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**Industrial Engineering is concerned with the analysis, design, improvement, installation and management of integrated systems of human resources, data, finances, materials, equipment, and energy as safely as possible with minimum impact on the environment, delivered within a holistic methodology.**

**INDUSTRIAL ENGINEERS MAKE IT HAPPEN BETTER**

The three key objectives of the IIEA are:-

- 1. TO UNDERTAKE AN ACTIVE AND VARIED PROGRAM FOR MEMBERS**
- 2. TO PROMOTE AND ENHANCE THE TRAINING OF INDUSTRIAL ENGINEERS**
- 3. TO PROMOTE AND CAMPAIGN FOR INDUSTRIAL ENGINEERING OPPORTUNITIES WITHIN INDUSTRY**

## **NEWSLETTER 10-September/October 2021**

### [INDEX](#)

[From the Editor](#)

[From the President](#)

[Survey Results](#)

[From the Divisions](#)

[Did You Know](#)

[The Future Is Bright For Industrial Engineers](#)

[IE Approach in Education Technology \(learning engineering\) Development Process](#)

[Advancement of Industrial Engineering](#)

[The Future of Work from An Industrial Engineer's Practical Perspective](#)

[Curtin University IE Student Presentation](#)

[Cutting Edge Project Management-Critical Chain](#)

### **FROM THE EDITOR**

Welcome to the first issue of the IIEA newsletter for the 2021/22 year. It is hoped to have varied and interesting Industrial Engineering Articles.

In this vane, Graham Eagles has been brought onboard to assist with articles for the Newsletter. Graham has undertaken excellent work with this endeavour.

It is hoped that members will continue to contribute to the newsletter

Industrial engineers devise efficient systems that integrate new technology, new innovation, workers, machines, materials, information, and energy to make a product or provide a service. Industrial engineering is the branch of engineering that encompasses how to make or do things better. Industrial engineers dedicate themselves to improving effectiveness, reducing costs, increasing efficiency, improving quality of products and services, ensuring worker's health and safety, protecting the environment and complying with government regulations.

We research and analyse the science of work, and work to reduce variation, eliminate waste and increase value to customers.(GE)

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[RETURN TO INDEX](#)

## FROM THE PRESIDENT-David Karr(CP Eng, FIIEA)



Welcome to the new financial year especially our new members.

We welcome also 2 new Board members:-

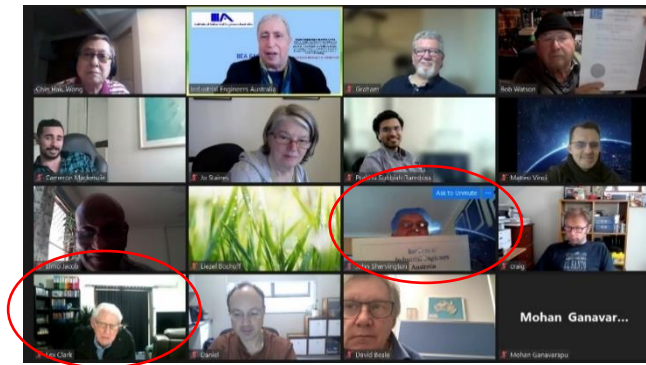
- Graham Eagles(SA)
- Mohan Ganavarapu(VIC)

I would also like to thank the outgoing board members

- Sam Ghaith(MIIEA)
- Damian Kennedy(FIIEA)
- John Shervington(FIIEA)
- Bob Watson(FIIEA)

for their long and highly valuable contributions over many years going back as far as 1964.

Congratulations should also be recognised to the the 2 Chris Heyde award winners. Lex Clark(FIIEA)(2020) and John Shervington(FIIEA)(2021) for their great contributions to the IIEA.



The proposal for the IIEA to change its trading name to Industrial Engineers Australia(IEA) was passed. This brings the organisation in line with organisations such as Engineers Australia(EA). It should be noted that the registered name of the organisation remains Institute of Industrial Engineers Australia(IIEA).

The challenge for the year 2021/22 will be to:

- Promote Industrial Engineering to industry as well as academia and government bodies
- Get members to be more active within the IEA by having interactive events
- Have an innovative events program contributing to IEA members IE skill base
- Increase the relationship with EA collaborating with College of Leadership and Management(CLM)

In this vane, I am planning a free form webinar later in October or early November, to gauge members ideas(to extend the discussion from the AGM). The idea is to get ALL members involved and participating in the organisation. A members survey was undertaken with some interesting findings(Refer Survey Results)

Our event schedule has been varied and very interesting this year with 8 events over the year. The focus in the past year was on the Future of Work(FOW). This topic is very crucial to work places and influences greatly on how IEs impact on work practices(Refer article on the FOW). Events could be online or F2F or hybrid.

Hoping to meet you all over the coming year.

David Karr(CP Eng, FIIEA)-Federal President

[RETURN TO INDEX](#)

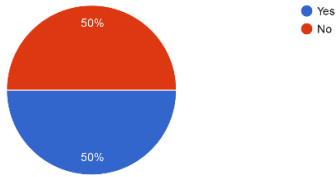
## SURVEY RESULTS

The first ever members survey was undertaken in July 2021. There were 10 respondents which is disappointing but....

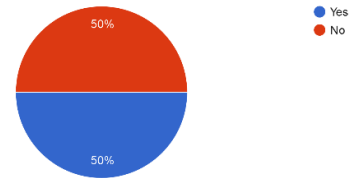
The results were interesting ranging from excellent(80% and above) to moderate(40%)

A summary of the survey results is presented below.

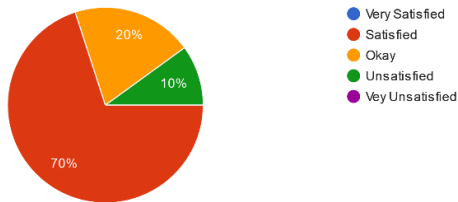
AGM/DIVISION MEETINGS ATTENDANCE 16. If the AGM was held locally or locally via Hybrid meeting, would you attend-Y or N  
10 responses



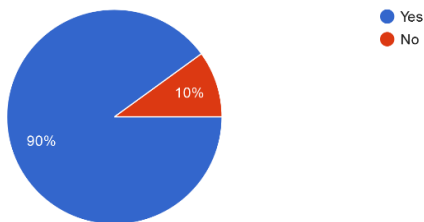
17. If you attended the IIEA 2020 AGM webinar, were you satisfied with the delivery  
10 responses



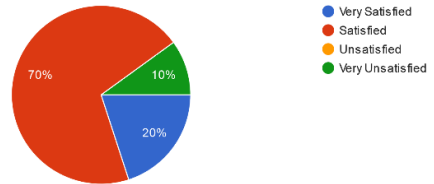
PROGRAM 1. Are you satisfied with IIEA program of events  
10 responses



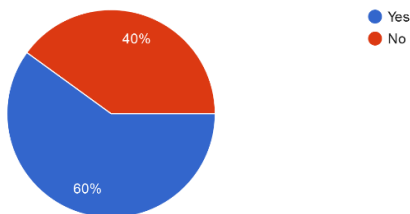
NEWSLETTER 6. Do you regularly read the newsletter  
10 responses



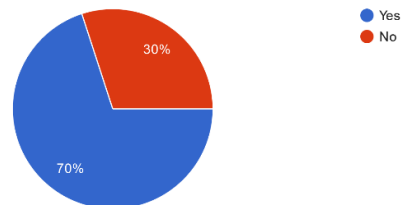
7. Are you satisfied with the content of the Newsletter  
10 responses



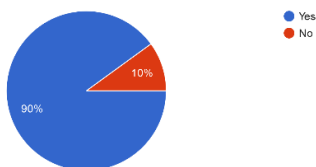
8. Would you be prepared to contribute articles to the newsletter  
10 responses



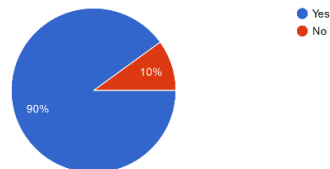
MEMBERSHIP 10. Do you feel that you get value for your membership-Y or N  
10 responses



RELATIONSHIP WITH ENGINEERS AUSTRALIA(EA) 12. Do you believe that the IIEA and its members benefit from the relationship with EA  
10 responses

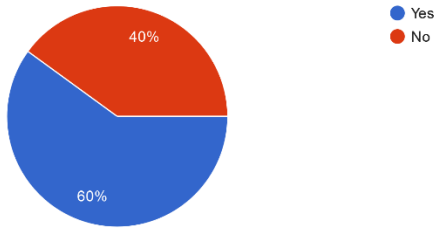


COMMUNICATIONS WITH MEMBERS 14. Does the IIEA communicate sufficiently with its members  
10 responses



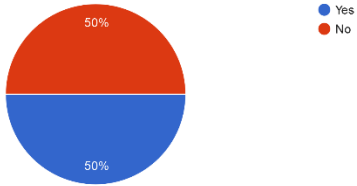
23. Is the existing IIEA Logo Suitable

10 responses



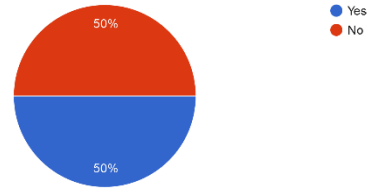
AGM/DIVISION MEETINGS ATTENDANCE 16. If the AGM was held locally or locally via Hybrid meeting, would you attend-Y or N

10 responses



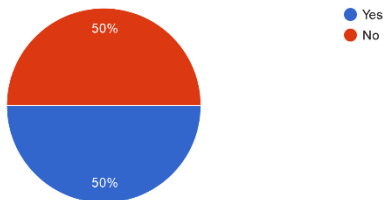
17. If you attended the IIEA 2020 AGM webinar, were you satisfied with the delivery

10 responses



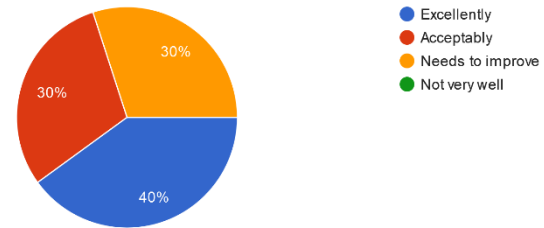
ACTIVE PARTICIPATION 19. Would you be prepared to be more active in the activities of the IIEA with attendance, assisting with events, documents etc

10 responses



OVERALL 21. How did the IIEA perform in the past year

10 responses



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[RETURN TO INDEX](#)

## FROM THE DIVISIONS

### SA Division-Graham Edwards(MIIEA)

The SA Division recently co hosted with University of South Australia(UniSA) Cutting Edge Project Management-Critical Chain With Lewis Trigger. Excellent and interesting presentation.

#### Other SA News

Adelaide defence contract to build a new fleet of nuclear submarines under an Australian, US and UK defence and security alliance.

South Australian Premier Steven Marshall says it is a difficult day for the 350 staff of French company already work-ing on the \$90 billion subma-rine program now scrapped, but they will easily find work in the state in the industry as “billions and billions” flood in from a broader federal defence spend-ing package. The new work coming to South Australia,” he said, referring to SA also securing a contract beyond 2026 for extensions and maintenance of the existing six Collins Class submarines.

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***“I don't spend my time pontificating about high-concept things; I spend my time solving engineering and manufacturing problems.”—Elon Musk***

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### WA Division-David Karr(CP Eng, FIIEA)-acting

This year was a busy one for the WA division. An onsite visit to Roy Hill, 3 webinars as well as the annual BBQ.

The WA division will be presenting another in the Future of Work(FOW) series with Konica Minolta in November.

In October the WA division will be undertaking the annual WA BBQ at David Karr's estate.



This event promotes friendships within the F2F social atmosphere.

Finally I would like to thank Bob Watson for his many decades of devoted service to the WA division as well as on the Federal Council.



[Did you know.....](#)

[RETURN TO INDEX](#)

#### Windows 10



##### Enhanced Windows Search-

Settings > Search > Searching Windows. Set search to Classic

##### Silence Notifications With Focus Assist-

Settings > System > Focus Assist

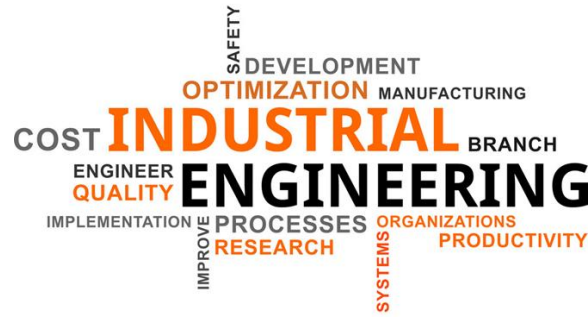
#### Web



**Ctrl+X**-Cut the selected text

**Ctrl+H**-View your browsing history

**Ctrl+R**-Reload current page



Article Submitted by Graham Eagles(MIIEA)

## **THE FUTURE IS BRIGHT FOR INDUSTRIAL ENGINEERS**

Current and new Industrial engineers (IEs) entering or working within enterprises today are in a rapidly evolving and interesting situation because of the global and domestic challenges being placed on organisations to improve and transform.

These competitive challenges when combined with the advance-ment in technology, prevalence of automation and the ease at which we can gain technical information has changed the land-scape of industry, services and manufacturing. This also leads to re-shaping industrial engineering into areas where previous generations have not had to face.

Previously we had major changes during the industrial revolution, scientific work design, total quality Management, the Toyota pro-duction system and now we are entering a very new phase. All past evolutions in industrial engineering still apply, and to a large extent are still alive and present in daily work, however these new advancements are reshaping the role of Industrial Engineering, Industrial Engineers and consequently the skill sets that IE's require will be more challenging.

Additionally, computer simulation and work analysis tools are now readily available at much lower costs enabling assessment of most effective work design ideas. Automation, logic control, data man-agreement, performance reporting and robotics work around the clock, delivering consistency, faster and data in real time, becoming more flexible to changing demands of customers.

The global economy is becoming more information based, relying less on our raw materials and more on what we can do with these materials. These changes can be intimidating as they present a challenge to our knowledge and experience. The shift required is mostly how we interact with emerging technology and how we can adopt the required skill sets. The analysis of the huge amount of in-formation being captured around the current state of work to im-prove decision making and redesigning processes is a major step forward for industrial engineers. We must continue to learn and work with our educators to maintain alignment with the emerging enterprise and industrial engineering challenges ahead.

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[RETURN TO INDEX](#)

## INDUSTRIAL ENGINEERING APPROACH IN EDUCATION TECHNOLOGY (LEARNING ENGINEERING) DEVELOPMENT PROCESS

by Mohan Ganavarapu(MIIEA)

It is already proven that industrial engineering approach treats software development as a process distinct from its unique application to any specific project. Its essential elements include formal process of defining, requirements engineering, software measurement, process engineering, and quality control.



Generations of technology redefining the application of engineering in various industry sectors. Often, we see a group of people set together with specialist knowledge in engineering, technology and business process to analyse and design a specific product or project. It is same in EdTech (Educational Technology) industry, EdTech is an interdisciplinary field which requires expertise from Learning Engineering, User Experience, Pedagogical Engineering, Product Design, Software Engineering, Artificial intelligence, and Quality Control. The whole process with high degree of complexity, the biggest challenge is to achieve all project goals within the given constraints. The below is an illustration shows the various expertise to develop an EdTech product or project.

Education Technology and Learning Engineering Core Knowledge

Source: IEEE ICICLE Design SIG

It is very similar like any other information technology to manufacturing environments and software development process with multiple domains integration. To be effective with a new technology must be integrated into an underlying process. That process must be managed explicitly. Industrial engineering approaches are comprehensive solutions to deal with the complex process in the EdTech product development, application of industrial engineering techniques and approach provides the product developers with a long-term plan for improving quality. Such techniques and approaches include:

- Evaluation and reviewing the schedules of development process
- Re-design and streamlining activities, removal of non-value adding tasks
- Identifying the needs and requirements as accurately as possible
- Apprehending the team about changes in certain tools and functions
- Presenting and discussing the opportunities for increasing the quality
- Evaluation of changes made earlier during other projects development

It is possible to makes the things happen in much better way with the approaches and techniques of industrial engineering in the development of education technology and its products.

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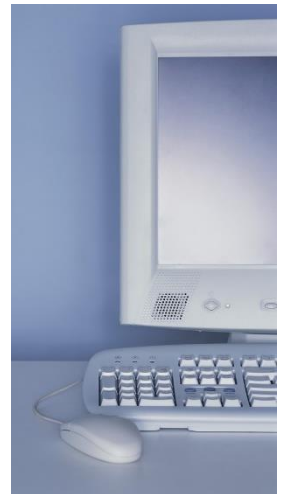
[RETURN TO INDEX](#)



## **ADVANCEMENT OF INDUSTRIAL ENGINEERING**-Submitted by Graham Eagles

Advances in Industrial Engineering and Management aim to serve as a vehicle for publishing original research in the field of industrial engineering and management. The papers of interest are all aspects of industrial engineering and management science. It includes Production Logistics System, Industrial De-sign, Data Mining Technology and Application, Decision Sup-port System and Models, Computer-aided Design and Intelli-gent Manufacturing, Human Reliability Analysis, Distributed Problem Solving, Vendor Man-aged Inventory (VMI), Man-Machine-Environment System, Systems Modelling and Simulation, Systems Safety and pre-Warning, Innovation and Entrepreneurship, Quality Control and Management, Decision Analysis, Production Planning, Project and Quality Management, Safety, Reliability and Risk Management, Supply Chain Management and Modelling as well as other related fields. It provides an international forum for the dissemination of research.  
Editor-in-Chief: Dr. Liu Zhenling

<http://system.sciencealerts.org/index.php/public/login>



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[RETURN TO INDEX](#)

# THE FUTURE OF WORK FROM AN INDUSTRIAL ENGINEER'S PRACTICAL PERSPECTIVE

By DAVID KARR (CP Eng, FIEEA)



Definitions:

**Future**-upcoming period which could be in a time frame covering anywhere from 5 years to 50 years, with a focus on 25 years.

**Work**-from an physics perspective-Work, is a measure of energy transfer that occurs when an object is moved over a distance by an external force at least part of which is applied in the direction of the displacement.(Encyclopedia Britannica)

Or another way, work occurs at a location or place of where endeavours are undertaken for gainful employment, home activities or other desired outcomes.

This paper looks at where work could possible evolve to from a practical Industrial Engineering (IE) perspective .

With the impact of Covid19, over the past 2 years, the way we look at work, where it is performed etc, has changed dramatically.

Historically work was carried by manual effort, but over time personkind has endeavoured to reduce the labour intensity by innovating devices and exploiting animals or other human beings.

Since the 18<sup>th</sup> century with the birth of the original Industrial Revolution, machines have taken a large amount of the manual load(although creating other challenges).

With the advent of the ability to harness the power of electricity, innovation has occurred in vastly exponentially increasing surges, to modify the way work is undertaken. For example one of the basic undertakings of personkind when we became settled, was the need to produce food.



Thus we have gone from digging holes in the ground to plant seeds, to having huge agricultural machines(combine harvesters for example), that can be preprogramed to follow a pre set pathway utilising GPS. Also this equipment does not need to be staffed for most of its activity.

With the rise of the fourth industrial revolution through the convergence of digital, biological, and physical innovations(Ref Encyclopedia Britannica), there is the emergence of "thinking" machines(Artificial Intelligence). This would reduce the need to have the person to system interface in the longer term. For example in the case of intelligent roads, a traffic control system that provides real time optimal alternate routes.

As an Industrial Engineer, systems and process are considered with an holistic approach. Thus the link between people, information, equipment, finances energy, safety and the environment are considered when undertaking processes.

Over the millennia of recorded history, personkind has progressed from manual operations to now being able to rely on technology to make "intelligent" decisions. This has had a profound effect of the way work and employment methodologies have evolved.

Manual→Device assisted/Animal→wind/waterpower→steam power→electrical→digital→AI→??

Intelligent information in a digital form is rapidly replacing and adapting many of the employment activities and processes that have been undertaken.

Examples include (but definitely NOT limited to):-

## **Agriculture**

manual sowing of seeds→basic use of tools→irrigation→use of animals to assist→introduction of more advanced animal drawn equipment→mechanised equipment(steam/chemical powered)→use of chemicals→advanced mechanised multipurpose equipment→high yield food varieties→use of digital information to optimise operations→automated equipment→use of UAVs(drones) (multispectral photogrammetry etc)→autonomised equipment

From 1 farmer producing food for 1.1 people to a ratio of over 1:150 people

## **Air Travel**

Gone are the days of phoning up or going to a travel agency and making a booking by another phone call or referring to a rudimentary ticketing system.

Nowadays one can go "online" select the optimal flight with reference to cost, time, route, number of stops. Then one can pre check in, select a seat and even obtain an eboarding pass. The physical component of checking in the bag is undertaken by the passenger and loaded onto the conveyor belt.

The only staffing component in the main, is to answer or sort out any queries. Another benefit is the travel planning process is available 24/7 365 days a year. From the point of view of travel industry, staffing levels are drastically reduced from the landside point of view.

(Ref <https://insight.futurestudents.csu.edu.au/work-beyond-2020-future-agriculture/>)

## **Manufacture**

This is the traditional core of the impact of innovation and technology on work in this area. There have been massive changes from having 100's or 1000's of employees toiling away at monotonous productivity driven work to semi and automated manufacturing processes.

The impact of automated robots undertaking tasks that replaced employees or the lack of employees(Japan), is becoming more prevalent.

Autonomation will be more and more prevalent in the near future.

## **Medical Research**

The traditional process of undertaking endless experiments taking years and costing tens of millions of dollars, will be replaced eventually by undertaking millions of cyber experiments utilising quantum computing.

## **Software Development**

The conventional method of developing applications by utilising traditional coding will be augmented and eventually superseded by artificial intelligence systems. By utilising AI and quantum computing , massive amounts of coding will be generated from existing and "cloned" software

## **Autonomous Vehicles and systems**

The advent of digitalisation and miniaturisation, has allowed for devices to be made smaller and have extremely powerful data processing capability(mobile phones). This will lead directly to systems that are more compact but also cheap.

The effect of electric private vehicles that are autonomous, will have one of the most influential impacts on modern day living. The concept of vehicle ownership will be reduced dramatically. It will be replaced by the need for transportation from place to place on demand. The situation of having vehicles sitting in a garage for most of the time(and the inherent costs), will be supplanted by affordable, safe transport on demand.

The massive impact on car manufacturing will be reduced dramatically.

## **Astronomy**

The Square Kilometre Array(SKA) telescope project will generate more data per day than the entire internet. This will result in massive data storage and data processing requirements. The applications, equipment etc will need to be innovated, manufactured, skills generated to operate this massive project

## **Delivery of Tertiary Education**

Education has moved from the traditional lecturer(teacher) student face to face classroom delivery method following a prescribed syllabus, to one whereby the delivery can be online or remote.

Due to the specific skillsets that companies(eg Woodside) require, the need for customary qualification is evolving. Companies will now determine their skillset requirements, and then choose to either to get their employees trained in certain specialties or disciplines or develop their own curricula. This will impact on the tertiary training institutions and the qualifications they deliver.

The above assessment can also be applied to below to name a few scenarios with respect to the future of work:-

- Finances
- Travel
- Education delivery especially at tertiary level-company specific skills
- House cleaning
- Flying aircraft
- Collecting, collating, analysing outputting data and the leveraging of this data
- Additive manufacturing
- Energy Storage

So where to next especially in light of the impact of Covid19:-

Impact of Intelligent information, Intelligent machines, robots, Quantum Computing , autonomous systems, different modes of manufacture, all within the impact of climate change.

The impact of confluence of technologies will also impact further the convergence of work. From truck driver to remote autonomous vehicle operator 2000km from the physical workplace to observing the universe.

[RETURN TO INDEX](#)

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## CURTIN UNIVERSITY IE STUDENT PRESENTATION

By DAVID KARR(CP Eng, FIEA)

On 15<sup>th</sup> September, the IEA participated in the 2<sup>nd</sup> Curtin University IE Student IE Student Presentation.

Over 50 first year Engineering students together with 2<sup>nd</sup> and 3<sup>rd</sup> year IE students attended.

The evening was introduced by Head of IE Program Associate Professor Dr Pawel Podsiadlo.

This was followed by 3 IE presentations



David Karr-Introduction to IE

Francis Hiew-Operations Excellence in the Aerospace Industry

Cameron Mackenzie-Working Experience in the Gas Industry

The IE presentation promoted IE to Curtin University students. During the after event socialising, a large amount of interest was shown by the students. One point was the interest students showed in further study in a Masters in Industrial Engineering. (Curtin has a MSc in IE but this degree is science based and NOT recognised by EA)

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### CUTTING EDGE PROJECT MANAGEMENT-CRITICAL CHAIN-Lewis Trigger



An interesting and educating webinar on Cutting Edge Project Management, was presented by Lewis Trigger, in co-operation with the University of South Australia(UniSA)

The topic focused on optimising projects highlighting the various challenges encountered. Participants benefitted from the 2<sup>nd</sup> presentation by Lewis.

A link to the presentation can be found at

<http://iie.com.au/events/iiea-slides-critical-chain-unisa/>

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[RETURN TO INDEX](#)