Continuity and Change – A History of The Future Of IChemE

Presidential Address by Dr. Andrew Jamieson OBE FREng FIChemE
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Ladies and gentlemen, friends and distinguished guests. I feel humbled and honoured to stand here before you this evening as the 75th president of the Institution of Chemical Engineers.

Now you may be forgiven for thinking there is something paradoxical in the title but all will become clear in the next couple of hours or so.

Our institution, IChemE, is dedicated to advancing chemical engineering worldwide and tonight I give you my firm commitment to continue this noble mission.

Today, the global community that is IChemE embraces some 42,000 members in 120 countries. Their needs and requirements are supported by a team of dedicated staff located in offices stretching from Wellington in New Zealand, via Melbourne, Australia, through Kuala Lumpur in Malaysia, Singapore and, of course, here in the UK .

For practical and logistical reasons, and indeed, the Institution's proud UK heritage, the centre of IChemE's operation has been located in Rugby for nearly 40 years.

At this point it is worth emphasizing that 'IChemE' is <u>not</u> in Rugby in the true sense. Rather, IChemE is located where ever our members find themselves. From Houston to Calgary, from Perth to Brisbane, from Cape Town to Lagos from Aberdeen to KL and Singapore.

Anywhere in fact that the chemical engineer deploys his or her skill to create value, and to secure and improve quality-of-life.

When you visit the Davis Building in Rugby, you can't miss the impressive wooden board that features prominently in the reception area.

There, in bold gold lettering, one finds the names of every IChemE past president stretching all the way back to our first president, Sir Arthur Duckham in 1922.

Now that my name has been added to the roll, I thought it would be insightful to use the first part of my address to explore, and comment upon, the origins of the Institution. For it is surely the case, that history rather than being a burden on the memory can be an inspiration to us all to strive to emulate the achievements of those originators of the Institution.

I will also shed a little light on my own involvement with our profession. And perhaps give you some insight into my own experiences and the way in which they connect with IChemE's historic and future trajectory.

As is traditional, I will conclude with some remarks concerning my ambitions for the next 12 months and how these will align with the strategic proposals being developed by Council as we look forward to celebrating the Institution's Centenary in 2022.

But let me return to the past presidents' board for a moment. What we see here encapsulates what I would describe as the continuity of the chemical engineering profession. From 1922, right through to the present day, the individual men - and more recently women - whose names appear in gold lettering are, or were, united by a common belief that the good design, construction and operation of chemical and process plants was vital to national economies, wealth creation, societal improvement and to the wider public interest.

That shared view of the early pioneers was fortified further by the conviction that the discipline needed an authoritative, credible and professional voice to make the case for chemical engineering's contribution to societal needs, a conviction I wholeheartedly share and support.

Chemical Engineers and the First World War

If one takes a closer look at the story behind the earliest names on the past presidents' board we find that direct wartime planning and organizational experience is a common

theme. Ten of the first sixteen presidents had wartime government experience in one form or other.

This institution was founded in the immediate aftermath of a time of the greatest global conflict the world had ever witnessed: war on an industrial scale. The professional experiences of my early predecessors in this role were forged in war. From the outset it seems, chemical engineers have been enlisted when faced with complex problems, grand challenges and clear and present danger.

This year marks the centenary of what was described by the Daily Mail as the "Great Shell Scandal" of the First World War, which led to the establishment of a Ministry of Munitions under the leadership of David Lloyd George.

Of course, looking through the lens of today, the scaling up of the supply of high explosives and propellants may not be regarded as the most honourable of genesis; indeed it is regrettable that our professional had a role in such colossal loss of life. However, in the context of the times it was a major achievement of a nascent chemical engineering profession. As a consequence, a momentum developed leading to a wider recognition of chemical engineering as a profession in its own right and the formation of IChemE in 1922.

This fascinating story has been recounted, by IChemE's former chief executive Dr. Trevor Evans.

His analysis, which represents an important addition to the history of World War I, is set out in a highly readable feature article in this month’s issue of *tce*. I commend it to you and I would like to offer a brief synopsis tonight.

It has always been the case that conflict accelerates the pace of technological development. The First World War was no exception with the development of aircraft, the tank and improvements to the internal combustion engine as well as new materials and major advances in agriculture and food production.

The chemical industry underwent massive expansion in response to the challenge of supplying upstream intermediates in the production chain for munitions.

Prior to 1914 the British chemical industry was heavily dependent on imports, not least from Germany, which was technically more advanced. The materials were often at the end of long supply chains from the British Empire and from South America.

To Britain's disadvantage, in 1909 Fritz Haber invented a route to ammonia production from hydrogen and nitrogen, and Haber’s invention was successfully scaled up by Carl Bosch before the outbreak of war.

The Haber-Bosch process is often cited as one of the greatest chemical engineering innovations in human history given its importance in the manufacture of fertilizer and its role in sustaining the world's population at current levels.

This was hardly the view of the British War Office in 1914.

At the outset of war, Prime Minister Asquith appointed Lord Kitchener to the War Office. Kitchener advised the cabinet that explosives and munitions would be required to prosecute the war on a scale not seen before in human history.

In classic British fashion an advisory committee on explosives was established under the chairmanship of a 70-year-old Law Lord, John Moulton. When in doubt, form a committee!

Nonetheless, Moulton's appointment proved an inspired choice. And thankfully for Britain, the committee’s life was short-lived. After 10 days of meetings Moulton submitted a report proposing that an executive should be established to "run explosives production for the nation".

Moulton and a small team set to work and the Explosives Supply Department (ESD) was born - with Moulton as its Director General.

An early decision was taken to concentrate on expanding production of the new and preferred high explosive, Trinitrotoluene - TNT. The limiting factor, however, was the availability of toluene, which had, up till that time, been produced from coal tar or petroleum from Borneo. It soon became clear that there was insufficient toluene to meet demand.

In response to this challenge, Moulton suggested a different approach and proposed that TNT be mixed with ammonium nitrate to produce a new hybrid explosive, 'Amatol'. Inevitably, and in again perhaps in classic British fashion, the generals objected. But necessity prevailed and the practicalities of winning a war trumped establishment politics.

But how could production be delivered on a scale sufficient to feed a World War? The answer was to scale up.

Now I don't need to tell you that scaling up is one of the fundamental things that chemical engineers do.

And so unsurprisingly, it was a chemical engineer who received the call and delivered.

Moulton enlisted a 36 year old self-taught, American chemical engineer who was the general manager at the De Beers Cape explosive company in South Africa.

Kenneth Bingham Quinan, or 'KBQ' as he was always known, had learned his chemical engineering from his uncle who had built an explosives factory some years previously.

A telegram was despatched on 19 December 1914 asking KBQ to join the Allied war effort and demonstrating a commendable sense of urgency he set sail for Britain on the very same day. He was both a brilliant organiser and a capable designer and the first TNT plant was built at Oldbury in the West Midlands in just 100 days. KBQ's planning was detailed with meticulous attention to material inputs and outputs, to heat transfer and to the utilities and services required to support production.

It was nothing short of a chemical engineering masterpiece and construction began on further plants in North Wales and on the Scottish border at Gretna.

These were the largest factories ever completed in Europe, producing hundreds of tonnes a week of TNT, nitrocellulose and the propellant, cordite. Operation commenced in early 1916 and the "Shell Scandal" was progressively overcome.

It's worth describing the scale of the sites that I am referring to here. At Queensferry in North Wales the workforce peaked at 7,000 of whom, 2,500 were female on a site occupying almost 300 acres.

At Gretna, two new towns were built. The factory itself stretched for 19 kilometres and the complex covered an area of nearly 9,000 acres. A new coal-fired power station was built and 16,500 workers were employed, of which 11,500 were women.

Interestingly and perhaps not surprisingly given the nature of the products, pubs and breweries in the neighbouring areas were nationalised and alcohol sales were curtailed. Occupational health proved a significant challenge as did safety. The safety record of KBQ's plants was impressive, certainly by the standards of the time; a tribute to his design and organisational skills. Officially, three deaths were recorded at the Gretna plant, although government secrecy may make this an underestimate.

By the end of World War One, 32 factories were under the direct control of the government's Explosive Supply Department, with a further 200 private sector operations working in accordance with government instruction.

KBQ and his team were intimately involved in all of these operations and many others overseeing the production and supply of ammonium nitrate, calcium nitrate, ammonium perchlorate, phenol, acetone, glycerol and industrial alcohols.

These early chemical engineers realised production and supply on a gigantic scale in a very short time period as this chart illustrates.

For his efforts in addressing the 'Shell Scandal', Moulton was recognised with a knighthood. Quinan was offered one also, but as an American citizen turned it down. He

was however included on the list of 17 names to be awarded the newly instituted Companion of Honour.

Chemical engineering was indeed special work and so it remains. But the description was rather obscure from the outset – a challenge that we still wrestle with today.

Trevor Evans sums up the collective treatments of Moulton, Quinan and their contemporaries rather nicely:

"Whilst perhaps properly, the greatest honour and collective memory falls to those at the front, at sea and in the air, it is not a claim too far, that without the contribution of those who turned around the manufacture of propellants and explosives in 1915, the war could not have been won. "

And so tonight, as we reflect on the achievements of our nascent profession in those turbulent times, it is appropriate to pause for a moment and remember those on all sides, military and civilian, who lost their lives in that "Great War" a century ago.

Pause

KBQ was a modest and understated character. He shunned publicity and was even ambivalent about the merits of 'advancing chemical engineering' as a profession. He returned to South Africa and to De Beers in 1919.

Nonetheless, his legacy was significant. He inspired a group of men, not least Lord Moulton, as to the importance of chemical engineering to the nation. He viewed his explosive department as a ‘great educational institution’ for those around him, and his design guides were subsequently published by William MacNab and Herbert Cremer as early teaching notes for chemical engineers.

During the latter part of the war, and with the increased visibility of chemical engineering, the Society of Chemical Industry established a chemical engineering group as a meeting point for discussion. McNabb and others began to explore the idea of a professional body

for chemical engineers in the image of the other engineering institutions that existed at that time.

The contribution of Moulton and KBQ and their contemporaries in the production and supply, of munitions, including McNabb, William Calder and Frederic Nathan was central, to the emergence of the Institution.

Moulton, in particular, was convinced of the importance of chemical engineering to British chemical industry, setting out the case in public lectures in Sheffield, University College London and elsewhere. He died in 1921, but a year later, in 1922 the embryo Institution of Chemical Engineers came into being.

The men and women described in this story serve as an inspiration to all of us and they are pivotal to the IChemE story as the president's board reveals.

Our first president was Sir Arthur Duckham who chaired the wartime industrial advisory committee to the Ministry of Munitions. His successor was Sir Frederick Nathan who had served as director of propellant supplies. Next came Calder who took over responsibility for KBQ's Oldbury factory.

They were followed by William MacNab in 1934, Herbert Levenstein in 1935, William Cullen in 1937 and Francis Heron Rogers in 1939. All were linked in some way to the Ministry of Munitions and the tackling of the 'Shell Scandal'. So as you can see continuity has been an important feature of this Institution from the outset.

The connection with KBQ continued after the Second World War, when Herbert Cremer was elected president in 1947 - the year of KBQ's death. Cremer had worked on TNT at several factories before serving as KBQ's executive assistant.

Finally, serving as President in 1951 and 1954, Sir Harold Hartley provided the last direct link back to KBQ in the Presidential succession, having worked with Quinan in the latter phases of the war.

The leadership of this new profession was forged in times of war. Their shared experience in the Ministry of Munitions forged a bond amongst a group of civilian engineers, which they took forward in their work to establish a new brand of engineering. Engineering that would shape much of the twentieth century in peace and, sadly in another world war.

They also forged our Institution, and as I remarked in my preamble, it is humbling to follow in their footsteps.

From Scotland to Nigeria In Football Boots

Now perhaps in the interests of context and continuity, it has become customary for the incoming president to share something of their own personal story from this platform.

My predecessor, Professor Geoff Maitland, was no exception. Those of you who were present for last year's annual general meeting will recall Geoff's fabulously entertaining address, in which oil and football featured strongly.

Geoff's beloved 'Potters' have enjoyed another successful season in the Premier league finishing in ninth spot after thrashing Liverpool 6-1 on the final day of the season.

The oil price has not fared so well; with Brent crude tumbling from just above $100/bbl when Geoff spoke to below $55/bbl at the beginning of the year. It has recovered at little to reach $65/bbl last week but the state of the market continues to dampen investment and employment prospects in many of the sectors where chemical engineering plays a key role.

Well, I am pleased to report continuity on both the football and oil fronts.

I started out on this journey as a fairly typical schoolboy in the early 1960s at Whitehill School in Glasgow.

I will profess that I was not a notable highflyer as my modest collection of grades attest. The distraction that I faced was a familiar and all consuming one - football.

But in contrast with my predecessor I wasn't sitting in the stands, cheering on my team, I was out there on the park.

And in 1964 I ran out for Glasgow Schools at Hampden Park against London Schools and it was an honourable draw - you chaps from Imperial don't get all the glory you know!

Geoff, put up a slide of Lionel Messi in a Barcelona shirt this time last year. Highlighting the fact that he shared the same sponsor.

Well let me tell you folks; this IChemE president actually played against Barcelona!

At 14 I signed with Queen's Park the oldest football club in Scotland and still fully amateur to this day. An ethos reflected in its motto, "Ludere Causa Ludendi" - To play for the sake of playing. I captained the youth side and it provided the opportunity to travel and kindle my interest in things international

In 1965 I travelled with the Queens Park team to Limoges in France to take part in an international youth tournament. Some of the big names in European football at that time were present including Borrusia Monchengladbach, St.Etienne and Hertha Berlin.

And on the 30th April 1965, this Glasgow schoolboy, who really ought to have been concentrating on his physics, chemistry and maths lined up against Barcelona.

Okay, it was the Barcelona youth team and we fought them to an honourable draw after extra time and penalties...

But what a fantastic experience for me and the dozens of other schoolboys who had travelled to France for the tournament. My international perspective started to take shape that night and it has remained with me ever since.

I had a great time with the Spiders as they are affectionately known. My football boots even took me on a summer tour to Nigeria in 1965, further opening my eyes to the world beyond Scotland and initiating my affection for the country that would prompt a return in a different guise some years later.

Despite the dedication to sport I managed to secure a place at Glasgow University and a wonderful opportunity to further my footballing interests.

My undergraduate time at Glasgow spanned the years 1966 to 1969 and I stuck around to complete my PhD in1972. It has been said that I was more interested in playing football than academic research, but that is not strictly true: I was much more interested in football, captaining the university, and Scottish Universities, winning the British Universities tournament on several occasions, and playing for British Universities for several years. Part of the drive to do research was to participate in the 1970 European Student games in Yugoslavia as one of only two university students: the rest were unbelievably good and fit PE college students, and we opened the tournament against the home side in front of 50,000 spectators, live on TV. We weren’t popular when we won 5-0.

But it wasn’t all glory as Glasgow University found out in 1969 when we won the Scottish Qualifying cup and then won our first round of the Scottish Cup. However we got a rude awakening in the next round with a 6-0 drubbing at the hands of Kilmarnock.

Finally on the football theme, on one notable occasion I turned out for Scottish Universities, and we travelled down to York to beat the 'auld enemy' 2-1.

The Telegraph reported

"Scotland's off the ball work proved a decisive factor, with the right half and Captain, Jamieson, a Scottish youth international particularly impressive..."

Though I should mention,

"But England were complaining bitterly at the end that they should've had two penalties in the last twenty minutes."

Some things never change

But given recent political developments north of the border, I think I'd better move on from such rivalries.

From Scotland to Nigeria (Take Two)

So what beckoned next for the chemical engineering right half from Whitehall Secondary School?

After completing my PhD and a short spell with Pilkington Glass, I joined Shell in 1974. This proved a career defining decision for the shell pecten was to feature on my business card for the next 35 years.

My early days were spent as a process engineer at the Shell Haven refinery on the north bank of the river Thames in Essex. Co-incidentally, the refinery owed its origins to the First World War, operations having begun in 1916 driven by the need to supply fuel to the Royal Navy.

My involvement with the refinery continued through to 1981 and then after a couple of years at Shell's central office in the Hague I returned for a two-year spell as the manufacturing manager for the complex.

Shell is a global company of course, and my career took me from the UK to the Netherlands, Denmark, and Australia (East and West coasts), in a variety of positions in refining, HR, planning, supply and trading and the upstream, before I returned to West Africa – minus football boots – to take up the role of managing director at Nigeria LNG Ltd.

This proved to be one of the most challenging, yet enjoyable periods of my career.

My passion for the country, first sparked during that visit with Queens Park football club over 30 years previously was rekindled despite the dire warnings of many about the difficulties of the country. Indeed there was huge scepticism that an LNG facility could ever be built there, and if it was built whether it would start up, and if it started up, whether it would operate reliably.

I arrived as the facility was entering the last stages of construction and it was subsequently completed on budget and schedule. The first two LNG “trains” were successfully commissioned and operated consistently and so successfully that more shipping was required to deliver the extra production.

During my time the facility was expanded to six trains, and an LPG and condensate production and export facility with the shipping fleet increased to 24 LNG export carriers. Today, the plant at Bonny Island has an LNG capacity of 22mtpa.

In 1970, as I was starting my PhD, the annual global LNG trade was 3bn cubic meters. It now exceeds 300bn cubic meters and most analysts project that the LNG market will be around 10% of the size of the crude oil market by 2030.

That's quite some growth. And I am proud to have participated in this phenomenon in Australia, Nigeria, the Netherlands and elsewhere.

As has been brought home to us recently, the oil and gas business is driven by economics and the bulk of chemical engineering activity around the world is driven by free-market imperatives and the need for share holder return, there are broader imperatives at play also.

I do not believe they are incompatible, nor does the Royal Charter of our Institution. Indeed, the Charter is quite clear on the matter. We are obliged to advance chemical engineering to the benefit of the community at large.

This obligation was not lost on me during my time in Nigeria where I sought to provide leadership for a range of community initiatives, including supply of power to local

communities of 50,000 people. But it was done in rational way. Making it completely free would drive undesirable and unintended consequences so a metered scheme was devised to provide a base amount of power for free, with the opportunity to purchase more power to run small business like welding shops, clothing production and fish freezing.

We also initiated microcredit schemes to support local businesses and build capacity in the country which has a troubled record when it comes to corruption and transparency. Indeed the President at the time told me I was mad and that, and I quote, “they will never pay you back”.

But rather than just simply throwing money at the project, we focussed first on capacity building for prospective borrowers and only then provided the loans: pleasingly repayments obligations ran at over 95%, which was ahead of our anticipated level of 90%. And I have to say that it was mostly the women who were the most active and the best credit risk. My partner, Pamela, in her book about her own adventures in Africa, titled one of her chapters, “What do the men do here?”

After 5 and a half years I left Nigeria as a proud honorary fellow of the Nigerian Society of Chemical Engineers and returned to the Netherlands for my third tour of duty there as EVP for Gas and Projects - so more LNG in Qatar, Sakhalin, Australia, coal gasification in China, GTL in Malaysia and Qatar.

It was an exciting time for technological and engineering game changers, in particular the development of floating LNG and the approval and construction of the huge Pearl GTL project in Qatar.

It was an exhilarating experience for an old process and project engineer like myself, to be involved in these projects and for young engineers starting out on their careers it was likewise.

Working and living in Africa can be a challenging affair and it could have been a different story for me without the support, guidance and encouragement of Pamela. Not only is

she an experienced Africa hand, she was courageous to start her own businesses in Nigeria. Now that is not a stroll in the park.

But Africa is the global economy's last economic frontier and we should not ignore it. My passion is undiminished. I want us to build on the excellent progress that IChemE has made already in South Africa and has commenced with our colleagues in the Nigerian Society of Engineers.

And it is my aim to use my experience and enthusiasm for Nigeria to explore avenues to advance our relationships with the Nigerian chemical engineering community.

I am keen to see the appointment of senior ambassadors in that country and I want to see what more can be done to develop IChemE's community in a country with huge potential.

And so I trust that you can see that there is continuity in my story that is intertwined with that of IChemE. After 35 years with Shell I am grateful for the wonderfully challenging jobs in diverse parts of the world and the opportunity to work with and befriend many great people.

Shell and IChemE - Continuity and Industry Partnership

But I'm not the first President with a Shell background to speak from this rostrum.

John Oriel was a Shell man who played a significant role in securing supplies of aviation fuel for the Royal Air Force in the Second World War. He oversaw the design, construction and operation of the refinery that produced 100 octane fuel that powered the Spitfires during the battle of Britain. John was President in 1955.

IChemE's first President from outside the UK [Build] was Han Hoog in 1969. Han spent his entire career at Shell, serving on the company board in the 1960s

[Build] Keith Walley was a Managing Director of Shell UK and Shell Chemicals. His name appears on the President's board in 1987.

In more recent times, we recall [Build] Richard Darton who worked for Shell in the Netherlands from 1975 before being seconded to set up a chemical engineering degree course at the University of Oxford in 1991. Richard was our President in 2008

And last, but certainly not least, we have my good friend and former colleague [Build] Greg Lewin who was the IChemE President in 2006. Greg coined the term 'boundaryless profession' to describe chemical engineering. Greg was the President of Shell Global solutions from 2003 to 2009 and his thinking continues to shape IChemE to this day.

Shell became a gold corporate partner of IChemE last year.

Collaborative relationships with industry have shaped the Institution from the outset and I am a profound believer in the benefits industrial partnerships bring to the profession.

Where do we go from here?

In seven years time, IChemE will celebrate its centenary. The continuity is clear as I trust my examples have illustrated, but this doesn't, and has never meant, no change. Rather it is a continuity of the commitment to continuous improvement, to change and development.

But where do we go from here; and what steps should IChemE's leadership take to ensure that the Institution is on a secure footing to celebrate its 100th birthday in 2022?

Council recently spent some time assessing the progress made since we marked the 50th Anniversary of the Royal Charter in 2007.

This slide illustrates the thought process we used, but please treat the right hand circle with caution. This is not an attempt to predict the future; rather it is a tool to provoke some serious thinking about the kind of Institution that the leadership, working hand in hand with our members around the globe and our partners in industry, aspires to create.

We are revisiting our business plan to address the continuing challenges of globalisation and internationalisation.

We need to embrace new ways of connecting with and inspiring the next generation of IChemE members and professional leaders and in so doing enhancing the pursuit of diversity of gender and nationality.

And we need to equip the Institution with the digital tools that will support the delivery of content and services to a connected membership in a world where remote working and virtual collaboration and knowledge exchange is the norm.

Few professional disciplines have such potential to make a positive impact on society as chemical engineering. Moving on from its genesis in wartime the profession has demonstrated its contributions to the well being of society in the fields of sustainable food supply; new materials; adequate and safe supply of water; advancing human health and well-being. More complex challenges remain to be tackled, and perhaps pre-eminently, the challenge of reshaping the world's energy mix while keeping the lights on and the wheels of economies turning, will demand that chemical engineers must rise to the occasion.

But by the same token, chemical engineers design and look after some of the most hazardous and safety-critical industrial processes: potential for good is often accompanied by potential for harm.

Chemical engineers, thus, carry great responsibility, and so their competence, their commitment to safety and their professional excellence are of vital importance. It is IChemE's role to assist and support its members in living up to their responsibilities whilst enjoying rewarding, fulfilling and worthwhile careers.

Greg Lewin's 'boundaryless' description is more appropriate than ever. 21st Century chemical engineering transcends geographic, sectoral and generational boundaries and those of traditional academic disciplines. In short, chemical engineers without borders.

IChemE has evolved into a diverse, international professional community. We have a record of sustained growth combined with greatly increased demand among young people to study the subject at university.

We can look forward, with some confidence to continued prosperity over the long term.

I am committed to working with my Council colleagues, the CEO, and our senior management team to shape a strategy and plan that will enable IChemE to evolve and grow.

I want this exceptional community; a community of 42,000 women and men in 120 countries, to support our fellow professionals into our second century and beyond. In that way we will continue to create value and quality of life for all.

Chemical engineering mattered in the First World War

But the pursuit of destructive power also unleashed a way of thinking that has given us so many of the things that have enhanced societies but are sometimes taken for granted.

Chemical engineering mattered when our predecessors were designing the processes that provide safer drinking water, antibiotics and cleaner fuels.

Polymers, the contraceptive pill and lithium-ion batteries.

And much else besides. It will continue to matter in the future.

And IChemE will be there to support those chemical engineers, from Houston to Calgary, from Perth to Brisbane, from Cape Town to Lagos, from KL and Singapore to Aberdeen..

Advancing chemical engineering worldwide.

Because ladies and gentlemen, chemical engineering matters

Thank you…