2021 IChemE Presidential Address

IChemE: Relevant in a changing World

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I deem it a special honour and a privilege to have this opportunity to serve this great institution, our IChemE. I accept this honour with humility.

I am proud to be the 80th President and the third female President – I note with some satisfaction that the time between female presidents is decreasing. It is particularly satisfying to lead our Institution into our centenary year as the first President elected by a popular vote of members.

As I have not had the opportunity to personally meet many of you, the first part of my address will be a reflection on aspects of my professional journey and will highlight some of the changes that have shaped me, other chemical engineers and our profession.

The second part of my address will touch on challenges and opportunities facing IChemE as we approach the 100-year anniversary of our founding and continue to deliver on our goals set out in strategy 2024.

I see my presidency as an opportunity for IChemE to reflect, review, reinforce and re-energise in times of change, challenge and opportunity, and, after 100 years, to answer the question “is IChemE relevant in changing times?”.

Only yesterday, members voted to update the inspiring words that are set out as our Institution’s Objects in our Royal Charter. These amendments will ensure that IChemE remains relevant, contemporary and aligned with its Royal Charter. Support for these amendments has already been granted by the Engineering Council. They will now be submitted to the Privy Council Office to obtain final approval from Her Majesty, The Queen.

The amended objects will reflect that IChemE has broadened its portfolio of activity since its Royal Charter was first granted in 1957, particularly in areas such as process safety. The amendments will also ensure that the objects clearly reflect the role of chemical engineers in addressing global challenges, especially sustainability, and promote responsible and sustainable action that is both collective and enduring.

I graduated with a Bachelor of Chemical and Materials Engineering from Auckland University in an era of bad hair and poor fashion. This is more or less our final professional year, yes there are not many of us, yes only one female. More important than what you can see in the picture is our collaboration, cooperation and mutual

support - we worked as a team and I am deeply appreciative. To put our chemical engineering year group into context, of the 200 engineers who graduated across all engineering disciplines at Auckland University that year - only 3, or 1.5% were female. Today most Chemical Engineering programs consistently have over 26% female participation.

As a profession we have come a long way:

The trend in numbers is also clear: this UK data is also reflected in other countries. with universities producing many more chemical engineers (along with many more graduates across most disciplines).

Positive and supportive job opportunities for graduates, ideally as part of a graduate program are essential to the future of our profession. I am not confident that the trends in graduate opportunities have followed growth in graduates which lag these numbers by 4 to 5 years. My understanding is that many companies have cut back on their graduate intakes this year – but this may be a somewhat limited view from here in Western Australia, it may be different elsewhere.

I am concerned that it will be harder than usual for many graduates to gain employment that uses and values the Chemical Engineering degree that has taken significant personal commitment of time, talent and treasure. University education is no longer essentially free.

Availability of graduate jobs varies each year. Part of the answer may reveal itself in smaller organisations realising the value of the skills embedded in a Chemical Engineer and taking on graduates. There is a difference between a job for a graduate (where the goal is to get the work done) and a position in a graduate program which seeks to develop professional skills, judgement and decision making alongside getting a job done. Smaller organisations are less likely to have the resources to offer the experience and training of a graduate program – there may be opportunities for IChemE to bridge this gap.

As a graduate I moved to Australia and joined an oil and gas company who offered a great graduate program and, as I discovered later, were a leader in recruitment of female engineers. Occasionally they fell short of their aspiration to provide a supportive work environment for all engineers, but their intentions were good, they responded to feedback and were heading in a positive direction.

The picture shows some “norms” of the time that are no longer acceptable:

- Personal protective equipment - today hearing protection, eye protection, gloves are mandatory …. Coveralls and jackets are “high vis” with reflective panels
- Almost no manual handling - technology has taken over the hard physical work – the physics and geology of drilling have not changed
- Analogue gauges have been replaced by a myriad of screens, lights, digital information. More data but the basic physics of the system are the same

Life-long learning is a personal credo. Here in IChemE we call it many things including Initial Professional Development and Continuous Professional Development. It is embedded in the DNA of our Special Interest Groups and Member Groups. Professional development is an ongoing journey – becoming qualified or getting chartered marks a level of achievement, not the end destination.

My journey has taken me from my Chemical Engineering qualifications and experience to a Master of Environmental Studies (University of Tasmania) and a Master of Business Administration from Heriot Watt University, and AICD's Company Directors Course as well as numerous professional, leadership and management short courses along the way.

Paralleling my learning journey have been career moves from the Oil and Gas sector to a self-employed consultant, back to oil and gas and resources / mining more generally, out to superannuation (aka pension funds) and back to oil and gas before becoming CEO of a regulator, the National Offshore Petroleum Safety and Environmental Management Authority known as NOPSEMA. I am now an Independent Director.

Early in my career I was active in IChemE, and other professional bodies, but unfortunately due to time, job changes, relocations and circumstance my enthusiasm and memberships both lapsed. Since re-joining IChemE, I have wondered whether my enthusiasm and contribution would have continued for longer if I was earlier in my career today?

Member opportunities today are not constrained by geography thanks to technology and some of the changes accelerated by COVID. IChemE has taken rapid steps towards its goal of being an institution for all, servicing its membership 365 days a year, 24/7, either directly or through its partners, wherever there is a connection to the internet.

Technology enables today's member to participate in a number of member groups or special interest groups to find one (or more) where they feel that they belong. Members who live away from the major (IChemE) population centres can enjoy the opportunities offered by IChemE and contribute as a volunteer more easily than ever. Our member communications will continue to publicise events and activities organised by member groups, branches, special interest groups which are open to all members.

Early in my career I didn't fully appreciate the significance of a chartered qualification. It provides recognition that you have satisfied your assessors, at independent review, that you are able to perform your duties in a professional, skilled and diligent manner.

In many countries, the engineering profession is self-regulated (i.e. not underpinned by statute). The lack of statute, in particular relating to protection of "engineering" title, means that any person who carries out an activity associated with engineering

occupations may style themselves ‘engineer’ regardless of their education or verifiable level of skill. Those who join a professional body, submit themselves for professional competence assessment by their peers, and subject themselves to a code of ethical conduct, are setting themselves apart. The commitment includes ensuring that they only practice in areas where they are competent and that they will ensure that they maintain their competence on an ongoing basis (CPD).

In summary, any person can say that they are an engineer, but only professionals go the extra mile and make a public commitment to uphold professional standards of competence and ethical conduct.

These individuals deserve to be recognised with a chartered status.

Whilst change is a hallmark of every aspect of our society and the environment where chemical engineers do their work, there are three particular areas of change that I would like to highlight together with a note of caution:

- Technology
- Systems Thinking, and
- Regulation

Technology has become the key enabler for society. The technology that chemical engineers use to do their work, has changed rapidly.

The slide rule in this photo was used more than once during my time at university, let’s just say any relief brought by the advent of computers was short lived.

Mark-sense or punch cards, neatly held together by a rubber band, were taken to the computer centre in the afternoon only to collect the print-out the following morning …. invariably there was an error so it hadn’t run.

Becoming a graduate and starting at my first job brought the delights of an IBM terminal on a desk linked by wires back to its brain in the form of a mainframe computer. Since then, we have all become familiar with the myriad of devices, software, apps that are intended to make our lives as engineers more straightforward.

As technology becomes more sophisticated, it brings with it risk as well as a tremendous upside, as we are able to shift our time and effort from handling data and calculations to generating information and drawing insights to inform decision making. Innovation has given us fabulous tools they can also mask our understanding of what is really going on. If bad things can happen when technology fails, or is compromised by cyber criminals, back-up systems must function in time to prevent disaster.

In high tempo flight operations on a sophisticated modern aircraft carrier, there is a constant flow of information. Every safety-critical activity is monitored. Layers of protection are designed to assure that any critical element that is out of place will be

noticed by *someone* before it causes problems. Visual checks and cross checks by human spotters provide the final assurance before the command to land / take off.

Advanced technology monitors the status and location of all aircraft on the deck and in the hanger below. Fail safe redundancy comes in the form of a physical model, watched and kept up to date by a team of people, in real time, in case technology fails.

As chemical engineers our thinking is continuously evolving. In his Presidential Address our immediate Past President, Stephen Richardson, highlighted the importance of systems thinking.

Before systems thinking there was a collection of knowledge but without a connecting framework. Elements of process safety were being taught as a range of techniques with no overarching scheme pre-1974 (and hence pre-Flixborough) which is often thought of the birth of process safety.

The Flixborough disaster was immediately followed by the Health & Safety at Work Act, which led to a sea-change in safety thinking, a new regulator, the Health & Safety Executive and the systematising of safety regulation

The result was that chemical engineers got into systems thinking early because they had to. IChemE got on board quickly too.

Others also do systems thinking - electrical engineers and computing engineers amongst them. But the question is: what is the system that they consider? The boundary of a computer system or an electrical network is fairly easy to define. As the results of chemical engineers getting it wrong affect much more than just their plant but also everyone and everything close by, they simply had to think bigger.

Now that we need to address climate change and sustainability, we have to think very big indeed.

These systems will almost certainly get even bigger as governments, insurers and the general public take more interest in what companies do - and what they will permit. Concerns about finite resources prompted development of concepts and tools such as life cycle analysis (LCA) which will become increasingly important. Life cycle analysis is tricky, and to do it well involves correctly defining the boundaries of the system and relevant, not theoretical, data inputs. My note of caution here is to think big enough and not just blindly follow the book

Expanding community and government concerns beyond the boundaries of the immediate activity is shifting expectations that companies and organisations consider their contribution to the 17 United Nations Sustainable Development Goals in addition to their contribution to greenhouse gas emissions directly linked to climate change. To remain relevant, Chemical Engineers need to expand their thinking beyond the immediate business cases for emissions reduction, opportunities to improve resource and energy efficiency and those involving water conservation. Whilst it can be difficult to make a commercial business case for activities that

contribute to the remainder of the UN Sustainable Development Goals, Chemical Engineers need to develop the skills to consider and contribute to decisions. Governments will step in and make the case through legislation where companies are not acting quickly enough. IChemE has a vital role to play in developing the skills knowledge of members to help bridge any gaps in skills and knowledge. Thanks to a very generous donation from Ian Shott, a Past President of the Institution, a project has commenced to help build our sustainability skills and knowledge.

Regulations and regulators are also evolving.

Unfortunately changes to regulators and regulations are usually written in blood. There is an (unwritten) change process. Initiated by a major accident, followed by an inquiry which usually reaffirms there are no new accidents, only repeats of prior accidents unravelling in a slightly different way. Recommendations usually point to a series of failings by the operator, flaws in the regulations and a regulator who had insufficient power, expertise or resources to regulate risk and keep the operator in check. The end result is invariably restructure for the regulator and new or strengthened regulations.

For example, Lord Cullen's report into Piper Alpha highlighted the weaknesses of the prescriptive or rules based regulatory regime of the time: to be effective, rules in a prescriptive regime must be both sufficient, correct, up to date, and enforced. Lord Cullen highlighted that responsibility for risk and maintaining safety should be with those best placed to manage risk - the operator of the facility. The role of the regulator was to provide assurance to governments and the community that the operator doing what they said they would do to manage risk to as low as reasonably practical.

Lord Cullen's key recommendations triggered an evolution of safety regulation, from prescriptive, or rules-based where the regulator sets the standards for operators, to goal setting where the regulator establishes the level of risk – often "as low as reasonably practical" or ALARP. Regulation governing well integrity and environmental management generally remained compartmentalised and more prescriptive.

Some jurisdictions, like Australia, followed the goal setting model with; regulatory effort focused on developing a risk- or hazard-management framework; a requirement to make the (safety) case to the regulator; a competent and independent regulator; workforce involvement; and a general duty of care imposed on the operator (to maintain safe systems of work).

However, unfortunately these changes were not sufficient to prevent further major accident events. In the case of the Montara spill and subsequent fire, in northern Australia, a key cause was loss of well integrity which at the time fell under different legislation and a different regulator to the safety of the facility.

The Montara oil spill which continued for 75 days and subsequent fire resulted in the West Atlas jack drill rig melting over the Montara wellhead platform. Fortunately, no one was injured …. But had circumstances been slightly different the outcome may have been catastrophic.

As expected, the pattern repeated, following the Montara inquiry. Well integrity and environment management of the offshore oil and gas industry became the responsibility of the Federal government's safety regulator, NOPSA renamed NOPSEMA.

New regulations were now goal setting for both well integrity and environmental management. Operators now had to make the case that risks to well integrity were as low as reasonably practical and that actionable plans were in place to respond in the event of an emergency. For the environment, a two-tier test was applied impacts to the environment had to be acceptable and risk had to be as low as reasonably practical.

In practice the regulator remained internally siloed with specialists focusing on safety, environment management and for drilling operations well integrity.

Five years later experience has shown that there may be a better way. NOPSEMA has stated that it is moving to Integrated Regulation. It is notable that this was not triggered by a major accident but by the regulator seeking both better regulatory outcomes and reduced risk. Integrated regulation aims to consider a broader set of risk factors and an asset or activity-based approach that incorporates the expertise of specialists in occupational health and safety, environmental management, well integrity and oil spill risk.

This holistic approach to compliance monitoring should allow better targeting of the most pressing risks and provide inspectors with a fuller picture of compliance issues to further enhance regulatory outcomes. This is an example of a regulator, in this case NOSPEMA, adopting systems thinking to drive better regulatory outcomes. If successful I am sure this model will be followed by others.

What chemical engineers do is help large (and not so large) companies and organisations solve difficult problems. Our systems thinking is a powerful tool, if we apply it to the right system. In the words of Roland Clift – "chemical engineers need to be able to work under uncertainty – to take decisions despite incomplete data". Our focus should be to design the reactor or the facility that is resistant to both short and long term change within the system. Chemical engineers should identify and communicate the answer that is least likely to be wrong over the life of the decision, given the range of uncertainty about the future.

Turning now to IChemE as we approach our 100 year celebration.

First let me acknowledge the challenges the global community has faced as a result of the COVID 19 pandemic. Whilst our experiences of COVID 19 have been very different depending on where we are, we have been united by concern, fear and

apprehension as the disease impacted communities across the globe. Whilst our experience may differ agility, resilience and trust have served IChemE and each of us individually. Looking back, had IChemE not invested heavily in IT systems over recent years, our ability to pivot to the digital delivery of services to members and remote working would not have been possible.

I have chosen to deliver my presidential address live here in Perth (where distance, space and hard borders have protected us (so far) from the worst of the pandemic) to send a message that there are opportunities to do things differently, as we adapt to a “new normal” - even the presidential address can be outside London or Rugby.

I see the way forward for IChemE is essentially more of the same, following the roadmap set out in strategy 2024.

We have already made significant progress towards our vision - led by members, supporting members, serving society.

Our Board of Trustees, including the President is now elected by members and has the responsibility and powers to lead our organisation. Therefore, we are led by members. As a result we likely will not please all members all of the time as our remit is to act in the interests of the organisation and the membership as a whole (and not in the interests of individual members of subgroups).

We have made significant steps towards delivering value and supporting members through a digitally connected institution – Digital IChemE – which allowed us to support members through COVID 19. This work has already resulted in the Loss Prevention Bulletin being made available to all members free of charge. Our knowledge hub, and the new application portal have been launched, with more to come to enhance our individual case procedure and other core services.

In our mission to serve society, such a critical part of our Royal Charter, our Learned Society has selected three priority topics on which to prioritise activity; responsible production, major hazards management and digitalisation. Initiatives in these areas are ongoing to meet targets by the close of 2024.

Following the launch of IChemE’s position on climate change in 2020, a key deliverable highlighted within the priority topics plans for 2021 includes climate change action plans for specific industry sectors and technologies. These plans are being developed by the institution’s special interest groups and coordinated by the Learned Society Committee.

Looking at how we achieve our aims and objectives, I want to refer to IChemE’s ‘Strategy 2024’ which is IChemE’s road map. As you are aware the strategy, launched in 2019, has four main aims which align our activity.

IChemE will realise our vision when we achieve these aims:

- We are respected for our professionalism and technical competence;

- We are recognised as a vibrant learned society that materially impacts on the Global Grand Challenges;
- We are acknowledged as a peer-group leader in which an engaged membership receives and adds value;

and:

- We are known as a high-performing organisation delivering significant value.

Significant progress has been made over the last two years, with realignments made where necessary, but I am very much looking forward to overseeing continual progress towards our goal.

What might prevent us from achieving our goal?

Let us pause and reflect on risks to IChemE both to the implementation of strategy 2024 and to the long-term sustainability of the Institution. There is a tendency in this type of presentation to focus on the bright future but as a former regulator I tend to go back to risk. Some might say once a regulator, always a regulator. We must be alert and keep our eyes on the ball. Should members, or the wider community, no longer value our Chartered status, IChemE would experience increases in members leaving, decreases in members joining and the start of a slide to becoming a competitor of online education providers rather than a Professional Engineering Institution.

We have a challenge to keep members happy but not at expense of the Institution and the collective membership. Across our 33,000 plus membership there are diverse interests and increasing calls to “speak out on this”, “contribute to that”. IChemE has limited resources and we must use the time, talent and treasure of our members wisely. I encourage those who are passionate and pushing IChemE to become an advocate for their area of interest to consider whether IChemE getting involved will influence the outcome or would we simply be talking for the sake of talking. More concisely – IChemE should focus on our (limited) sphere of influence rather than our (broader) sphere of interests.

My focus for the Institution during my presidency is strongly aligned to my predecessor’s.

Let’s celebrate our centenary in 2022 as we work better together to prepare for the next 100 years. I would like to see us continuing to value members, membership and chartered status so that non-members say, “Why not IChemE?”. We must recognise our contribution to society, continue to be a leading voice in process safety and offer more support to provide skills and knowledge to equip members to help contribute to the challenges of climate change and sustainability so that IChemE remains relevant.

How we work is important. Working better together is essential – there are three things that I will focus on.

Ethics

Our development as chemical engineers includes a strong focus on technical competence. While ethical issues are increasingly discussed during education and training, there is scope for more discussion, at all points of our professional journey, around judgement, ethical decision-making, dealing with uncertainty and how we engage with society. Embedding ethical culture in the chemical engineering profession would embrace other important professional behaviours such as operating sustainably, inclusively and with respect for diverse views. Greater visibility of an ethical engineering culture to the whole of society would help to ensure that engineers retain society's trust.

Respect

There are opportunities and challenges of representing a diverse community with differing views. The loudest voice is not always the one that is listened to and we all need to respect decisions though elected officers as member led.

Inclusivity

IChemE seeks equality, diversity and always inclusivity. But this means different things to different people, so we need to work together to help each other understand the needs of others and accept that IChemE may not be able to meet everyone's expectations. We each have a responsibility to "throw the rope down", to help others join in, to ensure all participants have an opportunity to contribute, to think broadly when putting forward names. We should put all opportunities on the volunteer page on the website, encourage others to view it and put themselves forward. Renewal is critical, perhaps those who have held positions on the same committee for a long time might consider letting go and trying something new when their term is complete, allowing room for other members to step up to fill their place.

As we contemplate celebrating our first 100 years and preparing for the next, I thought I would share the ethos that is embedded in the President's medallion,

The crest on the medallion is the original seal of the Institution dating back to 1923. It was designed by Edith Hinchley (wife of J W Hinchley, one of the founders of the Institution). It represents the emblematic watering of the Tree of Knowledge from the Fountains of Chemistry and Engineering.

For an audience of engineers, in 1929, Hinchley was explicit about the engineering connections:

> ..."Chemical engineering is that branch of engineering which is concerned with processes and plant in which chemical or physical changes are the principal features. A chemical engineer is therefore essentially an engineer with a knowledge of fundamental science, and a special knowledge and experience of those processes which are carried out on a large scale in the manufacture of chemical and technical products. Since these processes cannot be carried out unless

a commercial profit is obtained, the chemical engineer must possess a knowledge of industrial economics and factory management. “

If Hinchley were speaking today, I suspect that he would explain that since these processes are not carried out in a vacuum, an engineer must possess knowledge of systems thinking, process safety and lifecycle analysis.

I started preparing my address with a question:

“Is IChemE still relevant?

Expectations of Governments and communities for professionals to have and adhere to professional standards are increasing. IChemE’s role as the internationally recognised qualifying body and learned society for chemical, biochemical and process engineers is more important than ever, especially when things go wrong.

The IChemE community provides opportunity to access and contribute to the expertise, resources, and international reach of IChemE’s members and staff who are working together to:

- set and uphold professional standards that underpin our qualifications, which in turn protect the public. Done well, this will we help attract, develop and mentor the next generation of chemical engineers.
- share specialist knowledge and good practice to support continuous personal and professional development and help advance the future of the profession.
- facilitate networking opportunities between members, from both inside and outside our own sector and geographic location
- provide opportunities for members to contribute to and help shape our response to the global grand challenges and advance the contribution of chemical engineering for the benefit of society

IChemE is relevant in times of change.

As your President I will be working to ensure that IChemE continues to adapt and respond to the opportunities and challenges presented by our changing world.

However, even as President there is only so much that I can influence. Working together, as the IChemE community, we can achieve much more. Let’s all communicate the value, benefits and relevance of IChemE to colleagues, employers and our networks. As a result, employers may value membership and chartered status, non-members may join and current members may get more from their membership and consider volunteering.

Thank you.

I would like to thank and acknowledge the support of my family, especially my husband Brent, friends, colleagues and those who have helped me along the way, without your support I would not be here.