, from the United States. Eric Adams introduced Value Analysis into the Victorian State Electricity Commission saving many millions of dollars. He introduced Value Engineering, so called, in the design and construction of major power stations.
- Hawker de Havilland Pty Ltd in 1960's introduced VA concepts from the UK to aircraft and marine design, manufacturing and procurement.
- Value Engineering introduced into Australian Navy 1971 and Defence manufacturing, then extended across Defence in 1975.
- Australian Department of Defence publishes a Defence Reference Book DRB 37 Value Analysis in 1983.
- Defence convenes a meeting, around 1988, of VA practitioners which becomes the basis of the Institute of Value Management Australia (IVMA).
- Around this time, the term Value Management is adopted in Australia as an umbrella term for all applications, including VA and VE.
- Also in the late 1980's, the NSW Department of Public Works developes Value Management for public sector construction projects over $5m.
- In 1990 a NSW Government Value Management Guideline Manual is published together with associated policies.
- In 1994 the Department of Defence developes a Value Management Incentive Program (VMIP) and published "Value Management Incentive Contracting". This program is an interesting exercise in the differences between US and Australian procurement cultures.
- In 1994 Standards Australia publishes the first Australian and New Zealand Value Management Standard (incorporating VA and VE) AS/NZS4183:1994 based largely on overseas, particularly United States, concepts.
- In 2007 Standards Australia publishes the new revised Value Management Standard AS4183:2007 incorporating much Australian experience.

The basic concept of value management

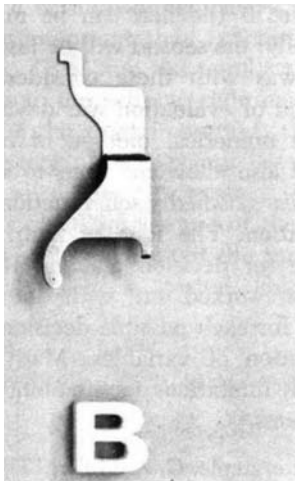
The basically simple concept behind the application of Value Analysis might be illustrated with the following example of a fuse timing mechanism taken from the Lawrence D Miles book Techniques of Value Analysis and Engineering, 3rd Edition 1989, Figure 17.8 and Figure 17.9, published by the Lawrence D Miles Value Foundation. While this example illustrates, in a simple way, the original application of Value Analysis in equipment design and procurement, over the years this has been equally applied to many large systems such as Hospitals, Power Stations, Weapon Systems etc.



1. First break the existing system down into its present components which of course reflect the requirements, materials, design ideas etc that were available when the system was designed, often some years before and commonly overseas. If from overseas, the components will reflect the manufacturing techniques, equipments, tolerances, facilities and trained operating and support personnel found in the originating country. These may not be available or understood in Australia.



2. Next analyse the existing system in terms of the component Functions and interrelationships being performed by the present design. This may be carried out using a structured, so called Function Analysis Systems Technique (FAST) diagram which asks the questions Why? to the left and How? to the right.



3. Finally, determine those Functions that are considered to be Essential to accomplish the needed outcome, while eliminating those Functions that are only there because of the original decisions. Determine new solutions to carry out these essential remaining Functions using more modern and hopefully local techniques. Classical Value Analysis results in a simpler, cheaper, more efficient and more reliable product (the single pressed metal component in B illustrated here carries out the same Essential Functions as the sixteen components in A above).

Value and value for money

The Australian Value Management Standard AS4183:2007 Definition 1.2.13 defines Value Management rather simply as: "A structured and analytical process which follows a prescribed Work Plan to achieve best Value or, where appropriate, best Value for Money".

The Work Plan (see Table 4.1) is a rather basic Decision Making process simply designed to help ensure that practitioners do not accidently leave out any steps, or, perhaps, try to take short cuts.

The Australian Standard AS4183:2007 also simply defines Value for Money in Definition 1.2.12 Value for Money as: "A measure used for comparing alternatives based on the relationship between Value and Total Cost".

But isn't this what good Managers & Engineers already do? After all, an Engineer has been defined as someone who can do for $1 what anyone else can do for $2 (19 Century quote).

TABLE 4.1

WORK PLAN FOR A VALUE ANALYST

Identify potential opportunities for the application of *Value Management*
Define the potential scope of the *Value Management* activities within the resources available to the *Value Analyst*
Prepare an individual strategy to apply the *Work Plan* within the day-to-day activities of the *Value Analyst*
Build knowledge and understanding of the *entity* and its context (including the elements of *value* and *value for money* to be analysed) and establish success criteria
Generate multiple ideas to achieve best *value* and, where appropriate, best *value for money* of the *entity*
Evaluate ideas against success criteria
Develop options and proposals
Make decisions and, where appropriate, recommendations
Record key steps and decisions taken in the process
Where appropriate, implement decisions and recommendations

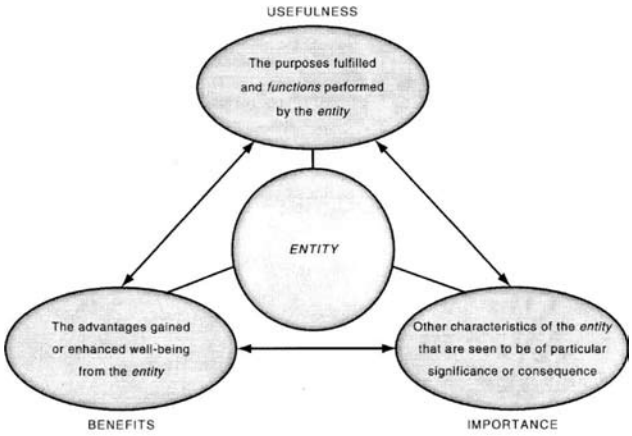


FIGURE 2.1 VALUE OF AN ENTITY

What is meant by value?

The term Value (like Worth) has a particular meaning in Value Management which may or may not be in common use, depending on who you talk to. "Value" in common usage may be expressed in $ terms e.g. what is its value, meaning what is its price. This is NOT the case in Value Management.

In the new Australian VM Standard AS4183:2007, Figure 2.1 illustrates the concept of Value as applied to any entity, where entity is the term applied to any "product, process, service, system or organisation (or part thereof) to which VM is applied". In terms of its Value as perceived by the user or owner of this entity, this is defined as: "An attribute of an entity determined by the entity's perceived usefulness, benefits and importance".

There is no implied mention of money here.

The standard value for money model

However, in the further concept of Value for Money (VfM), money is specifically introduced for the comparison of alternatives. A good example of a Value for Money type evaluation is the following matrix from the Australian Consumers' Association publication Choice, March 2010 edition, for 81cm televisions, pages 46-47.

This matrix evaluates a range of commercially available televisions in relative terms (generally rated from 0 poor to 100 excellent) for their Performance, Features, Specifications and Prices($). A series of carefully controlled tests are carried out on each basically similar product (an 81cm TV in this case).

This type of matrix is basically a refined version of the Value for Money procurement model found widely and used in Government and Industry. The basic sequence of questions underlying this competitive procurement process is typically:

1. What is it?
2. What does it cost?
3. Who else can supply it?
4. What will that cost?

Many organisations do not have the resources, skills or time to carry out a detailed analysis such as that conducted by "Choice", and so commonly it is assumed that market and other standards and requirements will mean that all the products are basically the same (whatever that might mean). The Value for Money decision therefore reduces to which Supplier can reliably deliver the product at the lowest cost.

This greatly simplifies the decision making process and hopefully reduces risk through the introduction of new products and ideas. However, this commonly results in a sub-optimal Value for Money decision. "Choice" is not generally in a position to ask individual customers what are their actual requirements and needs. The reader of "Choice" therefore has to ask the basic question "why am I buying a TV in the first place".

The value for money model in value management

Value Management asks a slightly different set of questions:

1. What is it?
2. What does it do or need to do?
3. What does it cost?
4. What is it worth?
5. What else will do the job?
6. What will that cost?

The three obviously different questions are No. 2, 4 and 5. If we may use the TV example again, a training officer looking at replacing some five old TV's in the classrooms might follow the following sequence:

1. What is it? – a TV.
2. What does it do? – it "aids training" (only part of the time).
3. What does it cost? – a new TV for a large classroom might be $2,000.
4. What is it worth? – a range of training aids such a white boards, video projectors etc are available for less than $1,000 even down to butcher's paper for $100 per year with pens. $2,000 compared to $1,000 or even down to $100 indicates that a new TV might be poor value.
5. What else will do the job? – a modern whiteboard might seem to be a more versatile and useful in many, if not all training requirements.
6. What will that cost? – an interactive whiteboard might be around $700, and a final answer might be five interactive whiteboards (one for each classroom) plus a mobile TV to move around for a total cost of $5,500 (verses $10,000) and a potentially more useful set of training aids.

If appropriate, VM will ask even more basic questions such as can the actual training be carried out in other ways

PRODUCT	PERFORMANCE									FEATURES		SPECIFICATIONS							
		PICTURE QUALITY																	
Brand / model (in rank order)	Overall score (%)	Broadcast TV score (%)	DVD viewing score (%)	Blu-ray viewing score (%)	Sound quality score (%)	Ease of use score (%)	Energy score (%)	Digital tuner score (%)	Viewing angle score (%)	Swivel stand	100Hz panel (as claimed)	HDMI inputs at rear	USB ports*	Claimed screen resolution (pixels)	Number of energy stars as labelled / as based on CHOICE testing	Energy consumption when in use (W)	Dimensions (cm, H x W x D)**	Contact	Price ($)
LG 32LH50YD	64	65	71	65	40	65	72	61	70	✓	✓	4	1	1920 x 1080	–/3.5	98	58.5 x 81.5 x 21	www.lge.com.au	1499
LG 32LH35FD	63	74	71	65	35	55	87	63	70	✓		3	0	1920 x 1080	5/5.5	60	58.5 x 80.5 x 21	www.lge.com.au	1299
Samsung LA32B650T1FXXY	62	68	67	60	40	64	76	61	60	✓	✓	3	2	1920 x 1080	3.5/4	87	60.5 x 80.5 x 24	www.samsung.com.au	1299
Panasonic TH-L32G10A	61	58	71	70	30	63	74	57	80	✓	✓	3	0	1920 x 1080	–/3.5	90	54.5 x 78 x 22	www.panasonic.com.au	1119
Sony KDL32V5500	61	64	54	75	45	63	73	60	60	✓		4	1	1920 x 1080	3.5/3.5	94	58.5 x 80 x 26	www.sony.com.au	1099
Panasonic TH-L32S10A	59	58	66	75	30	61	78	58	60	✓		3	0	1920 x 1080	–/4	82	55.5 x 80 x 22	www.panasonic.com.au	1099
Samsung LA32B550K1FXXY	59	64	61	55	35	64	79	59	60	✓		3	1	1920 x 1080	4/4	79	57 x 79.5 x 24.5	www.samsung.com.au	999
Sony KDL32W5500	59	68	55	45	45	63	76	61	60	✓		4	1	1920 x 1080	3.5/4	88	58.5 x 80 x 26	www.sony.com.au	1299
TCL L32P10FHD	54	55	57	55	25	60	84	68	60			2	1	1920 x 1080	5/5	65	58.5 x 80.5 x 25	www.tclelectronics.com.au	899
Panasonic TH-L32X10A	53	51	50	60	30	61	78	57	60	✓		3	0	1366 x 768	3.5/4	83	55.5 x 80 x 22	www.panasonic.com.au	999
Toshiba 32AV600A	50	46	56	55	20	54	83	62	60			2	0	1366 x 768	4.5/5	71	57 x 78.5 x 27	www.mytoshiba.com.au	1119
HiSense HL81V68P	48	52	56	40	25	50	79	59	30			3	1	1920 x 1080	–/4	80	60 x 80 x 24.5	www.hisense.com.au	899
Samsung LA32B450C4DXXY	46	33	62	40	35	62	82	52	20	✓		2	0	1360 x 768	4.5/4.5	73	57.5 x 80 x 25.5	www.samsung.com.au	849
Sharp LC-32D77X	46	53	41	45	30	51	66	62	20	✓		3	0	1920 x 1080	2.5/2.5	113	57.5 x 77.5 x 24.5	www.sharp.net.au	1299
Sanyo LCD-32XR9DA	44	24	56	65	30	57	74	44	20			3	0	1366 x 768	3.5/3.5	91	55 x 78 x 26	www.sanyo.com.au	799

USING THE TABLE Scores The overall score is made up of: Broadcast TV: 25%; DVD: 20%; Blu-ray: 10%; Sound quality: 15%; Ease of use: 15%; Energy: 5%; Digital tuner: 5%; Viewing angle score: 5%. **Picture scores 55% and lower** indicates a noticeable problem with the picture. Our panel believes the problem will be noticeable even without the benefit of being able to see a number of TVs together. The lower the score, the more apparent the problem. **55%-69%** indicates OK pictures that most people will be happy with. There are no major problems, but we allow a little latitude with colour shifts and black levels. Also, these TVs may not do well with some of the more demanding technical tests involving such things as up-scaling or noise reduction. **70%-79%** indicates good pictures. Very slight picture errors may be forgiven, but blacks are black (not brown) and whites are white. These TVs will usually perform OK in more demanding technical tests. **80%-89%** indicates very good pictures. These are hard to fault and will often perform well in some of the more demanding technical tests as well as with the viewing panel. **90% and higher** indicates excellent pictures. They may still have a very slight technical failing, but it won't be visible under normal viewing conditions. **Price** Recommended retail, as of February 2010. **TABLE NOTES** * Does not include ports that are for service use only. ** Rounded up to the next cm or half-cm, with the base attached and all protruding parts included, cord and connecting cables excluded, screen at zero degrees tilt and swivel if applicable. All TVs on test have HD digital and analogue tuners.

e.g. by contracting out or by remote learning. Even more basically, the question might be asked "why" are we training in the first place?

The importance of value for money in Australia

The application of improving Value for Money in Australia is widely discussed and applied in Australia, often very poorly. Every time you go shopping, you as an individual will be commonly employing the basic concepts e.g might I be better spending my money on another product or brand, or can I buy it cheaper somewhere else? However, some indication of the fundamental importance of this topic can be gained from the following examples:

- Value for Money and Management – as an example, Australian Government Procurement states that – "Value for Money is the core principle underpinning Australian Government procurement" (Australian Department of Finance and Deregulation publication "Selling to the Australian Government – A Guide for Business" February 2009.
- Value for Money and Politicians – again as an example, Hansard Records in the Senate on Wednesday 9 February 2011 show that there are 14 references to achieving VfM. Similarly in the House of Reps on Thursday 24 February 2011, there are 11 references to achieving VfM.

What did the Politicians mean when they referred to getting VfM? If you read the Hansard Reports (they are all On Line) comparisons are made by benchmarking or implying apparent Worth (lower cost alternatives). In these cases, the comparisons are typically based on commonly held public perceptions. For example:

  - Hastings Public School shade cloth – cost $1m (you can buy shade clothes in your local hardware shop).
  - Tottenham Central School – requested a new lab and got an 8 x 2.5m canteen for $600,000 with no cooking facilities
  - Marulan Public School – received a library they did not want at a cost of $853,000
  - Western NSW School – got a $225,000 new classroom with a total of 3 students.

- Value for Money and Industry – An Engineers Australia survey in 1999/2000 indicated that 12% of Government respondents and 43% of industry respondents stated that contracts were awarded on lowest up-front cost, rather than value for money. While value for money was seen as the correct goal in selecting a tender, this was not being achieved due to a lack of guidance, practical methodologies and expertise. – A Joint Committee of public Accounts and Audit, Australian Government Procurement 1999 noted that most agencies could not provide evidence of their efficiency and effectiveness in determining value for money. There was no evidence to show that this principle was being applied correctly or consistently.

Improving value for money

As already noted above, the Australian Standard AS4183:2007 also defines Value for Money in Definition 1.2.12 Value for Money as "A measure used for comparing alternatives based on the relationship between Value and Total Cost". This measure is simply expressed as the ratio of Value/Cost. This is actually just another Productivity measure of Outputs/Inputs. Improving Value for Money, as with Productivity, is achieved by increasing Outputs while decreasing Inputs or a combination of both (see Figure 2.2). Typically, achieving better VfM is sought by simply reducing Costs while hopefully not reducing Value to the user.

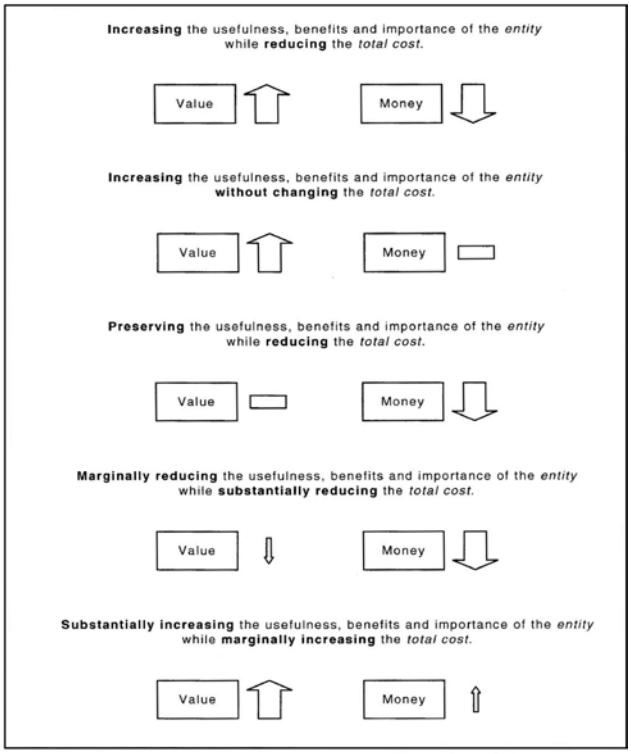


FIGURE 2.2 IMPROVED VALUE FOR MONEY[10]

So why put the spotlight on VfM now?

- There is a widespread recognition in Australia of the need to achieve and improve Value for Money.
- However, it is apparent that there is no valid, recognised and easily understood set of principles for achieving this.
- Value Management as expressed in the new Australian Standard has evolved to help provide this fundamental requirement.
- Introducing a Value Improvement culture at all levels can benefit all organisations and individuals. As Australia competes at home and in the world economy. Value for Money is integral to this process.

Opportunity

- To build on this opportunity, Value Management can be extended to the wider community.
- It should not be restricted to a small cadre of specialists.
- As a result, all will benefit…

Performance mapping and the utility-productivity performance equation

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Abstract

This paper introduces productivity performance mapping using the utility-productivity performance equation. This equation is shown to be useful in the measurement of performance against MAXimising, minimising and Targeted goals. A mini case study illustrates the application.

Keywords

Milestone value, MAXimising, minimising, Targeted goal values, performance parameter map, performance map, performance measurement.

Introduction

In the 'doing of work', some goal is to be attained. Another way of expressing this is that some objective has to be met that motivates one to do work. If there is no reason (no goal) in the doing of work then work itself is simply being done for its own sake. Very few entities – especially human, do this. One tends to 'avoid work' rather than 'do work' if no good reason exists to the contrary.

Performance is also to be both measured and maximised. That is, there is nothing to be gained in expending excess time, money, energy and effort in obtaining a goal in a roudabout way. Usually one is interested in obtaining the set objective in the most expedient (effective and efficient) way (Drucker).

In the doing of work, we often need to also assess the on-going performance of an entity (man or machine) that is doing the work. This requires some form of standard or level of expectation to be set *a priori* to the doing of this work, and usually takes the form of a specified paramenter of interest that relates directly or consequentially to the work being done. In the process of work, the value of this parameter is known as the 'milestone value'.

Once the work is completed, another performance measure of the overall work effort can then be made. This *post priori* measurement again requires an *a priori* value to have been set for the parameter of interest. In this case, the value of the parameter of interest reflects the overall objective of the work done as is termed the 'goal value'.

Performance parameter maps

performance parameter maps are tracking devices that show the tracking of a specified performance parameter (p) against some cumulative measure of work done. Such cumulative measures of work done can be; '*t*', the cumulative time in which work is done; 's', the cumulative spatial positioning in which work is done; or '*x*', the cumulative experience gained in the doing of work. This latter parameter (x) is often simply defined as a simple number count N which measures the number of work units completed in the doing of work. [Readers may recognise this latter example as the abscissa of a classical learning curve (Baloff)].

Figure 1 shows a typical performance parameter map for a MAXimising goal (Kennedy, 2009).

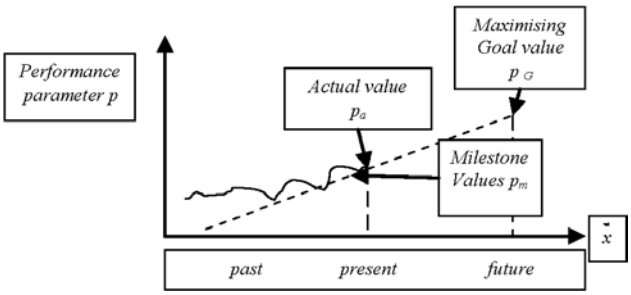

Figure 1. Performance Parameter Map showing a MAXimising goal point p_G

It shows a MAXimising goal value p_G to be attained at some future value of x. Prior to reaching this end point, the parameter of interest (p) takes on progressive values (p_a) – termed the 'actual' value of parameter of interest. These values can then be compared at any value of x with corresponding milestone values (p_m).

As work continues, a state is eventually reached whereby the actual parametric value of interest can be measured and compared against the final goal-value (P_G). This results in a performance measurement – a comparison of actual-value vs goal-value. This comparison can be formulated in ratio form (and expressed by a simple percentage) or can be formulated in a differential / variance form (and expressed by a simple statistic).

For the **Maximising** goal situation in Figure 1, the simple end-of-work ratio performance measurement is given by:

$$P_{p=p} = \frac{p_a}{p_G}$$

Figure 2 shows the case of a minimising goal:

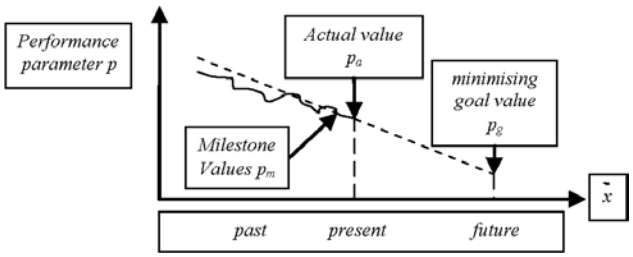

Figure 2. Performance Parameter Map showing a minimising goal point p_g

This figure shows a minimising goal value p_g to be attained at some future value of *x*. Prior to reaching this end point, the parameter of interest (p) again takes on progressive values (p_a). These values can then be compared at any value of *x* with corresponding milestone values (p_m). The corresponding end-of-work ratio-type performance measurement for this **minimising** goal situation is given by:

$$P_{p=p} = \frac{p_g}{p_a}$$

Finally, Figure 3 shows the situation with respect to Targeted goals:

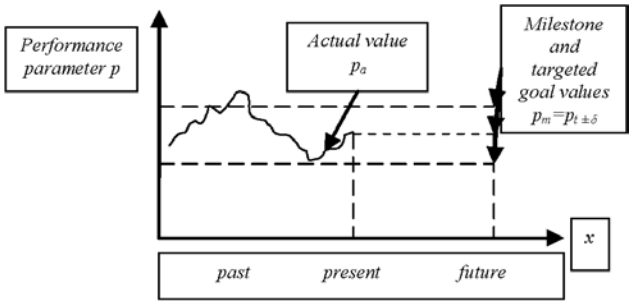

Figure 3. Performance Parameter Map showing a Targeted goal value $p_{t\pm\delta}$

Here, the goal is to remain within a set band of ± δ about the targeted p value of '*t*'.

The corresponding ratio performance measure for targeted goals is $P_{p=p} = \frac{p_a}{p_G}$ whenever the actual parametric performance parameter value falls below the lower control limit value *t* - δ, and $P_{p=p} = \frac{p_g}{p_a}$ whenever the actual value is above the upper control limit value *t* + δ.

Note that in all of the above cases, superior performance results in $P_{p=p} > 1$, 'paid-for' performance results in $P_{p=p} = 1$ and poor performance results in $P_{p=p} < 1$. Further, in all of the above expressions for $P_{p=p}$, it is normally expected, but not always necessary, that the condition $g \leq a \leq G$ be true for all sets of goal values.

Performance Maps

It is highly desirable to be able to automatically generate performance measures directly from data sets of p_a, p_m, p_g and p_G. This is particularly so if the performance parameter of interest is itself a ratio type measure such as μ (the utility of an input resource) or η (the productivity of a process) (Kennedy, 2009). If this is the case, then the utility-productivity performance equation $P_{p=\mu,\eta} = \mu_g \eta_a$ can be used directly to generate a performance map or graph. (This is possible since the utility experience curve is a milestone, goal curve and the productivity experience curve is an actual value curve).

The following case study illustrates the ease with which a performance map can be generated using the utility-productivity performance equation.

Case Study

This case study was first described by Kennedy (1988) and further elaborated on in research papers (Kennedy, 1993, 1999). The situation involved measuring the impact of major process technological change on the productivity performance of a local Australian automobile manufacturer. It was highly desirable to be able to do this *automatically* from known utility of labour milestones and (end) goals data and corresponding on-going measures of productivity of process data. Figure 4 shows the time series data for the utility of labour:

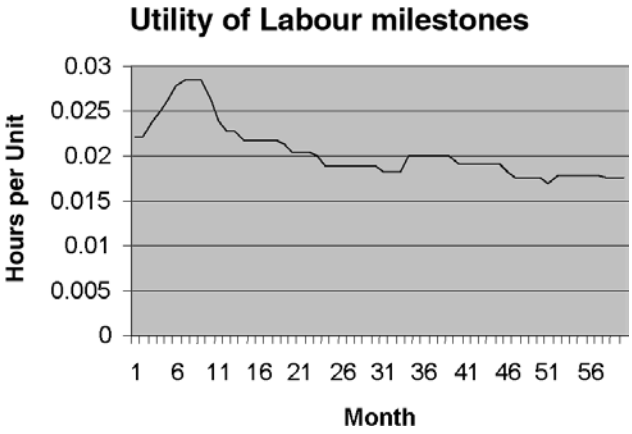

Figure 4. Utility of labour Milestones

Figure 5 shows the corresponding productivity of process data.

As both data sets resided in a simple spreadsheet, it was easy to multiply the two together to generate the resulting productivity performance map as shown in Figure 6.

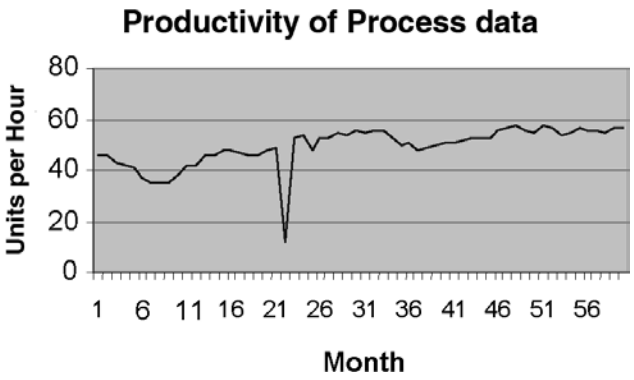

Figure 5. Productivity of Process data

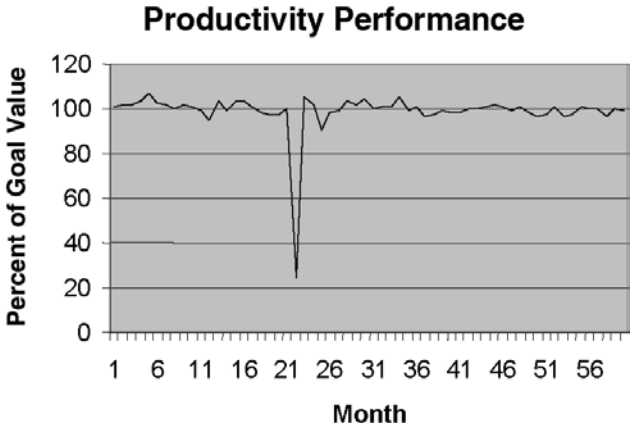

Figure 6. Productivity Performance Map of Automobile Manufacturer over 60 month period

Figure 6 clearly shows that upon introduction of the major process technological change, productivity performance plummeted from near 100% to less than 30% as extrapolated utility goal points decoupled from actual productivity time series data. Figure 6 also shows that the effect of the decoupling lasted a full 3 months before tight line rebalancing again moved productivity performance to historically recorded levels of approximately 100 ± 5 %.

Conclusion

This paper has shown the utility-productivity performance equation ($P = \mu\eta$) to be most useful in generating on-going and end-of-work performance measurements. It embodies the very essence of performance measurement by expressing the success or otherwise of the realisation of the potential of resources both in their utilisation and in their generation. This equation is a simple formulation of fundamental importance (especially to the field of industrial engineering) and mirrors the fundamental equations of other branches of engineering viz. $F = ma$ in mechanical engineering and $V = ir$ in electrical engineering.

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