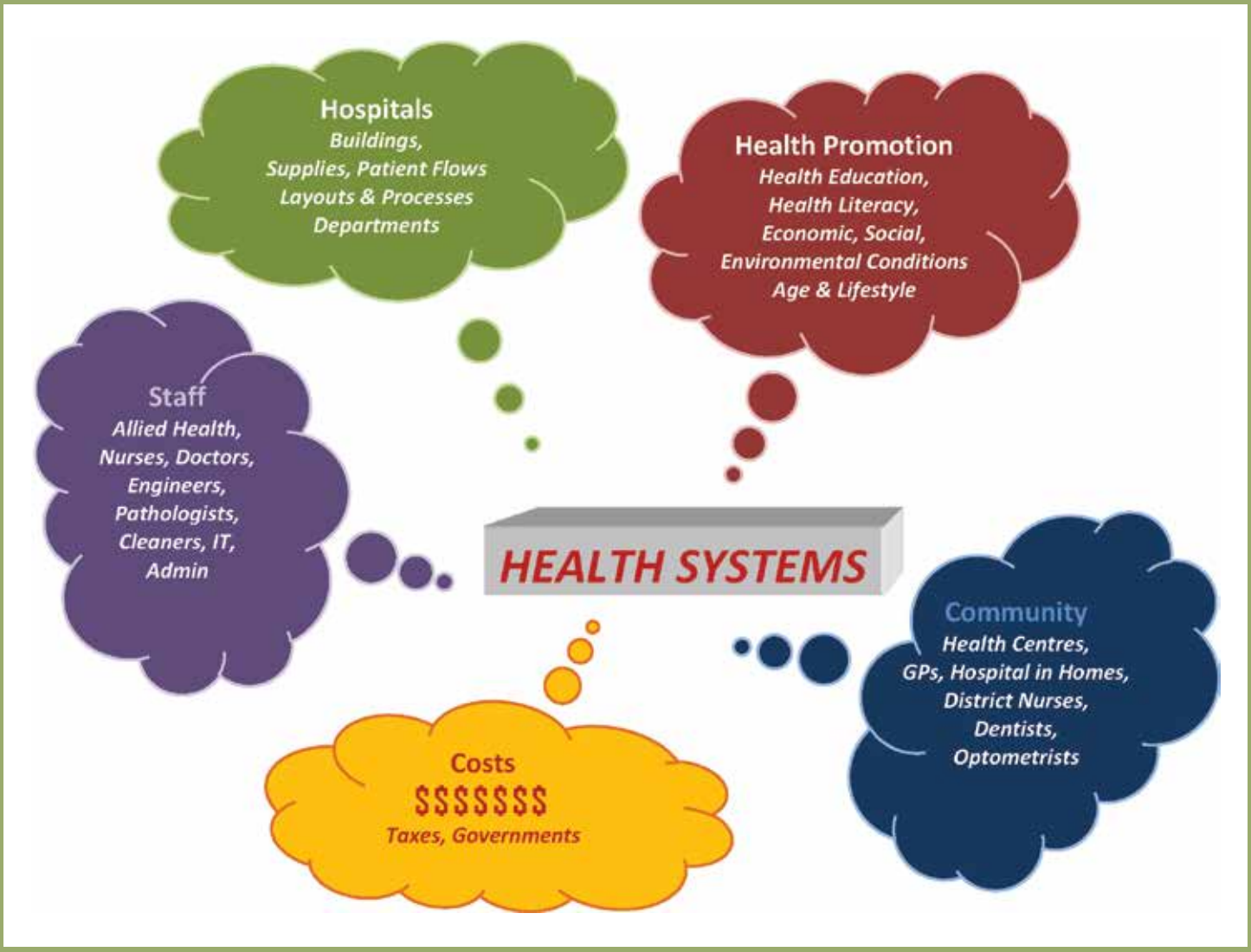
New Engineer JOURNAL

Servicing Manufacturing, Industrial Engineering and Engineering Societies



www.iie.com.au

In this Issue

- **Application of lean six sigma to the Finance Industry**
- **The Health/Healthcare industry**
- **The politics of quality improvement in hospitals**
- **Tales of Three IE Graduates**
- **Skilled migration is a tough challenge**

ENGINEERS AUSTRALIA

Offical journal of the INSTITUTE OF INDUSTRIAL ENGINEERS (Aust) and the INDUSTRIAL ENGINEERING SOCIETY of Engineers Australia

PRINT POST APPROVED NO: 349069/00125

Vol. 15 No. 2 October 2012

Vol. 15 No. 2 — October 2012

New Engineer Journal

PUBLISHERS
Research Publications Pty Ltd
ABN 95 004 562 074
PO Box 253, Vermont Victoria 3133

Management Advisory Board:
Dr John Blakemore (ManSA),
Dr Damian Kennedy (IIE)

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: Lex Clark
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: clarklh@clarkengineering.com.au
Web: www.iie.com.au

COMMERCIAL COORDINATION & PRODUCTION
Product News and Advertising
Research Publications Pty Ltd
PO Box 253, Vermont Victoria 3133
Ph: +61(0)3 9738 0533, Fax: +61(0)3 9738 0866
E-mail: respub@access.net.au

Subscription Rates New Engineer JOURNAL, including GST (2 issues per year, from 2011)
$60 per year (incl. GST)
$75 Overseas Subscribers (per year)
$85 For 2 Years (incl GST)
$100 Overseas Subscribers (2 years)

Registered Serial Number ISSN: 1440-785X

Contents

Front Cover: The complex interaction of stakeholders in the Health/Healthcare system is further addressed in this edition's feature articles by Morwood/Willoughby and Gough/Ballardie

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.

New Engineer – the voice of IIE (Australia)

This edition of **New Engineer** introduces first off the new Federal President of IIE (Australia) – Mr. Lex Clark. As is tradition for this journal, the Federal President's report takes precedence in the presentation of its content.

Lex introduces himself through highlighting many of the significant events that have brought the original Australian Methods Engineer Association (circa 1954) to the present day IIE (Australia). He has not only had the unique experience of witnessing such an evolution but has also been an active participant in this journey. Today, Lex 'caps-off' this extraordinary achievement by being our newly elected IIE (Australia) Federal President.

Lex gives a unique insight as to where the IIE currently stands in terms of its membership and in particular the relationship between the IIE and Engineers Australia. He is optimistic on recent developments and outlines significant recent progress … The 2012/2013 IIE Board is also presented via photo and role descriptions of the IIE (Australia) Board members.

This edition of **New Engineer** also presents articles and papers in response to the recent article 'Application of lean six sigma to service industries – health and finance' (NE Vol 15, No 1, May 2012) by Dr. John Blakemore.

Robert Ades' response-article 'Application of lean six sigma to the finance industry' offers further insight into the GFC and its lingering shadow – but does so in terms understandable to his fellow engineers. Robert is able to do this as a professionally qualified IE with nearly 30 years experience in both engineering and finance positions.

Lead papers in this edition also respond to the Blakemore paper. Jennifer Morwood and Amber Willoughby write in 'The health/healthcare industry and the role of industrial engineers' about the current status of lean application in the Australian hospital sector. Their technical-style and expertness reflects their joint 17 year consultancy efforts in this area.

Richard Gough and Ruth Ballardie of Victoria University present the second lead paper on the application of lean in the hospital sector. However, their perspective compliments that of Morwood, et al as evidenced by the title: 'The politics of quality improvement in hospitals'. Both papers are of value to current and new engineers contemplating a future role in Australia's complex and growing health industry.

Finally, this edition presents another of the 'reflective' articles of recent editions … Sam Ghaith, Mohammad Barghash and Scott Fairburn report on life IE experiences post graduation and Amin Hadjaran bravely tells his story of skilled migration to Australia, and the role IIE (Australia) played in his eventual success.

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 Australia new Federal President's Report

www.iie.com.au

As the new Federal President of the Institute of Industrial Engineers Australia, elected at the last AGM held in Melbourne on 8 September 2012, might I first thank the Immediate Past President, Daniel Kulawiec. Daniel was first elected President in 2009/10 and over the last three years has introduced changes which have included bringing new and younger members on to the Board of the Institute. New Board members have also come from the Manufacturing Society of Australia (ManSA) which is presently under review by Engineers Australia. The result is that the Institute appears to be well placed to introduce some new and interesting developments which I will mention in a minute. Thank you Daniel, who will of course continue to play a valuable role as the Immediate Past President.

Who Am I?

You may have noted me over the last few years at various times as the Secretary and the Federal Membership Chairman of the Institute of Industrial Engineers Australia. I have added Australia to the official name Institute of Industrial Engineers here so as not to confuse it with the very well known United States organisation also known as the Institute of Industrial Engineers. However, we are officially incorporated as the Institute of Industrial Engineers as a Company in Australia. To add to the complexity, we are also known as the Industrial Engineering Society within the Institution of Engineers Australia (IEAust but better known today as Engineers Australia with a membership of over 100,000).

Back to me. I first started training as an Apprentice and Cadet Engineer in what was then De Havilland Aircraft in Bankstown, Sydney in 1954. De Havilland apprenticed both Aeronautical and Industrial Engineers in those days, all studying part time at the University of New South Wales. Little did we know that Dr. Lillian Gilbreth, a well known US Industrial Engineer and wife of Frank Gilbreth of work measurement fame had visited Australia in 1953. This might seem to have helped set in train the formation of the Australian Methods Engineer Association in 1953, which became the Australian Institute of Industrial Engineers in 1959. One of the founding members was Chris Heyde, the Australian developer of MODAPTS work measurement system, who I was privileged to know later (see article in the New Engineer Vol.11 No.2 October 2008).

In 1971 I became the Director of Value and Industrial Engineering, brought in from outside Industry to develop Value Engineering and Industrial Engineering in the then Department of the Navy. This was expanded in 1975 to cover the new integrated Department of Defence activities in Industrial Engineering and Value Analysis across the Navy, Army, Air force and Office of Defence Production. This included bringing numbers of Industrial Engineers into Defence, and the expansion of training of large numbers of Work Study Practitioners, both Military and Civilian, at the Defence Work Study Wing in Albury Wodonga.

In 1995 I left Defence and set up my own Consultancy in Industrial Engineering and Value Management which I am still running today. What all this means is that I have a long and deep understanding of the principles and practices of Industrial Engineering and the important role that it can and should play in Australia and around the world. If you look on our Institute of Industrial Engineers Australia Facebook page (set up by Scott Fairburn, your new Federal Membership Chairman), you should already know that it can be a great career. Apart from its role in the Asian economies, it would seem that it is also the third largest group of Engineers in the United States, after Civil Engineering and Mechanical Engineering (Industrial and Systems Engineers Make a Difference Everywhere – YouTube).

Industrial Engineering and Engineers Australia

The membership of IIE peaked around 1974 at some 1,365, with a slow but steady decline afterwards. This decline in membership has been common in many professional organisations across Australia and overseas. Where young Industrial Engineers and Work Study Practitioners have gained recognition and promotion of their qualifications and specialist expertise through membership of organisations such as IIE, there are many additional ways today where this can be achieved.

Industrial Engineers in Australia have found that while their expertise is valued in a very wide range of activities, the recognition and understanding of this expertise has seemed to wane over a number of years for a variety of reasons. Others, particularly in Management Consulting, have taken over roles that have been carried out by IE's in the past with great success.

In 1993 the first discussions began with Engineers Australia to become the Industrial Engineering Society. However, Technical Societies were a relatively new concept at the time within Engineers Australia, and after formally becoming the Industrial Engineering Society (IES) around 1995, issues arose which resulted in IIE bringing the management of its membership numbers and the application of new members back under its own control around 2003.

Engineers Australia is today re-examining the roles of Technical Societies, and would seem to be recognising that they can play a more valuable role than they have been allowed to play in the past.This includes both the members of IIE who are also separately members of Engineers Australia (as I am) as well as those many members who are presently not. It is as a result of these new opportunities that IIE has re-opened negotiations with Engineers Australia.

These new developments are likely to manifest themselves to you as the members of IIE in a number of ways.As they develop, you are likely to see over the coming months, changes that should include:

- A new membership online application and renewal system.
- A new IIE website (www.iie.com.au) operated in connection with the Engineers Australia website (www.engineersaustralia.org.au).
- A stronger and more visible Industrial Engineering link to the other 100,000 Engineers Australia members which includes over 20,000 student members.
- A redevelopment of our IIE links with overseas Industrial Engineering organisations from the much more powerful Engineers Australia base.

If, as good Industrial Engineers, you have ideas and suggestions for ways that you believe the Institute can be redeveloped and support you as Industrial Engineers in Australia and overseas, please don't hesitate to contact me or members of the Board.

The 2012/13 IIE Board of Directors

Federal President ..... Alexander Clark

Senior Vice-President ..... Robert Watson

Federal Secretary ..... Hossam (Sam) Ghaith

Federal Treasurer ..... Selvarajah Radhakrishnan

Chairman of Federal Membership Committee ..... Scott Fairburn

Journal Editor ..... Dr. Damian Kennedy

Webmaster ..... Mo Barghash

Promotion and Development and co-editor ..... Daniel Kulawiec

Directors ..... Bill Ferme
Dr. John Blakemore
Chin Hak Wong

Industrial Engineering – a great career and a way of life.

Lex Clark
FIEAust CPEng FIIE, FIVMA
President
Institute of Industrial Engineers Australia

2012/13 IIE Board of Directors: Seated L to R, Robert Watson, Lex Clark; Back L to R: Mohammad ('Mo') Barghash, Daniel Kulawiec, Hossam ('Sam') Ghaith, Scott Fairburn, Dr. Damian Kennedy, Bill Ferme, Selvarajah Radharishnan ('Radah'), (in absentia: Dr. John Blakemore and Chin Hak Wong)

Application of lean six sigma to the Finance Industry – further observations

Robert Adès BE (Ind), MBA, Grad.Dip.Mtkt'g FAICD FAIM
E: robert@ades.id.au

Dr John Blackmore's article in the May 2012 edition of New Engineer (Vol. 15, No.1) was an insightful application of Lean principals in service oriented settlings. The article focussed on Heathcare more than the Finance Industry. This article in response expands on Finance Industry application, particularly in the lasting shadow of the GFC.

1. Introduction

Lean systems, six sigma and continuous improvement principals are as applicable to service industries as to manufacturing. The Finance industry is no exception, and we may have been saved from the worst of the Global Financial Crisis (GFC) if Lean philosophies and disciplines had been in place. It's unlikely that the GFC would have been avoided however, and another trigger would have taken the place of the now infamous CDO's[1].

2. Multiple causes to the GFC

The cause of the GFC was long-coming and not simple. Greed played a role, as did a reduction in regulation (particularly in the USA) and a lack of visibility and reporting. As we have since seen, the problems went much deeper than bundled mortgages and CDO's. Moral risk thrives when demand substantially outstrips supply and constraints are weakened; these are the market forces that dominated the years 2000 – 2007. The sub-prime scandal in the US was a catalytic event but not the underlying problem. Consider that the US is now recovering reasonably whilst Europe remains substantially broken. The problems currently plaguing global markets have little to do with financial advisors and derivatives, but much more to do with the overall structure of global capital, sovereign funding versus spending, use of credit in place of productivity, and structural weakness within the EU experiment.

3. The GFC in industrial engineering terms

With the benefit of a few years hindsight[2] we can see that many of the fiduciary and prudential rules applying to financial services were broken at a fundamental level (including those affecting CDO's and sub-prime lending). In engineering terms, the problems were failures in product design, watering down of standards, reliance on uncertified tests (and testers), a scramble to produce, and a lack of user understanding. With those very basic (low threshold) rules violated and unsupervised, it follows that the more demanding (higher threshold) rules of six sigma were not remotely complied with.

Traditional attempts were made to minimise variations (within financial product bundles) but the ratings system upon which this relied was flawed, like measuring with a badly calibrated or damaged micrometer. Or a biased one.

In this regard, the global finance industry has been analogous with manufacturing philosophies of 1960's, 70's and early 80's. That is, 'make it and sell it'. Cost of quality is either hidden, not understood or considered unavoidable.

4. Risk and failure rates

Convention still says that risk is unavoidable, and failure rates in investments are much higher than the 'parts per million' we talk about in Lean. Quality systems in Finance manifest as Risk Management but lack depth. Risk systems are analogous to old fashioned 'quality control' compared with modern QA & Lean; that is, applying a filter to inspect-out poor quality, rather than build it in from the design. Fragmentation of the value chain, lack of KPI's, poor harvesting of available data, uncertainty in valuations, NAV's[3], ratings and pricing, and the quality of actuarial oversight are all impediments to Six Sigma.

Risk is inherent in markets, now even in Government bonds traditionally regarded as risk free. Application of Six Sigma as the basis of the risk management discipline, rather than quality filtering, could reduce variation and increase governance.

5. Structural problems

A structural problem now recognised with the CDO market was that the stages (recruitment, origination, administration, ratings, bundling/collatorisation, marketing and trading) were hopelessly fragmented. There was no collective oversight, neither of the risk spread nor of the end-to-end processes within the value chain. Generally people did not know the full extent of the risks. Arguably they chose not to know, but it was the (lack of) depth of individual remits versus the size of the rewards that caused the structural weakness. Six Sigma cannot overcome this without structural change.

6. Other issues

Without doubt there were also issues of integrity, starting with the ratings houses that were paid for ratings

by the product originators; how objective could they be? Some mention should be made of the investors' conduct, and how their due diligence would have benefited from a six sigma approach. Most had no real understanding of what they were buying, which is obviously catastrophic in a manufacturing setting. If we are to (rightly) criticise the financial services industry for ignoring six sigma principals, the same criticism should apply to those who were investing.

7. US peculiarities

The US phenomenon of mortgagors walking away from sub-prime loans was driven by the US style of non-recourse and tax deductibility of mortgages. Certainly LVR's[4] were allowed to grow on inflated property values, and ignored the possibility of value declines, but it was the non-recourse US structure (which Australia doesn't have) that was the biggest 'retail' error. Add to this the 'distribution' error of US banks outsourcing their mortgage selling to commission paid agents who were remunerated on quantity not quality of loans and you have the main reasons for the sub-prime scandal.

8. Overheated demand and cheap credit

Overheated demand fuelled by cheap credit was another underlying problem. In Australia, banks' letters to clients offering to increase their credit card limits has abated somewhat, and mortgage selling is now in decline (note CBA's recent retrenchments from their home lending division). Bank growth models are swinging towards recruiting depositors rather than borrowers. Increased competition for depositors is now contributing to an increase in mortgage interest rate margins.

9. Three key factors

The collective financial disaster of the GFC should be seen in the context of three key factors. Firstly, there's the long bull market that had become accepted at the new normal. Investment emphasis had come to focus on growth, not efficiency. The greatest ROI was achieved from speculative turnover and asset gathering. Cost and risk factors were judged small by comparison. Cost of quality was unknown. Agency costs and rent extraction by fiduciaries increased. A few plaintive efforts to reign in excesses were met with dismissals like 'you can't cost-cut to success'. Poor alignment of interests and incentives beset the industry, hidden by a lack of adequate KPI's. Application of Six Sigma may have alleviated some of these trends, but not all.

Secondly, there was a lack of recognised history. The advent of the global market was a new paradigm, with new technologies upon which were built new financial products and markets. A lack of history was equalled by a lack of expertise. The implications weren't properly understood and efficiency wasn't a priority. A lack of history can be a real impediment to Six Sigma, particularly around the assumption of normality of probability distributions. This is now a known phenomenon in finance; probability curves are often *not normal* in nature. In practice, substantial skewing and/or kurtosis are common, or step functions abound (such as with options). This implies a bias and possible cancelling or amplification of component probabilities when combined in a single system.

Thirdly, markets and market values (unlike more conventional engineered products) can perform irrationally. Bridges, car and widgets are generally rational; they don't fall over due to emotion, but markets do. Fashionable and unfashionable asset classes come and go, and can change value overnight. For instance, the Australian Dollar is currently relatively high. It's a highly traded currency (5th highest globally) backed by a AAA-rated government and banking system, and more recently has been seen as a proxy for China and commodity markets. It's also regarded as a high risk currency, which is why it suffers when risk tolerances fall. Flight to safety away from the AUD can be sudden and fierce.

Globally, Australia isn't seen as a low risk investment destination. Ten years ago we were trading at US$0.45 and parity was a dream, now we are struggling to get under US$1.03 whilst our exports are being stifled. The Australian balance sheet simply hasn't doubled in value compared to the US in ten years. The shift is, at most, irrational.

Conclusion

So, more than Six Sigma and Lean, were needed to avoid the GFC. The structure of markets, the newness of technologies and global trading, the assumption of ongoing bull-market conditions, questionable reward structures, and watered-down standards all contributed. Like the speculative land rush (then crash) of the 1890's, the GFC was the result of the previous 10 – 15 years. Had Lean principals been in place before then, its magnitude may have been much less, and the consequences not so long lasting. But markets will still be irrational.

As a final positive observation, whilst job opportunities in Financial Services are now few and far between (in fact have been contracting for several years) there are a few notable exceptions. Risk, Compliance and Asset Allocation experts are now having their time in the sun. Perhaps this is the industrial engineer's opportunity to translate 30 years of Six Sigma and Lean into the new Risk Management paradigm.

References

1. Collatoralised Debt Obligations.
2. Except for Europe, where the crash keeps on crashing
3. Net Asset Values (generally of pooled instruments)
4. Loan to Value Ratio

The Health/Healthcare industry and the role of industrial engineers

Jennifer Morwood and Amber Willoughby
JenAm Industrial Engineers P/L
E: jm@jenam.com.au or aw@jenam.com.au

1. Introduction

Industrial engineers have been involved in improving the health/healthcare industry since the beginning of the twentieth century. Frank Gilbreth invented the role of the surgical nurse to circumvent surgeons having to waste time searching for the right instrument; Lillian Gilbreth has been called the "Mother of Industrial Psychology…Liberator of Disabled Veterans and Other Handicapped People" with her studies on worker fatigue and her programs to retrain the disabled to work [1].

Both Gilbreths were involved in the development of techniques to reduce wastes and increase patient safety through motion studies and ergonomics. Since then, the health industry has applied many of the techniques developed by these two early industrial engineers – including scheduling, operations research, quality control, facility planning, inventory management, JIT, TQM, lean and systems engineering.

2. Scope of this paper

The following discussion gives a brief overview of Australia's health system. It describes the similarities and differences between the hospital system and the manufacturing system, and briefly discusses the future role of IEs in the health/healthcare industry.

3. The Australian health system

Australia's health system is complex. It includes the local health community centres, general and specialist medical doctors' surgeries, over 1200 private and public hospitals, research centres, pathology and radiology labs, dental and optometry services, allied health services – including psychologists and physiotherapists, preventive services such as immunisations, insurance and health care regulating bodies. Funding for this system is dependent on state / federal revenues, medical insurance coverage, Non Government Organisations (NGOs) and donations from the public.

It is a network of systems involving people, organisations, institutions and resources. This network aims to promote, restore and sustain the health of the population. The campaign against smoking is an example of health promotion; hip replacements and cancer treatments are examples of restoring health, and insulin treatment for diabetics is an example of maintaining health.

Health is affected by social, economic and political issues. Poverty and homelessness are factors for decreasing health in the population, marginalisation of the disabled and elderly can lead to poorer mental health outcomes, and economic and political decisions concerning the health budget and workforce will affect hospital waiting lists and staffing issues (such as 'burnout').

There is a paucity of data concerning these services because, until recently, data collection has been lacking continuity; performance measures have been 'process' focussed (i.e. what was done rather than what the outcome was); most data collected by individual agencies are stored in data silos and not shared with other agencies (that is, health IT systems tend to be 'stand alone' and cannot communicate with other IT health systems).

4. Health demand and costs

Healthcare costs and demand are both increasing. This year, the Australian institute of Health and Welfare (AIHW) reported expenditure had increased by $52.8 billion since 2000 [2, 3]. Last year expenditure was $130.3 billion representing 9.3% of gross domestic product.

Over the last decade there has been an average, annual increase of 3.6% in people presenting for treatment at hospital emergency departments in Melbourne – see Figure 1. This means 7 million people presented for treatment – just in Melbourne alone. In general, in Australia, hospital admissions have increased by more than 40% over the past 20 years[4]. During this period Australia's population grew by 19%, the number of public hospital beds decreased by 30% and the average length of stay decreased from 6.2 days to 3.3 days.

The number of people suffering from chronic illnesses is also increasing.

For example:

- There are 366 million people around the w orld suffering from diabetes and, over the next 20 years, this is estimated to rise to 522 million people. In 2011 treatment costs consumed 11% of healthcare spending [5].
- Cardiovascular disease affects 3.5 million Australians and in 2004-2005 Australia spent $5.9 billion to treat this illness [6].
- Approximately 1,600 new cases of dementia are diagnosed each week in Australia. By 2050 this is expected to increase to 7,400 new weekly cases. Australia will then have over 1 million people with dementia with a health cost of over $83 billion per annum [7].

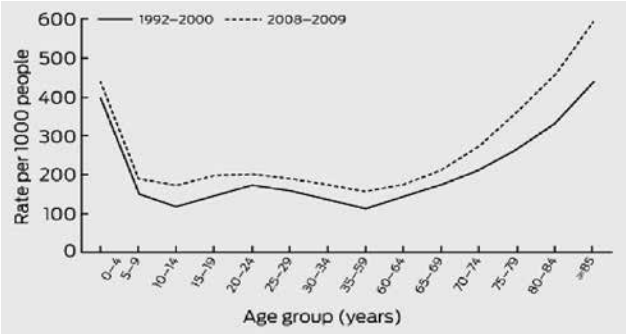


Figure 1. Presentation rates per 1000 people, by age group, to public hospital EDs in Melbourne, 1999–00 to 2008–09. Ref (4)

The above factors are contributing to the pressure on hospitals to become more efficient and effective. Hospitals now need to:

- increase capacity to match demand
- provide a greater range of services by developing and/or adopting new technologies and treatments for evolving and emerging health conditions (e.g. AIDS, Influenzas)
- improve the quality of care and treatment offered (i.e. reduce 'errors' and meet or exceed key performance criteria)
- become more lean and sustainable (i.e. undertake projects to continuously increase human and equipment resource utilisation, review and redesign procedures to be more efficient, minimise costs and reduce material waste and energy use)
- provide more training and education to staff in new techniques and regulatory requirements
- expand research to provide evidence and cost benefit analyses that support the adoption of new technologies and treatments

– all within the limitations of increasingly complex record-keeping requirements and a low fiscal budget…

5. Similarities and differences between hospital and manufacturing systems

Many engineers are now using techniques from manufacturing industries to improve the healthcare industry. The development of 'Lean Healthcare' is a recent example and there are many published papers in the literature – including this journal, describing how Lean has/can reduced hospital queues and wastes [8].

6. Parts / final products / patients

Manufacturing is focussed on the creation of products and making a profit. Public hospitals are focussed on restoring health and are generally not focussed on making a profit. If patients are considered products then restoring health could be viewed as 'product re-work'.

In manufacturing, input parts are assigned a part code (during assembly they are regarded as WIP) and the final product is given a new *product* code. For example, in the manufacture of a chair, all the chair legs may have the same part code and a completed chair will have the identical product code as all the other completed chairs. The cost on each chair is generally standardised and profit margins are decided.

In hospitals, each 'part' (patient) entering the system is assigned a unique identifying number that will be kept by that patient forever. On discharge each patient is classified into an International Classification of Diseases code (ICD10). There are over 12,000 ICD10 codes and determination of the code is based on the patient's diagnosis, problems and interventions (note: a patient can have one or many ICD10 codes assigned). The '10' represents the number of revisions since 1900 when this system was first introduced. The ICD code is also used by governments around the world to monitor the incidence and prevalence of disease.

The assigned ICD code is then grouped into a Diagnostic Related Group (DRG). There are 700 DRGs and these can be regarded as the 'final product'. DRGs are grouped into one of the 24 Major Diagnostic Categories to determine average costing data. Examples of these categories include:

- Diseases and disorders of the the nervous system
- Diseases and disorders of the eye
- Diseases and disorders of the respiratory system
- Diseases and disorders of the circulatory system
- Mental diseases and disorders
- Diseases and disorders of the digestive system

Each DRG is nationally priced and each patient's treatment is funded according to a basic weighted average costing formula (i.e. DRG cost weight = average cost of patients in a DRG / average cost of all patients across all DRGs). However, this formula is adjusted according to other variables such as how long a patient stays in hospital and the level of hospital specialisation required.

Hence each part/patient will have a unique ID (kept) and a unique ICD10 code (for each presentation), and be 'assembled' into a final product code (again for each presentation).

For example, Southern Health in Victoria, serves over 931,500 residents, therefore, there is the possibility of 931,500 unique ID numbers. Last year it treated over 193,000 in-patients, therefore generated over 193,000 unique ICD10 codes. In reality it had over 1.5 million episodes of care (including the 626,000 patients treated in outpatients), and thus each episode would have generated a unique ICD code which would then determine how much the hospital is paid.

There are problems with using DRGs as the funding method for hospital treatments. Underfunding of 27 DRGs (concerning head injuries, chest injuries, and severe burns) has been reported[4]. Also health services are set annual performance targets. If they do not treat the expected

number of patients then they have to refund money to the government, and if they treat more than the expected number then they will only be paid at a marginal or zero rate for the extra work. Separate funding grants are also allocated to pay for new technology, teaching, research, and patient complexity. Thus, there is an apparent real need for more research to be undertaken to determine more appropriate costing methods for healthcare treatments undertaken within the health industry.

7. Information technology (IT) systems

Health IT systems are vital for the above coding and final payments systems to work. The IT system is also used to manage patient files and each file can include reports/images/data from medical, nursing, pathology, radiology, and allied health departments. This system utilises a 'manufacturing resources planning' (MRP) type system (e.g. ordering pharmaceuticals, linen, meals, consumables such as syringes, dressing packs), schedules surgery and outpatient appointments, creates staff rosters, and it is also used for communication, administrative, financial, legal, and research activities, and for regulatory reporting. It further has to be secure and guarantee the privacy of patients. All staff must also have access and must log-on to document patient data.

If sharing a computer in the nursing office (everyone shares) the logging on and off becomes very frustrating. If a nurse for example, is interrupted when completing a computer entry (frequent occurrence), another staff member will often log the nurse off and separately log-on to complete another task. The original nurse will then have to wait and re-log on to complete the task. The computer system can often become slow to logon/logoff and the nurse becomes more pressured for time.

Again, using Southern Health as an example, there are over 13,000 staff, 40 sites including 6 hospitals, and each area in each site has multiple computers. In many ways health IT systems can be described as very large enterprise resource planning (ERP) systems located in a small geographical area.

However, in reality most hospitals have a *combination* of paper and computer based records. This often means staff has to enter the same information in both. For example on some wards, a nursing entry for the shift is manually recorded in the patient's paper file, the nurse then re-enters a summarised version on the computer.

After all the nurses on that shift have completed their computer summaries, the information is then printed out, photocopied approximately 7 times, and each photocopy is then used by the next nursing shift as their handover sheet. At the end of the next shift the photocopies are discarded into the security bin and the information on the computer is wiped in preparation for the next shift. There are several variations of this method. However, if this handover information is not printed the next shift is obliged to take detailed hand written notes about each patient and crucial information can be missed (if there are 25 patients on the ward then there is only approximately 1-2 minutes handover time for each patient).

One of the problems with an individual health IT system as described above is that a hospital belongs to a state wide and Australia wide health network. Although there are now multiple health service database systems containing health information that could result in better planning and costings (using data mining techniques), data sharing is limited because these systems often lack interoperability. Hospitals, GP and medical specialists' offices, local health community centres, and various government health departments are all expected to be able to have computer systems that can communicate with each other to allow the full use of the proposed Australia wide e-health records. There are also security requirements to protect confidentiality including the need for informed consent and data scrubbing to remove all forms of possible identity. This situation is unlikely to exist in manufacturing!

8. Process/product layout

Manufacturing systems generally use product or process layouts, and parts and products do not move on their own volition and do not have feelings. The factory does not have the general public wandering through to visit individual parts or families that need to be consulted on a regular basis.

Hospitals are arranged in product groups, e.g. emergency, surgical, medical, neurological, pathology, and radiology. However each group can also have various process flows and flows extend within other product group areas.

For example, the pathology department is responsible for analysing specimens such as blood, tissue, and urine. The specimens can arrive in 'routine' batches (e.g. blood collected by nurse phlebotomists from patients on each ward) or as an 'urgent' single tube (sent directly from ICU or emergency). Each specimen requires a pathology request form which specifies the required test. Specimens arrive at the central receiving desk where they are debagged and quality checked (e.g. sufficient amount of blood, correct signatures, patient details). Routine blood specimens are then transferred to the appropriate automatic analyser for testing. Thus the pathology department uses a combination of group technology, batch processing, continuous processing (automated routine tests) and job shop techniques (surgical pathology).

The emergency department, however, has many process flows (patients enter the system via ambulance, police escort, ambulatory) and patients are treated according to the Triage Scale which reflects the severity of their illness (if you are at risk of dying from a heart attack then you will have priority over someone who has broken a limb).

Patient flows can also be further subdivided into paediatrics and mental health streams because these patients are reviewed by specialised staff. However each

person presenting to emergency is assessed and treated by a nurse practitioner, a registrar, a consultant, or a trauma team, depending on the severity of the presenting illness (job shop production).

It is also noted here that hospitals will suffer financial penalties if they cannot assess people according to the Triage Scale times which are determined by the government. Approximately 45 – 50 % of people presenting are admitted to hospital and the hospital will be fined by the government if the admission does not occur within 8 hours. (Ed: see accompanying article by **Gough, et al**).

Sometimes patients cannot be admitted to a hospital ward because of bed blocking. Currently hospitals use 100% of bed capacity. Therefore, to admit a new patient requires the hospital to discharge an inpatient. If an inpatient cannot be discharged from the ward no-one can be admitted. For example, if an elderly patient does not need acute care anymore but cannot be sent home to live alone, and there are no rehabilitation or aged care beds available, the patient cannot be discharged. If that person is discharged home without support then there is a high risk of falls/injury and then re-admission to hospital within 28 days – the hospital will then be fined by the government for the re-admission (also it would not be ethical).

Thus, the hospital cannot admit (and is thus given a financial penalty), cannot discharge (financial penalty), resulting in longer queues in emergency (financial penalty for exceeding set Triage time), ambulance block occurs because paramedics cannot hand over patients and this then causes a shortage of available ambulances to respond to community emergencies, a lack of hospital trolleys because all patients waiting for admission are using them in the corridors, nurses in emergency to undertake extra duties to care for patients on trolleys as well as assessing new presentations, people in waiting areas to become frustrated and abusive towards staff because of the long wait, the hospital goes on bypass and not accept any more presentations, which then causes new ambulance emergencies to travel to other hospitals for treatment. The above scenario does happen – especially during the flu season (therefore the great encouragement for preventive health – have your flu injection early!).

An equivalent scenario in manufacturing would be a machine breakdown in the final assembly line, the sub-assembly lines keep producing at the same rate until there is no more space for the growing amount of WIP, and management arranges for some of the extra WIP to be transported to other manufacturing sites around the state. The owners of the business then reduce the budget for the final assembly line as a penalty for not adhering to the production target. Also all the parts start abusing the staff and sending complaint letters to their local member of parliament (or to the Minister for Industry).

Essentially hospitals must find ways to minimise costs while increasing performance and when this is not possible, they find ways of affecting performance measurements so that minimum performance requirements are still shown to be met (i.e. manipulate performance figures by subtly changing definitions and boundaries). One example of this is the relatively recent creation of 'virtual' wards; wards that allow patients from the emergency department to be admitted to hospital without physically leaving the emergency area. They are 'virtual' because they exist only on the computer and the hospital avoids financial penalties because it is seen to meet its performance targets.

9. Human Resources

Nurses, doctors, and other health professionals need to maintain their skill levels, learn about new techniques, apply evidence based treatments, ensure quality control procedures and health standards are followed, provide more documentation, and explain procedures and options for treatment to patients. They understand quality improvement techniques and many conduct quantitative and qualitative research projects to develop new approaches to healthcare. It takes several years to train skilled health professionals, many nurses and doctors are now working part-time (and expect to retire in the next 10 years), hence there is increasing stress on the system to cope with staff shortages. The growing complexity of healthcare, the aging population, and the faster turnover of patients are all contributing to staff burnout and higher turnover.

In most industries the workload capacity of staff can be determined using standard time studies and work sampling. However, the nursing workload is dependent on the type of patients, the type of ward, the logistical support, staffing levels and skill levels. For example, a 24 bed surgical ward could have 50% of its patients over 70 years old and five of these patients have cognitive impairments (i.e. they are confused, agitated, will wander off the ward if not closely monitored, and are at risk of falling). The other seven elderly patients require extra assistance to shower, toilet, eat and need more general reassurance. Some of these patients have elderly partners who also need extra staff time to explain what is happening.

The remaining patients are younger but two have post operative complications that require added pain management and more staff time. Staffing levels have not changed but due to illness there is a new agency nurse who has not worked on the ward before, and two new nursing students have joined the team for a 4 week placement. Hence the regular nurses will have increased interruptions (e.g. agency nurse asking where things are, student nurses needing guidance, confused patients needing to be taken back to their rooms), extra duties (e.g. pain medications which can require 2 registered nurses to check before administering; if patients are incontinent due to confusion it may result in shortage of sheets and therefore a nurse needs to travel to another ward to collect more; taking more physical observation time due to patient deterioration).

The following week 90% of the patients could be under

40 years old, there are no patient complications, all staff are regular team and the student nurses are familiar with ward procedures. In short, the nursing workload and activities will be uncontrollably different week to week.

There are also no standard definitions for 'direct' and 'non direct' patient care and thus applying lean techniques to reduce wastes can be difficult. Some studies have described feeding a patient as a 'non direct' nursing activity (patient's meal is delivered by catering staff and patient is capable) but some nurses argue this is 'direct' care depending on the patient (meal delivered but patient cannot eat without help and during this feeding time the nurse has the opportunity to assess mental/ physical health and provide 'one-on-one' time with patient).

10. Supply Chain management

There are over 220,000 different pieces of hospital equipment listed in the product catalogue of one American supplier [9]. Last year Victorian hospitals spent $1.6 billion on goods and supplies including catering [2, 3]. To minimise these costs various state governments have recently established a centralised hospital purchasing system. Prior to this development each hospital was responsible for its own ordering.

Figure 2 illustrates the developing ordering system by Health Purchasing Victoria.

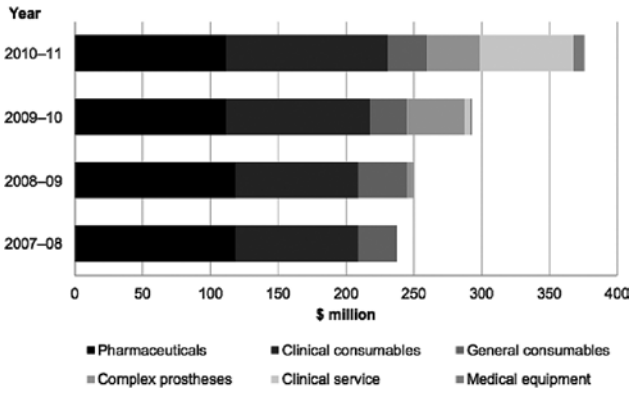


Figure 2. The Estimated $-value of hospital procurement-spending by Health Purchasing Victoria. Source: Victorian Auditor-General's Office

However, there are still many difficulties with hospital supplies including inaccuracies in recorded inventories. For example, hospital wards use clinical consumables at different rates and this is dependent on the type of ward (e.g. dressing packs will be commonly used on a surgical ward but seldom used in the psychiatric ward, but each ward will have a supply of the dressing packs). If one ward runs out of a needed consumable then the nurse will borrow from another ward, and if the nurse is in a hurry will often forget to record the borrowing. There is often no Kanban system for easy ordering on the ward. Nurses are generally responsible for re-ordering stock and are not trained in the amount to order, so some nurses might order extra "just in case".

Low use of clinical supplies, large minimum lot size and insufficient storage space also creates inaccurate inventory and waste. For example, cotton wool balls are occasionally used in psychiatric units but the minimum lot size is a box of 1,000, and there is little storage space in the clinical treatment room. Therefore, the nurse will place some into a smaller container and store the rest in a back storage room. Several weeks later another nurse will be responsible for the ordering (clinical supplies are usually checked on Sunday mornings) and not being aware of the box in the back room will re-order another box of cotton balls.

In manufacturing the MRP systems control the planning, ordering, and costs of inventory. The health industry is only now adopting some of these techniques.

11. The future role of Industrial Engineers in the health industry.

Over the past 10 years there has been a concerted effort to improve patient flow in hospitals to reduce bed blocking. Industrial engineering and lean manufacturing techniques and tools such as process mapping, value stream analysis and simulation modelling, have all been applied to optimise patient flows and bed capacity utilisation. However, hospitals and healthcare systems still operate as silos and often do not recognise the potential benefits industrial engineering can generate.

Sheth, Ramly, and Brennan[10] in their recent 2010 report to the U.S. Department of Health and Human Services have listed many of the barriers facing industrial engineers in the healthcare field. These include a lack of knowledge and awareness of IE tools; the health industry is a large scale system and its boundaries are fuzzy and the goals are constantly changing (compared to a manufacturing plant); computer modelling depends on robust data which is lacking in the health field; and there are only a few people who are trained in both fields. Table 1 lists their recommendations.

Many organisations such as the Institute for Operations Research and the Management Sciences, The Australasian Lean Healthcare Network, the Human Factors and Ergonomics Society, and the U.S. Institute of Industrial Engineers (IIE) have already started working and researching in this area. Collaboration with other organisations would allow Australian industrial engineers to also become engaged in this developing field.

Conclusion

Improving health systems involves collecting better data, establishing partnerships and networking with health organisations, government departments, academia, and the above groups. Limited funding, escalating demand, population growth, an increasing elderly population, and patients with more complicated diagnosis – all are having a detrimental effect on the Australian healthcare system. Therefore, the focus is on having more output with the same input – that is, 'good ol' industrial engineering'!

Table 1. Identified barriers and proposed recommendations. Source: Ref (9)		
	BARRIERS	**RECOMMENDATIONS**
Fragmentation of ISyE and health care communities	Lack of efficient ways to spread knowledge between ISyE* professionals working in health care	Collaboration Action Agenda
Government structures	No clear government structures to support development of new ISyE knowledge	Collaboration, Funding, and Administration Action Agenda
Policy constraints	Current policies constraining level of change possible	N/A
Multidisciplinary knowledge	Lack of professionals with an adequate understanding of both ISyE and health care	Education and Training Action Agenda

References

1. Kimble, G., Boneau, A., Wertheimer, M., 1996, 'Portraits of Pioneers in Psychology', American Psychological Association, Vol 2.
2. Australian institute of Health and Welfare, 2012, 'Health expenditure Australia 2010-11' http://www.aihw.gov.au/publication-detail/?id=10737423009
3. Health Purchasing Victoria, 2012, 'Health Procurement'. http://www.audit.vic.gov.au/publications/20111026-Health-Procurement/20111026-Health-Procurement.html
4. Lowthian, J., Curtis, A., Jolley, D., Stoelwinder, J., McNeil, J., Cameron, P., 2012, 'Demand at the emergency department front door: 10-year trends in presentations', Medical Journal of Australia, Vol 196. pp.128-132.
5. Diabetes Australia, 2012
6. AIHW, 2012
7. Alzheimer's Australia, 2012
8. J. Blakemore, 'Application of lean six sigma to service industries… health and finance', New Engineer, Vol 15 No 1, May 2012. pp.9-12.
9. Owens & Minor Medical Suppliers http://www.owens-minor.com/Products/MediChoice/Pages/Equipment.aspx
10. Sheth, R., Ramly, E., Flatley, P., 2010, 'Industrial and Systems Engineering and Health Care: Critical Areas of Research - Final Report', AHRQ Publication No. 10-0079. Rockville, MD: Agency for Healthcare Research and Quality.

The politics of quality improvement in hospitals

Richard Gough and Ruth Ballardie.
E: Richard.Gough@vu.edu.au or Ruth.Ballardie@vu.edu.au

Introduction

The transfer of Toyota's model of lean management from manufacturing into the service sector has been noticeable in recent years.

In Australia, following the example of US and UK hospitals, variations of lean management such as 'lean six sigma' and the NHS 'Productive Wards' program have been used as a way to improve patient flows – as well as to free up clinical staff time used for caring for patients by improving ward processes and housekeeping.

Australian State Health departments, driven by concerns about the rising costs of acute care hospitals, have encouraged these changes by imposing a range of Key Performance Indicators (KPIs) on hospitals, including setting patient flow rates through Emergency Departments (EDs). In 2006 the Victoria State Health Department mandated that 85 per cent of patients attending an ED, be either admitted or discharged within 8hrs. In 2012, following trials in WA, the Australian federal government introduced a new national standard, reducing this to 4hrs. This has also occurred in Victorian public hospitals.

In setting these targets, both governments have publicly drawn attention to the inconvenience caused to patients by long waits in EDs, and claimed that ED overcrowding results in increased mortality rates[1]. Hence there is an uncritical acceptance that a long length of stay in ED is unacceptable. However, our current research suggests that this construction may be simplifying what is actually a complex situation. The following discussion is based on interviews with 24 clinical and management staff in a major hospital.

Context

In the hospital studied there are a number of measures of performance suggesting that front-line workers (clinical and non-clinical) may be exposed to significant levels of workplace stress through work intensification. A significant indicator of work intensity is the level of bed occupancy,

which for a number of years has been running at over 100 per cent. (Over 100% occurs when extra beds, over those normally funded, are brought on line, and requiring agency staffs to supplement the normal ward staff).

The impact on nurses of such high levels of bed occupancy is revealed in a recent Finnish study [2]. This study showed that nursing staffs' exposure to bed occupancy rates of over 85 per cent (for more than 6 months) was associated with increasing rates of commencement (usage) of anti-depressants by nurses.

Furthermore, with nurses exposed to bed-occupancy rates of 95% for over 6 months, they were twice as likely to commence anti-depressants usage as those working in wards with 85% bed occupancy. Such high bed occupancy rates are not only deleterious to nurse well-being, but also create a severe problem of 'bed block' which negatively impacts on the efficient flow of patients out of ED.

Additional work pressure also arises on nursing and associated staff from increasing rates of bed turnover – a result of an on-going trend to also shorten hospital inpatient stays. Faster turnover of beds requires more frequent cleaning and bed preparation as well as attending to more discharge processes during a shift.

Patient discharges themselves are also becoming increasingly complex and time-consuming. Increasing rates of chronic disease in populations (e.g. diabetes, obesity heart and pulmonary disease), as well as increasing proportions of elderly patients in relation to changing population demographics, are adding to the problem. Patient discharges can now involve coordinating a range of both inpatient services (pharmacy, allied health services, doctors), as well as rehabilitation and community support services and the briefing of relatives. Hence these more complex types of patient discharges are taking an inordinately increasing amount of time.

KPIs

Before discussing the circumstances of the implementation of lean management in acute care hospitals, the role of KPIs needs to be critically assessed.

Such measures have grown up in the last 20 years in the context of a political demand for accountability and control in public sector organizations. A number of assumptions are built into the choice of KPIs, the implications of which, at a hospital level, may not be fully appreciated at the wider political level because politicians and others often lack a deep understanding of the complexity of the system interrelations operating within hospitals. This is particularly the case with the introduction of the 8 hour rule. These misunderstandings enter the public sphere through dramatic media reports of elderly patients spending upwards of 14 hours on a trolley bed in ED, with the resulting negative public perception compelling politicians to respond. The political power of KPI's to accrue their own logic and inhibit rational analysis of the underlying issues, including both short term and long term negative consequences, is exacerbated when senior managers have up to 30 per cent of their pay dependent on achieving such KPIs.

In assessing the 8 and 4 hours ED time KPI, it needs to be clarified that before these KPI's were introduced very ill patients needing urgent treatment did not wait, rather they receive immediate attention from clinical staff. However, less urgent, but still complex cases, such as elderly patients with pneumonia and other complications, may have stayed longer than 8 hours in ED while their condition was monitored and stablised before being admitted to the most appropriate ward, or discharged. Generally, EDs are better resourced overnight for monitoring and treating complex cases often associated with elderly patients, compared to wards which have reduced night nursing staff and support from medical staff and access to tests, during the night.

It has been argued that patients spending longer than 8 hours in ED have higher mortality rates compared to those who stay 4 hours or less. However, examining the data more closely, it is obvious that frail elderly patients with pneumonia and complications are more likely to stay in EDs to be stabilized for 8 hours or more, and their condition means they are more likely to die there during this critical period, than younger patients with pneumonia and no complications who may be admitted to a ward more quickly. A senior consultant indicated that one of the consequences of the adoption of the 'four-hour rule' has been that the overall admission rates have increased by 35 per cent. When broken down by triage categories (a measure of severity of illness from 1 to 5), category 4 and 5 patients were hardly ever admitted before, but now category 4 admissions have gone up by 38 per cent. Older patients, who could have been stabilised within 6 to 12 hours in ED and then perhaps have returned home, are now being admitted, exposing them to risks of hospital complications such as infections, falls and loss of muscle tone requiring rehabilitation.

There are significant costs associated with hospital admissions. Patients are subject to tests and assessments by nursing and allied health staff, which is a costly and resource intensive process in a hospital that is already lean in terms of staffing. Additional costs have been incurred through the need to increase the resourcing of ED to be able to achieve these KPIs. A significant increase in patient flow was only achieved by having consultants (senior specialists) on site in ED to assess patients alongside the registrar (trainee specialists) and intern, (rather than via a repeated chain of assessment which is more time consuming). This has contributed to faster patient flows, but at an additional cost of between $2 to $3 million a year.

Combined with annually increasing numbers of attendances at ED, this increased patient flow out of ED and through the wards significantly increased the work pressure at all levels of front-line staff, a view strongly expressed in interviews of senior medical staff and nurse unit managers.

For instance, porters who transport patients around the hospital are busier; cleaners have more beds to clean with patients moving through them more quickly; nursing and medical staff have more patients to see within shorter time spans.

Lean Six Sigma

The methodology used to increase patient flow though a case study ED involved extensive process mapping not only of the ED, but also of other key units and wards downstream from ED. This method was based on Lean Six Sigma principles developed from the Toyota Production System. It uses the DMAIC cycle of Define, Measure, Analyse, Implement and Control. Tollgates at the end of each stage allow the outcomes to be presented at group meetings and approved by the high level executive sponser, who, for this project, was the CEO.

The case-study hospital itself was also experiencing financial problems and severe ED access block, which the newly appointed CEO was required to address as a matter of urgency. Consequently the ED improvement project was pushed rigidly and vigorously by the executive, with tight timelines between Tollgates imposed. This became a source of contention between staff in the area involved and the CEO – especially since, at each stage, significant issues and complexity emerged during the process.

This frustration was also exacerbated because the project design explicitly ignored previous research and staff analysis of the problems, which had generated considerable knowledge relevant to the 8 hour project. One explicit rationale for this was the tendency for the Lean Six Sigma program approach to ignore pre-conceived notions about possible solutions. The adoption of this methodology was also seen by the quality improvement staff, as a break from past attempts to improve efficiency and patient care, which had not been successful or sustained.

Since the executive and improvement staff understood the problems of sustainability and staff buy-in being undermined by the use of external consultants, the quality improvement staff were trained (to black or green belt level) in Lean Six Sigma by a bank, who had invested heavily in the use of lean six sigma. Ownership of the change by the hospital staff was seen by the CEO as critical to success. To enhance staff buy-in and provide data collection and analytic skills some staff (mainly NUMs and some junior doctors, as well as the Deputy Director of ED) did two-day white belt training. However, also as a cross hospital project involving a large number of services and ward units, and the large number of staff affected by the project, this precluded providing training to front-line staff (e.g. nurses, allied health professionals, etc).

A key aspect of the process was a weekly meeting of senior clinical and management staff chaired by the CEO, who had a very 'hands-on' role in driving the project. While most rubrics on organizational change stress the importance of the leadership of a CEO in pushing change, as well as frontline staff buy-in, in this case the process was very top down with clinical staff feeling pressured to achieve results. Membership of this group varied over the eighteen months of the project with members being added along the way as the focus of the project shifted. Eight different subsidiary projects developed out of the main project.

While many staff involved were concerned about the rigidity of the program and managerial expectations for data measurement, analysis and improvement implementation, many medical staff also expressed concerns that the process was too drawn out and did not achieve tangible improvements fast enough. There were also concerns that the data collected was not that of most relevance to understanding patient flows and activities based on the patient journey, but data that was most readily available was collected for particular KPIs.

Nurse ward managers also considered that the process did not touch issues relevant to their wards, but instead focused on system wide issues, which though important, were remote from their spheres of influence and concern. A key issue in some wards was delays in discharging patients and hence freeing up beds to take patients from ED. This capacity varied across the wards, for example, discharging patients from the orthopaedic ward was limited by elderly patients access to rehabilitation facilities, which delayed their discharge, whereas in the cardiology ward there was more capacity to discharge patients more quickly.

The underlying agenda

The comments in the previous section have illustrated some differences of views from doctors and nurses about the efficacy of the lean six sigma process. These views, arising from the occupational and personal perspectives of clinical staff, indicate that hospitals, like other large organizations, are political and complex in how they operate rather than rational bureaucracies directed solely by senior management. Hence, the application of change processes, such as lean six sigma, cannot be applied in a top down mechanical manner to solve problems like those associated with the journey of patients through a hospital. The power relationships and interests of the different actors affect the nature of the change process, sometimes enhancing it and at other times redirecting it. Structural factors such as the number of available beds and the staffing levels can also affect what is achievable in a change process.

The nature of work in hospitals must also be recognized in discussing the use of change processes like lean six-sigma. In hospitals there is greater variability in the nature of the work than is found in car factories. For example, clinical staff are dealing with acutely ill patients, who can have a range of co-morbidities (concurrent illnesses). In particular, the degree to which the treatment of medical patients, as distinct from surgical patients, can be standardized through means such as clinical pathways (templates for dealing with

particular illnesses) is questionable for patients with co-morbidities. Such patients may readily fall off standardized 'clinical pathways'.

The enhancement of change is most noted amongst skilled, clinical-staff – who are innovators, and who also have their own agendas and solutions to the problems they face. Such staff use their ability to innovate in relation to both change projects arising from KPIs to meet the agendas of management and the State Government, but also from their concerns for their patients and their own needs. In this latter situation clinical staff have already identified the problem and have researched the literature to arrive at their preferred solution. Their main problem then is to gain attention and resources from senior management.

For example, in the case where the change was driven by the imperatives of State Government KPIs, as occurred in the 8 hour project, clinical staff had their own solutions. One of the significant changes in the ED department, the putting of junior doctors, registrars (trainees specialists) and consultants into a team to assess patients in emergency, arose from the initiative of a senior consultant. He considered that it was both more efficient for patients to be assessed by the three levels of doctors concurrently than by each level of doctor separately, thus reducing patient waiting time. This meant that each of the consultants had to be available for a fixed period of the year in ED instead of being on call. He and two colleagues, at their own cost, tried the change out for a three week period and saw that it worked well. Up to that stage he had not been part of the 8 hours project, but one of the senior managers, who became aware of the trial, coopted him onto the steering committee. He was able to put his ideas to the CEO, who gave the change support for an extended trial. He was also able by extended discussions with his colleagues to get most of them to agree to the change. The change also meant that the consultants were not buffeted by random demands from the ED.

Another example occurred in a ward, where there were considerable frictions between the ward and emergency. These arose from ED staff calling the ward repeatedly to indicate that a patient was ready to be reviewed by the doctors from the ward so that the patient could be admitted. Such delays could be more than a couple of hours depending on what the doctor was doing. The medical director and the nurse manager started to collect data on these delays and discuss the issue with the doctors to make them aware of the problem and to get their agreement to improve the situation. Their concern about this issue was in part due to a fear that a solution would be imposed on them, if they did not solve the problem themselves. Knowledge of what was occurring led the nurse manager being invited to attend the weekly meetings on the 8 hours project with the CEO and get some support from the quality improvement staff. The nurse manager subsequently did the two day white belt course on lean six-sigma and found the tools required to implement necessary change.

A different example is of a project, not related to a KPI, initiated by a senior consultant concerned with diabetes patients, who were being treated in the hospital for a range of illnesses not related to diabetes. His concern was that there were gaps in knowledge in how to treat diabetes patients in other wards, which was leading in some cases to poor outcomes for diabetes patients. He had a clear solution to the problem from researching the issue in the local and overseas literature. However, he and his colleagues agreed to go through the six sigma process to come up with a solution. In this case he already had in mind his outcome and was not going through the lean six sigma process step by step to arrive at a solution. Adopting such a strategy, however, made it more likely he could get resources from the CEO to implement the solution.

Conclusion

The discussion above has highlighted the way in which broader KPIs such as the 8 hour and 4 hour rules can achieve political salience in a way which distorts the focus of clinical staff away from more clinically based and nuanced measures of patient treatment. The results of the 4 hour rule, in particular, add to the pressures on clinical staff as well as having negative consequences for the wider system, which are not understood or ignored by politicians and the senior managers. This does not deny that some of the changes made may improve efficiency, but that these changes need to be seen against the wider systemic consequences.

At the organizational level there are also highly skilled and innovative clinical staff, who utilize the six sigma change process to achieve solutions, which they may not have been able to do in other circumstances. Obviously all change processes require champions if their colleagues are to be convinced of the need for change, but such champions can have their own agendas. Hence the process of quality improvement in hospitals is not merely a matter of simply using techniques to achieve change, but also depends upon the agendas and needs of key power holders in a highly political organizational environment.

Reference

1. ABC News (Feb 6, 2012).
2. Virtanen, M., Pentti, J., Vahtera, J., Ferrie, J.E, Stansfeld, S.A., Helenius, H., Elovainio, M., Honkonen, T., Terho, K., Oksanen, T. & Kivimäki, M., 2008, 'Overcrowding in Hospital Wards as a Predictor of Antidepressant Treatment Among Hospital Staff ', American Journal of Psychiatry, Vol. 165.pp1482-1486.

Tales of Three IE Graduates
(What they did and didn't teach me at University)

Sam Ghaith, Mohammad Barghash and Scott Fairburn
E: samghaith@hotmail.com, mo.barghash@gmail.com, scottfairburn l @gmail.com

My IE Journey to date (Sam Ghaith)

Introduction

I was always interested in how things worked and as a kid even more interested in pulling my toys apart to see what made them tick. Sadly I couldn't always put them back together but that's what parents are for. My dad had subscribed to a magazine in the 1980's called 'How it works'; it showed dynamic cutaways and broke down complex topics and presented them in an entertaining way. It's probably where I got the idea from to explore the world of engineering … I was amused recently to find the magazine is still around and has 'gone digital', my father would be pleased (note to self, birthday gift).

My journey

Graduating from Monash University, in 1999, as a 'newly minted' Industrial Engineer (IE), I was very excited about the potential and real opportunities that awaited me. I did have visions of course, for example, of conducting 'wiz-bang' lab experiments for NASA, on something in outer space such as shape memory alloys and their effect in the micro gravity environment of the ISS…

Since graduation, some 13 years have passed and, although I may not have donned a white lab coat in a clean-room environment in low Earth orbit, I do find myself wearing a nice suit and loose tie in my 4 x 4 m^2 cubicle shared among characters not far from those in an episode of 'Big Bang Theory'. I do digress here, but my role today is far closer to earth then I had ever imagined. As with no other engineering degree, IE offered me such a variety of subjects that covered not only the technical know-how but business acumen as well – subjects that have proven to be most relevant in my current, some-what more earth-bound, environment.

My engineering journey began as a Sales Engineer for Digital Peripherals (DP) – an I.T. integrator of managed products and services, and for years I learned the ropes from technical to sales to admin. DP was big enough for growth yet small enough to allow opportunity for varied roles, such as translating technical requirements to/from customers with no technical backgrounds and working with a team to create the I.T. solutions that best fit their business models. It was an interesting time as the dot-com bubble burst in March 2000. It didn't quite hit Australia that year as we were still getting over the Y2K bug that never quite came. During my time, I recalled many of my past lectures on topics such as 'People, Process & Technology' as well as 'Communications'. For the most part, the past 13 years of my very much more 'down-to Earth' experiences tell me that these subjects can cover all the theory in the world, but they won't teach you how to use it. The right process methodology is not always the right process when real-world politics, budgets and other peoples' opinions are added. I don't recall subjects on these matters and for good reason too. It's something you almost have to feel your way through, something only experience can give you.

Moving to the Big T (Telstra) I have had the opportunity (over my now 8 years to date and counting) to work for many functional groups within the organisation. From business and corporate, I have learned skills in customer relations and dispute resolution techniques, and from operations, I have learned network topologies and systems integration. With each new chapter of my journey, continuous problem solving and dependence on skills developed to date and experiences I have gained over the years have and continue to shape me. Above all, however, I believe that it was Industrial Engineering that gave me the grounding for what I am and know today.

What I didn't learn in Engineering that I wish I had

- Communicating / negotiating skills – not to be underestimated as its used everyday even when you're not realising it.
- Continuous learning – keeping your skills up to date, staying current and progressive.
- Social presence – keep in contact with a mix of friends/ colleagues not just engineers, opportunities through contacts are growing, sites such as linked-in are a great tool. Choose a social arena that suits your path
- Work/Life balance – don't lose who you are, have a hobby or passion outside work, it will keep you grounded and not make you feel like you're in a never ending rat race.
- If it all sounds like too much, then K.I.S.S were you can.

The universality of IE

Engineering purists are hard to find these days, more and more I see Engineering as a gateway to something better or for others an opportunity for a passion lost years ago.

Reading most job posts these days you will see titles for continuous improvement, business specialists and in almost every job you will find elements of the skills an IE education can give you.

My fellow graduates

Last I spoke to fellow graduates from 1999, I found one of them had opened a video rental store, another got into property consulting, another one a coffee distributor and several corporate big-shots who had climbed the ranks. Albeit our journeys are not the same, they were happy and had used their IE skills in some part on their own individual journeys.

Conclusion

Making the most of opportunities, friendships and finding that balance between work and life are keys and, for me, what better start than being an Industrial Engineer.

Some lessons learned in my experience as an Industrial Engineer (Mo Barghash)

Introduction

I graduated with an Industrial Engineering degree from the University of Jordan, in early 2008, and moved to the United Arab Emirates to work for a feed milling company. I started as an Automation Engineer, became an Automation and Safety Engineer, and 2 years after graduating I was promoted to Maintenance Manager for the whole company..

From Jordan to Australia

I moved to Melbourne in late 2010, to work as Manufacturing Manager for an industrial coatings factory, using my Industrial Engineering and management knowledge and experience.

In Australia

I've found that in Australia, many employers are searching for Industrial Engineers without knowing it. They seek process improvement specialists, manufacturing managers, LEAN and Six Sigma specialists and operations managers, etc. without expressly requesting an Industrial Engineer, which is a qualification perfect for any of these roles. I believe that Australian employers need to be educated about Industrial Engineering and this is a job for every Industrial Engineer to do. The more people who understand what Industrial Engineers can do, and the value they can add to an organization, the better the market will be for Industrial Engineers in Australia.

The benefits of IE

I have found that studying Industrial Engineering has given me great knowledge and the confidence and ability to stand up in front of management and be convincing and achieve great results. It has given me the framework to approach any problem in my job, based on a logical and scientific approach. This means being able to add value to the companies that I worked for, especially in improving productivity or decreasing costs.

Learning from obstacles

However, there are a couple of things that I didn't learn until I faced obstacles in my working life. One is that managing people is truly a personal and individual experience which cannot simply follow theory. The other is that it is not enough for a manager or employer to be convinced about Industrial Engineering as a relevant qualification – you also need to educate them about the specific concepts you want to apply to get their engagement in your work.

Managing people is much more personal than a simple application of management theories

In my first management role as Maintenance Manager, my initial approach to management began with me classifying each of my employees based on different managerial methodologies and theories, as per my Industrial Engineering training at University. This seemed to be going well at first, but I soon felt that my relationship with my employees was very formal and based on the concept that they will do things for me either because they have to or because they will get some financial benefit out of it. Their performance showed a lack of ownership and sense of belonging.

Given this issue, I decided my style of management would have a more personal approach. I scheduled time to meet each employee one-on-one at least once a week, to ask them how they were feeling/thinking, what they wanted and where they wanted to be. I worked on these things which each of them, making them feel that they were part of the company and the main value adding to the company itself. They were not only affected by work but also personal issues which they carried to work, which of course affected their performance. So as a manager, I kept my door open for them and asked them how their life was going outside the company and asked how I could help to facilitate their life both outside and at work.

I've found this psychological dimension of the management role to be essential for me to motivate my employees and get my job done well.

Not everyone is familiar with Industrial Engineering concepts

I proposed a time and motion study for the employees running the bagging section on a production line to my manager. His response was "No, why would we do that? What advantage would it give us?" My reaction was initially that he had a negative attitude towards an important study which could give us an understanding of our productivity. But when I thought it through, I realized that my manager is not an Industrial Engineer and maybe didn't understand the value of time and motion study. So I re-proposed my

idea again, this time introducing the concept to him and describing how it could help us calculate the cycle time for production lines, and discover where any bottlenecks were occurring so that we could optimise the process.

By describing my proposal in this way, I got my manager's approval to start the study. I collected the information and used it to create a simulated program of the current and an alternative production line process, to show the difference in the results. My manager was engaged in the study as he understood why we were doing it and the effect it could have on the production process, and was really satisfied with the resulting increased bagging capacity.

What I learned

What I learned was that it is not how important your idea seems to you but how you represent it to the management and show the importance to the company and the value that applying the idea will add. Using simulation programs and charts can help make it easier for the manager to visualize the change and its effects, get engaged and be supportive of the idea.

Conclusion

In conclusion, I believe Industrial Engineering should become more well known in Australia as a discipline which can be applied in many industries, not just manufacturing, and it is our role as Industrial Engineers to make that happen. We have to engage our employees on an individual basis to ensure that they are motivated and their role is structured to suit both their and our needs. And finally, we need to remember that not everyone has had the chance to be convinced by the value of Industrial Engineering concepts like we have – they need to be presented in a way which portrays the value they can add to the company and the steps required if we want to get any engagement or support from those not from an Industrial Engineering background.

My career journey so far (Scott Fairburn)

Introduction

After completing my degree in Industrial Engineering at Monash University in 2009 and not having been successful in obtaining a role in any of the Graduate programs that I had applied for, I was beginning to wonder what my options were and whether I had made the right study choice. Then while searching a career website I stumbled upon a notice for the Telstra Graduate Program. My first thoughts were "what could an industrial engineer do in Telstra?" However, despite my doubts, I applied as there was nothing to lose. What a great decision it turned out to be.

The beginning

Monday, 1st February 2010 was the beginning of my career post University. My first two days at Telstra were spent in training, learning about Telstra's culture, listening to senior executive's career stories, and meeting the other graduates. The Telstra Graduate Program was well structured and allowed for me to experience a number of areas of the business through five different 'rotations' within the business. Also included in the program were bi-monthly training days where I learnt various things ranging from networking and business structures to how to perform an effective presentation and how to dress in a professional environment.

Job rotations

My job 'rotations' were varied and included time within Process Solutions, Business Operations, Contract Services Agreements, Network Construction Department of Operations (DOO) and finally the Platforms and Products team. The various roles performed required me to utilise my Industrial Engineering skills in different ways. While in Process Solutions, Platforms and Products, and the Contract Services Agreements teams I found that stakeholder management skills and ability to systematically work through problems were used regularly to ensure projects were delivered and that key performance indicators were met. While in Business Operations and Network Construction DOO, I was required to use analytical skills to provide detailed reports on the performance of various areas of the business.

Process specialist

After the Graduate Program, which I completed at the end of June 2011, I returned to the Platforms and Products group, as a Process Specialist and was put onto a number of projects associated with preparing Telstra to provide services over NBN Co.'s fibre optic network. My role in this area was to provide knowledge of business processes and to facilitate the resolution of issues that were raised during workshops. The size and complexity of this overall program of work is enormous and reaches across all areas of Telstra and has provided a fantastic learning and networking opportunity.

Senior process analyst

On the 3rd of May 2012, I started my current role as a Senior Process Analyst within the Business Process and IT Operations group. This role will see me implementing a new business process modelling (BPM) tool and is a very exciting opportunity as I believe this will allow me to highlight and showcase the skills obtained from studying Industrial Engineering.

Conclusion

After two and a half years in Telstra, I believe I have now answered my question, what can an industrial engineer do in Telstra? An industrial engineer can do anything they put their mind to. This is true for any company or industry as the skills that Industrial Engineers have are so wide and varied that they can be applied in any situation to solve any problem.

Skilled migration is a tough challenge – an invited open letter by:

Amin Hadjaran
E: ahadjaran@yahoo.com

To the editor of the New Engineer Journal (6/8/12):

In addition to all the political, social and financial reasons that people have for migration, industrial engineers have an additional reason to migrate to developed countries like Australia. Being an almost insufficiently introduced and newly developed branch of engineering, industrial engineering mostly deals with those areas of the corporation and business which traditionally have been underestimated, overshadowed by other apparently more important areas, and eventually ignored! However, ironically, those very same areas are the key factors in the winning businesses all around the world. Imagine you are an industrial engineer in a business which is suffering from insufficient sales or expensive raw material or delays in critical project tasks. You try to convince the management that spending more on quality or planning the project more comprehensively are the key factors to more sales and better resources allocation, while all they think of is more investment on aimless marketing or, in less developed countries, lobbying with more influential hidden supporters in the employers' side!

As an enthusiastic industrial engineer, I have suffered from 'not being understood'! And in addition to other financial, social and political reasons, trying to find a position in which I can apply industrial engineering principles has been the reason why I chose to migrate.

But people usually have friends or family where they want to migrate. There should be reliable people who can help migrants settle and provide them with guidelines and resources. In my case, I really had no-one. Contacting the IIE was an effort to find people whom I could trust and consult with. After all, I had at least one thing in common with the members and I was hoping I could find help through them. The result was amazing. I contacted the members though the IIE website and eventually found one generous sweetheart who literally did everything he could to help me have a picture of what I was doing and where I was going.

The first thing to do after I settled down was to search for a job. But the problem about Industrial Engineering was that whenever I searched the career websites for 'industrial engineering' positions, the result was everything but 'industrial engineering'. Career websites like mycaree.com.au recognize industrial engineering and show great figures for the average yearly income of industrial engineers. However, words like 'industrial' or 'engineer', even when put together, meant nothing to almost all employers and job openings. With 'industrial engineer' being a broad term leading to no practical result, I tried to narrow down the search by looking for my specific field within the industrial engineering domain. But I could hardly choose suitable specialties for what I did in the job listings and drop-down menus provided by the search engines. So I typed in 'project planner', 'project scheduler', 'project controller', 'contract scheduler', 'project planning engineer', 'project controls engineer', etc. And with each word, almost new job ads popped up.

In some sites, project planning is not classified under engineering jobs. In some other, there is no position as project planner. In some ads when you search for 'planning', you end up being reading about 'urban planning', 'electrical planning' or even 'programming'! Some sites have both 'project planner' and 'project scheduler' as two separate specialties, alongside project control and cost control. And some other show ads from other specialties like 'systems control' or 'control systems' when you type in 'project controls'.

The next challenge is to make employers understand the different between project management versus project planning or maintenance planning versus maintenance supervision. The special feature about industrial engineering is that unlike other branches of engineering, principles and techniques practiced within this field are almost always independent of the context within which they are being applied. Just because an industrial engineer has had the experience in, say, construction does not mean that one does not have the potential to plan projects in other fields. I do not underestimate the role of background knowledge about the nature of the business on performance. Rejecting an industrial engineer merely because one has no experience in a field of business or no technical information regarding equipment in an industry is absolutely a mistake, but unfortunately a common one!

The next trouble for me is not having the so-called 'Aussie experience'. I admit this is a righteous obstacle. I have worked in several offices with several roles and responsibilities. But yet, Australians have their own way of running businesses and projects. This probably means I will have to start from an inferior level in the company, under supervision and guidance for the non-technical aspect of jobs, as I was told in one of the interviews I attended.

However, as a part of the 4-year long process of applying for a skilled worker visa, I have been assessed by the Engineers Australia and based on the projects in which I have been involved and the experiences that I have had, have been entitled to be a 'professional engineer' and my previous employers have been contacted in order to reassure my experiences. That, unfortunately, does not seem to have a significant meaning with the employers in Australia when considering me for a position, however normal.

Another opportunity to find well-paying jobs is to look for FIFO jobs. But in my case, this is not an option because I have a partner to look after. It is not possible to leave her on her own for three weeks, at least for the early months after arrival when she is learning English.

So with FIFO jobs off the table and other positions being offered to those with 'Aussie experience', the adventure of finding a job gets even more difficult. Now if I apply for a professional position, I get rejected because of not having the Aussie experience or not enough experience in that specific field of business, while the reason for being rejected for junior positions is 'to be overqualified'!

Skilled migration is a tough challenge. You try hard and earn yourself a reputation with years of experience in your own country, and by migrating to another county, you practically kiss all the experience and opportunities good-bye. Despite all the difficulties that we are facing and will face in the days to come, I believe an industrial engineer will always win the way through any difficulty as we are trained to be systematic thinkers and logical problem solvers. I have been granted with a membership of the IIE and it is definitely an advantage for me during interviews. I use an effective method of search-call-send to win interview opportunities. I have my database of great construction and manufacturing companies. And I am sure I will find a good job soon; since after all, if an industrial engineer can't, then who can?

Eventually, once I sort things out with my job, I know what I will be trying for. IIE needs to work more on introducing and establishing the correct meaning of industrial engineering and its sub-branches all across Australia, and I will be proud to be a part of that process. I also believe that a great deal of being unknown will vanish if universities in Western Australia, where I live, offer industrial engineering as an official major. IIE needs recognition by the career websites to be able to make its own portfolio in job search.

All in all, migrating to Australia has been the wisest decision of my life. The road ahead seems amazing and the challenges are enjoyable. I will try my best to use the opportunities to establish the role of the industrial engineer in the country's effort to make a better life for the citizens.

Postscript (18/8/12):

Dear Sirs,

This is to inform you that I have found a job as a planner in Pacific Industrial Company (www.pacind.com.au) with an excellent salary package. I wish to express my sincere appreciation to you for your heart warming support over the past month and if it hadn't been for you and your support, I would really have had trouble here. Now we can all say that IIE has changed one life, and hope for other similar stories to happen in future.

With Best Regards
Amin Hadjaran

Upcoming Conferences and Exhibitions

Knowledge Risk in Engineering Firms – introduction and diagnosis

13 November 2012
Suite 202, 21 Bedford Street, North Melbourne, Victoria

SESSION OVERVIEW

Are your experienced staff near retirement age? Are your experts on the move? Do you learn from project successes and failures? Is critical knowledge maintained and used? The seminar guides you to identify knowledge risk and plan effective knowledge retention processes for engineering settings.

GETTING STARTED:

- What is 'knowledge risk' in engineering settings?
- Limitations of succession planning approaches
- Case study example – approaches used in Australian engineering organisations and their strengths and weaknesses

IDENTIFYING KNOWLEDGE RISK

- Applying the Impact, Can't buy, Unique (ICU) framework to identify roles and people
- Applying the knowledge lifecycle model to identify business continuity knowledge sets
- Review of lessons learned effectiveness
- How to identify relative risk in your setting: the prioritisation process

DEVELOPING YOUR KNOWLEDGE RISK APPROACH

- Guided practice to develop your own plan for knowledge risk identification, prioritisation and mitigation

WHAT YOU WILL LEARN. You will be guided to 'understand':

- What is knowledge risk in engineering firms?
- What specific knowledge risks exist in my company?
- What are my company's priorities for knowledge retention?
- How can my organisation improve knowledge retention?

WHO SHOULD ATTEND: Engineering leaders, Practice Managers, Risk managers, Workforce Planners, Human ResourcesFor exhibition and sponsorship opportunities please contact Allison Miller on 02 8586 6193 or email amiller@intermedia.com.au

APIEMS 2012

2-5 December 2012
Patong Beach, Phuket Thailand
www.apiems2012.org

Since its initiation in 1998 APIEMS conference is now becoming the premier industrial engineering and management systems conference in the Asia Pacific region. The conference was held every other year until 2004 when it became an annual event. Since then, the conference has become the major event for international scholars in the areas of Industrial Engineering and Management Sciences.

The conference encourages contributors to address a topical theme that is very relevant for the region: Achieving Sustainability through Effective Resource Management.

The 7th Australasian Congress on Applied Mechanics (ACAM 7)

9-12 December 2012
University of Adelaide, South Australia

The Congress aims to provide an international forum for researchers, industry practitioners, engineers and postgraduate scholars to promote, exchange, and disseminate knowledge and experiences of the most recent results and advances in a wide range of topics in Applied Mechanics. The program includes keynote speakers from the US, UK and Australia and promises to include international presenters in areas of Fluid Structure and Interactions, Nano-mechanics, Bio-mechanics, Composites, Fatigue and Fracture, Computational Mechanics, Rock and Particle Mechanics, etc.

Southern Manufacturing 2013

13-14 February 2013
Five, Farnborough, Hampshire UK
www.industrysouth.co.uk

See the most comprehensive trade show for advanced engineering, manufacturing solutions, innovations and education. This is the only forum for industry professionals to assess and compare the latest products and services for engineering, electronics and manufacturing all under one roof.

STAY AHEAD OF THE MARKET

Plan today to attend and see the very latest technology, components, materials, products and services available in the south of england. Technical staff will be on hand to offer specialist advice that will improve your manufacturing processes, component sourcing, materials selection and overall business efficiency.

MAKE THE MOST OF YOUR VISIT

Are you looking for autosport/automotive specialists, electronic components and contract electronics manufacturers, aerospace and defence contractors, packaging and labelling solutions, marine engineering and offshore suppliers or specialist suppliers to the pharma/bio sector? Simply follow the sector trails and looks for the industry logos on exhibitor stand facias.

YOUR TIME IS VALUABLE – WE'LL HELP YOU USE IT EFFICIENTLY

- Discover new local and national suppliers – many exhibiting for the first time
- Learn from the free technical seminar programme
- See innovations, new products and live demonstrations
- Resolve your manufacturing issues in one time-efficient visit
- Bring your plans and technical drawings for an instant response

WABS 2013

18-21 August 2013
Perth Convention & Exhibition Centre, Perth WA

The conference will be a 'must' for Australian and overseas geoscientists, engineers, managers, researchers and students who are interested in the geoscience and latest industry developments in Australia's most important petroleum region where there is currently unprecedented activity.

WABS 2013 will deliver a wide program with technical sessions over 3 days, an industry exhibition, short courses, field trips and social events. The program will present topical, peer reviewed, technical papers and posters that are expected to provide a new landmark for the understanding of the sedimentary basins of Western Australia. The conference will build on the knowledge of past WABS conferences and present new material relating to recent exploration and production in the onshore and offshore basins, the latest discoveries and the oil and gas fields in those basins.

Under the theme 'Expanding Our Horizons', the Conference will include provisional sessions covering:

- New Frontiers
- New Giant Fields
- Geophysical Advances
- The Northwest Shelf Triassic
- Reservoirs
- Environmental Geoscience
- Unconventional Energy Resources

NATIONAL MANUFACTURING WEEK 2013

7-10 May 2013
Melbourne Exhibition & Convention Centre, Melbourne Victoria

Manufacturing Fair: engineering, machine tools, instrumentation and control, computer-based processes, systems and services, automation and robotics, welding, heat-treating, joining, logistics, warehousing and materials handling, OH&S, pneumatics & hydraulics…