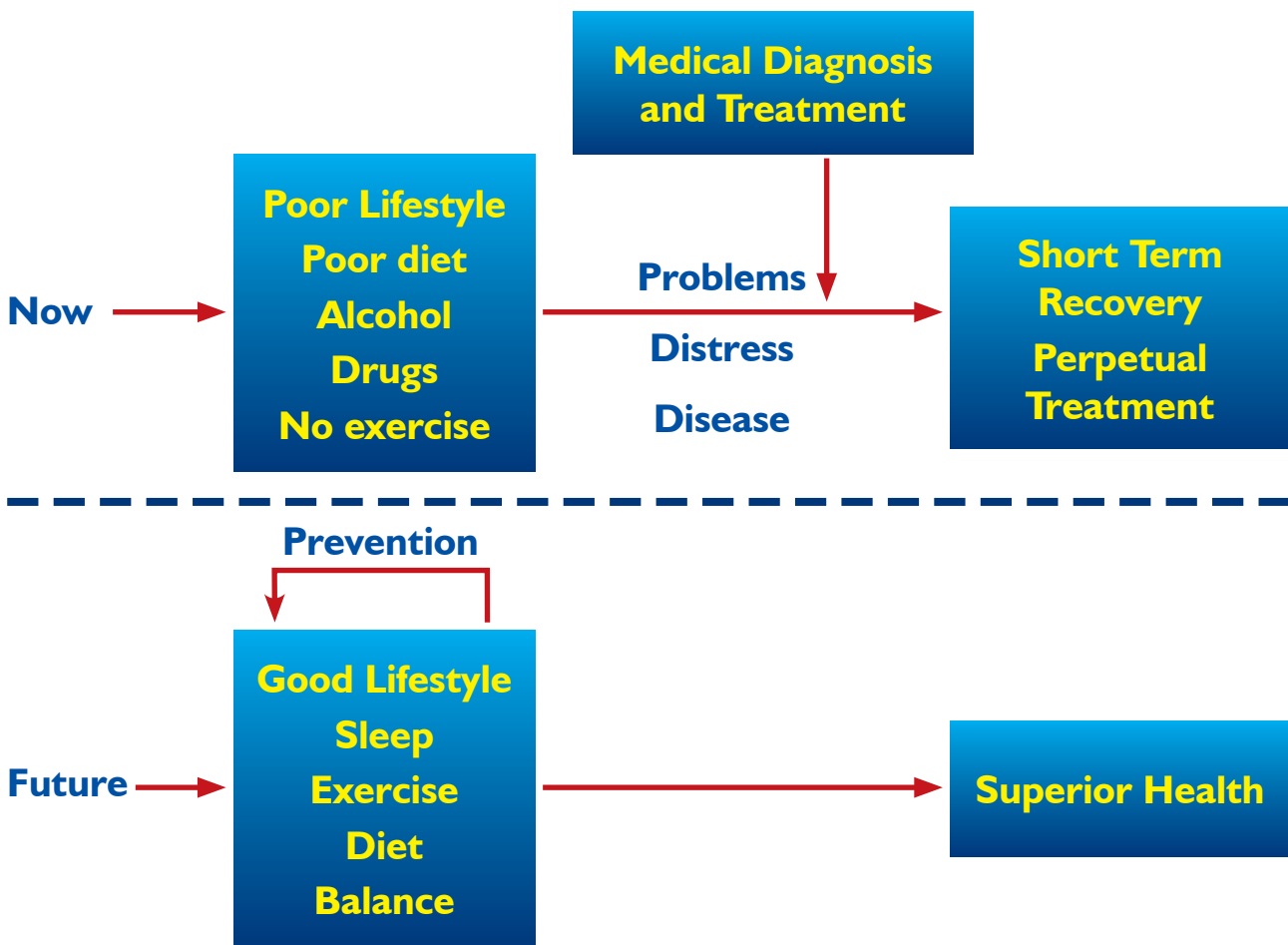


New Engineer JOURNAL

Servicing Manufacturing, Industrial Engineering and Engineering Societies

Prevention is better than cure



Changes to healthcare

In this Issue

- ◆ Some lessons I have learned
- ◆ MODAPTS today
- ◆ Application of lean six sigma to service industries
- ◆ Improving value for money (VfM) in Australian procurement
- ◆ Innovation, Australia II and the 1983 America's Cup



**ENGINEERS
AUSTRALIA**

Upcoming Conferences & Exhibitions

Supply Chain 2020

26-27 June 2012

Melbourne Exhibition and Convention Centre

www.supplychain2020.com.au

Supply Chain 2020 is an exhibition accompanied by an interactive and educational conference program for supply chain & logistics managers to source new products and solutions in line with best practice in supply chain management. Due to its success in 2010, Interpoint Events, EEAA award-winners of Best Australian Show in 2010, will bring Supply Chain 2020 to Melbourne in June 2012 and is proudly supported by our Educational Partner, Swinburne University and Media Partners MHD and TandLNews. Supply Chain 2020 will address the future of supply & logistics with a focus on key competitive issues and best practices.

TAILORED EDUCATIONAL PROGRAM

Supply Chain 2020 Conference Program is based on extensive industry research, international trends and feedback from our database and key supply chain leaders who are faced with critical issues such as sustainability, safety management, human resources and emerging new technologies within their business every day. Conference sessions will be presented by industry experts who have the insight of business obstacles the logistics and supply chain sector typically face.

INTERACTIVE SESSIONS AND WORKSHOPS

Through round table discussions and small workshops, delegates are able to share best practices, discuss key issues and suggestions from business associates. Supply Chain 2020 Conference will provide the latest tools and strategies by industry experts who have effective executive and open your mind to new perspectives and focuses in the future of Supply Chain.

For exhibition and sponsorship opportunities please contact Allison Miller on 02 8586 6193 or email amiller@intermedia.com.au

ASEC2012 – Australasian Structural Engineering Conference

11-13 July 2012

Perth Convention Centre

www.asec2012.com

The Past, Present and Future of Structural Engineering

The aim of this theme is to place papers in the context of the development of structural engineering. This theme will welcome papers on historic projects and the maintenance or renovation of older structures, highlight current methods and projects and will also look to the future of our profession and practices.

With increasing importance placed on sustainability and greater awareness of the overall lifetime performance of a structure, the conference aims to review how such requirements are being implemented and measured.

ASEC 2012 promises to be an interesting event showcasing the Structural Engineering profession.

ANZ 2012 – “Ground Engineering in a Changing World”

15-18 July 2012

Crown Promenade Hotel, Melbourne

www.anz2012.com.au

11th Australia New Zealand Conference on Geomechanics

The Australian Geomechanics Society and the New Zealand Geotechnical Society invite you to attend ANZ 2012, the regional conference of the International Society for Soil Mechanics and Geotechnical Engineering held approximately every 4 years.

The world wide community is facing great change; a changing financial system, a changing climate, a changing legislative environment and changing community perceptions and awareness. There are a host of risks and opportunities associated with this change. This conference seeks to explore and better understand those changes and the risks and opportunities they present to our profession; be they challenges and risks associated with the changing coastline morphology, changing weather patterns, different modes of living, new materials and constructions methods, new methods for generating power or new ways to recycle or manage waste.

Nonstoichiometric Compounds V

– An ECI Conference Series

23-28 September 2012

Taormina, Sicily, Italy

Outline

This conference will cover all aspects of nonstoichiometry in inorganic compounds. Topics will span from fundamental theory to advanced characterization and device demonstrations at both the macro- and nano-scale.

The conference will last four and a half days and each half day session will consist of two keynote talks, followed by shorter presentations on current research topics germane to the keynote talks. There will also be two poster sessions.

Contributions that include one of the following aspects are welcome:

- Bulk defect properties
- Surface/Interface defect properties
- Mass and charge transport
- Structural studies
- Thin films and coatings
- Theory and simulation of defects
- Nanoscale phenomena
- Materials synthesis and processing
- Materials and devices for information conversion and storage
- Materials and devices for energy conversion and storage
- New techniques and methods for characterization

New Engineer Journal

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Dr John Blakemore (ManSA),
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EDITORIAL MANAGEMENT

Research Publications Pty Ltd
 PO Box 253, Vermont Victoria 3133
 Phone: (03) 9738 0533 Fax: (03) 9738 0866
 Email: respub@access.net.au

EDITORIAL COMMITTEE

The Editor (ex officio), J. Blakemore (ManSA),
 D. Kennedy (IIE)

PARTICIPATING TECHNICAL SOCIETIES

Manufacturing and Industrial Engineering

The Manufacturing Society of Australia

National Chair: Roger La Brooy
 Phone: +61 (0)3 9925 6009
 Email: roger.labrooy@rmit.edu.au
 Web: www.mansa.org.au

Institute of Industrial Engineers

Industrial Engineering Society
 Federal President: Daniel Kulawiec
 Federal Office: Engineering House
 11 National Circuit, Barton ACT 2600
 Phone: +61 (0)2 6270 6555, Fax: +61 (0)2 6273 2358
 Toll free: 1300 653 113
 Email: daniel.kulawiec@bigpond.com
 Web: www.iie.com.au

COMMERCIAL COORDINATION & PRODUCTION

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Research Publications Pty Ltd
 PO Box 253, Vermont Victoria 3133
 Ph: +61 (0)3 9738 0533, Fax: +61 (0)3 9738 0866
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Front Cover: Changes to Healthcare – a new paradigm as suggested by John Blakemore in the feature article: 'Application of lean six sigma to service industries... healthcare and finance'

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.

IE, as ubiquitous as ever...

This edition of New Engineer contains a good mixture of reflective, current and 'current/looking-ahead' type IE pieces, from a very interesting and diverse range of authors...

A reflective article is presented in this edition. It is rich in the lessons one can learn beyond formal training as a professional IE. The value of the lessons learned and the knowledge gained is, I suggest, in their direct applicability to anyone's future general and/or specific productivity and/or performance improvement endeavour.

Invited author Neil Erbs – one of the early graduates of the IE program at Monash University – tells of some of the 'knowledge gems' he's gained over the last 27 years, working as a professional IE in a major-Australian company in retail and logistics. His article, titled, 'Some lessons I have learned' is informative and well evidenced by many pertinent examples, and the lessons learned are as diverse as they are plentiful.

'What's current' is covered by an update of what is happening in the work-measurement world re: 'MODAPTS'. Invited authors, Victor van der Heyde and Mike Jones, present an informative brief on the MODAPTS system of work measurement covering its local and international acceptance, its strengths compared with competing systems, and its consequential wide range of applications not only in work-measurement but also in occupation health and safety.

'What's current?' and 'Looking ahead' is bridged by this edition's IIE Federal President's Report. Daniel Kulawiec highlights his most recent conference with Engineers Australia (EA) and writes enthusiastically of EA's promised

new approach to better engage with its own technical societies – of which EA's Industrial Engineering Society is represented by our own, but separately incorporated, 'IIE'. Daniel outlines EA's proposed 'document of affiliation' and invites IIE members to be part of the drafting of this futuristic endeavour to better the relations between the IIE and EA.

Also bridging 'current to the future', are articles by regular authors Dr. John Blakemore and Lex Clark. John presents the feature article of this edition titled 'Application of lean, six sigma to service industries...healthcare and finance' and Lex: 'Improving value for money (VfM) in Australian procurement'. Both papers are again 'to the point' and offer a challenge to us all, not only those who work in the healthcare or finance industries, but also for those who may also have design/management responsibilities of the purchasing function.

Finally, John Blakemore offers a truly reflective, current and forward looking paper titled: 'Innovation, Australia II and the 1983 America's Cup'. This paper draws upon John's personal knowledge of the historic event, and utilises his '22 creative ideas for innovation' to pick apart the secrets to success in the never-ending quest for innovation.

To all, I sincerely wish you enjoyment in reading this edition of New Engineer, and invite your feedback and comments at any time.

*Dr. Damian Kennedy,
rdk4567@gmail.com*

We seek your contributions to the New Engineer Journal

- recent articles, programs, blogs, etc. you think are topical and should have wider exposure
- your feedback on articles that have appeared in the **New Engineer** Journal
- articles on topics you think should appear in the **New Engineer** Journal
- 'other' – your chance to be **creative** !

**Please send your contributions to the editor:
Dr. Damian Kennedy at rdk4567@gmail.com**

Institute of Industrial Engineers Federal President's Report

www.iie.com.au

In early 2012, I once again had the opportunity to represent the Institute of Industrial Engineers (IIE) at Engineers Australia's annual conference for Technical Societies. This is an opportunity for the Chairs of the various Technical Societies with affiliation to Engineers Australia (EA) to meet and work through matters of interest. This year's event was the most productive and valuable I have attended in my three years as Federal President of IIE. This was in part due to a new team of EA officeholders, including John Anderson as Director, Engineering Practice & CPD, and Stephen Durkin as the newly appointed EA CEO.

So what is the relationship between IIE and EA? What should the relationship entail? This question has been the subject of ongoing discussion for the IIE Board over many years. I thought I would use my article this month to explore these matters, and by asking the questions, it will reveal more about what IIE is, what IIE stands for, and what IIE members want from their Institute.

The Technical Societies of Engineers Australia fall into two main categories – societies that are incorporated in their own right, and societies who are not incorporated, and exist under the legal structure provided by EA.

IIE falls into the former category. IIE has been incorporated since 1959, making it one of the oldest Technical Societies currently operating. Being incorporated, IIE exists as a legal entity in its own right, with its own Constitution and Board. I wonder how many members are familiar with the Constitution of the IIE? A copy of the Constitution is posted on the Institute's website which can be reached by logging in as a member with your username and password, and accessing the Governance / Constitution page. I encourage all members to have a read of this document as it defines how the Institute operates and carries out its business of serving members and representing Industrial Engineering in Australia.

Being incorporated brings with it a number of benefits and obligations. The benefits include:

- recognising and maintaining the history of the Institute. IIE represents over fifty years of history and heritage, and the accumulated knowledge and experience of members. The current Board values this heritage and respects the responsibility of preserving it for the future.
- providing the Institute with the capability for self-determination. The future direction and strategy for the Institute is completely within our own control, and the Board can determine the most appropriate future as demanded by the collective needs of the members that it represents.

- providing control over records. In the past the Institute has suffered by having its records under the control of a third-party whom did not pay the attention or respect to our records as we would have liked. IIE was disadvantaged during this time through the degradation of precious member records and resources which to today we are still working to recover. The Board takes its responsibility as custodian over the Institute's records seriously.
- management of membership levels and post-nominals. As an independent body, the IIE maintains control over the assessment, rewarding and maintenance of membership levels, and the post-nominals which are assigned to members for use.

Associated with the benefits of being an incorporated legal entity comes with it certain obligations:

- the cost and obligations to ASIC. This include maintaining appropriate corporate governance, an operating Board and Constitution, company directors and office bearers, and associated reporting
- maintaining our own books and financial records, audited once a year
- running an AGM each year

Most of these items the IIE is committed to preserving irrespective of the corporate environment in which it operates. As such, being incorporated doesn't pose an additional obligation. In fact, even unincorporated societies of EA are still required to undertake financial audits and election of office bearers. The IIE is fortunate in that it has in place a number of low cost solutions and services, provided either from current members, or long-standing suppliers that understand our needs. However, there is a financial impact that is unavoidable with this arrangement, and the Board is always mindful of this and ensuring that it reflects value-for-money for members.

EA has this year proposed the establishment of a document of affiliation for incorporated Societies. IIE applauds this move, as the exact relationship between IIE and EA has always remained a little nebulous.

For a number of years now the IIE has been represented as the Industrial Engineering Society (IES) on Engineers



Australia's website, pamphlets and records. The role of the IES has been performed by IIE, and although IES remains in place to allow EA members to join IIE under Technical Society framework, in reality most members join IIE directly.

Having said that, IIE values its relationship with EA and seeks to strengthen that relationship in the future as long as there is no erosion to the rights of IIE and its members.

There are many benefits of operating as a Technical Society of EA. Technical Societies gain access to a number of valuable technical and administrative services that EA provides. IIE members are invited to local EA division functions, have access to EA resources such as meeting rooms, and can access services such as event / conference organisation, education and media services. In turn IIE offers Industrial Engineering specific resources, knowledge and support for EA members within our fields of specialty. IIE also provides Engineers Australia with visibility over a wider

definition of Engineers that for whatever reason may not be members of EA.

It is important for both Industrial Engineers in Australia, and Engineering in general in Australia, that there is a close and strong working relationship between each of these organisations. IIE is keen to document the rights and responsibilities of both parties in growing this important relationship into the future. If any member has specific views of what should or shouldn't be included in this document, please feel free to contact me.

I look forward to continuing to work with members throughout 2012 on these and other challenges facing Australian society, and look forward to continuing to grow the role of IIE into the future.

Daniel Kulawiec
Federal President, IIE
daniel.kulawiec@bigpond.com

Some lessons I have learned

Neil Erbs
Neil.erbs@coles.com.au

Introduction

In a career now approaching 30 years in retail & logistics, I have made my fair share of mistakes but have had lots of success too. By my reckoning the ratio of mistake to success is 1:2 in number, but in terms of effect 1:6.

The aim of this article is to provide you with some of the lessons I have learned, so that you move these ratios in your favour by focusing on the non technical part of what Engineers do.

Understand what is important

If you understand what is important, by definition, you know what is not – use this to manage your resources (you're own and /or your teams' time, money, energy and effort).

Retailers, like all customers, want to get what they pay for. When a Distribution Centre (DC) provides the wrong stock item it is called a 'Pick Error'. On one occasion, when we visited a DC offering to supply Coles, the management took great pride in showing us their system for dealing with these errors. However, it eventuated that it was a bit like a surgeon telling their patient how good they are at autopsies! The DC subsequently did not get our business, and they had wasted not only many of their own resources in building something, but had built a facility that Coles (as a potential customer) simply did not value highly.

You will be well served in your endeavours if you can really answer the following, three seemingly simple questions

posed by Peter Drucker:-

1. What is your business?
2. Who is your customer?
3. What does your customer value?

'Efficiency is doing things right; effectiveness is doing the right things.'

Peter Drucker

Everyone has something you can learn from

Everyone – from the cleaner to the Chairman, from suppliers, competitors and most obviously your customers – all have lessons for you if you are open to them.

There is a great deal of information that is readily available on learning from your customers. For example, the turnaround of the American airline Southwest Airlines circa 2003 was mainly based on responding to the information their frontline staff had gathered from passengers (1). However, there are endless other examples that are not so readily accessible...and reportable...

For example, to send a shipping-container from Melbourne to Perth costs thousands of dollars – empty or full. Coles sends a lot of containers in a year. A truck driver seeing how empty the containers were, mentioned he had seen a competitor load differently, cleverly enabling pallets to be stacked on top of each other. Applying this simple

observation, we more than tripled the quantity we can fit in a container, and 'virtually overnight', shipping costs were cut by 70%.

Sometimes the lesson is what not to do. In all operations, projects, builds etc. there will be 'bumps' (ed: 'issues' preventing goal attainment). I had a manager who tended to overreact to the first bump making any second bump even bigger – in this case stopping groceries being delivered to about 200 supermarkets!- not the business I'm in!!! The 'sub lesson' is *think very carefully before you act or react in any given situation.*

People are not always truthful – verify

This can be an unintentional or a deliberate combination of ignorance and desire to please/hinder. Your work often relies on the information from others. If they are wrong – you are wrong.



Look closely to find the truth...

For instance, as part of an Industrial Engineering Degree, I did some work for the Ford Motor Company at their Broadmeadows (Victoria) plant. This involved time & motion

measurements being used to improve the productivity of a production line that prepared engines before fitting them into car bodies on the main production line. The workers on the production line felt threatened by increasing the output with less labour (e.g. less overtime on offer). Key to the measurements was the speed of a crane that lifted the transmission to be bolted onto the engine.

As student Engineers we were not qualified/permitted to drive the crane. So we approached the workers to help. The first guy we asked told us in perfect English that he did not speak English then, without seeking a response, walked off – clearly avoiding the approach. The next line-worker showed us two freshly minted nuts and washers claiming they had come off the crane as 'it is broken'. However, simple observation showed the crane was encrusted in grease and dust, and that, therefore, the nuts and washers could not possibly have come from that crane...

We then all agreed to call Maintenance to 'fix' the broken crane. Maintenance subsequently found it to be in perfect working order. So maintenance personnel operated the crane and we took our measurements. If what you are told is inconsistent with your own observations, pursue an alternative path to get to the facts.

Another, more recent example, involves the commissioning of a new distributions operation. As with all start-ups, there were teething issues. However, the folks running this operation were so consumed by these issues, that some information being reported 'up the chain' (of command) was wrong, creating the potential for the gravity

of the situation to be underestimated and consequently corrective action being delayed. They were saying some stock had been delivered, but it had not. My action was to 'walk the warehouse', verify and feedback the real facts to the site management.

A consequential, valuable adage might be:

'you do not always get what you expect, you get what you inspect'.

Neil Erbs

Simplicity does not equate to ease

I frequently hear people assert that such and such a task is 'simple', implying its execution is easy. Blind acceptance of this often leads to an under-baked plan which adds to the risk of failure. Using a sporting example...running a marathon is simple...one foot in front of the other is simple, but 42 kilometres is clearly hard (remember, the Marathon killed the first guy who ran it!) and success requires thorough preparation.

Confusing 'simplicity' with 'ease' can be done by the best of us. A very senior manager, whom I greatly respect, berated a presenter for "over complicating" the Supply Chain challenge of getting boxes from supplier to supermarkets, saying "it's just boxes in and out".

The road ahead seems simple when viewed from inside the car. However, when viewed from above, the bigger-picture perspective reveals the complexity.



Seems simple...from inside the car!

At the micro, local level this appears true, but the presenter then calmly used the whiteboard to illustrate the macro-scale of getting millions of boxes from thousands of suppliers to hundreds of stores spread across our continent – in reality, not simple and not easy.

'Simplicity is the most deceitful mistress that ever betrayed man.'

Henry B. Adams

Own your mistakes

We all make mistakes. The key is to make sure they are not 'fatal' – either literally and/or figuratively (recall the above 'Understand what is Important'), and to learn from them. To learn from our mistakes, you must own them. When operations or projects fail to achieve their objectives, there is normally an investigation into the cause. The depth of the investigation is generally in proportion to the scale and consequences of the failure. When someone unfortunately (literally) dies, the Coroner does this. In business – a business

failure – an investigation is undertaken and is often called a ‘Post Implementation Review’ (PIR).

The common objective of a PIR is to find the cause(s) then implement changes to deliver better outcomes. Participants, however, often find the criticism inherent in the process quite threatening.

Recently I saw the ‘go-live’ – in the first state of program being implemented nationally – run badly (it rated 3/10). The team responsible worked through a painfully honest PIR, owned their mistakes and changed much of their approach for the subsequent states. The next state was rated 9/10 and the entire program subsequently took accolades from across the business.

There are many examples where the failure to face a mistake has become a bigger issue than the initial mistake itself. Arguably the most infamous example of this was when Richard Nixon was impeached from the US presidency – not because of the initial Watergate break-in but because of the subsequent cover-up.



Own your mistake...

‘The successful man will profit from his mistakes and try again in a different way.’

Dale Carnegie

Strength through diversity

Most work is done by individuals organised into teams. As individuals, we all have strengths and weaknesses and this carries over to our teamwork. Work at understanding your own strengths and weaknesses and with/of those with whom you work. Manoeuvre (in the true strategic-sense of the word) – to honestly exploit the strengths, and bridge-over the weaknesses in both self-development and in team-building.

Building a house is done by a fairly large diverse team of people with clear skill sets. If your skill is plumbing, it is wise not to accept the role as electrician.

Beware ‘Group Think’

Beware meetings or decisions where everyone too easily agrees with each other. This can often mean that the idea/proposal has not been ‘pressure tested’.

The movie ‘Twelve Angry Men’ (2) clearly illustrates this, through the deliberations of a jury. A dissenting juror forces the other eleven jurors to reconsider the evidence and, as eventually proved, prevent the wrongful conviction of an innocent man.

A parallel tactic, I have successfully used, is – even if my inclination was to agree, is to oppose or support an

alternative then let the team convince me otherwise. Occasionally the team has reversed their position to join my view and, if not, at least we know the alternative has been properly considered.

‘Diversity: the art of thinking independently together.’

Malcolm Forbes

Conclusion

It is people that do things. You may design the bridge, washing machine, TV, warehouse, widget, or whatever it may be but it is built and used by people. If people can’t build it then the design, no matter how technically brilliant, is pointless. I have learnt that PEOPLE MAKE THE DIFFERENCE and your best hope of leveraging this is with an open mind.

**‘A mind is like a parachute,
it only works when it is open’**

‘Uncle Martin’ from the TV Sit Com
‘My Favourite Martian’

References

1. Jody Hoffer Gittel; The Southwest Airlines Way: using the power of relationships to achieve high performance. McGraw-Hill (New York), 2003.
2. Film: ‘Twelve Angry Men’ United Artists, 1957. (directed by Sydney Lumet, written by Reginald Rose and starring Henry Fonda).

Suggested further reading

These have been the most useful...

- a) Almost anything written by Peter Drucker, just reading his quotes is insightful.
- b) “Up The Organisation – how to Stop the Corporation from Stifling People and Strangling Profits” written by Robert Townsend and re-published by John Wiley & Sons Inc. in 2007. An entertaining, often tongue in cheek, read. First written about 35 years ago and is about leading people so remains relevant. Don’t take it too literally. Not one for the academics
- c) “What Management Is: How It Works and Why It’s Everyone’s Business” written by Joan Magretta & Nan Dundes Stone and first published by Harper Collins in 2003. Provides solid insight into how business works in a very structured way by reference to a series of easily digestible case studies (What else would you expect from editors of the Harvard Business Review?). Academics amongst you should take to this. Good reading when you have been in a business for a year or two.

About the author

After completing my Industrial Engineering Degree in 1984, I started work at G.J. Coles, then ColesMyer, and now Coles Supermarkets. I have worked mainly in Operations across various divisions and most recently in Fresh Produce Logistics.

MODAPTS today

Victor von der Heyde W: www.modapts.com and Mike Jones jonesmdj@bigpond.com

Introduction

MODAPTS is the work measurement and ergonomic analysis system that was developed in Australia in the late 1960s, then refined and expanded over many years. MODAPTS has a strong following in the United States and is currently used there in rehabilitation centres and recognised for its validity by the U.S. Department of Labour. It's also used extensively in America by Ford, Caterpillar and Chrysler, in Malaysia (Intel), in Europe (Renault, Landrover and others) and in South Africa largely in Occupational Therapy training.

MODAPTS Goes Global

There have been translations of MODAPTS training manuals in recent years into Spanish, Russian and Japanese. Despite not having any large organisation to promote it, MODAPTS has stood on its own merits and has many proficient practitioners. There is one small central MODAPTS organisation and this is the not-for-profit International Modapts Association (www.modapts.org) based in the U.S., which runs training courses, certifies trainers and provides various forms of support. Australia has accredited trainers/practitioners who provide the same type of service. In Australia MODAPTS is used by Ford, Australia Post, IGA, Coles and other small to medium sized organisations.

MODAPTS at Chrysler

The Chrysler Group in the United States implemented MODAPTS some years ago as their corporate standard for work measurement. Chrysler did this after a careful comparison and used what they called a Standard Data Evaluation Matrix. The time study methods they compared were MOST, MODAPTS, Chrysler Standard Data and traditional stopwatch. The evaluation criteria included the following:

- Accuracy
- Speed to Derive
- Ease of Use
- Training
- AMPS Integration
- Product Versatility
- Total cost

Each criteria was ranked from 0 (lowest) to 5 (highest) and in all but one criteria (Speed to Derive) MODAPTS ranked a 5.

What MODAPTS is

MODAPTS stands for Modular Arrangement of Predetermined Time Standards. It is similar to other well known second-generation systems, e.g. Master Standard Data (M.S.D.) and MTM2. However MODAPTS is different from other systems in that it concentrates on the body part doing the moving/work rather than on the distance covered by the body part or the object being handled. This is a key feature and with basic training and the use of the MODAPTS training manual (Heyde's MODAPTS) the system can be easily understood by both workers and employers.

The Superiority of MODAPTS

The MODAPTS system is such an effective and efficient system it can be summarised on a single sheet of paper— see the summary MODAPTS guide sheet shown below.

MODAPTS has been seen as a (and the) superior work measurement system due to its range of applications as well as ease of use. As a language MODAPTS is able to describe very precisely work or tasks in offices, factories, distribution centres, workshops, a whole range of settings. It enables one to deconstruct a task and describe that task in terms of its elements. Having tasks constructed in such detail, with accurate times associated with each movement (work-element) in the task, means that MODAPTS can:

(a) Quantify degree of disablement for particular tasks

In considering the extent to which quality of life has been diminished by injury or illness, MODAPTS can assist in determining whether a person's performance is slower than average. It can also map progress towards improved capability due to various treatments, therapies and the natural healing process. This is achieved by having various tasks with a variety of body movements allocated on an individual basis thus enabling a benchmark for measuring/identifying improvements.

(b) Be used as a modelling tool

Using MODAPTS an alternate method can be provided by simulating the process at the industrial engineer's desk and then evaluating it against the current method. Altogether new process and procedures can be evaluated and accurate standards provided which in turn can be used in costing the product to establish its viability. In addition tools, equipment and staff levels can be accurately determined in advance by using MODAPTS to model the process, line balance and ascertain other requirements.

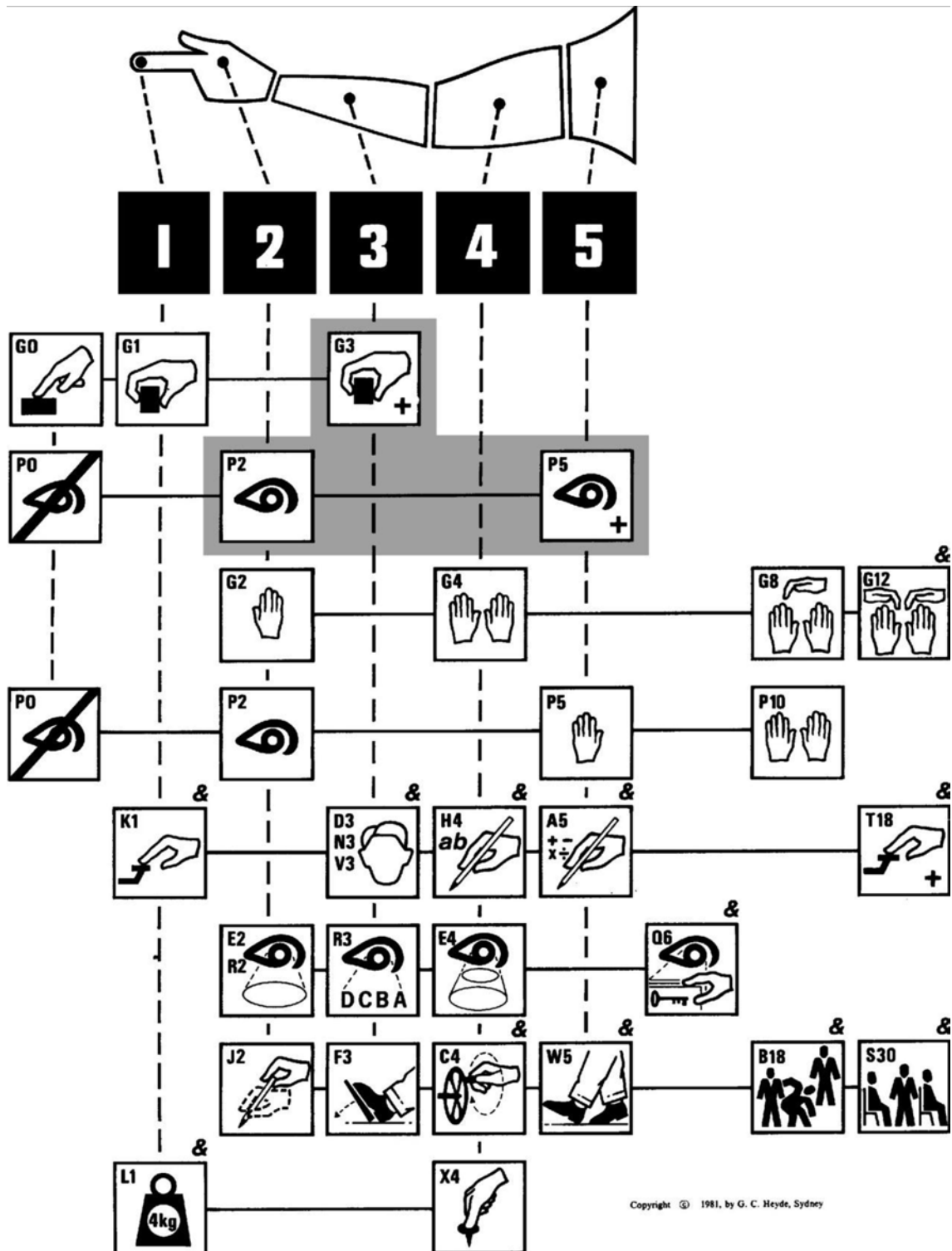
(c) Avoid conflicts from non-acceptance of standards

Most important is the acceptance of standards by employees, unions and employers. The whole process of rating is eliminated. If a disagreement occurs, the study can be taken to the task in question and each element checked to see if it occurs or not, including the exact movements required to complete the element/task. It is easy for all parties to understand and competently review the task, which provides the ability to resolve disputes in a logical

manner. In contrast, trying to defend a standard set by stopwatch study with a rating of say 90 (100/133 rating scale) completed the day before is impossible because one cannot reconstruct the perceptions that occurred.

Conclusion

MODAPTS has not only stood the test of time but it keeps getting used or taken up by major corporations. It's an Australian success story.



Application of lean six sigma to service industries...health and finance

Dr. John Blakemore

E: masc@blakemore.com.au; W: www.blakemore.com.au

1. Introduction

The application of *Lean Systems* into the Service Industries is exactly the same as that for the manufacturing industry. In both cases, the information flow systems are the same in principle and only differ in content. The tangible product in manufacturing is replaced by the tangible service element in the service industry. For example: in hospitals, the tangible outcome is patient care. In the Service Industry, generally it is customer service, which has all the product characteristics of the tangible product, quality, cost and delivery.

All manufacturing industries have a service component while many service industries have a manufacturing component. A restaurant manufactures a meal in the kitchen. A surgeon uses tools and techniques analogous to an operator in a manufacturing plant, or a builder or a carpenter...saws, drills, or says a sail-maker...needles and thread. The similarities are endless. Therefore, it is not surprising that already the serviced industry is starting to embrace the methodologies of *Lean Systems*. It is perhaps a little more difficult to see the analogies for the finance industry, but this is because the key system issues are information flow and communication.

2. Lean six sigma in the healthcare industry

We are all living longer healthier lives despite increasing obesity and perhaps greater stress. Although a negative placebo effect can give rise to premature death, overall superior diagnostic medical and surgical treatments have added many years of high quality life to all of us. Health and wellbeing can be improved even further if the individual takes control of their own health with good lifestyle choices, the correct diet and the correct amount of exercise.

All this places new demands on all the participants in the healthcare industry. Healthcare professionals can learn a lot from the very high degree of precision and accuracy of process control developed in the manufacturing industry. And, in particular as first developed by Drs. Ohno, Deming and the outstanding process control practiced in Japan, when these concepts are integrated with the skill and training of the Samurai. All the rules of statistical process control leading to Six Sigma and the quality rules practised by extending Dr. Deming's 14 points, assist us to redefine

the 26 Rules for Lean Six Sigma systems as shown in Table 1 as follows.

Table 1. 26 Rules for Lean Six Sigma for the Healthcare Industry	
People	
1.	Continuously Improve the culture...improved customer focus and care
2.	Team Up...doctors, nurses and specialist scientists working together
3.	Focus on the patient with care speed and accuracy integration
4.	Ensure the correct number of professionals are available
5.	Once treatment begins ensure that it is seamless and continuous
6.	Apply all rules to the whole of the health system from cradle to grave
7.	Ensure the treatment and precision is adhered to and medication is not missed and supplied at the correct intervals with minimum variation
8.	Improve cash flow in the providers enterprise
9.	Apply Six Sigma (6σ)
Planning	
10.	Flexible resources to the bottleneck (cooperation between say hospitals sharing resources)
11.	Even the flow (on say hospitals by digital integration)
12.	First in first out if of equal priority
13.	Optimise the availability of all professionals
14.	Level the load between providers if possible
15.	Batch size of one (the patient)
16.	Optimise the sequencing on instrumentation
Operations	
17.	Minimise waste
18.	Aim for continuous flow of patients in the system with the elimination of queuing

19.	Maximise adding value to the patients experience
20.	Link processes where possible
21.	Match processes
22.	Minimise hold points
23.	Aim for illness prevention
24.	Use Statistical Process Control (SPC) on all processes and systems
25.	Maximise professional value by preparing patients
26.	Use checking and quality systems at all times

3. Current healthcare status (USA data)

Ranked Major U.S. Health Issues

A priority listing of the major costs associated with healthcare in the USA today are given in Table 2 below:

Table 2. Ranked Major Health Issues (USA)

- Alcoholism
- Arthritis
- Cancer
- Cardiovascular disease
- Dental disease
- Depression
- Diabetes
- Digestive disease
- Drug abuse
- Homicide or suicide
- Infant mortality
- Infectious disease
- Respiratory disease
- Accidents

Major Gaps in U.S. Healthcare are:

- Inoculation – lack of
- Education – lack of
- Screening – availability and practice
- Personal health habits (diet, exercise, alcohol, smoking, drugs, etc.)

4. Process Variability in Healthcare

The variability of all processes can be illustrated using the following familiar bell-shaped frequency distribution (Figure 1). The top half of Figure 1 illustrates that most people have good health, but some have unnecessary illness and some unavoidable illness. The challenge for a world class healthcare system is how do we ‘sharpen’ the bell curve and make all systems more capable of delivering superior health benefits.

The bottom half of Figure 1 shows that a six sigma system aims for the system capability to have a range which includes 4.5 Sigma of variation of the process or a defect rate of 3 parts per billion.

In the figure below, the variability of the process for all illnesses and for the overall population can be described by a normal distribution as per the bottom graph. Improved application of six sigma processes and systems will skew the distribution as shown in the top graph.

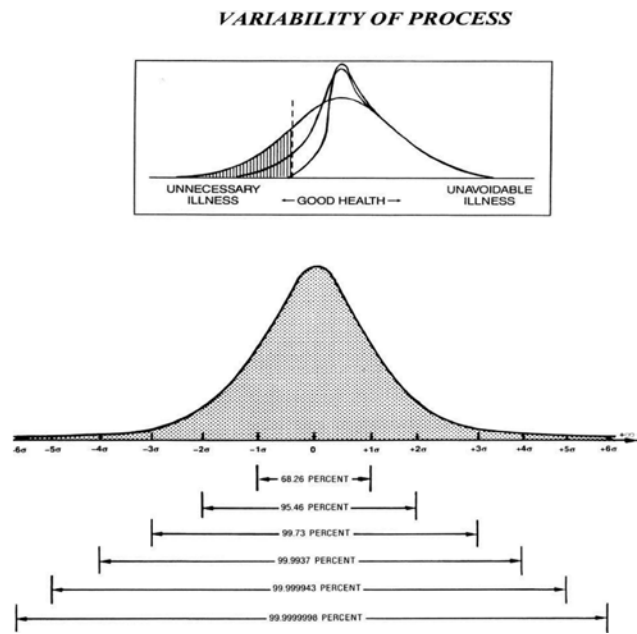


Figure 1. Variability of Process

The historic impetus to achieve Six Sigma quality in the manufacturing industry was driven by the interdependence of processes and components in complicated systems like computers or motor vehicle components. Since, if there is a relationship between the performance of one component and the next, then the failure rate is determined by multiplying the performances of the individual parts. For example, for a manufactured product that contains 200 parts; if every part is made to plus or minus 3 Sigma capability (0.27% outside specification at each process) and each part is dependent on the other, then the failure rate would be 42%. Clearly, 3 Sigma quality at 0.3% defective is not good enough for multicomponent systems. This argument applies more so for the Healthcare Industry: not because of the large number of process steps, but because faults can result in death or serious permanent disabilities of the patient. Six Sigma must become the mantra of the Healthcare Industry.

Note: This was not understood in the finance industry when good quality mortgages were bundled with poor quality ones and this will be discussed in more detail later. Of course, if it was understood, then one might conclude that the drivers were simply greed and dishonesty in the finance industry, which many believe helped bring about the Global Financial Crisis (GFC)...

5. Prevention is better than cure

The following schematics (Figures 2, 3 and 4) are designed to illustrate that the focus of all medical and health processes should be on prevention. For example, rather than focusing on gastric banding as a solution to obesity, the focus should be on lifestyle. We are all advised to avoid cigarettes and drugs; use alcoholic drinks in moderation; exercise moderately and continuously and to eat a good balanced diet so that weight remains in the healthy range of a Body Mass Index (BMI) of 20 to 25.

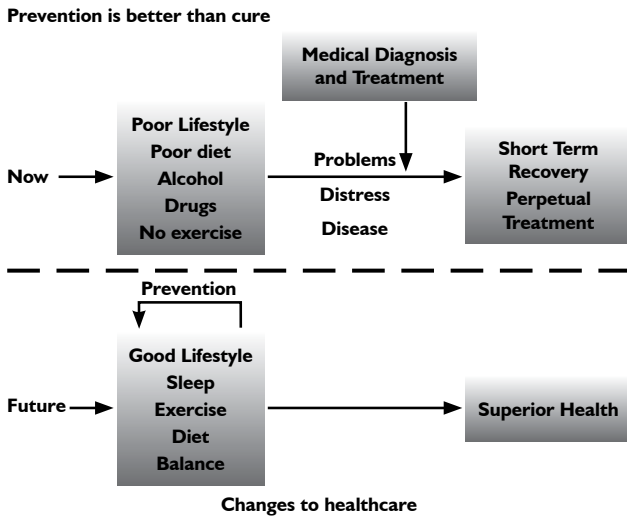


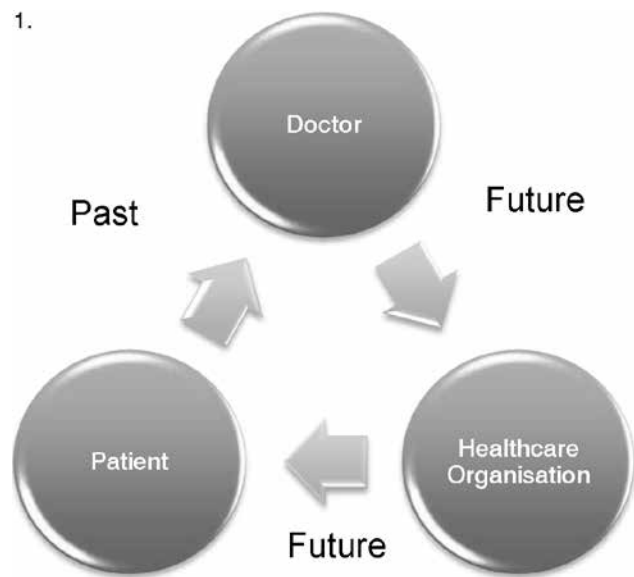
Figure 2. The Superiority of Prevention

6. Comparison of healthcare to manufacturing

Table 3 summarises the comparative development status of Manufacturing Industry and the Healthcare industry:

Table 3. Manufacturing Vs Healthcare Development				
	Item	Some Manufacturers	Equivalent Healthcare Item	Healthcare
1.	Future unpredictable	✓	Disease may be unavoidable	✓
2.	Future preordained	✓	Disease preordained	✓
3.	Poor use experience	✓	Poor use of experience	✓
4.	Control in limits (3σ)	✓	Control in limits (3σ)	–
5.	Tighter Control in tighter limits (6σ)	✓	Tighter Control in tighter limits (6σ)	–
6.	Maximum control	✓	Maximum control	–
7.	Total control – to target, not tolerance	Some	Total control – to target, not tolerance	–
8.	Knowledge of all laws – profound statistical and cause and effect knowledge	–	Knowledge of all laws – profound statistical and cause and effect knowledge	–

Notes: 1. Some Japanese automobile manufacturers at Stage 7
 2. Japanese computer chip manufacturers are at Stage 7
 3. Beyond Quality Awards: Statistical Process Control; 6 Sigma; Input Control; Prevention; Community; Just in Time



- 1. Tampering of process has not helped Healthcare Control
- 2. SPC can add Precision and Accuracy to Therapy

Figure 3. Changes to Healthcare

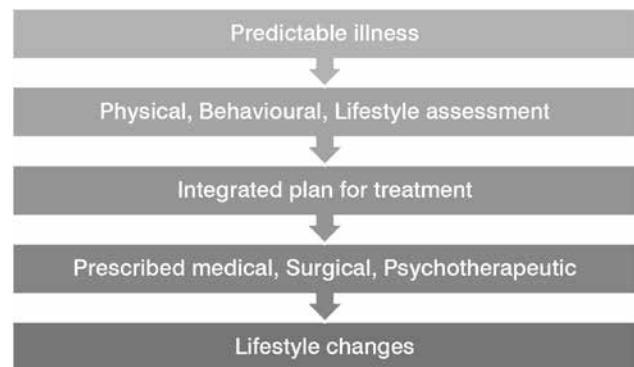


Figure 4. The Future of Healthcare

When variability is understood and then reduced the distribution can be tightened and very often new ways of process improvement that were not visible before suddenly, almost intuitively, become clearer.

7. Lean Six Sigma in the Finance Industry

Failure to use The Deming Philosophy and Lean Six Sigma...The GFC

What caused the Global Financial Crisis (GFC). Was it pure greed? Was it the failure to understand probability theory? Was it the poor quality control of processes and systems? Was it the use of poorly controlled derivative trading or was it the invention of derivatives themselves? Could it have been avoided?

If we apply the 5 *Whys* to the GFC, we end up with greed...*animal spirits*. Along the way, however, there were few controls on the systems and even now the controls on bank lending particularly in the USA are still not tight enough. In Australia, the control is tighter, but there is still a lot of pressure applied by banks on borrowers to accept loans beyond what could be expected as reasonable risk. The banks do not have a lot of worry under most circumstances in Australia at present. In the USA, however, many homes were so highly geared that the loan exceeded the value when the property bubble burst that people simply walked out leaving the bank to pick up the tab.

In a free market economy, it is the marketplace that sets value. The Australian Dollar is high because the world sees Australia as a low risk place to invest. Adam Smith would say that it is the invisible hand controlling the system.

Using the correct levels of quality control and removing tampering would have saved the USA from the GFC.

Let us now look at the causes and see how Lean Six Sigma could have helped.

Bundled Mortgages

To understand what happened here, it is necessary to introduce some simple laws of probability.

In a bundled mortgage of ten mortgages, for example, of which nine were of very high quality and one was not, the financiers argued that the probability of failure was very low since the nine good ones would carry the one poor one and the package of ten would have a low probability of failure.

Let us look at this in more detail:

Let the probability of failure of the nine good ones be very low at one in 10,000. That is, let the Pr to fail = 0.0001.

Let the probability of failure of the one high risk mortgage be 0.8.

What is the probability of failure of the bundle?

Now, the probability of failure plus the probability of not failing is one.

$$1e \text{ Pr (fail) + Pr (not fail) = 1.0}$$

$$\text{Therefore: Pr (fail) = 1.0 - Pr (not fail)}$$

$$\text{And Pr (fail) = 1.0 - ((0.9999 to the power 9) \times 0.2) = 0.8}$$

Hence the probability of failure is set by the one bad mortgage.

It appears most likely that these bundled mortgages were sold in a deceitful manner by the compilers.

Application of the 26 lean rules to the finance industry

Referring back to Table 1 *26 Rules for Six Sigma* for the Healthcare Industry, we can see many equivalent failures in the Finance Industry that led to the GFC. The rules broken are as follows:

1. Continuously Improve the Culture
2. There was no attempt to team up honestly with the lenders to the bundled mortgages
3. There was no attempt to optimise service in terms of quality cost and delivery to the customer
4. There was no attempt to match resource with the honest demand
7. There was no attempt to minimise variation of the probabilities in the bundled mortgages
19. There was no attempt to maximise the value added to the customer
23. There was no prevention at all
24. There was no use of SPC
26. No quality systems were in place

At least ten rules were broken because of *animal spirits*. The problem was people, just like "Moneyball" with Brad Pitt.

Conclusions

All service industries can benefit from the implementation of the six sigma process improvement techniques. In particular, the healthcare industry should be striving continuously to remove process variation as much as humanly possible since lives are often at stake. It is remarkable that the healthcare industry generally has lagged so far behind the manufacturing industry in this regard.

The Global Financial Crisis was the result of financial advisors and investors gambling with massive funds using all forms of derivatives. The short example of bundled mortgages clearly illustrated what people who bundled the mortgages should have and probably did know but they went ahead and deceived the world's investors anyway.

Improving value for money (VfM) in Australian procurement

Lex Clark
clarklh@clarkengineering.com.au

Introduction

In 2011 I published an article in the *New Engineer* journal titled 'Value for money and value management' (1). This article was intended to illustrate how Value Management (VM) has developed in Australia over the last fifty years or so, including a core but unstated principle of achieving Value for Money (VfM). VfM is simply defined in the latest Australian Value Management Standard AS4183:2007 as 'a measure used for comparing alternatives based on the relationship between Value and Total Cost' (2).

The *New Engineer* article noted that the application of improving Value for Money in Australia was widely discussed and applied in Australia, although often very poorly. However, every time you go shopping, you as an individual will be commonly employing the basic concepts e.g. what product will meet my need, might I be better spending my money on another product or brand, or can I buy it cheaper somewhere else?

As simple as this may seem, it has very important and wider implications both in Australia and around the World. As an example, the Australian Government Procurement Guidelines state that 'Value for Money is the core principle underpinning Australian Government procurement' (3).



Transferring this simple philosophy of achieving Value for Money when buying items at your Supermarket across to a large, costly and complex government procurement operation might seem to be wishful thinking. *It does not need to be.*

Value for money as a core governing principle

the following extracts from the Commonwealth Procurement Guidelines help to illustrate the way in which the emphasis of VfM has been simplified by placing an emphasis on reducing both the Cost of resources required and the degree of Risk involved in a new procurement. Under Division 1, Section 4 states that:

- 4.1 Value for money is enhanced in government procurement by:
- encouraging competition by ensuring non-discrimination in procurement and using competitive

procurement processes;

- promoting the use of resources in an efficient, effective and ethical manner;
- making decisions in an accountable and transparent manner.

Section 4.4 of the Guidelines then goes on to also note that:

4.4 Cost is not the only determining factor in assessing value for money. Rather a whole of life value for money assessment would include such factors as:

- Fitness for purpose;
- the performance history of each prospective supplier;
- the relative risk of each proposal;
- the flexibility to adapt to possible change over the lifecycle of the property or service;
- financial considerations including all relevant direct and indirect benefits and costs over the whole procurement cycle; and
- the evaluation of contract options.

Section 6 of the Guidelines then discusses the Efficient, Effective and Ethical use of resources noted before in 4.4 above. Chief Executives are required to promote the efficient, effective and ethical use of Commonwealth resources... by ensuring that their agencies have appropriate policies, procedures and guidelines in place to achieve value for money on procurement processes. In particular;

6.3 Efficiency relates to the productivity of the resources used to conduct an activity in order to achieve the maximum value for the resources used;

6.6 Effectiveness relates to how well outcomes (in the procurement process) meet objectives... This entails correctly identifying the need, accurately drafting functional specifications, rigorously assessing responses, negotiating the final contract and then diligently managing the contract.

6.17 Ethics are the moral boundaries or values within which (procurement) officials work. Ethical behaviour encompasses the concepts of honesty, integrity, probity, diligence, fairness, trust, respect and consistency. Ethical behaviour identifies and avoids conflicts of interest, and does not make improper use of an individual's position.

Figure 1, from the Commonwealth Procurement Guidelines explains the procurement process used by Australian government agencies. The Guidelines explain that most procurement processes will commence with identifying

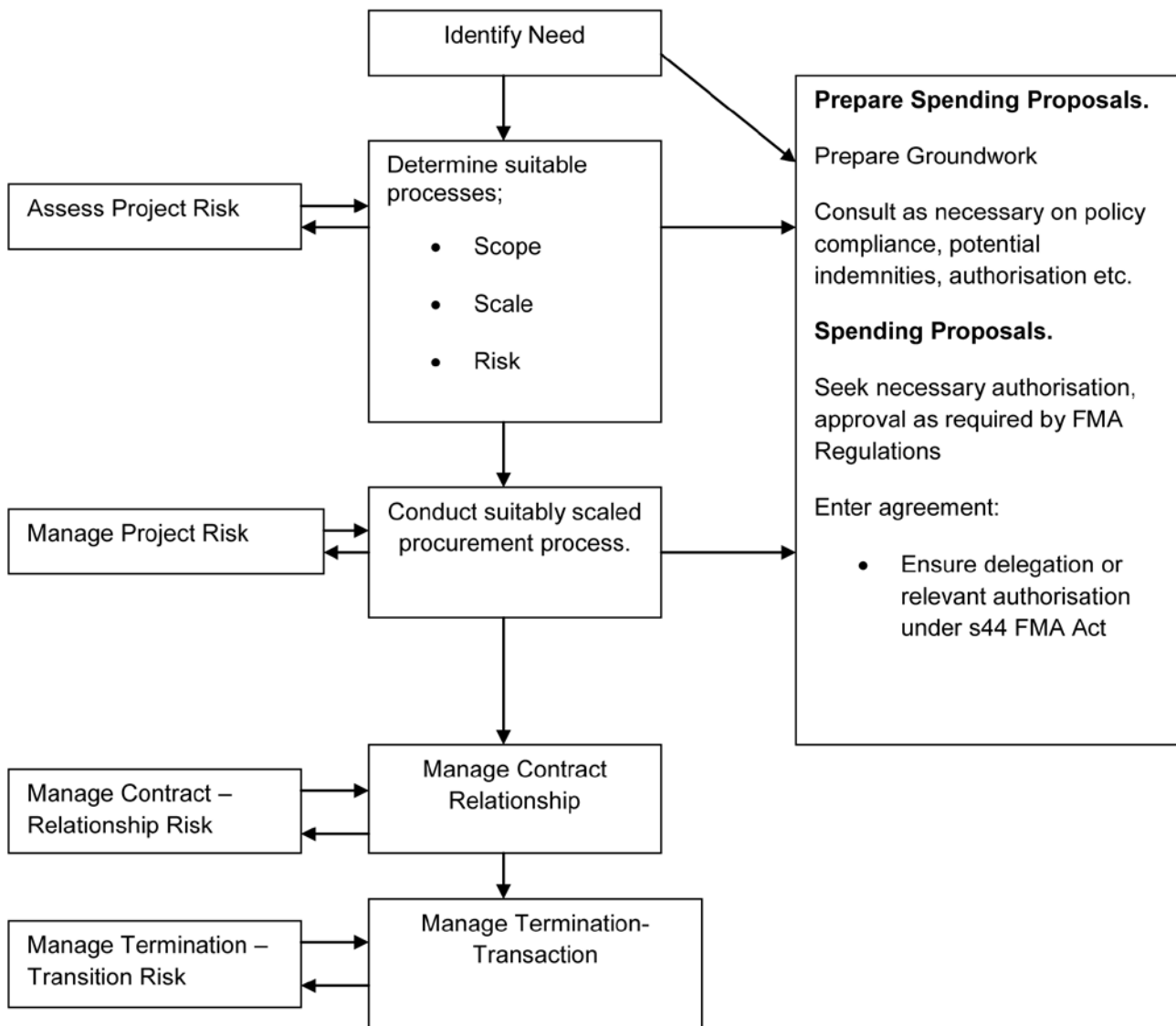


Figure 1. Commonwealth Procurement Guidelines (Figure 2)

[An efficient and effective procurement process incorporates rigorous risk management, enabling issues to be identified early in the process.]

a need for the procurement followed by a determination what a suitable process for the procurement would be, by reference to the scope, scale and risk of the procurement.

A need for improving the value for money model?

Figure 1 places the emphasis on the actual procurement process, rather than the overall achievement of best Value for Money in a project:

1. First identify the need for a procurement,
2. Next decide which is the most appropriate procurement process to apply, based on the anticipated scope, scale and risk involved.
3. Manage the procurement process and the potential risks.

The first essential action to “Identify Need” is identified as the need for a procurement action, rather than to identify the need to which the procured item/s is to be put to use.

The question Why do you need to procure this item is presumably supplied by the customer who will need to justify the requirement.

The fact that Figure.1 does not apply a Risk Analysis to the Identify Need requirement (unlike all the other actions) is presumably due to the emphasis being on the procurement process only. The identification of What is needed to be procured and Why it is needed is presumably left up to the requesting agency. The risk lies with them. Of course, if the Need is incorrect then everything else is incorrect and achieving Value for Money is an exercise in futility.

However, this emphasis on procurement greatly simplifies the procurement process and its risks. The basic sequence of questions underlying the competitive procurement process is simply, and typically:

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

Applying the definitions in the Australian Value Management Standard AS4183:2007, the 'it' in the above process, defined as an Entity, can be a product, process, service, system or organisation to which the analysis is being applied.

Many organisations do not have the resources, skills or time to carry out a detailed analysis and so commonly it is assumed that the market and other standards and requirements will mean that all the entities available are basically the same. The Value for Money decision therefore reduces to which Supplier can reliably deliver the entity at the lowest cost.

This greatly simplifies the decision making process and hopefully reduces risk. However, it also commonly results in a sub-optimal Value for Money decision, as it typically results in procuring only what was procured before. The original decisions that were made, often years before, for the original procurement can almost always be improved today and in the future. In Australia, many of the original decisions were in fact also made overseas to meet requirements that only partially meet Australia's needs today. Finding the best solution to meet the needs of today and in the future might therefore seem particularly difficult amongst a range of sub-optimal options.



An improved value for money procurement model

The Commonwealth Procurement Guidelines do however mention in Section 4.4a (see above) that 'fitness for purpose' is another factor other than Cost for consideration in determining Value for Money. But who is to decide what this fitness for purpose means? Who is to decide Why the procurement is needed and then How the need can be met in the most Cost Effective and Efficient manner?

As noted at the beginning of this article, VfM is simply defined in the Australian Value Management Standard AS4183:2007 as 'a measure used for comparing alternatives based on the relationship between Value and Total Cost'. This measure is made using the simple productivity model where Value for Money is proportional to Value divided by Cost (outputs over inputs). Thus VfM can be improved by increasing Value (eg. fitness for purpose, guaranteed supply etc) and/or decreasing Costs (eg. total costs including procurement, operation, support etc).

This genuine search for better alternatives results in a modified procurement process where a slightly different set of questions are asked:

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 from the typical cost reduction procurement process shown above are No.2, 4 and 5.

Q2. What does it do or need to do?

The Commonwealth Procurement Guidelines note in Section 6.6 (see above) that Effectiveness relates to how well outcomes in the procurement process meet objectives. This includes correctly identifying the need and accurately drafting functional specifications.

Question 2 in the VfM model above is about identifying the actual need of the procurement and how well the existing procurement items meet this need. A simple but powerful method (or philosophy) commonly used for this analysis is a so called Function Analysis System Technique (FAST). This utilises the famous 'Asking Why' chain of questioning widely employed in systems such as Value Management, Lean Manufacturing, Kaizen, Six Sigma and by many individuals (including Leonardo da Vinci).

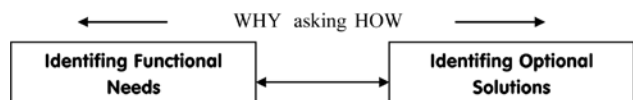


Figure 2. The connect between "WHY" and "HOW"

Using 'functional' descriptions, a series of Why questions are asked of the functions being performed or needed to be performed. A simple example might be procuring a hammer:

- Why do we need a hammer? – Answer – to drive nails, remove nails (this raises other options for driving nails such as nail guns, staplers etc).
- Why do we need to drive nails – Answer – to join wooden pallets together (this raises other options, in addition to nails, for joining wood such as glue, etc).
- Why do we need to join wood – Answer – because the pallets we are joining were originally designed in wood (this raised the possible option of replacing the wood with moulded plastic, fibre glass etc).
- Why do we need pallets – Answer – because the original materials handling and storage systems required pallets (modern material handling and storage systems may have eliminated old style pallets in many cases).

So in these four questions of Why, the procurement action has raised the possibility of buying new plastic pallets (with other benefits) instead of just hammers, or possibly eliminating the need for pallets and their associated costs altogether. This much wider range of other options can provide improved Value (fitness for purpose) at lower Cost (whole of life).

This is a questioning philosophy which, for example, all managers, procurement officers and designers should

commonly apply in their normal day to day roles. Using the so called '5 Whys', this simple cause and effect analysis can be widely utilised as long as its users are also aware of its limitations (eg. limited knowledge to ask the right questions and understand ever widening options etc). The basic principle is always to ask Why before How.



Q4. What Is It Worth?

Having more clearly identified the actual need for the product, process, service, system or organisation under analysis (as described in Question 2 above), this VfM model applies a process called Worth or the lowest cost to perform the essential or supporting functions. Other examples of ways to meet the basic need or function are examined to indicate possible lowest cost options, even though they might not exactly meet some of the stated requirements.

Thus, existing Industry or Commercial solutions might be compared with Government examples which, while not

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THIS IS THE REAL THING. folks, an honest to-goodness, old-fashioned steel washer. Take our word for it, no frills hardware like this flat metal disk that McDonnell Douglas sold to the Navy is going to get kind of hard to find one of these days, what with all these fancy alloys, weird metals you can't spell, and hair splitting, eyeball bending machining tolerances. We figured we were pretty lucky to get our hands on 'em! They've got 1,001 uses around the home or shop, and at our prices that works out to less than 40¢ per use!

EASY-TO-HANDLE CIRCULAR SHAPE

Contractor Price: **\$387.00**

National Stock Number: 5365-01-140-7392

Sources: Corneau, Hirt and Bots at the Pentagon, U.S. Senate Committee on Governmental Affairs, staff investigation; Transaction of Procurement by A. Ernest F. Fozzard and Sergeant Charles D. Clarke on the floor.

exactly meeting all of the Government requirements, can more clearly indicate the potential for improved VfM. Classic examples often quoted of this approach in the

United States Department of Defence are the \$435 hammer, the \$7,622 coffee maker and the \$74,165 ladder.

This Benchmarking approach both indicates potentials for savings as well as directions in which alternatives may be found. It is often at this stage that apparently overly rigid or inappropriate regulations and specifications are questioned.

It may also be the case that at this stage it is found that the present procurement does amply meet the real needs and there is no other lower cost way of achieving this. In which case, it can be stated with some confidence that the present procurement does actually achieve best Value for Money and there is evidence to prove it.

Q5. What Else Will Do the Job?

Often the questions and options raised as a result of Question 2 and Question 4 above will have provided information and direction which will greatly assist in analysing Question 5: What else will do the job?

However, further questioning will usually raise even more options, which in connection with the earlier options will need to be analysed and developed in more detail in order to help identify those that will better achieve best Value for Money.

The ability of agency personnel to ask these questions and identify viable options and costs involved is of course most important. As already noted above, the present procurement process places most emphasis on risk management in the procurement contractual process. Understanding the functional and technical requirements is typically, but not always, left to the requesting agencies that must identify and justify the Need.



With a heavy emphasis on Risk Management, there is always the incentive to take the apparently easiest option, which is usually to do what has been done before. Asking the three additional Q2, Q4 and Q5 basic questions as indicated above might be thought to result in additional complexity and hence risk, even though it is recognised that there is almost always "a better way". In practice, an inadequately conceived Total Cost project will compound the complexity, risks and costs that must be managed over its Whole of Life.

Of course, asking more questions and making more decisions in a non-structured manner can also result in much time wasting confusion in the short term. Australian and overseas experience in creative problem solving and decision making over the years has illustrated the benefits that can be gained from structured approaches such as:

- High Level group decision making – Facilitated value management studies with key stakeholders.
- Operating group problem solving and decision making – working to a prescribed Work Plan which incorporates an understanding of the concepts and principles of Value (usefulness, benefits and importance) and Value for Money. This includes the application of Function Analysis and matrix decision making.
- Individual value analysis – individuals working with an understanding of the principles of Value for Money and utilising the techniques of Function Analysis, Creative Thinking and Problem Solving.

Conclusion

With the right system which allows the right people to ask the right questions, improved and hopefully best Value for Money can be readily achieved and justified with reduced overall project risk, as the right needs are met at the lowest practical cost.

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Innovation, Australia II and the 1983 America's Cup

Dr John Blakemore.
masc@blakemore.com.au, www.blakemore.com.au

Introduction

Innovation may be defined as the taking of opportunities and the creation of newness to improve existing services, products and processes. It involves the use of advanced conceptual thinking, continuous improvement of existing processes, and applies to marketing, operations, service, products, finance and all parts of the business. Innovation is newness and originality in doing things. It includes 'eureka ideas', research and development, commercialisation and Kaizen.

Continuous innovation

To be successful in the future, all parts of the business must undergo continuous innovation. A company's ability to innovate will depend on its capability, how it measures the opportunities both in the market internally and externally, and the general creativity that business can apply to a particular problem. It is incumbent on the people in the industry to use all idea generating tools that are available.

In particular, frequent use must be made of the 22

Creative Ideas for Innovation developed while I was Chief Metallurgist Research and Development at a BHP subsidiary, John Lysaght Australia (now Bluescope Steel) in 1971. These are listed in Table I. The ideas here are not exhaustive and are similar to those developed by Altov and published in 1996 (1). Other techniques include:

- Knowledge databases
- SPEED teams (Honda Sayama Works, Japan)
- Staged innovation strategies with Kaizen
- Risk management (Bernstein's "Against the Gods, The Remarkable Story of Risk")(2)
- TRIZ techniques (Altov)
- Rapid prototyping and tooling (SMED)
- Business process reengineering
- "Six Thinking Hats" (Edward De Bono)(3)
- Reverse engineering and Reengineering

Sources of new ideas

- Patents
- Trade shows

Table I: 22 Creative Ideas for Innovation

	A: Change	B: Example	C: Result
1.	Properties	Bimetallic strips	Different coefficient expansions of metals enables temperature to activate switch
2.	Space	Fill sunken objects with foam to displace water	Steel ship recovery from ocean floor
3.	Order	High purity materials create new ordered structure	Self-Assembling Materials (SAMs)
4.	Energy	Use pre-energy in pre-loaded spring to overcome high loads	Self-activated doors with a minimum force to open
5.	Shape	Offset impellers for mixing chemicals/ cakes	Better, faster and more uniform mixtures
6.	Movement	Energy from falling object used to feed another	Lifts
7.	Friction	Overcome friction with cushion of air or use point contact	Hovercraft (cushion) or sharp contact point (ball bearings)
8.	Magnetism (attraction, affinity)	Ferromagnetic iron becomes paramagnetic at Curie point	High temperature switch
9.	Gravity	Inertia reels in seat belts	Retractable belts that tighten under load

10.	Dissecting	Analysing causes of lack of tone quality – piano	Stuart piano has more precise tone
11.	Fragmenting	Modular computers	PC upgrades/plug and play
12.	Self-service	Eliminate action steps in process	JIT
13.	Copying	Resin copying of CAD/CAM	Stereolithography
14.	Coatings	Zinc/aluminium coatings on steel	Strength of steel corrosion resistance of Al/Zn
15.	Blending	Micro-processors/ memory	High-speed devices
16.	Phases	Heat treat alloys in critical phase transformation zones	Special zinc coatings on intricate steel parts
17.	Solvent	Organic solvent added to polystyrene	Volume decreases markedly
18.	Oxidation	Use nitrogen instead of steam to strip liquid zinc off steel	BHP buys world-wide processes
19.	Potential	Use sacrificial anodes	Steel hulls protected
20.	Combination	Combining functions	Multi-purpose pen
21.	Multi-use	Hang glider become parachute	Life saver
22.	Prevention	Asymmetric plugs	Three-pin plugs/prevents loss of life

- Customers
- Journals
- Competitors
- All people
- Internet
- Overseas trips
- Brainstorming/ Imagineering
- Annual reports of competitors
- Suggestion boxes

Evaluating ideas

One of the biggest problems with ideas is evaluating them in terms of their probability of success. Numerous techniques have been devised to assist in this, but some of the essential elements that must be continuously measured for products and services and processes to enable implementation of the best innovation strategies are:

- Lifetime of products
- Processes
- Number of ideas generated
- Number of new products developed
- Total expenditure on research and development
- Number of new processes developed
- New technologies introduced
- Measurement against state of the art
- Sources of innovation data
- Surveillance methods

Application of the 22 Creative Ideas for Innovation and thinking outside the square

I was privileged to meet Ben Lexcen (born Bob Miller) once – very briefly – just after he designed the revolutionary 18-foot skiff ‘Taipan’, and later ‘Venom’. This creative design revolutionised 18-footer sailing.

‘America’s’ cup 1983

Ben was in fact the designer of Australia II, the revolutionary 12-metre yacht that defeated the USA’s Liberty to win the America’s Cup in 1983, even though it appeared that the skipper of Liberty, Dennis Connor, outsailed and out-maneuvred Australia II’s skipper, John Bertrand. The contest went to a full seven races and despite the greater manoeuvrability and going-about speed of Australia II, John Bertrand lost six of the seven starts. However, after a fortunate clever manoeuvre of the last square turn, and with superior speed on the last windward leg, Australia II crushed the American boat and Australia II and Ben Lexcen wrote themselves, John Bertrand and the crew into the history books. I only wish I knew the thought processes that went into the design of this mighty 12-metre yacht.

The winged keel

Analysts claim that the secret was the winged keel. Certainly this gave the Australians a psychological advantage. How did Ben come up with the idea? Did the winged keel make the boat faster? If we use the 22 Creative Ideas for

Innovation we can find out. An analysis of the 12 Metre design formula is given in Figure 1, for the design equation in Table 2. The most important variables affecting the performance of two yachts, is given in Table 3.

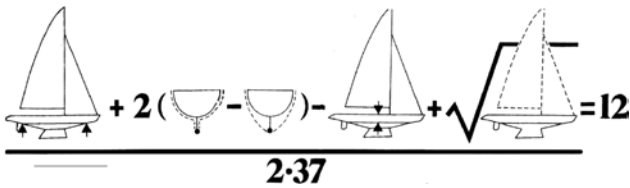


Figure 1. An Explanation of the Design Parameters for a 12 Metre Yacht and why it is not 12 metres long.

Table 2. Design equation for a 12-metre yacht

$$\frac{(LWL+2(G1-G2)-F+\sqrt{SA})}{2.37} = 12$$

- LWL = Length on Waterline (m)
- G1 = Surface Girth at Beam (m)
- G2 = Surface Girth Side Extrapolated (m)
- F = Freeboard (m)
- SA = Sail Area (square metres)

Going against tradition

Ben Lexcen decided to make a shorter vessel on the waterline (LWL) and design against the well-known logic that for a displacement yacht, the ultimate speed is a function of the square root of the waterline length. It has been proven many times that the longer a displacement yacht is, the faster it will be. He, therefore, went against tradition. By sacrificing length he could increase the sail area, and build a smaller, lighter yacht. Now he had two factors assisting speed and one negating.

To satisfy the equation, Lexcen would build a shallower keel but overcome this disadvantage by designing two wings that would actually increase the draft as the boat heeled whereas for the more conventional Liberty, the effective draft would decrease. Also since the Length Overall (LOA)

was greater for Australia II than Liberty, the angle from stem to waterline was sharper and the extra benefit of an increase in waterline length could be realised as the boat heeled. The wings on the keel would also dig in as the boat manoeuvred at the start and give the helmsman, John Bertrand, an advantage of extra lift to windward. Despite this, Bertrand lost six of the seven starts so it could not have been much of an advantage.

Ben clearly thought outside the square. He designed the boat to sail more effectively to windward, and overcame the apparent disadvantage of a shorter waterline length – with the sharper rake at the stem, but was able to have more sail area and therefore more power than Liberty.

From all accounts the extra power was not enough to compensate for the shorter waterline length when the yachts were running with the breeze. This was more than compensated for when the yachts were sailing to windward, and since most of the time in the race the yachts would be on this tack, the slight disadvantage of a lack of downwind speed would not matter a great deal. Ben, I can imagine, had listed the major variables and prioritised them and then compensated for the smaller draft and shorter boat, with the wings to satisfy the basic measurements in the 12 metre equation.

Numerous attempts to use wings on keels in Sydney have failed because they do not make the boat faster; they are purely a way to generate more lift in a yacht on heeling if there are formula imposed restrictions. As far as the 22 Creative Ideas for Innovation are concerned, what had Ben done? This is summarised in Table 4. Not all the ideas can be applied to all situations. In this case the ideas that can be applied are given in Table 4.

Another example of thinking outside the square

Another example of thinking outside the square is the Sydney Opera House. Figure 2 illustrates how a simple orange peel motivated Joern Utzon to design what is often regarded as one of the most beautiful buildings in the world.

Table 3. Summary of important dimensions determining the speed of Australia II and Liberty

Australia II Liberty Comparison in the 1983 America's Cup				
	Liberty	Australia II	Diff%	Australia II
LOA (m)	19.3	19.6	1.53	Assist in increasing stem rake
LWL (m)	14.0	13.4	4.48	Disadvantage running
Beam (m)	3.6	3.6	0.00	Neutral
Draft (m)	2.7	2.6	3.85	Wing keel extra draft working
Weight (Tonnes)	25.2	23.8	5.87	Lighter
Sail Area (square metres)	167.2	170.0	1.65	More power

Table 4. Summary of the 22 Creative Ideas for Innovation applied to Australia II			
	A: Change	B: Example	C: Result
1.	Properties	No change as far as we know. Both Liberty and Australia II were made from the same or similar materials.	No difference
2.	Space	Australia II was lighter than Liberty since she was a smaller boat and therefore would be faster. She would also have less wetted surface area partially negated by the surface friction of the wings which could supply lift not only to windward but also vertically.	Less volumetric displacement for Australia II therefore she would be faster
3.	Order	The major variables would have been listed and prioritised	Sail Area and weight are probably the most significant, so once again Australia II would be faster
4.	Energy	Greater lift to windward would be generated by the winged keel as it heeled since the Depth to width ratio would improve	Australia II would be faster to windward and suffer from less leeway
5.	Shape	Shape of the keel had to be downwards to gain maximum benefit	Better, faster and more uniform tacking by Australia II
6.	Movement	Keel would effectively act as a stored energy spring as the yacht heeled	Australia II would be faster
7.	Friction	Australia II as the smaller boat would have less wetted surface area therefore less friction	Australia II would be faster
8	Dissecting	Dissecting the major variables and prioritising enabled the analysis to come up with a superior design	Thinking outside the square and ignoring the age old idea that the boat had to be longer to be faster

Conclusion

The purpose of this paper is to illustrate what is believed to be some of the inspirational processes that enable all of us to release our creative power. The 22 creative ideas were born in discussions at John Lysaght Australia Pty Limited, in the period 1957 to 1978, after extensive investigation by a team of researchers studying papers and patents in steel production. In essence, the application of many of these concepts led a work colleague of mine, Paul Reid, to innovate a new way of stripping liquid zinc from steel sheet during hot dip galvanizing, and the ultimate ownership of the zinalume process by John Lysaght (for steel coating after all new production records and reduced cost records were broken). This product is now marketed as 'Colorbond' by Bluescope Steel. There are many similarities with the TRIZ process, but the list of 22 creative ideas is much simpler and people find it easier to use.



Figure 2. The orange peel shape that inspired the Sydney Opera House

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