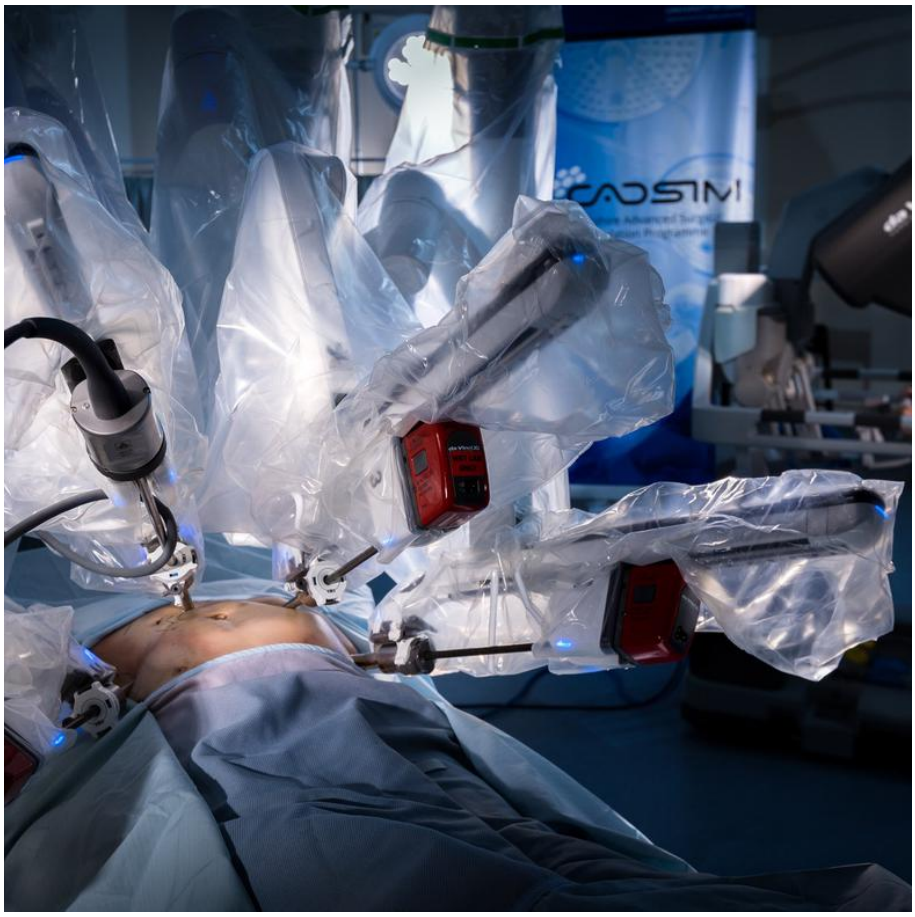
The Institute of Science & Technology

The Professional Body for Technical, Specialist, and Managerial Staff, across all sectors.



# The Journal

Winter 2024

# The Journal

**The Official Journal of the Institute of Science & Technology**

The Professional Body for Specialist, Technical and Managerial Staff

**ISSN 2040-1868**

7th Floor, 2 Pinfold Street, The Balance, Sheffield, S1 2GU

T: 0114 553 1401 office@istonline.org.uk

www.istonline.org.uk

# Contents




# The Journal

**The Official Journal of**
**The Institute of Science & Technology**

The Professional Body for Technical, Specialist, and Managerial Staff

**December 2024**

**ISSN 2040-1868**

# Editor's welcome

**JP Ashton-Kinlin, FIScT, RSci**
IST Marketing Officer & Journal Editor

**Welcome to the 2024 edition of IST's The Journal.**

As we celebrate the release of this year's Journal, we reflect on another remarkable year of growth, excellence, and innovation within our technical community.

Once again, the annual Journal arrives as an e-publication, aligned with the festive season. This digital format continues to complement our suite of resources, which includes *The Tech Magazine a.k.a. The Technician Magazine* periodical, our website, and *The Bulletin*, ensuring we keep you informed year-round with articles, news, and key updates.

This edition showcases the ingenuity and dedication of our members and contributors. We are pleased to feature an exceptional array of articles this year, and I extend my heartfelt thanks to all the authors for their invaluable contributions. To honour your efforts, we have introduced a dedicated section on our website listing all publication authors, ensuring your work receives the recognition it deserves.

Highlights in this annual Journal include an engaging piece by Dinesh Chacko, who examines the paradox of clean technology adoption, highlighting how increased electricity demand often accompanies sustainability efforts. Shinu Yohannan explores cutting-edge advancements in rail and energy infrastructure, showcasing transformative solutions for a sustainable future. Sumant Gadge provides vital insights into effective strategies for addressing iron deficiency during pregnancy, improving maternal and infant health and many more fascinating articles from Michael Quigley, Amro Heikal, Carly Ward and Tim Sandle. Alan Gall also returns with another captivating look into the IST archives with 'Map Girl'.

My deepest thanks go to the Editorial Team for their input to the peer-review process and to the many contributors and authors for their dedication in bringing this year's Journal to fruition.

As always, we invite all members to contribute articles or updates, whether for *The Journal*, *The Tech Magazine*, or even to publish on our website. From ground-breaking research to technical innovations across the creative, scientific, artificial intelligence and engineering spheres, your work enriches the collective knowledge of our community.

We hope you enjoy exploring this year's *The Journal*. Wishing you the very best in all your endeavours, whether celebrating or spending time with family.

As we look ahead, the IST remains committed to fostering a vibrant, inclusive, and innovative technical community. We encourage you to engage with our resources, share your expertise, and contribute to the ongoing dialogue that drives our fields forward. Whether through insightful articles, participation in events, or networking with peers, your involvement strengthens the foundation of our collective success and inspires future advancements.

For article submissions, event promotions, job advertisements, or recognition of awards, please don't hesitate to contact us at office@istonline.org.uk.

It is both an honour and a privilege to serve IST members and the wider Technical Community as the new Editor. I look forward to collaborating with and hearing from you all.

Here's to another year of collaboration and discovery. Wishing you all a prosperous 2025!

*JP.AK*

# Chair's view

**Terry Croft MBE, FIScT, CSci**
IST Chair & CEO

With 2024 drawing to a close, it's time for me to look back over what has been another very busy year for myself and our brilliant teams of volunteers. As Chair, I have been privileged to visit many institutions and organisations over a number of years and I am still amazed at the work and roles the technical community undertake. New skills and technologies have been required over time and the technicians and specialists have met these needs through their CPD and additional training and development activities. This is where the IST has been playing a leading role, not only advising individual members on their personal development plans but offering support in with their applications for professional registration. In addition, as a member of the IST, they also have free access to CPD Central, to log their CPD activities over the year, which can be used for their professional registration renewal as well as any appraisal they undertake with their employer.

Meeting these technicians and seeing the work they do is inspirational. I always go away thinking "wow". It's these highly skilled professionals that will inspire not only the next generation of technicians but also those wanting to progress their career to the next stage. So, Arthur Nicolas, our Education Officer and I, want to hear your story about your work and career pathway, so we may use these as part of our 2025 project around apprentices, trainees and those choosing to take the T-Level route into technical employment. From Science and Engineering to the Creative Arts, we want to hear from you so please contact me directly on t.croft@istonline.org.uk and help inspire the next generation of technical and specialist staff.

Chatting to our members and the wider technical community serves many purposes especially in directing our work and the support we provide to the technical and specialist community across all sectors. We do listen and take onboard feedback from our many presentations, training sessions, webinars and of course our annual conference to influence our many activities. We listened to our members and delegates who have attended many of our events and webinars over the last few years. These comments and conversations for example resulted in the development and successful launch of the both the AI and Creative Industries and Technologies registers. In addition, we have updated our Affiliate Membership offering to Apprentices, T-level and other students as well as Trainees to give them access to a variety of resources and activities. Additional support and advice are also available to help them achieve full membership as their careers develop.

As a not-for-profit professional body, the IST wouldn't exist without you. You should take pride in the fact that your contributions over the year, for example by manning the IST stands at various events, delivering the highly successful annual conference, giving talks and workshops on a variety of subjects, driving our Specialist Interest groups and being members of our Boards and Committees to name a few, haves ensured that the IST has remained a highly successful professional body and allowed us to support our members but and also the technical community at large. Your passion to support our members and the technical community can be seen through the hard work you put in to ensure our annual conference isa resounding success. Many thanks for all your hard work. This also applies to our sponsors, exhibitors, presenters, and delegates for making the day and being a key part of our conference community.

During the day, we also celebrated the hard work, dedication, and achievements of our members.

Congratulations were in order as our President, Dr Helen Sharman CMG OBE FRSC FIScT, presented the award of Fellow of the IST to James Fox (image left) and Murray Webster (image right).

Congratulations are also in order for one of our long-standing members and Fellow of the IST, Lawrence Dawkins-Hall, BSc, CBiol, CSci, FIScT, FRSB, who was awarded the lifetime award 'Outstanding Achievement' at the Lab Awards 2024.


With Christmas approaching rapidly, our teams are working hard on a variety of projects and events during these last few weeks of 2024, to ensure we continue to provide excellent support and advice to our members and the technical community at large. From our Professional Registers to a new programme of webinars and events, to our Annual Conference which is being hosted by the University of Birmingham on the 18th of September 2025. The team and I look forward to supporting you once again in 2025.

Wishing you a wonderful holiday season and a peaceful New Year.

Enjoy a well-deserved festive break.

Best Wishes,

Terry

# President's view

**Helen Sharman CMG, OBE, FRSC, FISCT**
IST President

The last few weeks of the year can be a time for reflection but for many, it is one of the busiest times, whether it be research, operations, supporting students now fully engaged in multiple activities, end of term deadlines, end of year reports, or conferences still to arrange and attend.

The IST Conference already feels like some time ago, with a date in September chosen as being the most convenient for most people. Lancaster University welcomed us warmly and quite literally breezily, at a time of weather warnings of wind and rain, yet technicians are made of strong stuff and it was tremendous to see so many of you there. John Amaechi, psychologist, author and former professional basketball player, kicked us off with a super keynote about the psychology of learning and the benefits of professional development, and he didn't laugh too hard (!) at my attempts to throw the soft box microphone to delegates for questions. The multiple workshop sessions were well-attended, lots of networking happened in and around the exhibition, there were awards including for the image competition and we also had a panel session featuring technicians talking about their careers. There was lots going on and it was all timed over a day to enable as many of you as possible to attend. Many thanks to the Conference Organising Team, who are already working on next year's conference. Save the date: 18 September!

As a Professional Body, the IST's aims remain unchanged, which is to provide professional support to specialist, technical, and managerial colleagues wherever you work. Help and advice networks, skills training, specialist forums, recognised qualifications, continuing career development opportunities and guidance are all available to members, and we are always open to new suggestions and contributions from you. The Artificial Intelligence and Creative Arts activities are growing particularly fast.

The IST works closely with the Science Council and we are supportive of the Technician Commitment, which seems to have made an impact in various ways with new sharepoints, networks, newsletters, exhibitions and workshops, not to mention local, area-wide, subject and sector specific conferences. I have seen scales peel away from the eyes of some university staff, when they realise the depth and breadth of activities that technical and specialist staff carry out. There's still a way to go but in terms of recognition and development, there has been a big change in many organisations, with now over 120 signatory and supporter organisations working to champion technicians.

There has been great public showcasing of the technical profession by the Science Museum's Technicians Gallery. IST members were involved from the early stages of the gallery and have made key contributions. In March it celebrated its one millionth visitor; over the school summer holidays, the Gallery hosted the Environment Agency with nine days of hands-on family activities (thanks to 93 volunteer technicians), reaching 92 000 visitors with excellent feedback from visitors and wide press coverage; and there have been workshops giving school students the chance to meet a technician and experience what it's like to do their job through hands-on activities and a Q&A session. I am delighted that the importance of technical roles is being seen by so many people.

Looking towards the holidays, it's a time for us to be thankful for family and community, perhaps also with memories of those who are no longer with us. No doubt there will be some members who will be working or on-call throughout everyone else's holiday period, and if that's you I hope your Holidays will be safe and uneventful. And for everyone, I hope for a safe and peaceful time, with at least some relaxation.

I would like to take this opportunity to thank Terry Croft, the IST Chief Executive, and the Executive Team for everything they have done this year. They are all volunteers, helping others in their technical, specialist and managerial careers, because the IST believes it is the right thing to do. If you would like to find out more about getting involved with the IST, contact us at E: office@istonline.org.uk.

Happy Holidays and may your New Year be joyous!

*Helen*

# IST Journal Publication

Back copies of our journal publication are viewable online:

***www.istonline.org.uk/ist-journal-publication***

## Article submissions for the IST Journal & The Tech Magazine

The IST Journal is a quality annual publication. Its style and content strongly reflect the IST's unique standing as a professional body that has an extremely diverse and vibrant technical membership.

The Journal's informal style offers an opportunity for our members and guests to freely present and publish articles, papers, and news items that would be of interest to our readership's varying expertise and extremely broad subject range. We do try to encourage articles to be written with our diverse technical membership in mind.

We positively welcome article submissions from all and any areas of technical interest, including areas such as IT, media, medicine, and the arts. We like to cover existing, historical, and new technological advances, and also unusual aspects of science or technology.

We particularly want to encourage technical people to publish for the first time, as part of their career development, and we can offer help and assistance in putting a first article together.

***Find out more here for The Journal***

***Find out more click here for The Tech Magazine***

The guidelines for article submissions for the IST Journal and TechMag are:

1. submission deadline for The Journal should be mid October 2025, with deadlines for the TechMag being February 2025 and June 2025.

2. Your article should be submitted electronically in Microsoft Word format; with its images supplied separately as JPEG files (it is important that all your article images have a minimum resolution of 300dpi. Images embedded in a Microsoft Word document are not usually reproducible to the necessary print resolution). **Authors must have permission to use any images supplied and need to include credits if required.**

3. Short articles: these can be any length up to roughly 2,000 words.

4. Major articles: these are normally no longer than roughly 6,000 words. We can only publish one or two major articles per edition. Larger articles may need to be accommodated across two or more editions.

5. All articles should be written in UK English. This is important as, depending on the content size and quality of English, they can take up a lot of editing time. Some can require extensive re-writing. We may have to decline very poorly translated articles.

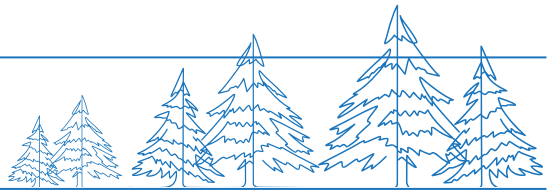
6. Editing – we will edit all articles into the IST Journal's house-style, and may have to correct for spelling and grammar. Text layout and images may need to be changed, altered, or omitted. Pease see "IST Journal house-style" description on our web site. It will help enormously if your article follows this style as much as possible.

7. Article submissions should be submitted via email to office@istonline.org.uk. Your email should clearly state "Journal (or TechMag) Article Submission" and the article and separate images sent with it as email file attachments.

### The Tech Magazine:


### The Journal:

# New members



## New members (December 2023 - 2024)

| No. | Name | Grade |
|---|---|---|
| T16830 | Yutong Chen | Student |
| T16831 | Tianhao Chen | Student |
| T16832 | Irteza Faruqi | Student |
| T16833 | Ava Han | Student |
| T16835 | Lin Mei | Student |
| T16836 | Sherry Qian | Student |
| T16837 | Tanya Sabharwal | Student |
| T16838 | Clarysa Suwandy | Student |
| T16839 | Ahmad Walizada | Student |
| T16841 | Jiawei Yin | Student |
| T16842 | Kai Zhang | Student |
| T16865 | Eugene Shcherbinin | Student |
| T16866 | Yunus Qayyum | Student |
| T16886 | Bern Igoche | Student |
| T16887 | Hans Reimann | Student |
| T16888 | Huseyin Yildirim | Student |
| T16889 | R Hashami | Student |
| T16890 | Thita Sawaengha | Student |
| T16891 | Maryam Alka | Student |
| T16892 | Dilem Kaya | Student |
| T16907 | Akshat Sharma | Student |
| T16815 | Anas Umar | AssocISCT |
| T14423 | Damian Sancho | MIScT |
| T14447 | Olufunke Oyewole | MIScT |
| T14567 | VINOD GOVINDBHAI | MIScT |
| T14782 | Adetola Adeyemi | MIScT |
| T15652 | Amanda Valentine-Baars | MIScT |
| T15782 | Hammad Muzaffar | MIScT |
| T15883 | Nuala Tipping | MIScT |
| T16350 | Ronit Prawer | MIScT |
| T16399 | John Warren | MIScT |
| T16435 | Stephen Hibberd | MIScT |
| T16482 | James Morley | MIScT |
| T16483 | Abraham Bright | MIScT |
| T16554 | Lydia Inaku | MIScT |
| T16562 | Lawrence Willie | MIScT |
| T16576 | Rahima Islam | MIScT |
| T16809 | Emma Agnew | MIScT |
| T16811 | Kenneth Gondo | MIScT |
| T16812 | Beatrice Elijah-Nyior | MIScT |
| T16813 | Amina Mughal | MIScT |
| T16814 | Nagu Sathappan | MIScT |
| T16816 | Sreenivasa Sunku | MIScT |
| T16817 | Ayowole Ayeni | MIScT |
| T16818 | Anubhav Seth | MIScT |
| T16820 | Nadia Rahman | MIScT |
| T16821 | Amratpal Jandu | MIScT |
| T16822 | Carole Noon | MIScT |
| T16823 | Fawad Naseer | MIScT |

| No. | Name | Grade |
|---|---|---|
| T16824 | Gustavo Toledo da Silva | MIScT |
| T16825 | Laurence East | MIScT |
| T16826 | Gayathri Balasubramanian | MIScT |
| T16827 | Rosa Colamarino | MIScT |
| T16828 | Michael Flynn | MIScT |
| T16829 | Rajeshkumar Mohanraman | MIScT |
| T16843 | Juan Carlos Roncancio Garcia | MIScT |
| T16844 | Abigail Howell | MIScT |
| T16845 | Victoria Hoyland | MIScT |
| T16846 | Dinesh Chacko | MIScT |
| T16847 | Christopher Portman | MIScT |
| T16848 | Rana Al Hammouz | MIScT |
| T16849 | Ross Massie | MIScT |
| T16850 | Nicholas (Nick) Spencer | MIScT |
| T16851 | Philip Apps | MIScT |
| T16852 | Adam Longfellow | MIScT |
| T16853 | Joseph Danaher | MIScT |
| T16854 | Denise Rushton | MIScT |
| T16855 | Abigail Thomas | MIScT |
| T16856 | Ryan Green | MIScT |
| T16857 | Helen Stephens | MIScT |
| T16858 | Neil Duncan | MIScT |
| T16859 | Mohammad Rahman | MIScT |
| T16860 | Jack Folland | MIScT |
| T16861 | Welldone Moyo | MIScT |
| T16862 | Elvis Ogbe | MIScT |
| T16863 | Tracey Stevenson | MIScT |
| T16864 | Trudy Workman | MIScT |
| T16867 | James Fox Robinson | MIScT |
| T16868 | Harry Adams | MIScT |
| T16869 | Pim Reuderink | MIScT |
| T16870 | Ganesh Murugesan | MIScT |
| T16871 | Michael Udejiattah | MIScT |
| T16872 | Jenny Buckley | MIScT |
| T16873 | Jordan Maclean | MIScT |
| T16874 | Rabo Abubakar | MIScT |
| T16875 | William Kenny | MIScT |
| T16876 | Ivan Byrne | MIScT |
| T16877 | Phil Faulks | MIScT |
| T16878 | Lucy Kitchin | MIScT |
| T16879 | Ellen Rothwell | MIScT |
| T16880 | Emma Wilkinson | MIScT |
| T16881 | Harry Adams | MIScT |
| T16882 | Oganya Odo | MIScT |
| T16883 | Nadine Cook | MIScT |
| T16884 | Jordan Roper | MIScT |
| T16885 | Iain Taylor | MIScT |
| T16893 | Summer Hydes | MIScT |
| T16894 | Lawrence Dennison-Hall | MIScT |

# New members

## New members continued...

| No. | Name | Grade |
|---|---|---|
| T16895 | Luke Burgess | MIScT |
| T16896 | Laura Durrant | MIScT |
| T16897 | John Haschak | MIScT |
| T16898 | Sam McNab | MIScT |
| T16899 | Sandra O'Brien | MIScT |
| T16900 | Albertina Uogintiene | MIScT |
| T16901 | Megan Hamilton | MIScT |
| T16902 | Adam Stokes | MIScT |
| T16903 | Zeyang Zhang | MIScT |
| T16904 | Simranjeet Sidhu | MIScT |
| T16905 | Nikhil Bangad | MIScT |
| T16906 | Daniel Bowen | MIScT |
| T16908 | Harry Jones | MIScT |
| T16909 | James Goodyear | MIScT |
| T16910 | Katarzyna Kowalska | MIScT |
| T16911 | Alyssa Belcher | MIScT |
| T16912 | Luke Michell | MIScT |

| No. | Name | Grade |
|---|---|---|
| T16913 | Yousef Alshammari | MIScT |
| T16914 | Christopher Glover | MIScT |
| T16915 | Husan Leal | MIScT |
| T16916 | Abu Bin Abu Sofian | MIScT |
| T16917 | David Collier | MIScT |
| T16918 | Robert O'Donoghue | MIScT |
| T16919 | Mark Donoghue | MIScT |
| T16920 | Mandeep Kaur | MIScT |
| T16921 | Jamie Roberts | MIScT |
| T16922 | Ajii Ogbu | MIScT |
| T16923 | Charlie Yorath | MIScT |
| T16924 | Catherine Sharpe | MIScT |
| T16925 | Jasmine Lawton | MIScT |
| T16926 | Sharon Moncur | MIScT |
| T13340 | Joseph Pottelli | FIScT |
| T16819 | Anthony Roberts | FIScT |

## Fellowship Upgrades

| No. | Name | Grade |
|---|---|---|
| T15321 | John Paul Ashton-Kinlin | FIScT |
| T16180 | James Fox | FIScT |

| No. | Name | Grade |
|---|---|---|
| T16662 | Murray Webster | FIScT |
| T16819 | Anthony Roberts | FIScT |

# New registrations

## Science Council New Registrations

| No. | Name | Grade |
|---|---|---|
| T16809 | Emma Agnew | CSci |
| T16909 | James Goodyear | CSci |
| T16850 | Nicholas (Nick) Spencer | CSci |
| T16350 | Ronit Prawer | CSci |
| T16913 | Yousef Alshammari | CSci |
| T16844 | Abigail Howell | RSci |
| T16855 | Abigail Thomas | RSci |
| T16917 | David Collier | RSci |
| T16860 | Jack Folland | RSci |
| T16925 | Jasmine Lawton | RSci |
| T16896 | Laura Durrant | RSci |
| T16894 | Lawrence Dennison-Hall | RSci |
| T16878 | Lucy Kitchin | RSci |
| T16895 | Luke Burgess | RSci |
| T16901 | Megan Hamilton | RSci |
| T16576 | Rahima Islam | RSci |
| T16829 | Rajeshkumar Mohanraman | RSci |
| T16435 | Stephen Hibberd | RSci |
| T16852 | Adam Longfellow | RSciTech |
| T16902 | Adam Stokes | RSciTech |
| T14782 | Adetola Adeyemi | RSciTech |
| T16900 | Albertina Uogintiene | RSciTech |
| T16911 | Alyssa Belcher | RSciTech |

| No. | Name | Grade |
|---|---|---|
| T16813 | Amina Mughal | RSciTech |
| T16924 | Catherine Sharpe | RSciTech |
| T16923 | Charlie Yorath | RSciTech |
| T16847 | Christopher Portman | RSciTech |
| T16854 | Denise Rushton | RSciTech |
| T16879 | Ellen Rothwell | RSciTech |
| T16880 | Emma Wilkinson | RSciTech |
| T16881 | Harry Adams | RSciTech |
| T16908 | Harry Jones | RSciTech |
| T16872 | Jenny Buckley | RSciTech |
| T16897 | John Haschak | RSciTech |
| T16873 | Jordan Maclean | RSciTech |
| T16884 | Jordan Roper | RSciTech |
| T16853 | Joseph Danaher | RSciTech |
| T16843 | Juan Carlos Roncancio Garcia | RSciTech |
| T16910 | Katarzyna Kowalska | RSciTech |
| T16912 | Luke Michell | RSciTech |
| T16859 | Mohammad Rahman | RSciTech |
| T16883 | Nadine Cook | RSciTech |
| T16851 | Philip Apps | RSciTech |
| T16918 | Robert O'Donoghue | RSciTech |
| T16893 | Summer Hydes | RSciTech |
| T16845 | Victoria Hoyland | RSciTech |

## Artificial Intelligence New Registrations


| No. | Name | Grade |
|---|---|---|
| T16555 | Murray McMonies | APAI |
| T16230 | Marie Oldfield | APAI |
| T16543 | Richard Saldanha | APAI |

| No. | Name | Grade |
|---|---|---|
| T16846 | Dinesh Chacko | RPAI |
| T16898 | Sam McNab | RPAI |
| T16662 | Murray Webster | RTAI |

## Creative Industries & Technologies New Registrations


| No. | Name | Grade |
|---|---|---|
| T15827 | Alan Copley | RPCIT |
| T16187 | James Davoli | RPCIT |

| No. | Name | Grade |
|---|---|---|
| T16201 | Martin Robinson | RPCIT |

Registered Practitioner
RPCiT
Creative Industries & Technologies

**Registered Practitioners in the Creative Industries and Technologies** work as mid-career specialists, driving innovation by designing, developing, and implementing creative solutions and technologies. They leverage their expertise to address complex challenges while upholding ethical and professional standards in their field.

# Registered AI Practitioners

**Ethical and Robust:** the IST is making AI safer for Society with our new professional registration scheme. This accreditation is for all who work with AI models and has been developed by an interdisciplinary group.

The accreditation framework has been fully scrutinised and approved by specialists and experts from partner organisations in Industry, Government and Academia.

Registered Technician
RTechAi
Artificial Intelligence

**Registered Technicians in Artificial Intelligence** work as an entry level career professional or student. They apply technical skills to maintain, troubleshoot, and optimise AI systems, including software, hardware, and data processes, ensuring efficient and ethical AI functionality.

Registered Practitioner
RPAi
Artificial Intelligence

**Registered Practitioners in Artificial Intelligence** work as a mid career specialist and design, develop, and deploy AI solutions, leveraging expertise to address complex problems while ensuring compliance with ethical and professional standards.

Advanced Practitioner
APAi
Artificial Intelligence

**Advanced Practitioners in Artificial Intelligence** work as a leader and expert in your field, they lead the innovation, development, and strategic implementation of cutting-edge AI technologies, driving transformative solutions while addressing ethical, technical, and organisational challenges.

## Prove your value as a practising scientist with professional registration from the Science Council

Science Council

RSciTech
Registered
Science Technician

**Registered Science Technician**
Registered Science Technicians work in technical roles, delivering essential scientific services and support within laboratories, schools and universities, hospitals and in many other workplaces.

RSci
Registered
Scientist

**Registered Scientist**
Registered Scientists apply their skills and knowledge in a managerial or relatively senior role, where they have responsibility for others but are not yet working at a chartered level.

CSci
Chartered
Scientist

**Chartered Scientist**
Chartered Scientists lead teams and departments, using their specialist knowledge and broader scientific understanding to develop and improve the application of science and technology.

# IST Organisation

## Executive Board (December 2024)

### President: Helen Sharman CMG, OBE, FRSC, FIScT

Helen Sharman is the UK Outreach Ambassador at Imperial College London and a world-class inspirational speaker. She became the first British Astronaut in 1991, when she launched on a Soyuz rocket to carry out experiments on the Mir Space Station. After her return from space, Helen spent many years communicating science and its benefits, winning prizes for radio and TV and for her inspirational talks on STEM, leadership, teamwork and problem solving.
**E: office@istonline.org.uk**

### Chair & CEO: Terry Croft MBE, FIScT, CSci

Terry is the Chair of the IST. He is passionate about, and is committed to, the technical community. His work involves promoting the professionalisation of the technical workforce. He brings a wealth of experience to the board through his involvement with the wider sector and as the Founding Director of the National Technician Development Centre (NTDC) for HE.
**E: t.croft@istonline.org.uk**

### Secretary: Lucy Hudson FIScT, CSci

Lucy is the IST Secretary, and has responsibility for ensuring that we comply with legislative requirements and that we maintain suitable official records, and also for the coordination of our Executive meetings and documentation. Lucy is the Operations Manager in the Dept. of Biology at University of York. She is a Trustee at The Royal Society of Biology, Fellow of the IST, & external advisor for the National Technician Development Centre.
**E: lucyhudson@istonline.org.uk**

### Deputy Chair & Finance Officer: Joan Ward FIScT

Joan is Deputy Chair of the IST. As Finance Officer, Joan's primary role is to control expenditure on behalf of the Executive and be responsible for ensuring that satisfactory accounts of all monies received and expended are maintained.Further to this, Joan provides advice as to how annual financial performance might be improved, within the context of the IST being a not-for-profit organisation. She carries out tasks agreed by the Executive to maximise overall financial wellbeing.
**E: joanward@istonline.org.uk**

### Education Officer: Arthur Nicholas FIScT

As Education Officer, Arthur maintains knowledge of vocational training and qualifications for technical practitioners. He also participates in regional and national development programmes. Arthur is involved in the development and delivery of technician training and manages the IST's service to employers to validate their in-house training schemes. Arthur is a Trustee of the Science Council and a Specialist Advisor to the NTDC.
**E: arthurnicholas@istonline.org.uk**

### Marketing & Development Officer: JP Ashton-Kinlin FIScT, RSci

John-Paul (JP) worked as a technician in Industry and in HE for around 10 years and provided support in advisory capacities to the IST, NTDC and HEaTED. JP currently runs a number of businesses in different sectors; medical events, property and marketing/training, and is Chair of the Editorial Group, and Editor & Creative Designer of The Tech Magazine and The Journal.
**E: jp.ashton-kinlin@istonline.org.uk**

### AI & External Engagement Officer: Dr Marie Oldfield CStat, CSci, FIScT, SFHEA, APAI

Marie is the AI and External Engagement Officer working to increase the profile of the IST and AI Special Interest Group as well as delivering the AI Professional Registrations, Frameworks and Standards. Marie is a recognised and published AI and Ethics Leader with a background in Mathematics and Philosophy. Marie is a trusted advisor to Governments, Defence, and the Legal Sector amongst others. Marie works at the forefront of Ethical AI, driving improvement and development.

**E: marieoldfield@istonline.org.uk**

### Equity & Diversity Officer: Jan Brett FIScT, CSci

Jan was a technical team leader managing the University of Liverpool's research labs at Leahurst for over thirteen years and in July 2020 moved into her new role in the Technology, Infrastructure and Environment Directorate, where she is the Technical Development and Planning Officer. Her goal is to support the development of the technical staff at the University of Liverpool and embed the aims of the Technician Commitment at Liverpool.

**E: janbrett@istonline.org.uk**

### Registrar: Michelle Jackson FIScT, CSci

As Registrar, Michelle oversees the registration schemes run through the IST and contributes to the development of associated strategic and operational procedures. She liaises with the Science Council with respect to continuing development of the registration process and monitors all aspects of the IST registration and assessment processes.

**E: michellejackson@istonline.org.uk**

## IST Advisors

### Executive Advisor: Lee Shunburne FIScT, CSci

Lee is Department Manager at the University of Sheffield, an IST Fellow and is an assessor for professional registration at CSci level and sits on the Science Council's Registration Assessment Committee.

### Assistant Registrar: Dr Kranthi Maniam FIScT, CSci

Dr Kranthi Maniam is the Marie Curie Fellow at the Materials Innovation Centre- University of Leicester, UK and also works as a Senior Project Leader -Technology at TWI limited, UK. He is active in the scientific community as peer reviewer and serving as an executive team member in IET-Tribology Network Community, Science Committee member in IMF, contributes to IST as common application process assessor, continuous professional development assessor, professional and personal development (PPD) audit reviewer.

### Executive Advisor: Russell Wilson MIScT, CSci

Russell is a Senior Laboratory Technician in Sport and Exercise Science at Heriot-Watt University and provides outreach support for the IST. Russell is the Scotland Regional coordinator and in the process of formally setting up the IST Scottish Network Specialist Group and has made a significant impact to technicians across the Scottish universities.

### Fellowship & Overseas Advisor: Derek Sayers FIScT

As Fellowship & Overseas Advisor, Derek coordinates the review of Fellowship applications, setting in place panels of other Fellows for peer review, and advises the Executive on the outcome of the reviews. He also maintains the documentation of those applications. Derek is our point of contact for overseas inquiries from members and for organisations wishing to work with the IST; he liaises with such organisations and reports back to the Executive. Derek is a Vice President of the IST.

### Executive Advisor: John Dwyer FIScT

John is co-ordinator for Partnerships/Champions. His role involves actively promoting professional registration for the IST throughout the UK: attending meetings, workshops, and conferences, and seeking champions for this cause at institutions nationally.

### IST Archivist: Alan Gall FIScT

Alan has been IST Archivist since 2004. Originally a laboratory assistant, he has worked in industries concerned with edible oils, food additives, polymer stabilisers, electroplating and explosives. He is currently a company director involved with magnetic materials, electrical engineering and general mechanical engineering. Contributions to the Journal began in 2003 with an article on the Manchester University technician William Alexander Kay. He has provided regular articles since then.

## Advisory Boards

### The Education Board – Chaired by Arthur Nicholas

Ian Gray MIScT

Melanie Hannah MIScT, RSci

Joan Ward FIScT

Michelle Jackson FIScT, CSci

Chris Pambou MIScT, RSci

### The Editorial Board – Chaired by JP Ashton-Kinlin

James Fox FIScT, CSci

Nigel Cook FIScT

Alan Gall FIScT

Ian Moulson FIScT

Stephen Gamble MIScT

Joan Ward FIScT

### The Artificial Intelligence Group – Chaired by Marie Oldfield

Dr Alicia Colson FIScT

Murray McMonies FIScT, CSci, APAI

Dr Richard Saldanha FIScT, CStat, CSci, APAI, MIET

Murray Webster FIScT, MA, RTechAI

### The Women in Tech Group - Chaired by Joan Ward

Jan Brett FIScT, CSci

Dr Marie Oldfield FIScT, CSci, APAI

Emeritus Prof. Margaret Ross MBE, FIScT

Prof. Liz Bacon FIScT

| IST Vice Presidents |
| --- |
| Terry Evans MIScT |
| Simon Fairnie FIScT |
| Ian Gray MIScT |
| Robert Hardwick FIScT |
| Ian Moulson FIScT |
| Derek Sayers FIScT |

# Applying for IST Fellowship

Fellowship of the Institute is the most senior grade available and is an indicator of the highest level of achievement within the profession. Individuals may apply, or be nominated, according to the guidance laid down by the Executive and, if suitable, will be elected by the Fellowship Committee. Applicants for Fellowship would be expected to have at least one year's membership at MIScT level prior to a Fellowship application/nomination, but in exceptional circumstances the Executive may elect Fellows who have not previously been members.

The Fellowship Committee will take into consideration your qualifications, professional work experience, length of service, supervisory ability, and any contribution to the advancement of science, technology, education and training.

Fellows are expected to contribute in some way to the activities and/or development of the IST and/or the UK technical workforce and the nature and extent of that potential contribution will be taken into account when Fellowship applications are assessed and renewals reviewed. Contributions could include the submission of Journal articles, support for professional registration, enhancement of the IST profile in the workplace – to name just a few examples. We will expect Fellows to be able to evidence how and when they contributed in support of the IST and/or the technical community if such activities are not already known to us. We would be happy to discuss options with potential applicants.

Fellows may be nominated (by two or more Executive members) and/or applications made on the designated form, which is available for download. Nominated candidates would be subject to the same review/ assessment channels as per individual personal applications.

Application forms and guidance documents can be downloaded at: *istonline.org.uk/membership/fellow*
**E:** ***office@istonline.org.uk***

# Users of Clean Technologies also consume the most electricity

**Dinesh Chacko, MIScT RPAI**

UK homes which consume more electricity than others are also more likely to use two of the most energy efficient technologies, new analysis shows.

My investigation into electricity supply data reveals that homes with a heat pump and electric vehicle (EV) consume more electricity on top of the power they use for these two innovations – that's according to information supplied by Northern Powergrid.

Uptake of EVs and heat pumps is integral to the UK government's targets to reach net zero emissions by 2050, so any link between the use of these technologies and higher domestic consumption is significant.

While the UK has made strides towards cutting carbon emissions in part by promoting energy saving technologies, it appears that in some areas, domestic consumption remains high regardless.

My analysis uses data about the distribution of heat pumps and EVs from Northern Powergrid's Distribution Future Energy Scenarios (DFES) project aimed at mapping progress towards net zero on a local level. Estimates from some 550 primary substations covering 3.5 million homes in Northern Powergrid's network were then applied to reveal the correlation between domestic consumption and the use of EVs and heat pumps. In this instance domestic consumption refers to the residential energy use, but crucially it excludes consumption by EVs and heat pumps.

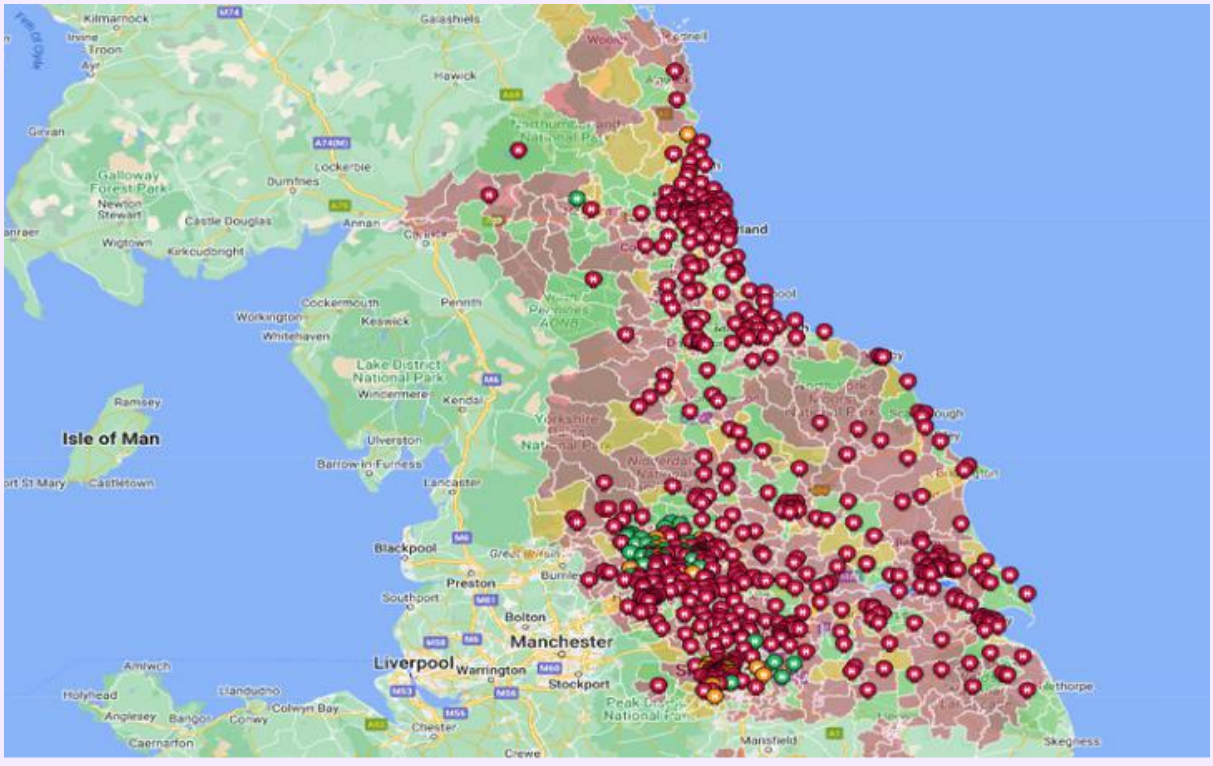



*Figure-1: Northern Powergrid generation availability heat map designed to give a high-level indication (red/amber/green) of their network's capability to facilitate new connections. Credit: https://www.northernpowergrid.com/generation-availability-map*

Heat pumps work by transferring rather than generating heat (*see Figure 1*), producing fewer emissions than traditional heating and cutting our reliance on fossil fuels. In part subsidised, they are used in homes and commercial buildings, and sometimes form part of district heating, where heat is piped from a central source. EVs rely on charging infrastructure in residential and commercial areas.

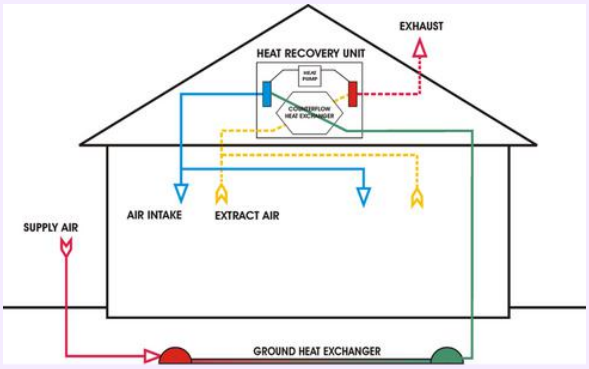



*Figure-2: Ventilation unit with heat pump and ground plate heat exchanger (cooling). Attribution: Kobraklb, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons.https://commons.wikimedia.org/wiki/File:Ventilation_unit_with_heat_pump_and_ground_-_cooling.png*

So why is there a direct relationship between higher levels of domestic electricity consumption and greater use of heat pumps and EVs? Why are these homes are using more energy despite their adoption of cleaner technology? (*See Figure 3 and 4*).

This is most likely driven by two factors – the relative affluence of an area and ease of access to EV charging infrastructure.

Affluence matters because the more money people have, the more energy they use. These same, wealthier households are also the ones who may be able to afford to install a heat pump or buy an EV. In a similar way, EV charging infrastructure is likely to be more available in better-off areas - another reason for a greater uptake of electric vehicles in those regions.

*Note - energy consumption is calculated in megawatt hours (MWh). A megawatt hour is used to measure electric output and is equivalent to 1,000 kilowatts (kW) of electricity consumed per hour. Currently, the average UK household uses around 10 kWh of electricity per day. Therefore 1 MWh would run 100 houses for one day, and one house uses around 3.6 MWh per year.*

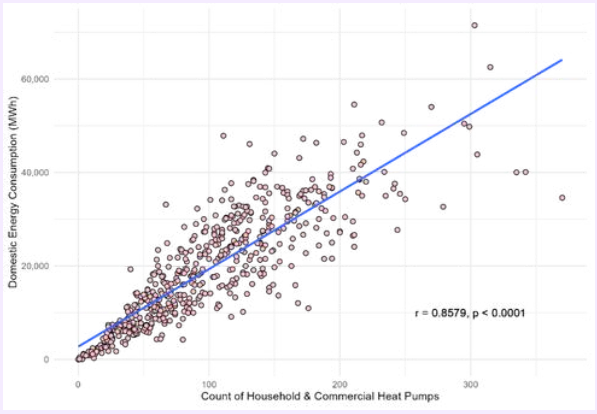



*Figure-3: Number of heat pumps positively associated with domestic consumption. Correlation coefficient: r = 0.8579 (p < 0.0001). Strong, positive, linear relationship. Locations with higher count of heat pumps also had higher domestic energy consumption.*

On an energy policy level this unequal distribution of cleaner technologies requires attention. While the wealthier appear to have the means and the infrastructure to adopt heat pumps and EVs, these types of technologies need to be more prevalent across all households for the UK to cut domestic greenhouse gas emissions.

Electricity use is forecast to rise with the growth of EVs and changes to heating – and this switch towards more electrification will cut CO2 emissions based on the current fuel mix. Emissions will also fall further as the electricity network incorporates more renewable energy and low carbon sources of generation, and fossil fuelled power plants will be decommissioned.

UK electricity became entirely coal-free on 30 September 2024, gas powered power stations are decreasing but as of 2023, there are 35 active gas fired combined cycle power plants and 14 single cycle power plants operating in the United Kingdom, which have a total generating capacity of 35.7 GW **(1)**.

As home heating moves towards electricity as the primary energy source, homes will need better thermal properties, both to provide sufficient warmth and to prevent further fuel poverty and the knock-on effects that this has on people's quality of life and wellbeing.

## CLEAN TECHNOLOGIES

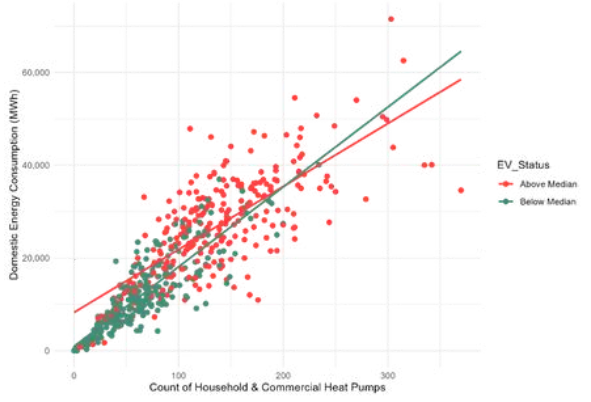



*Figure-4: Number of EVs also positively associated with domestic consumption. Number of EVs per primary substation were skewed; many high outliers. Colour-coded orange for "above median" number of EVs. Colour-coded grey for "below median" number of EVs. Similar relationship as between heat pumps and domestic consumption.*

Would incentives such as higher subsidies or better information encourage more low and middle income households to adopt EVs and heat pumps?

Data presented in this research suggest that answering these questions will be vital if the UK is to drive the increasing electrification and shift away from fossil fuel to meet climate goals.

Energy efficiency measures such as the adoption of heat pumps are significantly behind schedule. Currently, heat pumps heat only 1% of homes, falling far short of the 10% target the Climate Change Committee (CCC) estimated for 2030. Consumers will play a large part in the uptake rate of both electric cars and air source heat pumps and moving towards a net-zero carbon emission future. This is highly dependent on financial incentives, advice, availability of materials and a trained workforce **(2)**.

Electricity use is forecast to rise with the growth of EVs and changes to heating – and this switch towards more electrification will cut CO2 emissions based on the current fuel mix. Emissions will also fall further as the electricity network incorporates more renewable energy and low carbon sources of generation, and fossil fuelled power plants will be decommissioned.

**References**

1. *https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*
2. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*

**Author:**

**Dinesh Chacko, MIScT RPAI** is an independent DevOps Advocate with a knowledge and passion for AI, cloud computing, blockchain technology, and cybersecurity. He has held multiple roles for small and large organisations, including the public sector, oil and gas, banks, telecoms, financial services, EU institutions, and directly for IT solution integrators.

# Transformative Innovations and Insights in Rail and Energy Projects

**Shinu Yohannan, MIScT CSci**

The intersection of rail transportation and energy initiatives is driving significant opportunities for sustainable development and technological advancement. As a Principal Engineer with extensive experience in power electronics and rail systems, I have observed remarkable progress in these domains. This blog examines the latest innovations, inherent challenges and future directions in rail and energy projects, highlighting their potential for synergistic collaboration.

## Understanding the Synergy Between Rail Transportation and Energy Systems

Rail transportation is inherently energy-intensive, creating a pressing need for the integration of advanced energy solutions to enhance operational efficiency and sustainability. The rail sector's unique attributes—such as its capability to transport large volumes of passengers and freight over considerable distances—position it as a vital contributor to reducing transportation emissions on a broader scale.

Conversely, rail systems provide a stable and predictable demand for energy, which supports the deployment of renewable energy sources and the implementation of smart grid technologies. This reciprocal relationship fosters the development of innovative projects aimed at optimising both rail infrastructure and energy systems. By leveraging renewable energy and cutting-edge technologies, rail systems can play a crucial role in advancing national and global sustainability objectives.

## Key Innovations Driving Rail and Energy Integration

### 1. Advancements in Renewable Energy Utilisation

The integration of renewable energy sources into rail operations is a key focus area that promises substantial environmental benefits and operational efficiencies:

- **Solar Energy Deployment in Rail Systems:** The installation of solar panels along railway tracks and atop station rooftops has emerged as a significant trend. These installations can generate considerable amounts of clean energy, thereby markedly reducing the carbon footprint of rail operations. Noteworthy examples include solar-powered trains and dedicated solar farms designed specifically to supply energy to rail networks. Furthermore, the potential to utilise solar energy for powering station facilities, such as lighting and ticketing systems, enhances the overall energy efficiency of rail services.

- **Harnessing Wind Energy:** The strategic deployment of wind turbines alongside rail corridors or at train stations represents another promising approach to capturing wind energy. This method is particularly advantageous in regions with high wind potential and can significantly contribute to the overall energy mix utilised by rail systems. Innovative designs, such as vertical-axis wind turbines positioned near tracks, are being explored to optimise land use while capturing wind energy effectively.

### 2. Integration of Smart Grid Technologies and Electrification Efforts

As the rail sector evolves, the integration of smart technologies and electrification has become increasingly essential:

- **Adoption of Smart Grid Systems:** The integration of rail systems with smart grid technologies is becoming more commonplace, enabling optimised energy usage and enhanced operational efficiencies. Smart grids facilitate real-time monitoring and management of energy consumption, which ultimately improves the reliability and efficiency of rail operations. This integration enables the implementation of demand response strategies, allowing rail systems to shift energy usage during peak periods to minimise costs while maximising the utilisation of renewable energy sources.

- **Electrification Initiatives for Rail Lines:** The electrification of rail lines significantly reduces dependence on diesel engines, resulting in substantial reductions in greenhouse gas emissions. Recent advancements in overhead wire systems and third-rail technology have made electrification more feasible and cost-effective. Additionally, the emergence of battery-electric trains presents a viable solution for non-electrified lines, allowing for the benefits of electric propulsion while expanding operational capabilities.

- **Exploration of Hydrogen Fuel Cell Technologies:** Hydrogen fuel cells are gaining traction as a sustainable alternative to diesel engines for rail systems, particularly on non-electrified tracks. These hydrogen-powered trains produce zero emissions and are increasingly being deployed in pilot projects across various regions. Ongoing research efforts focus on enhancing the efficiency and cost-effectiveness of hydrogen production, storage, and distribution, positioning hydrogen as a key player in the future of sustainable rail transport.

## Addressing Challenges in Rail and Energy Projects

### 1. Navigating Technological Integration

The integration of new energy technologies with existing rail systems presents a multitude of challenges. Ensuring compatibility and seamless operation between traditional rail components and modern energy solutions is crucial for preventing disruptions and maintaining operational integrity. Industry stakeholders must collaborate to establish standards and best practices that facilitate this integration while minimising risks associated with technological upgrades.

### 2. Overcoming Energy Storage and Management Obstacles

Effectively storing and managing energy generated from renewable sources remains a critical challenge. Advances in battery technology and energy management systems are vital for addressing these issues and maximising the utility of renewable energy in rail applications. Innovative solutions, such as grid-scale batteries and flywheel energy storage systems, are being investigated to support the intermittent nature of renewable energy sources and ensure a reliable energy supply for rail operations.

## Future Prospects and Strategic Directions

### 1. Expanding the Role of Renewable Energy in Rail Systems

The ongoing development of solar, wind, and other renewable energy technologies will further facilitate the integration of clean energy into rail operations. This trend is essential for achieving the decarbonisation of rail transport and aligns with broader sustainability goals at both national and global levels. The formulation of supportive policy frameworks that encourage investment in renewable energy infrastructure will be instrumental in advancing these initiatives.

### 2. Driving Innovations in Energy Storage Solutions

Continued research into high-capacity, low-cost energy storage solutions will greatly enhance the efficiency and reliability of energy systems tailored for rail applications. Improved storage capabilities will facilitate better management of energy supply and demand, ensuring a consistent energy flow for rail operations. Collaborative efforts between industry players, research institutions, and government agencies will be crucial in driving innovations in energy storage technologies.

### 3. Leveraging Artificial Intelligence and Machine Learning

The application of artificial intelligence (AI) and machine learning will play a pivotal role in optimising energy usage, predictive maintenance, and enhancing operational efficiency within rail systems. These advanced technologies will enable the development of smarter, more responsive rail networks, ultimately improving service reliability and reducing operational

costs. By analysing vast amounts of data generated by rail operations, AI can enhance decision-making processes, allowing for more informed strategies regarding energy management and system optimisation.

## Conclusion

The integration of rail and energy projects represents a critical opportunity for advancing sustainable development and fostering technological innovation. By leveraging renewable energy sources, enhancing energy storage solutions and adopting smart grid technologies, the rail industry can significantly mitigate its environmental impact while improving operational efficiency. As we move towards a more sustainable future, ongoing research and investment in these domains will be essential to fully realise the potential synergies between rail and energy systems.

## About the Author

Shinu Yohannan is a Principal Engineer at Turbo Power Systems, UK, with a strong focus on power electronics and rail system innovations. He holds a Master of Technology in Engineering.

Shinu Yohannan has achieved notable professional recognition, including:

- Chartered Scientist (CSci) awarded by the Science Council, acknowledging Shinu's expertise and significant contributions to the scientific community.
- Chartered Engineer (CEng) awarded by the Engineering Council UK, reflecting a high standard of engineering competence and commitment.
- International Professional Engineer (IntPE) awarded by the Engineering Council UK, denoting global recognition of Shinu Yohannan's professional engineering skills.

In addition to their professional achievements, Shinu Yohannan is dedicated to mentoring the next generation of engineers. By providing guidance and support, he helps young professionals navigate their career paths and achieve their goals. Passionate about sustainability and innovation, he continues to drive progress in the integration of rail and energy projects, contributing to a more sustainable future for the industry.

## Inspiration for a Career in Engineering

My journey into engineering and science was profoundly influenced by my father. He was an Electrical Supervisor with extensive experience in Middle Eastern countries, including service with Airwork Vinnell for the US Air Force. As a child, I was captivated by the electrical work he did at home. This fascination with his work ignited my interest in Science, Technology, Engineering, and Mathematics (STEM).

My father encouraged me to pursue an engineering degree, seeing my enthusiasm for making things and understanding how they worked. His support, along with my mother's unwavering encouragement and the guidance of extraordinary teachers and mentors, set me on the path to becoming an engineer. Their collective influence was instrumental in shaping my passion for problem-solving and innovation.

Throughout my career, the drive to integrate scientific principles with engineering applications has been a constant source of inspiration. The dynamic and ever-evolving nature of these fields keeps me motivated to explore new frontiers and contribute to technological advancements that benefit society. By combining my engineering skills with scientific inquiry, I strive to develop innovative solutions that address complex challenges and push the boundaries of what is possible.

In addition to my technical pursuits, I am passionate about mentoring and supporting the next generation of engineers and scientists. Sharing my knowledge and experiences with young professionals helps them achieve their goals and fosters a collaborative environment where innovation can thrive. My career journey is a testament to the power of inspiration, mentorship, and the relentless pursuit of knowledge in shaping a successful and fulfilling career in engineering and science.

## Author:

**Shinu Yohannan, MIScT CSci CEng** is a Principal Engineer at Turbo Power Systems, UK, with a strong focus on power electronics and rail system innovations. He holds a Master of Technology in Engineering. Shinu is passionate about sustainability and innovation, he continues to drive progress in the integration of rail and energy projects, contributing to a more sustainable future for the industry.

# One-Day Technical Conference at The University of Birmingham

**Save the Date: Thursday 18th September 2025**

## 2025 Conference Title:

**Technical Professionals: innovating and evolving in a changing landscape**

We recognise the challenges posed by the cost-of-living crisis and its impact on work-life balance. Our conference is designed to equip you with essential insights to navigate upcoming challenges and provide valuable strategies to adapt, improve, and thrive. Don't miss this opportunity to future-proof yourself and your workplace.


## 2025 Conference Themes:

**AI and Technology**

Understanding the rapid advancements in AI and technology is crucial to stay ahead in an increasingly digital world and to ensure ethical, effective integration into your work.

**Creative Technologies / Media / Comms**

Keeping pace with innovations in creative industries and communication ensures you remain competitive and can harness new tools to engage audiences and drive impact.

**Health & Safety and the Environment**

Adopting forward-thinking strategies in health, safety, and environmental management is vital to creating sustainable, resilient workplaces and addressing evolving regulatory demands.

**Careers**

Developing strategies to future-proof your career ensures long-term success, adaptability, and the ability to thrive in a constantly shifting job market.



## Conference 2024 Review

You can go to Page 56 to hear about last year's Technical Conference at Lancaster, including delegate feedback.

### Previous Conferences:

| | |
|---|---|
| **2015** | Leeds |
| **2016** | Manchester |
| **2017** | Leicester |
| **2018** | Newcastle |
| **2019** | Birmingham |
| **2020** | Online |
| **2021** | Hybrid |
| **2022** | York |
| **2023** | London |
| **2024** | Lancaster |

Thousands of technical staff have attended from across the UK and Overseas.

### Delegates attending:

1. Industry and Businesses
2. Higher Education
3. Research Centres
4. Foundation Education
5. Partners

# Managing Iron Deficiency in Pregnancy: A UK Perspective

**Sumant Gadge, MIScT RSci**


## Abstract

The mineral iron is present in the human body in various forms. It plays a vital role in the normal functioning of various body organs. Deficiency in iron can cause some serious illness at various stages of life. Iron depletion is the major cause of anaemia (lower RBC count) during pregnancy. Each year, iron deficiency anaemia (IDA) complicates around 50% of pregnancies globally. This condition should be effectively managed by relevant bodies by employing measures such as early screening and diagnosis, dietary enhancements, use of supplements and regular monitoring.

This article mainly focuses on managing iron deficiency in pregnant people from the UK perspective. The two versions of the UK gold standard guideline on the management of iron deficiency in pregnancy Pavord *et al.* (2012) and Pavord *et al.* (2020) are discussed in detail outlining prominent differences and updates to rationalise the evolution in understanding the underlying science and plan of action.


## Introduction

Iron is one of the vital minerals that is essential for living cells. A number of enzymes (haem and non-haem) and proteins require iron during oxygen transport and oxidative phosphorylation. Iron plays a vital role in erythropoiesis, the process in which mature red blood cells are produced from erythropoietic stem cells. Red blood cells contain haemoglobin, a type of protein, which helps in transferring oxygen (one of the main components required during energy production) from the lungs to tissues. In a human body, iron is also present in various other forms such as myoglobin (a protein that supplies oxygen to muscles), ferritin (the iron storage protein) and gets delivered to tissues by transferrin, a blood plasma glycoprotein via cellular iron procurement in human cells (Abbaspour *et al.,* 2014). There are iron dependent enzymes in human cells including foetal and placental tissues. Iron also play a vital part in DNA synthesis (as a cofactor for ribonucleotide reductase) and so a steady supply of iron is required to maintain these activities (Thelander *et al.,* 1983).

Due to its high demands, human body needs a certain level of iron each day through diet and/or supplements to maintain the balance between uptake and utilisation. Deficiency in iron uptake may cause some serious issues especially in growing infants and pregnant people (Bothwell *et al.,* 1979). IDA can be a cause of many symptoms including fatigue, pagophagia (compulsive ice chewing), restless leg syndrome and poor quality of life. In pregnant people, it can cause preterm labour, high chances of caesarean section, postpartum haemorrhage and sometimes maternal mortality. Prenatal maternal anaemia can cause autism disorders and compromised memory in neonates.

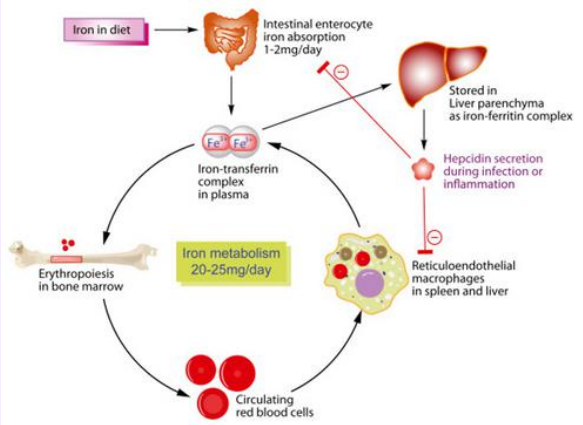



*Figure-1: An overview of iron metabolism in human body and various forms of iron. Credits: Iron Metabolism, ScienceDirect. Elsevier Publications.*

In females, the daily standard intake of iron should equate between 15 to 18mg during healthy/normal conditions (Recommended Daily intake (RDA) for females aged between 19 and 49). During pregnancy,

this value goes up to 30mg as more iron is required for developing foetus and placenta and for increasing the maternal red cell mass (Hallberg *et al.,* 1988). Various food items contain varying levels and types of iron such as haem iron and nonheme iron. Our body absorbs haem iron more easily than nonheme iron. Any deficit in iron storage will lead to RBCs getting smaller in shape with less haemoglobin and thus less capacity to transport oxygen to tissues. This condition is called iron deficiency anaemia and can be risky as heart has to work extra hard to transport oxygen across body. Also, anaemic patients are more prone to catching infections easily. Numerous factors can be responsible for anaemic situation during pregnancy like decreased levels of folate and vitamin B12, thalassaemia, haemolysis and blood loss, poor nutrition, worry and negligence to health condition. Iron deficiency has been evidenced as one of the major factors to cause anaemia. Hence it becomes very crucial to monitor and maintain the iron levels during pregnancy and promptly treat if levels deplete.

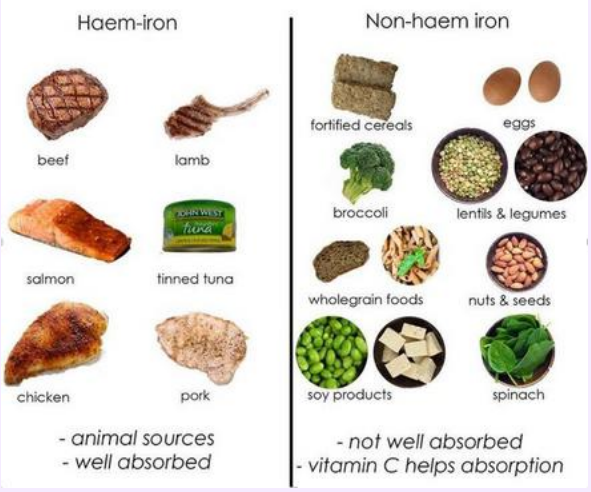



*Figure-2: Sources of Iron. Credits: Moving Dietician.*

## Screening and Diagnosis

Routine Screening: There should be a regular screening during first prenatal visit and then again in second and third trimester focusing on iron deficiency and anaemia.

Blood Tests: Blood tests for haemoglobin (Hb), haematocrit (Hct), serum ferritin, and serum iron levels should be completed for every pregnancy. Research shows that ferritin is the most specific test for iron deficiency.

Criteria: A haemoglobin level below 110 g/L in the first, 105 g/L in the second trimester and 100 g/l in third trimesters suggests anaemia.

## Dietary Enhancements and Iron Supplements

Dietary Sources: During pregnancy, people should increase the uptake of iron-rich foods such as:

- Red meat, poultry, fish (heme iron, better absorbed)
- Beans, lentils, spinach, fortified cereals (non-heme iron, less readily absorbed)
- Vitamin C: Enhances the absorption of non-heme iron and can be paired with iron-rich foods.

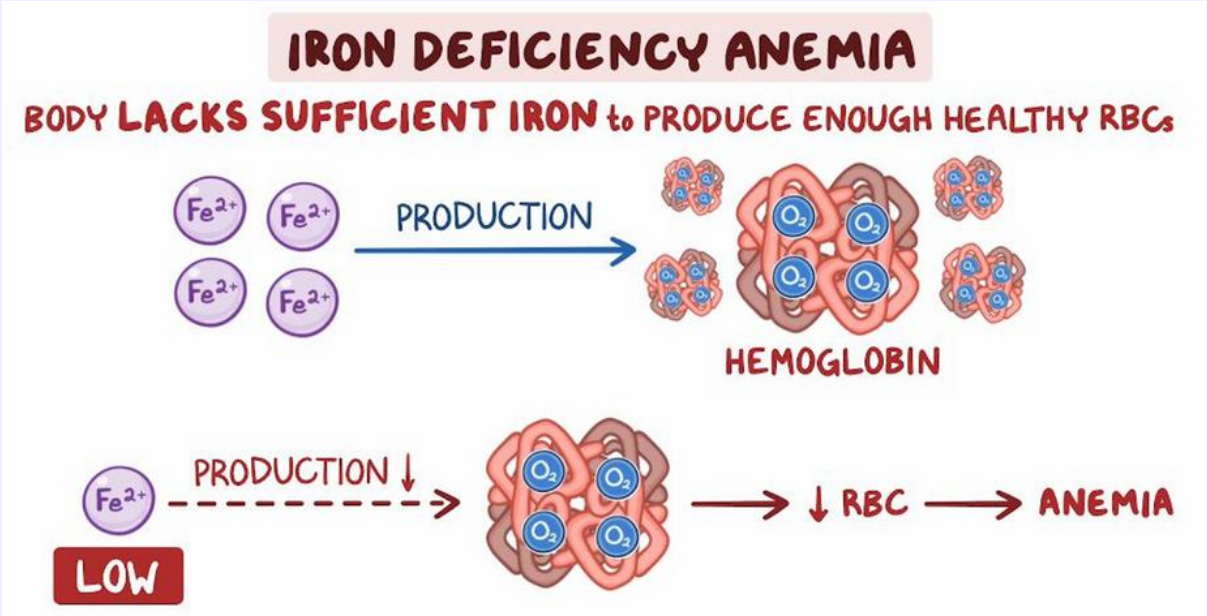



*Figure-3: Iron Deficiency Anaemia. Credits: Iron Deficiency Anaemia Clinical Sciences by Osmosis, Elsevier Publications.*

Iron Supplements: When iron deficiency is diagnosed and dietary intake is not sufficient, oral iron supplements (ferrous sulphate, ferrous gluconate) should be prescribed. These should be taken daily or every alternate day to improve absorption and reduce gastrointestinal side effects.

### Managing of Iron Deficiency Anaemia as per severity

- Mild to Moderate Anaemia can be treated by iron supplementation (100 to 200 mg of elemental iron per day). For side effects (nausea, constipation), dose can be adjusted or different form (e.g. ferrous gluconate) can be prescribed. Vitamin C (ascorbic acid) can be taken with iron supplements to enhance absorption.
- Severe Anaemia should be treated by intravenous (IV) iron therapy. Intravenous iron (iron sucrose, ferric carboxymaltose) is usually indicated for rapid replenishment of iron stores but is limited for more severe cases or those close to delivery. Blood transfusion is preferred if there is symptomatic anaemia or delivery is close.

### Monitoring and Follow-Up

Treatment response check: A blood test should be done after 2-4 weeks of starting the iron supplements for haemoglobin and ferritin levels. The prescribed iron supplements are often continued for 6-8 weeks after delivery to replenish the iron stores in mother. This aspect should also be monitored closely.

### Preventative Measures

Expecting parents with a history of anaemia or related known risks should be prescribed prenatally a low dose iron supplementation as well as vitamins containing iron as a preventative measure.

### Specific Populations

Vegetarians/vegans mostly consume non-haem iron due to their plant-based diet. Iron supplements must be considered for such population as non-haem iron is less efficiently absorbed.

People with multiple pregnancies and/or shorter interval between pregnancies are at high risk of iron deficiency anaemia. This population may require a more intense iron management.

### Excessive Iron Supplementation

More than required dose of iron may to introduce unnecessary side effects like constipation and nausea. Certain population (e.g. genetic biases) may suffer from haemochromatosis (iron overload) that may prove detrimental during pregnancy.

### UK Guidelines

In pregnant people, from first trimester to third trimester, the blood plasma volume increases exponentially but the production of RBCs and haemoglobin doesn't pick this pace so quickly. This state is called haemodilution and is the main contributing factor for decreased Hb levels during pregnancy. As the amount of blood goes up, the body demands more iron for self as well as for the growing foetus. As per NIH (National Institutes of Health) recommendations, a pregnant female needs 27mg to 30mg of iron per day; nearly double the normal level. For this very reason, pregnant females are easily prone to iron deficiency if due consideration is not given in time. Sustained anaemia during pregnancy and postpartum can lead to postpartum haemorrhage (PPH) (Briley *et al.,* 2014). Once a pregnant person becomes iron deficient, it is immensely hard to replenish the iron levels through diet only and so oral iron supplements must be given. NIH published a generic guideline on iron deficiency anaemia confirming the level of Hb in anaemic pregnant women. However, this guideline does not specifically discuss recommended course of action for management and treatment for pregnant people with iron deficient anaemia. There was an utmost need for a guideline that outlines well researched and clear recommendations in such specific conditions. These standardised recommendations on iron levels for anaemia and further treatment will help clinicians provide a common framework for decision making.

Pavord et al. (on behalf of British Society for Haematology (BSH) in conjunction with British Committee for Standards in Haematology (BCSH) and Obstetric Haematology Group (OHG)) produced the first ever list of recommendations to manage iron deficiency in pregnant people in the UK. This got publicly available in the UK in 2012 (referred to as the old guideline) Pavord *et al.* (2012) with some key aspects on detection criteria, treatment planning and further prevention. This guideline got superseded by its new version in 2018 (also referred to as the current guideline) (Pavord *et al.,* 2020). This guideline mainly focuses on iron deficiency due to it being the major contributing factor for anaemia during pregnancy.

### Key recommendations from the current guidelines are summarised below:

- If the Hb level falls below 110g/l, 105g/l and 100g/l in first, second as well as third and postpartum respectively, the patient should be classed as anaemic.
- The early detection and planned treatment in such conditions will reduce the risk of PPH.
- Clinicians and nursing staff should be made aware about the commonness of anaemia during pregnancy due to iron deficiency and can lead to

- risk of morbidity and mortality in women and also may cause neuro-development complications in new born babies.
- A well-balanced routine of blood tests (for Hb concentration) and clinical examination should be in place and followed for every pregnancy.
- Serum ferritin can be a good pre-indication of iron deficiency and should be screened in cases with known haemoglobinopathy. A ferritin value <30ug/l can indicate iron deficiency and possible case of anaemia.
- Expert dietary advice especially focusing iron intake and absorption should be available to females irrespective of their anaemic status.
- Oral iron supplements in the range of 40 to 80mg with a glass of water or source of Vitamin C on an empty stomach should be recommended each morning avoiding any other medications or multivitamin supplements. Hb should be checked at 2-3 weeks for response. Slow releasing or enteric coated supplements should be avoided.
- Severe cases of anaemia (Hb<70g/l) must be treated immediately. If a treatment is initiated, effectiveness must be confirmed by checking Hb in 2-3 weeks period.
- Treatment should continue for 3months and at least 6 weeks after delivery even though Hb measured in the normal range. This will help them replete iron during this development activity.
- The guideline recommends the intra venous (IV iron administration) dosing for severe cases where there is no/poor response or complete intolerance to oral iron supplements and also lists the available doses for the UK market. This can be useful postpartum too if they have similar issues. It is worth noting that these are the recommendations from the committee and clinical judgment should always take the precedence.
- The mode (C-section or normal) and timing of delivery should not be determined by iron deficiency but anaemic cases should be delivered in an obstetrician lead unit.
- Clear and concise local guidelines should be in place for postnatal red cell transfusion in anaemic cases irrespective of any active bleeding.
- Full information should be provided and written consent should be obtained before administering red cell transfusion.

### Comparison between the Old and New Versions

For the old version (2012 guideline) the guideline group referred to publications from 1966 to 2010 on MedLine and Embase search engines with a limited number of search terms whereas current one is a product of extensive search terms and referred to only very recent and relevant publications between 2012 to 2018 from MedLine, Embase and Central search engines.

The old version used recommendation criteria guided by Procedure for Guidelines by BCSH, where as a much more robust and universally accepted GRADE criteria was employed to arrive at the concluded recommendations on the current version. Grading Recommendations, Assessment, Development and Evaluations or GRADE provides the balanced approach to conclude clinical recommendations on the basis of available evidence. It then rates the quality of evidence in four levels of certainty from Very Low to High. The current guideline was rated as High certainty.

The current guideline provides a deep insight into the recommended dose and diagnostic time frames for prenatal, perinatal and antenatal periods. The current guideline is in-depth whereas the old one was lacking the qualitative analysis.

The biggest difference between these two versions is in the dosing of oral iron e.g. recent recommended dose is 40-80mg (Moretti *et al.,* 2015). The authors researched this aspect in greater depths. They stress upon the importance of not taking more than one tablet per day, as the successive tablets can interfere with absorption and utilisation of the previous one. It should be one every morning (due to low levels of hepcidin in the morning Schapp *et al.* (2013)) or alternate mornings, with a glass of water or juice of orange (as a vitamin C source to enhance iron absorption) on an empty stomach one hour before food, drink or other medications. This practice will optimise the iron absorption and minimise any side effects and so ultimately the intolerance will be really minimal.

Another emphasis which is evident in the new version is attention to the non-anaemic females who may be iron depleted, so risk factors should be identified proactively so that treatment can be planned beforehand. and a low threshold for giving oral iron empirically- twins, multiparity, vegetarians etc.

Currently, 4 IV iron preparations are in use in the UK e.g. sucrose, dextran, ferrinject and monofer; of which ferrinject and monofer are administered only once while sucrose and dextran need more than one dose. Recent guidelines have been slightly updated in case of intravenous administration of iron. They stated that use of monofer can be avoided in first trimester as it was unclear in the old version. Additionally, a recent study Simon G et al. (2020) has shown that use of liposomal iron, a ferric pyrophosphate accompanying with vitamin C preparation, is a newly invented oral iron with lesser side effects, lower gastric imbalance, readily biologically available, and can be administered without protein carriers with low dose.

Hepcidin plays a key role in regulating iron absorption. It binds to ferroportin and inhibits the activity of enterocytes resulting in reduced absorption of iron (Means, 2020). However, there is no significant data available on the use of hepcidin as a key biomarker in the diagnosis of iron deficiency in pregnancy.

Finally, research has shown that iron salts such as ferrous fumarate, ferrous gluconate, ferrous sulphate and ferrous feredetate might be one of the reasons for gastric irritation in pregnancy (Nguyen *et al.,* 2024). Hence correct dose should be administered. For this reason, in recent guidelines the concentration of iron salts in oral iron preparation has been slightly changed e.g. ferrous sulphate 200 mg instead of using extra 300 mg.

## Summary and Future Recommendations

This work elucidates various aspects of guidelines for healthcare professionals regarding iron dose, factors affecting iron deficient expecting parents, future approaches to prevent, diagnose and treat anaemia with iron deficiency.

Despite these recommendations and recent techniques available to diagnose iron deficient status, some areas are still unanswered. In the case of normal pregnancy, research is needed to treat iron deficiency in non-anaemic pregnant people. Secondly, like ferritin, hepcidin could also be a potential biomarker in early diagnosis of iron deficiency. However, further research is needed to explain its standard role in iron absorption, cost efficiency and if readily available. In late pregnancy, development of brain occurs very rapidly and hence there is an increased need for overall nutrition. However, the effect of iron supplements on neurocognitive development is still unclear. Because of lack of universally accepted standard dose for iron supplements during pregnancy, future studies are inevitable for alternative preventive measures for iron deficiency.

Also, effective collaboration at every stage between healthcare provider and pregnant people will ensure a successful pregnancy outcome for both parent and the tiny new-comer to this world.

## Reflections

Having studied the above guidelines, I must say it gives us the first step towards having a robust plan for expecting parents. In this digital age, our NHS is embarking on the journey of making all the relevant aspects of care readily available to patients. One such initiative by my NHS Trust is to have a mobile app that provides the patient with a digital schedule of all the tests, scans, visits, the respective reports, diet plans, medications as well as GP/Midwife follow ups. I am sure the expecting parents will feel assured by using such an app.

**References**


1. *Thelander, L., Gräslund, A., Thelander, M. (1983). Continual presence of oxygen and iron required for mammalian ribonucleotide reduction: Possible regulation mechanism. Biochemical and Biophysical Research Communications. Volume 110, Issue 3, page 859-865,ISSN 0006-291X, https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*
2. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*
3. *Bothwell, T.H., R.W. Charlton, J.D. Cook, and C.A. Finch. (1979). Iron Metabolism in Man. Blackwell Scientific Publications, Oxford. 576 pp. https://doi.org/10.1113/expphysiol.1980.sp002513*
4. *Bezwoda, M.R., T.H. Bothwell, J.D. Torrance, A.P. MacPhail, R.W. Charlton, G. Kay, and J. Levin. (1979). The relationship between marrow iron stores, plasma ferritin concentrations and iron absorption. Scand. J. Haematol. 22:113–120. https://doi.org/10.1111/j.1600-0609.1979.tb00411.x*
5. *Charoenlarp P, Dhanamitta S, Kaewvichit R, et al. A WHO collaborative study on iron supplementation in Burma and in Thailand. Am J Clin Nutr. 1988;47(2):280-297. https://doi:10.1093/ajcn/47.2.280*
6. *Brise H, Hallberg L. (1962). Absorbability of different iron compounds. Acta Med Scand Suppl. 1962;376:23-37. https://doi:10.1111/j.0954-6820.1962.tb18680.x*
7. *Balesaria, S., Hanif, R., Salama, M.F., Raja, K., Bayele, H.K., McArdle, H. and Srai, S.K.S. (2012) Fetal iron levels are regulated by maternal and fetal Hfe genotype and dietary iron. Haematologica, 97, 661–669. https://doi.org/10.3324/haematol.2011.055046*
8. *Abbaspour, N., Hurrell, R., Kelishadi, R. (2014). Review on iron and its importance for human health.Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences,19,2, page 164–174.https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*
9. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*
10. *Pavord, S., Myers, B., Robinson, S., Allard, S., Strong, J., Oppenheimer, C. (2012). UK guidelines on the management of iron deficiency in pregnancy. British Journal of Haematology,156, page 588–600. https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*
11. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*
12. *Pavord, S., Daru, J., Prasannan, N., Robinson, S., Stanworth, S., Girling, J. (2020). UK guidelines on the management of iron deficiency in pregnancy. British journal of haematology, 188, page 819-830. https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*
13. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*

14. *Briley, A., Seed, P.T., Tydeman, G., Ballard, H., Watersone, M., Sandall, J., Poston, L., Tribe, R.M. and Bewley, S. (2014). Reporting errors, incidence and risk factors for postpartum haemorrhage and progression to severe PPH: a prospective observational study. British Journal of Obstetrics and Gynaecology, 121, page 876–888.https://doi.org/10.1111/1471-0528.12588.*

15. *Means RT. (2020). Iron Deficiency Anaemia: Implications and impact in pregnancy, fetal development and early childhood parameters, Nutrients,12, page 447. https://doi.10.3390/nu12020447*

16. *Auerbach, M., Abernathy, J., Juul, S., Short, V., Derman, R. (2019). Prevalence of iron deficiency in first trimester, non-anaemic pregnant women. Maternal, Fetal and Neonatal Medicine, 3, page 1–4.https://doi.org/10.1080/14767058.2019.1619690*

17. *Schaap, C.C., Hendriks, J.C., Kortman, G.A., Klaver,S.M., Kroot, J.J., Laarakkers, C.M., Wiegerinck, E.T., Tjalsma, H., Janssen, M.C., Swinkels, D.W. (2013). Diurnal rhythm rather than dietary iron mediates daily hepcidin variations. Clinical Chemistry, 59, page 527–535. https://doi.org/10.1373/clinchem.2012.194977*

18. *Garzon, S., Cacciato, P.M., Certelli, C., Salvaggio, C., Magliarditi, M., Rizzo, G. (2020). Iron Deficiency Anemia in Pregnancy: Novel Approaches for an Old Problem. Oman medical journal, 35,5, e166. https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*

19. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*

20. *Kazma JM, van den Anker J, Allegaert K, Dallmann A, Ahmadzia HK. (2020). Anatomical and physiological alterations of pregnancy. J Pharmacokinet Pharmacodyn. Aug;47(4):271-285. https://doi:10.1007/s10928-020-09677-1*

21. *BBenson AE, Shatzel JJ, Ryan KS, et al., (2022). The incidence, complications, and treatment of iron deficiency in pregnancy. Eur J Haematol.109(6):633-642. https://doi:10.1111/ejh.13870*

22. *Nguyen M, Tadi P. Iron Supplementation. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available from: https://en.wikipedia.org/wiki/List_of_active_natural_gas_power_stations_in_the_United_Kingdom*

23. *Colverd, G., Bardhan, R., & Cullen, J. (2024). Benchmarking Domestic Energy Consumption using High-Resolution Neighbourhood Energy Data and City Clustering in the UK. Proceedings of the 11th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation, 121–131. https://doi.org/10.1145/3671127.3698183 Platt, S., & Ward, D. (2022b). Technical Study on Energy and Renewables in Hope Valley. Hope Valley Climate Action Energy Group.*

## Author:

**Sumant Gadge, MIScT RSci** is a is a Clinical Scientist at East Kent Hospitals NHS University Foundation Trust. After completing his MSc in Medical Physics in 2006, he has been working within various sections in MPACE (Medical Physics and Clinical Engineering) group. Sumant also teaches at the University of Kent (Visiting lecturer) and supervises final year projects for B.Eng. students. He is an active member of Policy and Guidance group at Department of Neonatology and assists the simulation team conduct study days and signs off the device competencies for clinical staff including newly qualified doctors. Sumant is a qualified ISO QMS auditor and had been conducting the internal audits within the MPACE group. His main areas of interest are Medical Device design and regulations, MRI, teaching, training and policy.

# Limitations of Analytical Calibrations

Michael N. Quigley, FIScT

## Introduction

A previous article described the importance of accurate preparation of standard solutions, and the various factors that need to be considered. From an analytical chemistry point of view, standard solutions are often used in the preparation of calibration graphs (usually referred to as curves) enabling various types of analytical instrumentation (e.g. spectrophotometers, chromatographs, etc.) to provide accurate results.

For instance, in the case of a UV-visible spectrophotometer, detector absorbance values for a given analyte can be plotted against sequentially increasing concentrations, displaying a linear relationship between the two. Incidentally, it is interesting to note that while the concentrations are based on a linear scale, absorbance values are based on a logarithmic scale. Regardless of linear or logarithmic scales, this type of straight-line calibration curve is defined by the equation:

$$Y = mX + C$$

Where: **Y** = y axis value; **m** = slope of the curve;
**X** = x axis value; **C** = y axis intercept.

Although the concept is relatively easy to understand and implement, there are important limitations.

## Matrix Effects and Modifications

In preparing calibration standard solutions, it's always recommended to match the medium (matrix) in which the analyte is contained. For instance, powdered organic samples digested with concentrated nitric acid, and finally diluted to a known volume with deionized water, need to be analyzed against calibration standards emulating the acidic condition of the samples. However, it is easy to imagine situations where the sample medium is either not accurately identified or contains species capable of interfering with the determination of the analyte. Analysis of seawater for the determination of trace metal ions, or the analysis of chemical pickling solutions for the determination of macro metal ions are just two examples in which matrix modification together with the method of standard additions is recommended.

In general, matrix modification involves the addition of a reagent to a sample solution with the intent of altering constituent(s) capable of having an interfering effect on an analysis. In the case of seawater analysis, matrix modification has been used to:

1. Convert sodium chloride into more volatile compounds.
2. Decrease the volatility of metal ion analytes to thermally stable compounds.
3. Increase the volatility of metal ion analytes using organic compounds.

Consider the use of graphite furnace atomic absorption spectrophotometry (GFAAS) for the direct determination of trace metal ion concentrations in seawater. This method removes the need for preconcentration. With the concentrations of many metal ions in the ppb range, the interfering presence of sodium chloride (typically 3.5 % in seawater) can be removed by the addition of ammonium nitrate solution. The ammonium nitrate converts sodium chloride to sodium nitrate and ammonium chloride:

$$NaCl + NH_4NO_3 \longrightarrow NaNO_3 + NH_4Cl$$

NaCl has a melting point of 801 ºC whereas NaNO3 has a melting point of 307 ºC and NH4Cl has a melting point of 335 ºC.

## Dilutions

Care should be taken to avoid accepting sample data that lies much beyond the accepted upper limit of the calibrant range. Such use assumes that extrapolation of what is intended to be a straight line is predictable and capable of providing accurate results. Test results lying below the lower limit of the calibration curve should not be rejected out of hand, as in some

applications stochastic effects of high dilution can cause the curve to tail off. Cf quantitative real-time PCR, where cycle threshold values above the LOQ (limit of quantitation) can actually represent low numbers of DNA copies the initial test solution. However, once the high limit of the normal calibration range for a given analyte is exceeded, the more likely that there will be signal suppression (and thus flattening and eventual plateauing) of what starts out as a straight-line relationship.

In general, if an interpolated sample concentration value lies beyond the high limit of the calibrant range, the sample needs to be diluted such that the projected dilution concentration lies within the calibrant range.

As an example, consider an ICP calibration curve problem: An ICP spectrometer provides an initial indicated concentration of approximately 400 mg/dm$^3$ (mg/L, or ppm) of analyte species $M^{2+}$ in an unknown solution, but the acceptable calibration range extends only up to 5 ppm $M^{2+}$.

We need to dilute the inaccurately known 400 ppm solution sufficient that the final concentration falls within the 5 ppm $M^{2+}$ calibrant range to obtain an accurate result.

Traditional glass volumetric pipets can be used to create sequential dilutions:

1. 10.0 mL of 400 ppm $M^{2+}$ soln. in 100.0 mL = 40 ppm $M^{2+}$ ($1/10^{th}$ sequential dilution)
2. 10.0 mL of 40 ppm $M^{2+}$ soln. in 100.0 mL = 4 ppm $M^{2+}$ ($1/100^{th}$ sequential dilution)
3. 50.0 mL of 4 ppm $M^{2+}$ soln. in 100.0 mL = 2 ppm $M^{2+}$ ($1/200^{th}$ sequential dilution)

Alternatively, a single small volume pipettor can be used in accordance with the classic concentrations and volumes formula...

$$C_1 \times V_1 = C_1 V_1$$

Where $C_1$ = Concentration of Solution # 1
$V_1$ = Volume of Solution # 1
$C_1$ = Concentration of Solution # 2
$V_1$ = Volume of Solution # 2

With our approximately 400 ppm $M^{2+}$ solution, the formula can be used to calculate the volume required to prepare an approximate 2 ppm $M^{2+}$ solution.

$$400 \text{ ppm } M^{2+} \times V_1 = 2 \text{ ppm } M^{2+} \times 100 \text{ mL}$$

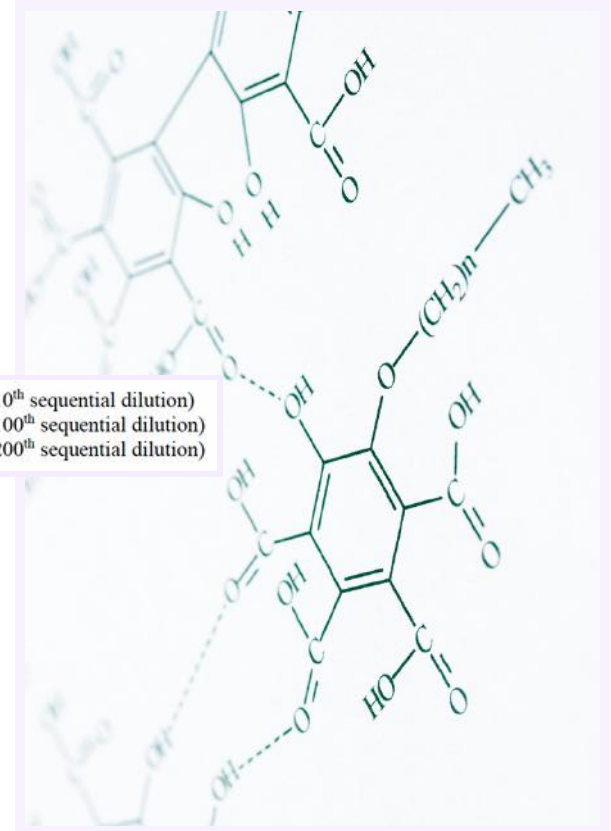
Therefore...

$$2 \text{ ppm } M^{2+} \times 100 \text{ mL} / 400 = 0.5 \text{ mL}$$

So, pipetting 0.5 mL (500 µL) of the approximately 400 ppm $M^{2+}$ unknown solution and diluting this to 100 mL, should bring the concentration of $M^{2+}$ within the acceptable calibrant range. Multiplying this accurately determined concentration by the dilution factor of 200 reveals the accurate concentration of $M^{2+}$ in the original unknown solution.

Summarising, straight-line curves are the preferred means of determining amounts or concentrations of analyte species. However, knowledge of potential limitations and the appropriate corrective procedures, enables the veracity of results to be maintained, even when dealing with difficult samples.

**Author:**
**Michael Quigley, FIScT** is is the CEO of Createc Corporation, Ithaca, New York. Michael has worked in Chemistry Education & Educational Research Plant Sciences Agriculture. He has a lof of publishing experience as has had his work cited more than 120 times.



# National Education Technical Professional Pathway

## National Technician Development Centre


### Summary

The National Technician Development Centre (NTDC) has been supporting the sector with technician career pathway development for over a decade and currently has over 100 member organisations. The Higher Education Technical Taxonomy (HETT) Framework has been used with over 70+ organisations and continues to be redeveloped and modernised. The National Education Technical Professional (ETP) Working Group is developing a pathway for education technicians (Education Technical Professionals) similar to those for Research Technical Professional (RTPs). This is critical to ensure recruitment and retention of the best education technical talent and to deliver the best education and experience to students.


### Introduction

The challenge of recruiting and retaining technicians is well published. This is considered a significant barrier to the attraction and retention of technical talent and a major contributor to the technical skills shortage continuing to face the UK.

The National Technician Development Centre (NTDC) is the Office for Students (OfS) National Body for the Higher Education Sector. We are a not-for-profit organisation with over 100 member organisations. We have been supporting organisations with technical career pathway development for over a decade. Our roots go back to 2014 when the Higher Education Funding Council for England (HEFCE, the government body that preceded OfS & UK Research & Innovation, UKRI) funded the Technical Development & Modernisation Project.

The Higher Education Technical Taxonomy (HETT) Framework has been used to support 70+ organisations to refresh or redesign their technical career pathways. The HETT Framework consists of 4 components:

1. Higher Education Technical Taxonomy: Architecture of incremental roles and their names;
2. Capability Framework: Describes the abilities required to complete each role;
3. Role Outlines: Define the tasks and objectives of each role in the family;
4. Progression Criteria: Used to determine promotion criteria where organisations require promotional pathways.

We continue to redevelop and modernise the HETT Framework so that it remains sector leading. In our most recent update, we introduced our Research Technical Professional Pathway, which can be implemented as either a traditional or a promotional pathway (Figure 1).

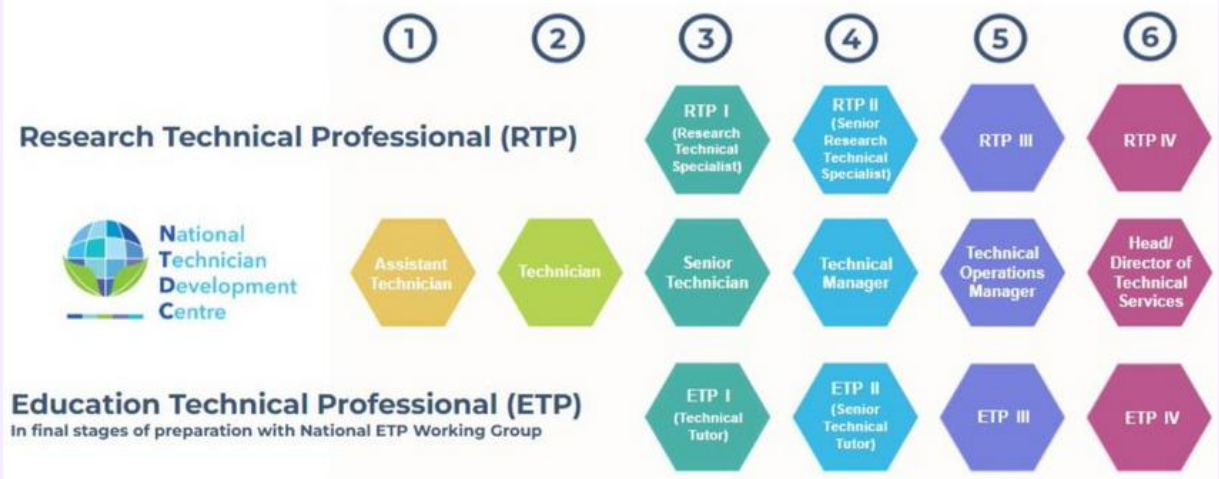



*Figure-1: The Higher Education Technical Taxonomy (HETT) Framework .*

## Evolution of Education Technicians

£27,030m (56%) of university income was derived from course fees and education contracts in 22/23 (OfS data). Technicians who are teaching focused are usually core funded. The NTDC Technician Survey has been run at 30+ universities, surveying 5,100 technicians. Our data demonstrates that 46% of respondents are employed in primarily education focused roles, with 67% of respondents stating their role contributes to education success in some way. 86% of respondents state that they train others irrespective of role focus (see Table 1).

| Focus & Responsibilities | Percentage of Respondents Agreeing |
|---|---|
| Role is Primarily Education Focused | 46% |
| Role Contributes to Education Success | 67% |
| Role involves Training Others | 86% |

*Table-1: Table showing how many respondents (as a percentage) agree with the focus and responsibilities focus.*

The role of the education focused technician has expanded in line with other technical roles. Our research reveals that education technicians are now undertaking higher capability duties given they possess highly refined practical skills and are experts in the use of technology and related innovation. This is also reflected in their formal qualifications (29% level 6; 27% level 7; 14% level 8). These additional duties have a direct impact on student outcomes, with education technicians:

- Teaching students academic reasoning by learning how to select and utilise a variety of skills, techniques and equipment to achieve learning objectives;
- Leading taught practical sessions;
- Assessing students work;
- Using learning objectives to design practical sessions (pedagogical innovation);
- Analysing student outcome data to improve content to increase future student attainment.

Working collaboratively with academic colleagues, education technicians ensure that content and delivery modes enable the highest continuation, completion and progression (as measured by OfS B3 rates), teaching excellence (as measured by the Teaching Excellence Framework) and student satisfaction (as measured by National Student Survey).

## A Spotlight on Education Technicians

A specific pathway for education technicians does not currently exist. Such a pathway would give parity with RTP colleagues who:

- Are increasingly recognised as professionals in their own right;
- Can benefit from targeted development and promotion.

## NTDC National Education Technical Professional Pathway

Our National Education Technical Professional Working Group is comprised of the best technical, HR & Organisational Development and academic talent from 25+ universities from across the sector. We have been co-creating the National Education Technical Professional Pathway.

We have defined the Education Technical Professional (ETP) as, usually technicians who:

- Make vital contributions to the education of students;
- Deliver excellence in technical & technology education and its innovation;
- Deliver as a team (e.g. with academic colleagues) providing the fullest experience and offering optimum conditions for student success.

## Benefits

Our National ETP Pathway will deliver the following benefits:

- Attracting, developing and retaining ETPs with cutting edge technical and technology skills crucial for educating current and future generations of students;
- Realising the full potential of ETPs in collaboratively driving forward technical and technology education and its innovation;
- Value and promote the work of ETP in securing positive student outcomes, driving innovation in education and as members of the wider education community;
- Introduce parity with the RTP Pathway.

## What doeS the ETP pathway offer?

Our National ETP Pathway will provide a framework of four ETP roles with associated capabilities and progression criteria. The ETP Pathway will be released without restriction to the HE sector once complete (it will not require a subscription to access). We are gathering feedback to enable finalisation. Feedback sessions have taken place at:

- Institute of Science & Technology Conference (September 2024);
- Staff Development Forum Festival of Learning and Development (November 2024).

Feedback sessions are taking place at the following universities:

- Coventry University;
- University of Derby;
- Edinburgh Napier University;
- University of Leeds;
- The University of Liverpool;
- Manchester Metropolitan University.

Role information is presented in Table 2. We welcome any feedback at enquiries@ntdc.ac.uk

## National Education Technical Professional Network 'ETP' Net

In October 2024 we launched the National Education Technical Professional Network, 'ETP'Net. Our first meeting will be at our Partner Affiliate Forum in January. 'ETP'Net will unite education technicians (ETPs) from across the sector and beyond. We will explore education focused technical roles (including our new ETP Pathway), share best practice and seek solutions to collective challenges. We are establishing Interest Groups including the SuperLab Interest Group.

If you would like to get involved please contact enquiries@ntdc.ac.uk.

## About the NTDC:

The National Technician Development Centre provides organisations with everything they need to support the delivery of high quality and sustainable technical services across all sectors.

| Education Technical Professional I | Education Technical Professional II | Education Technical Professional III | Education Technical Professional IV |
|---|---|---|---|
| Focusing on technical skills & technology in education, the role holder provides an excellent student learning experience as part of the education team. They develop and deliver inductions, skills demonstrations, skills training and supervise students. They assess students' work (typically pass/fail) and analyse local student performance data to improve future provision. They manage and maintain both education equipment and infrastructure (inc. H&S) contributing to development. | As part of the education team, the role holder initiates, designs, develops and leads a wide range of technical & technology educational activity (including taught classes in which numerous practical skills and theory combine). They design new activity directly from learning objectives including new assessments. They provide an excellent student learning experience, assess students' work and innovate to drive student attainment and satisfaction. They disseminate their work widely internally and externally. | With a national standing they are considered an expert in technical & technology education and innovation. They deliver excellent education, innovate and disseminate high quality outputs. They co-create education strategy and operational plans with Faculty/College/Institute (or similar) influencing university strategy. They are a member of key education focused committees and co-ordinate and prepare cases for change and significant investment into educational equipment and infrastructure. | They are considered a national/international expert in technical & technology education and innovation. They are a leader in the development of the national technical skills and technology policy agenda. They strategically develop new technical and technology education aligned to employer requirements defined through partnership working and backed by their own practice-based pedagogical research. They advise on high-level future equipment and infrastructure required to meet national strategic technical and technology aspirations. |

*Table-2: The table shows four Education Technician Professional (ETP) roles with associated capabilities and progression criteria.*

# The Role of Digital Transformation in Enhancing Environmental Compliance in the Chemical Industry

**Amro Heikal, FIScT CSci**

The chemical industry stands at the forefront of both innovation and responsibility. As global sustainability initiatives continue to grow, companies face increasing pressure to meet stringent environmental regulations while ensuring efficient operations. One of the most powerful tools at their disposal is digital transformation. By integrating advanced technologies such as IoT, AI, automation, and data analytics, companies can not only meet regulatory requirements but also unlock new levels of operational efficiency, cost savings, and innovation.

## Real-World Impact of Digital Transformation

Recent data illustrates just how transformative digital tools have been in driving environmental compliance in the chemical industry (see Figure 1):

- Operational Efficiency: Digital transformation has driven a 30% improvement in operational efficiency. By leveraging IoT devices and real-time monitoring, chemical companies are optimizing production processes, reducing downtime, and streamlining resource use. This real-time monitoring allows companies to continuously track emissions, waste output, and resource consumption, ensuring compliance with environmental regulations.

- Cost Savings: Automation and predictive maintenance, powered by AI, have led to a 20% reduction in operational costs. By identifying and addressing equipment failures before they occur, chemical companies can prevent costly compliance breaches. Predictive models help companies anticipate maintenance needs and optimize the use of resources, all while ensuring they meet environmental guidelines.

- Enhanced Reporting Compliance: One of the most labour-intensive aspects of environmental compliance is reporting. Digital tools have made compliance reporting more efficient and accurate, leading to a 62% improvement in this area. Automation eliminates the need for manual data entry, reducing human error and ensuring timely submissions to regulatory bodies. Furthermore, blockchain technology offers secure, transparent records, providing regulators with an easily auditable trail and reducing the risk of non-compliance.

- Safety & Risk Mitigation: Safety and risk mitigation are critical in the chemical industry. Digital platforms equipped with real-time monitoring have improved safety measures by 40%, allowing companies to respond quickly to potential environmental hazards. Proactive risk management systems help companies avoid accidents and ensure they are always in compliance with strict safety regulations, safeguarding both the environment and their workforce.

- Collaboration & Innovation: Digital platforms have also fostered greater collaboration within the industry, leading to a 35% boost in innovation. By connecting companies with research institutions, regulatory bodies, and other stakeholders, these platforms allow for the sharing of best practices and the co-development of new technologies aimed at reducing environmental impact. Collaboration leads to breakthroughs in emission-reduction techniques, sustainable chemical solutions, and improved waste management.

## Key Areas of Transformation

1. Real-Time Compliance Monitoring: IoT devices and AI-powered analytics enable companies to continuously monitor their environmental footprint. With real-time feedback, companies can ensure compliance with emissions and waste regulations, making necessary adjustments before violations occur.

2. Automating Compliance Reporting: Manual reporting is time-consuming and prone to errors. By automating compliance reporting, companies can streamline the collection, organization, and submission of data, ensuring accuracy and timeliness. Blockchain technology further enhances transparency, creating a verifiable audit trail that reduces the risk of regulatory disputes.

3. Improving Safety Through Proactive Management: Safety isn't just about having protocols in place—it's about preventing accidents before they happen. Digital tools allow companies to proactively manage risks, ensuring compliance with safety regulations and reducing the chance of environmental accidents. This proactive approach minimizes environmental damage, improves workplace safety, and protects company reputation.

4. Collaboration Across the Industry: No company can tackle environmental challenges alone. Digital platforms enable collaboration across the industry, fostering partnerships that lead to new technologies and sustainable practices. By sharing data, insights, and innovations, companies can collectively reduce their environmental impact and set new standards for sustainability.

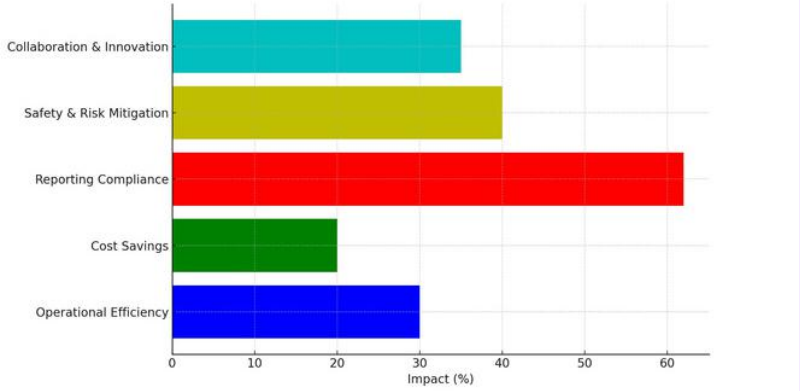



*Figure-1: Graph showing the impact of digital transformation on Environmental compliance in the chemical industry (Real Data).*

## Future Trends in Digital Compliance

As technology continues to evolve, we can expect even more innovations in digital compliance. AI-driven analytics will provide deeper insights into compliance data, identifying trends and areas for improvement. Digital twins - virtual models of physical assets - will enable companies to simulate different production scenarios, optimising operations for sustainability before changes are implemented in the real world. Smart contracts powered by blockchain will automate compliance processes, triggering actions such as submitting reports or adjusting operations when conditions are met.

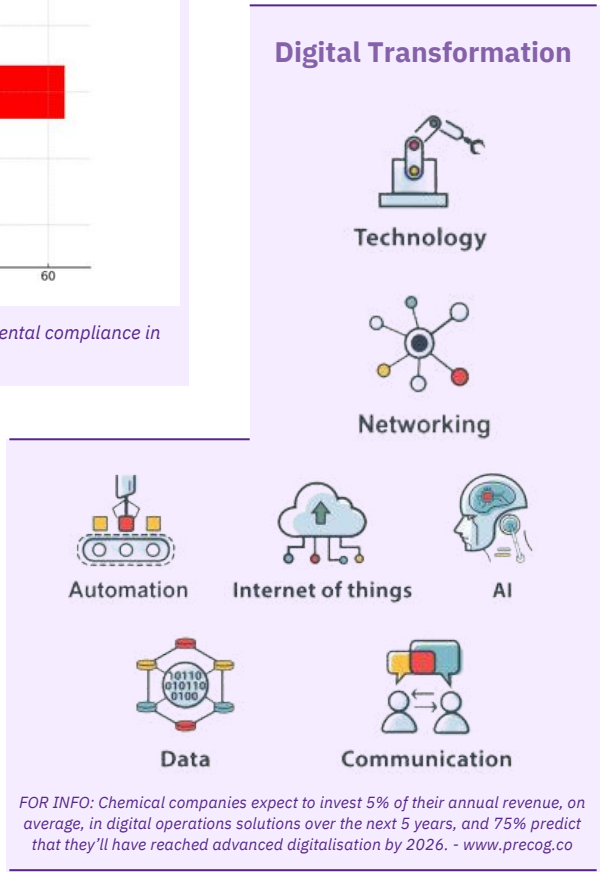
## Conclusion

Digital transformation offers chemical companies more than just a way to meet environmental regulations; it provides an opportunity to enhance operational efficiency, reduce costs, and foster innovation. By adopting these digital tools, companies can turn regulatory challenges into competitive advantages. As the regulatory landscape becomes more complex, those who embrace digital transformation will be best positioned to thrive in the future.

From predictive maintenance to automated reporting, the impact of digital transformation on environmental compliance is undeniable. It's not just about following regulations; it's about transforming how the chemical industry operates for a more sustainable, efficient, and innovative future.

## Author:

**Amro Heikal, FIScT CSci** has more than 27 years of experience working in the Oil & Gas industry for such companies as Halliburton, Schlumberger and Baker Hughes. He has worked in most Middle East countries, the United Kingdom, all North Africa, and Azerbaijan, focusing on new technology developments that reduce pollution and optimize operation. Amro was awarded an IST Fellowship in 2021 and gained Chartered Scientist in the same year.




*FOR INFO: Chemical companies expect to invest 5% of their annual revenue, on average, in digital operations solutions over the next 5 years, and 75% predict that they'll have reached advanced digitalisation by 2026. - www.precog.co*

# The Outstanding Achievement Award - Lab Innovations

## Congratulations Laurence Dawkins-Hall, FIScT CSci

### An account from Laurence

On October 30th, 2024 I won a National award for the ongoing work I do, throughout the United Kingdom, pertaining to the Technician Commitment in general and, more particularly, Science Council Professional Registration, a pillar thereof. I perform this work for the Science Council, IST, NTDC, Midlands Innovation and the Royal Society of Biology. The work engenders on-line workshops and in-person workshops, provided for these organisations as regular, scheduled events; and also ad-hoc events, like University Technician Commitment conferences, industrial forums, one-off Specialist meetings, e.g., The University of Oxford, University of Cambridge LMB Cambridge, the Sanger Centre and the Francis Crick Institute, London. The principal workshops are augmented by in-person bespoke mentoring and a plethora of on-line materials that I have designed for the Science Council and NTDC, in particular; but also inter alia the University of Glasgow, Lab Innovations, QUB, and MI Talent.

In the past, this work has culminated in a plethora of awards, including a Citizens Award from the University of Leicester (circa 2022), an Outreach Finalist for the Papin award (circa 2022) and two Fellowships for "Distinguished conduct" from the IST and RSB, respectively. Taken in conjunction with concomitant activities for the Royal Society of Biology pertaining to mentoring and instruction for the award of Chartered Biologist (CBiol), the current Lifetime achievement award for outstanding achievement, presented to me by the Science Editor of the Times and Sunday Times, Tom Whipple, at the Lab Innovations show at the NEC, circa 2024, not only ratifies my Technician Commitment endeavours, during the last eight years, but also my wider body of work, derived from 30+ years of international experience and falling under the aegis of the Technician Commitment, which includes contributions to the current state of Technician recruitment, retention and opportunities and more recently, a seminal contribution to an industrial report, in which I expound the current state of play of (in particular) technical training and potential pertinent steps that could be taken (including retention of demonstrable good practices) to improve the landscape.

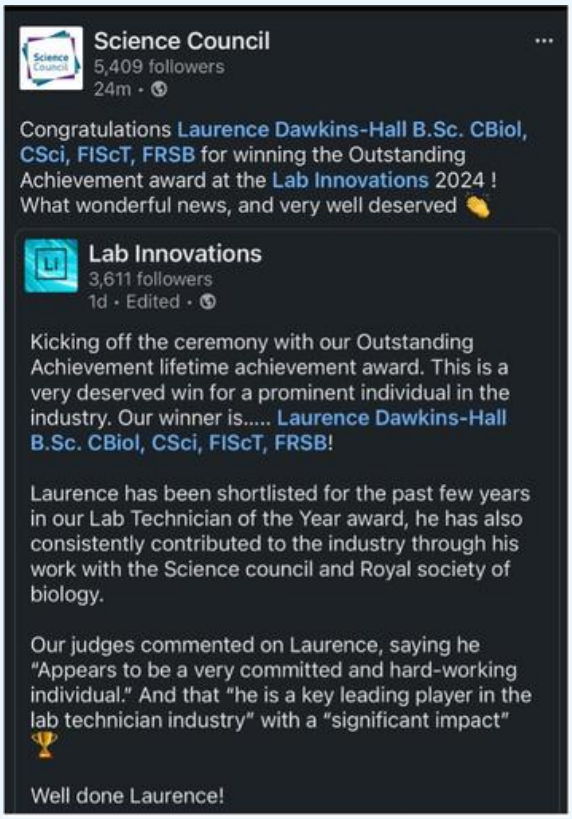



*Figure-1: Screenshot from LAb Innovations LinkedIn post.*

To achieve this "Winner of winners" award, an initial cache of 196 entries was whittled down to a short list of approximately 24 entries, of which 6 final winners were selected, for 6 categories.

My selection was predicated, in the first instance, on shortlisting for the "Skills and Innovation" category in 2 consecutive years, which is unprecedented.

To garner this award, I had to "Win over" entries derived from teams of technical specialist in Industry and HE alike as well as single outstanding individuals, selected in a similar context.

My ultimate selection testifies to the **3,000** **technicians**, including STEM apprentices, I have personally supported for Professional Registration, as well as the 300 or so I have assessed for the Professional Registration award.

This has been complemented by instruction, assessment, mentoring and tutoring of perhaps (a further) 100 or more Professional Biologists, ranging from technicians, industrial technical specialists and fully fledged University Professors, seeking to obtain the RSB award of Chartered Biologist.

I will leave "final reflections" on the significance and impact of this award to my colleagues at the NTDC:

> *"We're delighted to congratulate our colleague and Specialist Advisor, Laurence Dawkins-Hall, on his remarkable achievement of receiving the 'Outstanding Achievement' Lifetime Award at the 2024 Lab Awards! This well-deserved recognition alongside Laurence's second consecutive nomination for the 'Commitment to Skills and Training' award, highlights his lasting impact and dedication to the sector. Laurence's passion for advancing technical skills, building stronger training pathways, and supporting his colleagues is widely recognised and celebrated across the sector, and this award acknowledges his lifetime of contributions.*
>
> *Laurence has always been an influential voice and advocate for technical staff development. At Lab Innovations, his insights were showcased in 'UK Industry's Call to Government', published by Lab Innovations/Advanced Engineering, where he authored 'Upskilling a Nation'. In this piece, Laurence addresses the urgent STEM skills shortage and shares actionable solutions, including the strengthening of apprenticeships, the expansion of the Technician Commitment initiative, and the importance of fostering regional collaboration among institutions. Read the report here.*
>
> *Laurence's commitment to skills development and his tireless efforts to uplift technical colleagues have made a profound impact on many within our community. We couldn't be prouder of Laurence for his dedication, his vision, and his much-deserved recognition with this prestigious award.*
>
> *Congratulations, Laurence, on this exceptional milestone and thank you for the inspiration you continue to provide to the NTDC network!"*

IST Chair and CEO, Terry Croft MBE congratulated Laurence with the following:

> *"We are delighted to hear that one of our colleagues and esteemed Fellows has been given the Outstanding Achievement Award at this year's Lab Innovations – Lab Awards event. Over many years, he has demonstrated a strong passion and commitment to the professionalisation of the technical workforce through his work with the Science Council and the IST. Laurence's dedication goes above and beyond what would normally be expected, as he devotes his free time to a wide range of technician support activities.*
>
> *His work in mentoring and supporting registration applications is extensive and widely recognised. Not only does he bring a broad range of expertise to his support work, but he also offers a high degree of enthusiasm and a genuine willingness to go the extra mile. Laurence has shown remarkable commitment, passion, and drive in supporting the technical community at large, making an impact on many careers.*
>
> *We are proud that one of our Fellows has been recognised for their excellent contribution to the development of the technical workforce. My colleagues at the IST and I, would like to offer our heartfelt congratulations on this prestigious award, which is so richly deserved."*


# WELL DONE LAURENCE!

# Communications and the IST

## Staying Connected: How the IST is Enhancing Member Communications

Effective communication is at the heart of any successful organisation, and at the Institute of Science & Technology (IST), we are constantly evolving to ensure our members remain informed, engaged, and supported. In today's fast-paced world, staying connected is more important than ever, and we are committed to maximizing our resources to keep you in the loop while creating opportunities for your professional growth.

One of our key initiatives is leveraging **The Journal** and **The Tech Magazine** as platforms for member contributions. These publications are not just about sharing knowledge; they are a gateway for members to showcase their expertise, research, and ideas to a wider audience. By submitting articles to our editorial peer review board, you gain invaluable experience in publishing, establish credibility in your field, and potentially open doors to further opportunities. Whether you're a seasoned professional or just starting out, these platforms provide a welcoming space to share your voice and make a meaningful impact on the IST community.

We also recognise the value of updates, which is why the **IST Bulletin** remains a cornerstone of our communications strategy. Distributed when necessary, the Bulletin delivers timely news, key announcements, and event highlights directly to your inbox. It's designed to keep you informed about what's happening across the IST and technical community, from professional development opportunities to updates in the science, creative industries, engineering and digital technologies; including artificial intelligence. This bite-sized format ensures you can stay up-to-date without missing a beat.

Our choice to focus on **LinkedIn** as our primary social media channel underscores our commitment to professional communication. LinkedIn's professional network aligns perfectly with our members' needs, enabling us to share updates, industry insights, and opportunities in a targeted and effective manner. It's also an ideal forum for engaging in discussions and building valuable connections with fellow professionals. While other social media platforms might be popular, we believe that LinkedIn offers the professionalism and focus that our members value.

But communication isn't just about what we provide; it's also about listening to you. We recognise that our members are our greatest resource, and we're always looking for ways to improve. Whether it's suggestions for The Journal, ideas for The Tech Magazine, or feedback on how we engage with you through LinkedIn or other channels, we want to hear from you.

**Share Your Thoughts**

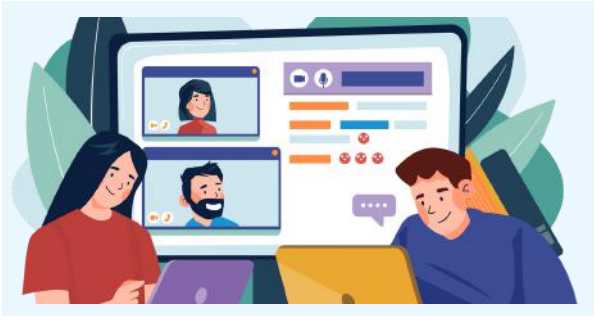
We encourage you to get in touch with us to share your thoughts on how we can enhance our services. What works well for you? What can we do better? Your input helps us shape a more connected and responsive IST community.

Together, we can continue to build a network that supports and inspires all our members.

Reach out to us today (office@istonline.org.uk) and let's keep the conversation going!

Connect with us on LinkedIn:

- **IST Page:** ist-online
- **IST Group:** private listed - Institute of Science & Technology (IST)



# IST Artificial Intelligence Training

## Unlock Your Potential with IST's Artificial Intelligence Training

Are you ready to take your career to the next level in the rapidly evolving field of artificial intelligence?

The IST offers world-class AI training that empowers professionals like you to gain industry-recognised credentials, advance your skills, and stand out in a competitive job market.

Our comprehensive course catalogue includes programmes leading to RTechAI, RPAI and APAI designations; prestigious certifications that demonstrate your expertise in AI and set you apart as a leader in your field. For those looking to refine specific skills, we also provide standalone modules and short courses, covering both technical and soft skills to meet the demands of today's dynamic workplace.

All IST courses are aligned with FHEQ levels in Higher Education, ensuring the highest standards of quality and relevance. Better yet, every course is customisable to address the unique needs of your organisation or career path.

As a UK Government-registered Learning Provider, we deliver training that is not only industry-approved but also eligible for matched funding through the AI Upskilling Fund. This initiative allows small and medium-sized enterprises (SMEs) to enhance their workforce's AI capabilities at a fraction of the cost.

Whether you're upskilling to stay ahead or reskilling for new opportunities, completing IST training offers tangible benefits:

- Accredited certifications like RTechAI, RPAI and APAI to boost your professional credentials.
- Flexible, tailored programmes designed to fit your goals and schedule.
- CPD certificates issued for every course, ensuring you stay on track with your professional development.

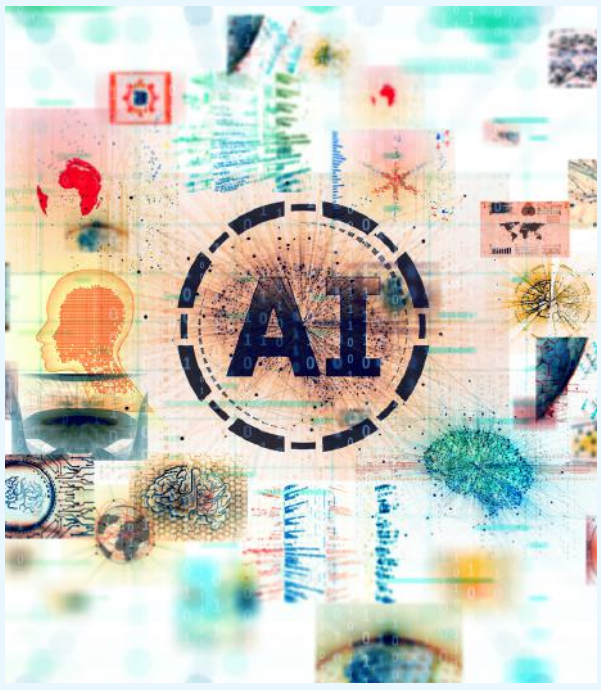
Don't wait to future-proof your career. Take advantage and join the growing community of professionals who are shaping the future of AI.

Contact us today to explore your training options: training@istonline.org.uk.

**Courses Available:**

| | |
|---|---|
| IST25PA10 | Registered Technician in Artificial Intelligence (RTechAI) |
| IST25PA20 | Registered Practitioner in Artificial Intelligence (RPAI) |
| IST25SD10 | Advanced Practitioner in Artificial Intelligence (APAI) |
| IST25AI10 | Artificial Intelligence for Beginners |
| IST25TE10 | Technical Introduction to Artificial Intelligence |
| IST25TE20 | Intermediate Concepts in Artificial Intelligence |
| IST25TI10 | Large Language Models |
| IST25TI20 | Deep Learning |
| IST25TI30 | Data Science I |
| IST25TI40 | Data Science II |

Download the Course Catalogue



# ISO 9001 and the laboratory

Tim Sandle, FIScT

## Introduction

ISO 9001: 2015 is a process-focused quality management system (QMS) standard that requires all quality system processes to be measured, monitored, controlled, and improved. To comply, both business and quality objectives need to be established for relevant functions at appropriate levels, and these objectives need to be measurable. When objectives are measured, the quality system's effectiveness is verified by achieving those objectives, typically via audit and assessed through management review (1).

With many laboratories, certification to ISO 9001 is normally required, providing evidence that the organisation has an operational and fit-for-purpose quality system. The three core elements of ISO 9001 are to help laboratories to:

- Organise processes,
- Improve the efficiency of processes,
- Continually improve.

In terms of general laboratory benefits, these can be summarised as:

- Organising a QMS,
- Ensuring satisfied customers, management, and employees,
- Having a system in place that continually improves processes,
- Delivering cost savings.

ISO 9001 is based on a number of quality management principles including a strong customer focus, the motivation and implication of senior management, following a process approach and with the practice of continual improvement. This article provides an anatomy of the standard, drawing out its key features.

## ISO 9000

ISO 9001 is linked to the ISO 9000 series of standards produced by the International Organisation for Standardisation (ISO), an international agency composed of the national standards bodies of more than 160 countries. ISO is a non-governmental organisation and it is the largest standards organisation in the world (2).

The ISO 9000 series are based on seven QMP (3). These seven QMP are:

1. QMP 1 – Customer focus - Organisations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.
2. QMP 2 – Leadership - Leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives.
3. QMP 3 – Engagement of people - People at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit.
4. QMP 4 – Process approach - A desired result is achieved more efficiently when activities and related resources are managed as a process.
5. QMP 5 – Improvement - Improvement of the organisation's overall performance should be a permanent objective of the organisation.
6. QMP 6 – Evidence-based decision making - Effective decisions are based on the analysis of data and information.
7. QMP 7 – Relationship management - An organisation and its external providers (suppliers, contractors, service providers) are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

## ISO 9001

ISO 9001:2015 is an internationally recognised standard for creating, implementing and maintaining a QMS for any company. Hence, central to ISO 9001: 2015 is the 'QMS'. The QMS refers to a collection of policies, processes, documented procedures and records. This collection of documentation defines the set of internal rules that will govern how a laboratory creates and delivers its product or service to its customers. The QMS must be tailored to the needs of a specific company and the product or service provided.

ISO 9001 is constructed around a plan-do-check-act methodology, and it is designed to provide a process-oriented approach to documenting and reviewing the structure, responsibilities, and procedures required to achieve effective quality management in an organisation. Topics included within the standard are:

- Requirements for a quality management system, including documented information, planning and determining process interactions.
- Responsibilities of management.
- Management of resources, including human resources and an organisation's work environment.
- Product realisation, including the steps from design to delivery.
- Measurement, analysis, and improvement of the QMS through activities like internal audits and corrective and preventive action.
- An emphasis on risk-based thinking to enhance the application of the process approach.
- Requirement for overall management and organisational leadership.

ISO 9001 is designed as a global standard, meaning that one certified organisation working in the same sector as another but in a different region of the world can be sure that similar standards of quality are in place, both within the firm and in terms of its supply chain (4). In terms of 'what is quality', ISO 9001 does not specify what the objectives relating to "quality" should be. Instead the standard requires organisations to define these objectives themselves and continually improve their processes in order to reach them.

The core elements of ISO 9001 are shown in figure 1:


*Figure-1: The core structure of ISO 9001.*

In terms of the main drivers and enablers, these structural components have an interrelationship, as figure 2 shows.

In terms of what ISO 9001 is not:

- It is not a product standard: It does not define product quality. This is a process-based standard: you use it to control your processes, then your end product should meet the desired results.
- It is not a personal standard: An individual cannot personally be certified to ISO 9001.
- It is not a membership group: An organisation doesn't "join" ISO 9001. Instead the organisation must follow the steps to implement an ISO 9001 QMS within the organisation.

ISO 9001 focuses only on the functions that most directly affect product quality. It does not, therefore, deal with questions of economic effectiveness and cost efficiency.

## Anatomy of ISO 9001

In terms of the high-level structure, ISO 9001: 2015 consists of the parts listed below. Text in italics is designed to assist with interpretation and this is not part of the standard but instead contextual information this author has added.

**1. Scope**

This opening part of the standard specifies that the organisation needs to meet customer and regulatory requirements and ensure its employees follow its policies and procedures while advancing quality through continual improvement.

**2. Normative references**

This part provides normative references—those that conform to ISO 9000's related norms—to constitute the terms of ISO 9001.

**3. Terms and definitions**

General terms and definitions applicable to the standard are outlined. Terminology used throughout this standard comes directly from ISO 9000:2015, QMS – Fundamentals and vocabulary

**4. Context of the organisation**

This part of the standard determines external and internal issues, the needs and expectations of interested parties, quality management system scope and its processes.

**4.1 Understanding the organisation and its context**

*Determine what the relevant external and internal issues are for your organisation, and that are relevant to its strategic direction.*

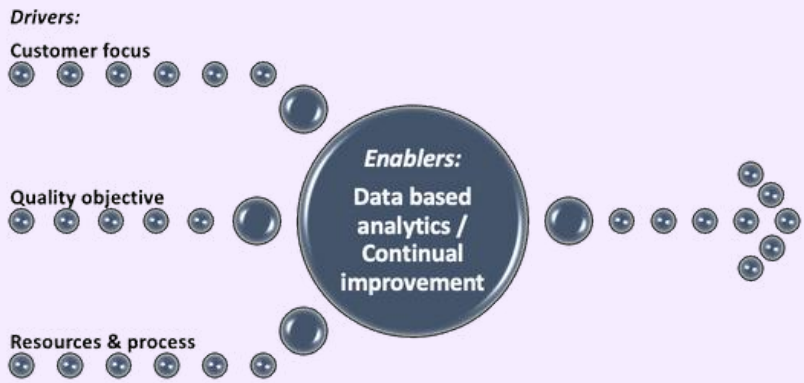



*Figure-1: Drivers and inputs for achieving ISO 9001, with the desire result being customer satisfaction.*

- *Retrieval. Documents are created to be used, or potentially used, in the future. When retrieval of documents is complex, specific retrieval methods must be implemented.*
- *Retention period. Documents contain information on past facts that can be meaningless and useless in the future. The organisation must define how long documents must be preserved.*
- *Disposition. The term refers to the order arrangement and distribution. This requirement is closely related to the storage. The organisation shall define in writing those management and distribution methods that are needed to easily locate documents.*

**4.2 Understanding the needs and expectations of interested parties**

*Identify the relevant interested parties and their relevant requirements.*

**4.3 Determining the scope of the quality management system**

*This part describes the standard's general requirements, which encompass all activities from quality manual documentation and control of documents and records to determining the sequence and interaction of the processes to implementing actions to achieve planned results.*

**4.4 Quality management system and its processes**

*With 4.3 and 4.4, the requirement for the scope is now better defined, must be documented and the organisation must consider:*

- *external and internal issues,*
- *requirements of relevant interested parties,*
- *the products and services covered (this must also be stated in scope),*
- *allowing applicability of specific requirements,*
- *justification for any case where a requirement cannot be applied (exclusion).*

*Documentation often remains the most practical method available to control processes and their outcomes, as well as providing evidence. Key elements are:*

- *Documents identification. Documents must incorporate some type of control to allow its clear identification.*
- *Storage. The organisation must define a plan to file/store all the relevant generated documents.*
- *Security. Documents, depending on their format and way of storage, must require the implementation of protection methods. For instance, the generation of back-up copies.*

**5. Leadership**

Top management must demonstrate leadership and commitment, establish and communicate a quality policy, and ensure responsibilities and authorities are assigned, communicated and understood. There needs to be an explicit requirement for relevant roles to be assigned, communicated and understood and the responsibility now resides with top management to assign and manage.

**6. Planning**

This section refers to organisational QMS Planning to address organisational risks, opportunities, changes and quality objectives.

**6.1 Actions to address risks and opportunities**

*This clause requires the determination of risks and opportunities which need to be addressed, actions to be taken and evaluation of the effectiveness of these actions.*

**6.2 Quality objectives and planning to achieve them**

*Here objectives should be:*

- *established for processes relevant to the QMS,*
- *in line with customer requirements,*
- *in line with products and services conformity,*
- *monitored, communicated & updated.*

**6.3 Planning of changes**

*For this, changes to the QMS should be carried out in a planned manner.*

**7. Support**

This part of the standard is all about providing resource needs, ensuring employees are competent and aware, and with including documented information to support the quality management system.

**7.1 Resources**

*This means there should be adequate resources to ensure effectiveness of the QMS. Resource considerations now include:*

- *internal resources and external providers,*
- *people,*
- *monitoring and measuring resources,*
- *organisational knowledge required to ensure the processes provide conforming products and services,*
- *external communication.*

**7.2 Competence**

*With competence, the aptitude of those who execute QMS processes need to be assessed against the requirements for the tasks, and any deficiencies be addressed through personnel training, exposure, outsourcing or reassignment.*

**7.3 Awareness**

*For awareness, the standard requires that everyone, not just those who administer the QMS, become familiar with its policies and objectives and know what they must do to achieve its goals, including what happens if they don't adequately meet these requirements.*

**7.4 Communication**

*In relation to the above clauses, relevant persons doing work under the organisation's control need to have awareness and communication (internal and external) of the QMS and benefits of improving performance.*

**7.5 Documented information**

*The control of documented information requires confidentiality, integrity and access. In addition, systems must be in place for the creation and updating of documented information, such as controlling factors like description, format and suitability.*

**8. Operation**

This is about plan and control processes needed to meet the requirements for products and services (Design and development, external providers, production and service provision, release of products and services, nonconforming outputs).

**8.1 Operational planning and control**

This clause has an explicit requirement for establishing criteria for processes and requirements for customer communications; customer property, and contingency actions.

**8.2 Requirements for products and services**

This is about having a system for robust, ongoing customer dialog for general information, order/change orders, measuring performance, complaint/discrepancy handling and use/care of customer-supplied assets – including a plan for dealing with any out-of-bound or unsatisfactory results.

**8.3 Design and development of products and services**

This clause relates to the design and development of products and services, along the lines of a process orientated approach. There is discussion about the involvement of customers and users as part of design planning to be considered.

In terms of design and development inputs there are explicit requirements for internal and external resource needs, potential consequences of failure, level of control expected by customers. For design and development controls this includes the need for reviews, verification and validation.

**8.4 Control of externally provided processes, products and services**

Conditions are applied when controls are required for externally provided processes, products and service.

**8.5 Production and service provision**

This clause specifically considers:

- monitoring and measurement activities will ensure the control of processes and output,
- acceptance criteria for products and services are met,
- the use, and control of suitable infrastructure and process environment,
- suitable monitoring and measuring resources.

The control of changes and the need for a formal change control system is also outlined here.

### 8.6 Release of products and services

Before releasing a product or service, there must be a process to ensure that customer expectations have been met at each stage of product/service production, including documentation of formal customer approval that agreed upon product/service needs were met.

### 8.7 Control of nonconforming outputs

The control of nonconforming output considers the options to apply correction and corrective action.

## 9. Performance evaluation

This is about monitoring, measuring, analysing, and evaluating the quality management system.

### 9.1 Monitoring, measurement, analysis and evaluation

*This clause is about identifying what needs monitoring and measuring, and the methods to be used. There are specific requirements for analysis and evaluation when using results as inputs to management review. Effective implementation of planning and actions to address risks and opportunities are also part of the clause.*

### 9.2 Internal audit

*In order to confirm that the QMS conforms to the ISO 9001:2015 standard and the organisation's standards internal audits must be conducted at planned intervals. A formal internal audit program needs to be established which defines the methods used, scope and frequency as well as assigning responsibility to objective and impartial auditors.*

*The internal audit program has explicit considerations for: quality objectives, customer feedback and changes impacting the organisation; and management responsibility for action. To achieve this, an auditor is now required to be impartial.*

### 9.3 Management review

*In this section of the standard requirements for management review are set out. These include: changes in external and internal issues (such as strategic direction); performance concerning external providers; adequacy of resources for effective QMS and effectiveness of actions taken addressing risks and opportunities. It is important that management reviews are aligned to the strategic direction of the organisation.*

## 10. Improvement

### 10.1 General

*This part of the standard is concerned with selecting opportunities for improvement, taking action against nonconformities, implementing corrective actions as necessary, and continually improving the quality management system.*

### 10.2 Nonconformity and corrective action

*Emphasis here is placed on nonconformity and corrective action. In addition, risks and opportunities need to be updated when required following a nonconformity. When nonconformities occur, it is important that the organisation reacts to them appropriately by controlling, correcting, or dealing with the consequences. Determining what the cause of the nonconformity is and taking actions to ensure the nonconformity does not recur are key steps.*

*After the organisation has implemented these corrective actions, it should review them to ensure they were effective. Corrective actions will often require updating QMS processes and/or risks and opportunities determined during planning. Records describing nonconformities, actions taken, and the results of those actions must be kept.*

### 10.3 Continual improvement

*This is concerned with continually improve the QMS. This can be by internal audits, management reviews, or company performance metrics to help identify opportunities for improvement.*

## Risk-based approach

Risk management and risk assessment are key parts of ISO 9001. In adopting this mindset, risk-based thinking ensures risk is considered from the beginning and throughout. Furthermore, risk-based thinking makes preventive action part of strategic and operational planning. The general framework for assessing risks is (5):

- Balance risks and opportunities.
- Analyse and prioritise your risks, and ask:
    a. what is acceptable?
    b. what is unacceptable?
- Plan actions to address the risks, considering:
    a. how can I avoid, eliminate or mitigate risks?
- Implement the plan.
- Take action.
- Check the effectiveness of the action and ask "does it work?"
- Learn from experience and seek to improve.

Despite the importance of risk assessment, some commentators suggest this is the weakest and least developed area in relation to the practical use of ISO 9001 (6).

## ISO 9001 and laboratories

ISO 9001 is applicable to any laboratory. ISO 9001 provides a model for a QMS which focuses on the effectiveness of clinical, business and support processes to ensure high quality care is provided. It can assist with:

- Ensuring quality and safety in the treatment of clients and patients.
- Ensuring that medicines and medical devices of the appropriate quality are prepared and administered.
- Identifying and managing the risk to patients, staff and the organisation.
- Determining, managing, monitoring and improving complex and interrelated processes.
- Complying with relevant international and national legal requirements.
- Implementing best practice routines and procedures.
- Preventing incidents from occurring.
- Identifying areas of improvement and ensure continual enhancement of the quality management system.
- Providing assurance to patients, authorities and other stakeholders that the organisation has implemented a well-functioning management system and are committed to continual improvement.

For example, with patient interfacing services, the standard can ensure that the patient understands and acknowledges ethical issues such as confidentiality, privacy, security, communications in regard to anaesthesia plans and consents and orders (such as admission and discharge) and formally agrees with any contracts affecting his or her rights as a patient. Furthermore, with design control, this could be used for designing a plan to control patient flow or a specific service such as a new neonatal care facility, expanded oncology program or off-site human immunodeficiency virus (HIV) treatment facility.

With purchasing, ISO 9001 can assist laboratories with the accurate and timely purchase of materials and supplies from approved vendors. It also is an area that can create runaway costs if not effectively controlled. In terms of inspection and testing, areas included would be pre-admission testing and admission, in-processing of products (for example, Is this what was ordered? Has it been tested to determine if it meets purchasing requirements and final inspection?), material release, and with the processing of laboratory samples.

As a final set of examples, with nonconforming products these could be an improperly functioning magnetic resonance imaging (MRI) machine, an in-vitro diagnostic computer that is out of calibration, in-vitro reagents that do not meet purchasing requirements, or sterile drapes in packaging that was punctured in transit. With nonconforming services could be electrical outages that shut down a surgical room, untrained personnel conducting a patient testing procedure, or a loss of critical patient or laboratory records.

Case studies suggest that ISO 9001 has been applied to areas like Pharmacies, Cancer Services both hospital and community based, Fertility Services, Radiology Services, Hospital Theatres, Rehabilitation Services, Dental Services, Mental Health and Psychological Services, Medical Engineering and Medical Device Training, Hospital Essential Support Services such as Estates, Catering, Cleaning, Laundry, Procurement and Delivery Services.

Further good practices that ISO 9001: 2015 can drive for laboratory operations includes:

- Written records and procedures appropriate to the processes taking place.
- A control process for these records and procedures.
- That personnel are properly trained and qualified to perform their jobs.
- That work environments are properly maintained.
- That customer complaints and nonconformances are addressed, and that appropriate corrective actions are taken to prevent recurrences.
- That equipment be maintained and calibrated.
- That products be properly identified throughout the manufacturing cycle.
- That there be product release procedures, analysis of product, and conformance to specifications prior to release.
- Appropriate quarantining and control of nonconforming product to prevent its release to the marketplace.
- The application of good scientific principles and statistical techniques.

## Summary

ISO 9001: 2015 is a quality management system and it provides a way of defining how a laboratory can meet the requirements of its customers and other stakeholders affected by its work. This article has discussed the main aspects of ISO 9001 and, given that ISO is a generic standard for all types of organisations, applied examples for the laboratory. By applying ISO, laboratories can drive improvements in terms of monitoring, reviewing and improving their quality systems and to drive improvements across all areas.

**References**

1. *Spreha, S. A. and Helms, M. M. (1995) ISO 9000 - A struggle well worth the effort, Production and Inventory Management Journal; 36 (4): 46*
2. *Heras-Saizarbitoria, I., Boiral, O., and Allur, E. (2018) Three Decades of Dissemination of ISO 9001 and Two of ISO 14001: Looking Back and Ahead. In Heras-Saizarbitoria, I., Boiral, O., and Allur, E. (Eds.) ISO 9001, ISO 14001, and New Management Standards, Springer, USA, pages 1-15*
3. *ISO 9001: 2015 Quality Management Systems, International Standards Organization, Geneva, Switzerland*
4. *Bastas, A., and Liyanage, K. (2019) Integrated quality and supply chain management business diagnostics for organizational sustainability improvement. Sustainable Production and Consumption 17: 11-30*
5. *Rybski, C., Jochem, R. and Homma, L. (2017) Empirical study on status of preparation for ISO 9001:2015, Total Quality Management & Business Excellence, 28 (9-10): 1076-1089*
6. *Sandle, T. (2016) Risk Assessment and Management for Healthcare Manufacturing: Practical Tips and Case Studies, PDA / DHI, Bethesda, MD, USA*

**Author:**
**Tim Sandle FIScT** is a pharmaceutical microbiologist. He is a lecturer at UCL and the University of Manchester as well as the Head of Compliance and Quality Risk Management at Bio Products Laboratory Limited (a pharmaceutical organization. Dr. Sandle is a chartered biologist (Royal Society of Biology) and holds a first class honors degree in Applied Biology; a Masters degree in education; and obtained his doctorate from Keene University.


The cost, timeline, and documentation requirements for ISO 9001 certification in the UK depend on factors such as the size and complexity of the organisation, its industry, the number of locations, and the existing level of quality management systems.

## Cost

Typical costs for ISO 9001 certification range from £3,000 to £10,000 for small to medium enterprises. This includes consultant fees, documentation preparation, training, and audit fees.

Additional costs may arise if ongoing maintenance and annual audits are required. Larger or multi-site businesses may incur higher expenses due to the increased complexity of processes and audits.

## Timeline

The certification process can take anywhere from 3 to 12 months, influenced by the organisation's readiness, size, and complexity. Smaller businesses with simpler structures may achieve certification more quickly than larger organisations with multiple sites and complex processes.

## Documentation

The documentation requirements for ISO 9001 are significant and include a quality management system (QMS) manual, process flowcharts, and evidence of compliance with ISO standards.

While some organisations develop their documentation internally, others may use consultants to simplify the process. Expect to produce a detailed set of records covering procedures, quality objectives, and internal audits.

For specific advice, many certification bodies offer calculators or consultations to help estimate the cost and time based on individual circumstances

# Strategic Development Network (SDN) Overview

## Carly Ward

Strategic Development Network (SDN) is a team of workforce development specialists dedicated to improving the intersection between education and industry, focusing on workforce development and technical education.

Their expertise extends to **OVER 1,500** technical education providers and 3,000 employers across England.

SDN offers comprehensive support through CPD programmes, bespoke organisational advice, coaching initiatives, and practical tools to enhance educational outcomes and workforce readiness.

### Core Areas of Work:

**1. Education and Provider Support:**

SDN helps technical education institutions improve delivery by focusing on funding, quality, curriculum design, and learner assessment processes. Their goal is to ensure providers are equipped to support students effectively through every stage of their learning journey, including end-point assessments.

**2. Apprenticeships:**

As a lead partner in the Department for Education's Apprenticeship Workforce Development program, SDN supports educators and staff across further and higher education institutions. They deliver CPD and tailored support to enhance apprentice retention and performance, ensuring both learners and organisations achieve their potential.

**3. T Level Industry Placements:**

SDN works in partnership with the Department for Education to establish strong partnerships with T Level providers and employers, facilitating industry placements and creating a practical toolkit to assist these collaborations. This initiative ensures students gain valuable real-world experience while supporting organisations with fresh talent pipelines. Please find all in person and online events here. There is no charge to attend.

**4. Employer Engagement:**

By demystifying the education landscape, SDN empowers SMEs to engage effectively with education systems, guided by resources like the Education Landscape Guide and Index. Please download the free resources here.

**5. Coaching and Early Career Support:**

Recognising the importance of strong managerial coaching, SDN trains managers to develop young talent and foster workplace growth. This initiative directly addresses challenges in retaining skilled, motivated employees. Please register for upcoming events here.

### Impact:

SDN's works in partnership with the Department for Education and various educational institutions for its significant contributions to educational quality, workforce development, and practical implementation of policy initiatives.

Through its specialised team of technical education experts and workforce development professionals, SDN continues to drive improvements that enhance educational frameworks and strengthen industry ties. Whether by providing training, guiding employers, or supporting education providers, SDN is committed to fostering a skilled and adaptable workforce that meets evolving industry needs.

For more information please visit www.strategicdevelopmentnetwork.co.uk or email carly@strategicdevelopmentnetwork.co.uk

# Map Girl

**Alan Gall, FIScT - IST Archivist**

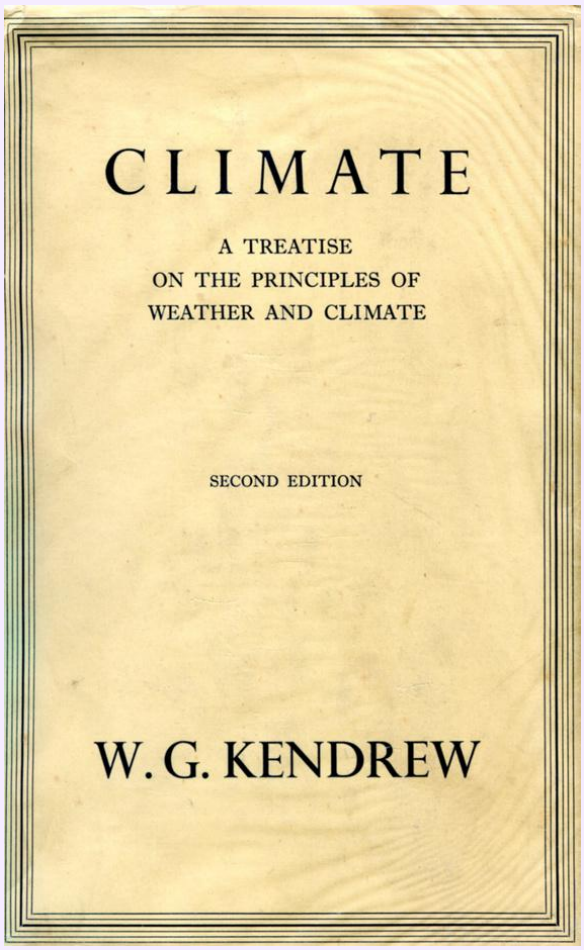



*Figure-1: Daphne Portway's copy of Climate.*

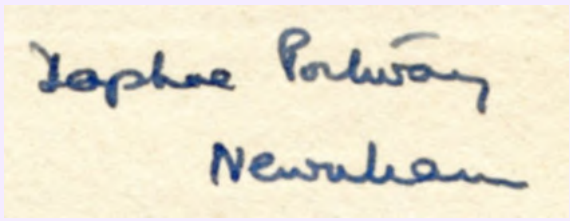



*Figure-2: Signature on the flyleaf of Climate.*

## Introduction

Ten years ago I bought a second-hand copy of W. G. Kendrew's *Climate* from the Treasure Chest, a rabbit warren of a bookshop in Felixstowe. On the flyleaf, written in blue ink, is **"Daphne Portway Newnham"**. Inside were a few pages of notes that helped identify the previous owner as Daphne Laura Maud Portway, geography student at Newnham College, University of Cambridge (Figures 1 & 2).

The title of this article is borrowed from Avril Maddrell's paper, **"The 'Map Girls'. British women geographers' war work, shifting gender boundaries and reflections on the history of geography"**. On page 137 is a brief mention of Shirley Carpenter (as Shirley Hewitt) and her colleague Daphne Portway, indicating that they had a prominent role during WWII as the only two women involved with surveying for the military.

As a championship-winning sportswoman, Daphne has left a highly visible trail. Other aspects of her life are less evident. What might have been illuminating is her father's autobiography, but it gives disappointingly few details of his only child. Nevertheless, Donald Portway's book gives a fascinating account of an eventful academic and military life from 1887 to the 1960s.

War makes extraordinary demands on the young. When World War Two broke out on 1 September 1939, Daphne Portway had yet to complete her education as a pupil in the sixth form at the Perse School For Girls. By D-Day, she had attained the rank of junior commander, working with Shirley Carpenter to ensure that the most up-to-date maps for the Normandy landing were available.

Daphne continued with her army career, spending time in Germany and taking what opportunities were available to engage in her love of sport. She transferred from the Active List to continue as a reserve officer until retiring from the Territorial and Army Volunteer Reserve with the brevet rank of major.

## The Portways

The autobiography of Donald Portway is called *Militant Don*. This is a play on words as his abbreviated name of Don is also the name given to lecturers or senior members of a Cambridge or Oxford college, and he served in various military roles. His grandfather, Charles Portway, had invented the **"Tortoise"** stove to heat his ironmongery store, which afterwards went into production and sold in the thousands.

Manufacturing continued under the name of Charles Portway and Son but Donald did not join the business. He did, however, study engineering with the possibility of taking up a position in the firm.

As a boy, Donald collected stamps like his father Harry. The first stamp, the penny black, dates to 1840 and since Harry had started collecting in the early 1860s, there were many early stamps in the coveted album. Donald says: **"My father said he would give me the collection if I ever became head boy ... it seemed as likely as flying over the moon. However, the unlikely came to pass and both his album and mine are now owned by my daughter."** In 2012 a stamp album was sold on eBay, containing the inscription **"March 27th 1931 – Daphne Portway"**.

All of Harry's sons were army officers during WWI, apart from Harold Pugh Portway who had died of diphtheria as a child. Of the trio shown in Figure 3, Lionel Felix Portway did not survive the war. Donald held the rank of lieutenant in the Royal Engineers and Cedric served as a 2nd lieutenant with the Essex Regiment. At the time of the photograph, Lionel was still training at Sandhurst as an officer cadet.

*Figure-3: Brothers in arms. Left to right: Donald Portway, Lionel Felix Portway, and Cedric Portway, 1915 (Militant Don).*

Donald graduated with a BA (first class honours) in the Mechanical Science Tripos. It's a wonder he had any time for academic study. His sports activities included swimming, soccer, hockey, lawn tennis, boxing and water-polo. In 1909, the year of his graduation, he set a record by winning the inter-university middleweight boxing for the fourth year in succession. After spending a year on some research work he left to join up as second lieutenant at The School of Military Engineering, Chatham, followed by three years lecturing at the Royal Naval College, Dartmouth.

Donald did not particularly intend to return to the University of Cambridge. After active service in WWI he spent two terms in his old job at the Royal Naval College, at which point he was offered a fellowship at St Catherine's College.

On 24 April 1919, Captain (acting Major) Donald Portway married Sofia Magdalena (Maud) Grace Ablamowicz Bezant, niece and adopted daughter of James and Mrs Bezant of Mettingham, Bungay. Their only child, Daphne, was born 30 December 1920.

Daphne entered the Perse School For Girls, Cambridge on 20 September 1933. Early examination marks show she had an aptitude for maths and a good command of Latin (Donald may have had a hand in this – he studied Latin at Felsted School). Results from the autumn term 1936 and spring term 1937 placed her second in the class. Her position in summer term 1938 fell to seventh but she did receive a form prize. There is a lack of evidence that she actually studied geography at sixth form level, although it does appear to have been an option.

Hockey, netball, tennis and swimming featured prominently in Daphne's school life. She captained the netball team in 1939, receiving favourable comments on her performance, although an assessment included the advice **"... she must beware of playing rough."**

There are numerous reports of Daphne's progress in the school's magazine, *The Persean*. This publication also allowed students to offer comments on their experiences. In the July issue of 1939 Daphne wrote about the bathing facilities at the bottom of the playing field: **"We hope soon to have a nice roomy hut in which to undress, as the Hessian from former years has rotted and the small hut has a habit of collapsing on its occupants."**

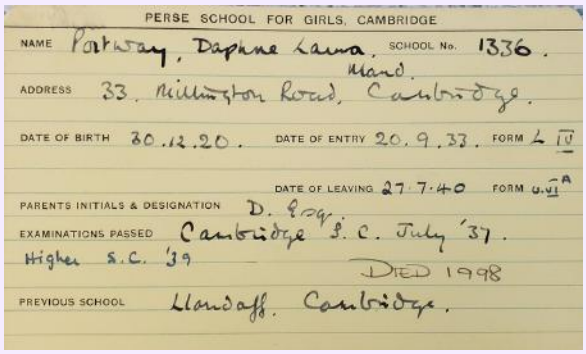
Secondary education over, Daphne departed from the Perse School on 27 July 1940. Her alumni record card is shown in Figure 4.

Daphne had the University of Cambridge in her sights. An obvious destination given her father's education and fellowship there. Moreover, her aunt Dina (later Dina Portway Dobson-Hinton, Litt. D) had gone to Newnham College in 1903 to study history. Dina made her mark as an intrepid potholer (speleologist) and

author of archaeological and historical books.

By the time that Daphne entered Newnham College, Donald had left his university lectureship to prepare for a return to army life. After some string-pulling he received a commission to command the 209th Field Company, Royal Engineers, 44th Division. Daphne would later receive a commission with the Royal Engineers.

Frank Debenham, the professor of geography since 1931, had a particular interest in surveying and mapping. These specialisms were taught to Daphne and to Shirley Carpenter, later put to good use when both girls joined the Auxiliary Territorial Service (ATS). Shirley Carpenter (as Shirley Hewitt) paid tribute to Frank Debenham after his death in 1965: **"To me he was the absolute personification of a professor, both from the human and the academic point of view."** Professor Debenham gave lectures in glaciology and perhaps these inspired Daphne to take up **"glacier touring"**, during visits to the Alps as a member of a skiing club.



PERSE SCHOOL FOR GIRLS, CAMBRIDGE

NAME Parkway, Daphne Laura. SCHOOL No. 1336.
Maud.

ADDRESS 33. Millington Road, Cambridge.

DATE OF BIRTH 30.12.20. DATE OF ENTRY 20.9.33. FORM L IV

DATE OF LEAVING 27.7.40 FORM U.VI A

PARENTS INITIALS & DESIGNATION D. Esq.

EXAMINATIONS PASSED Cambridge S.C. July '37.
Higher S.C. '39

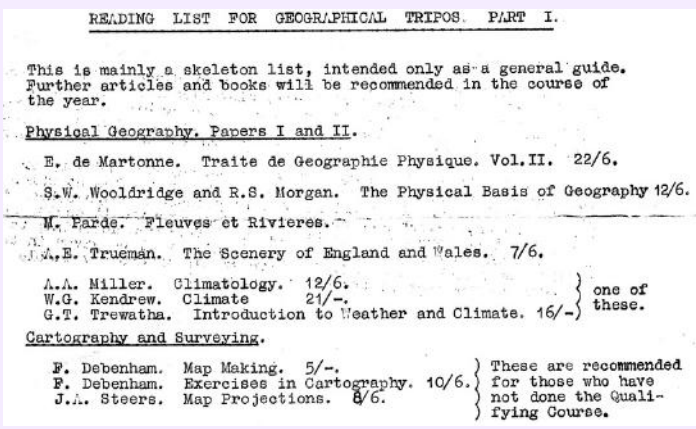
DIED 1998

PREVIOUS SCHOOL Llandaff. Cambridge.

*Figure-4: Alumni record card. Courtesy of the Stephen Perse Foundation Archive, Cambridge.*

Debenham joined Robert Falcon Scott's ill-fated last expedition 1910-1913 and subsequently persuaded the University to establish the Scott Polar Research Institute in 1925. Initially it operated as a separate institution from geography, Debenham being its director as well as holding the geology professorship.

Inside Daphne's copy of Climate are three inserted items: a reading list for the Geographical Tripos with suggestions for an essay, a note on the published sources required for Regional Geography and three pocket-sized pages of hand-written notes on climatology (Figures 5 & 6). The reading list indicates the various subject areas for the course: Physical Geography I & II, Cartography and Surveying, Economic Geography, Regional Geography, Historical Geography, and Political Geography. The recommended readings for Cartography and Surveying are texts by department staff members F. Debenham and J. A. Steers.



READING LIST FOR GEOGRAPHICAL TRIPOS. PART I.

This is mainly a skeleton list, intended only as a general guide. Further articles and books will be recommended in the course of the year.

Physical Geography. Papers I and II.

E. de Martonne. Traite de Geographie Physique. Vol.II. 22/6.

S.W. Wooldridge and R.S. Morgan. The Physical Basis of Geography 12/6.

M. Parde. Fleuves et Rivieres.

A.E. Trueman. The Scenery of England and Wales. 7/6.

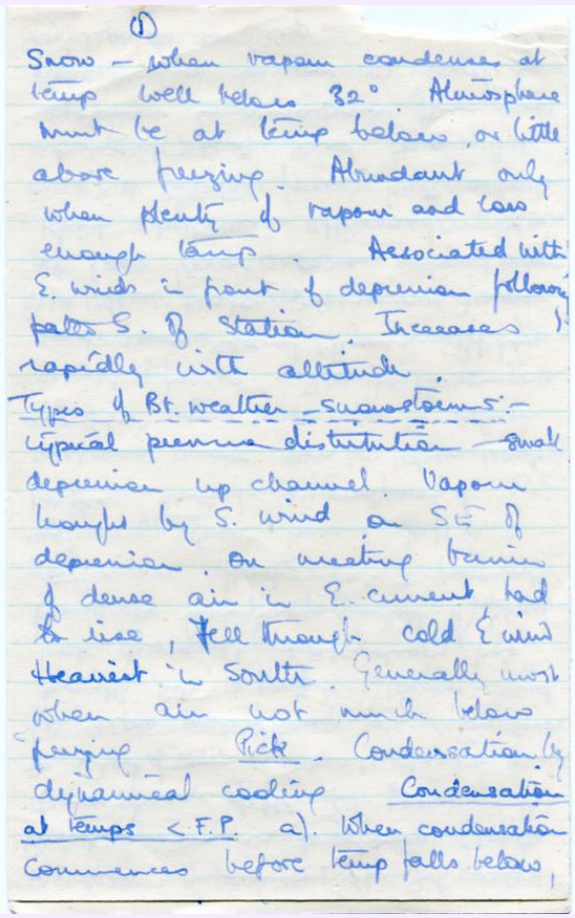
A.A. Miller. Climatology. 12/6.
W.G. Kendrew. Climate 21/-.
G.T. Trewatha. Introduction to Weather and Climate. 16/-
} one of these.

Cartography and Surveying.

F. Debenham. Map Making. 5/-.
F. Debenham. Exercises in Cartography. 10/6.
J.A. Steers. Map Projections. 8/6.
} These are recommended for those who have not done the Qualifying Course.

*Figure-5: Part of the reading list for the Tripos.*

Part 1 of the Tripos also required Daphne to complete some practical work, on which there seems to have been considerable latitude in the choice of subject.



(1)
Snow – when vapour condenses at temp well below 32°. Atmosphere must be at temp below, or little above freezing. Abundant only when plenty of vapour and low enough temp. Associated with E. wind in front of depression follow falls S. of station. Increases rapidly with altitude.
Types of Bt. weather – Snowstorms:–
Typical pressure distribution – small depression up channel. Vapour brought by S. wind on SE of depression. On meeting barrier of dense air in E. current had to rise, fell through cold E wind. Heaviest in South. Generally most when air not much below freezing Pick. Condensation by dynamical cooling Condensation at temps < F.P. a). When condensation commences before temp falls below,

*Figure-6: Daphne's notes on climatology.*

*You will be required to produce a short dissertation of about 5,000 words dealing with a physical, historical, industrial or agricultural aspect, or two or more of these combined, of any region you know well. The region can be large or small, from one square mile in a large city to a hundred square miles in the open country. Alternatively the essay may deal with any one industry or factory or any problem of trade, transport, or settlement which you are interested in. It would be*

*well to produce a rough scheme in the Long Vacation; select your area on the map, examine it on the ground, and collect photographs, statistics and references according to the type of problem you choose. Further details will be given in the Michaelmas Term but the Long Vacation should afford a valuable opportunity for much of the preliminary work.*

**(The Long Vacation begins after the Easter term and lasts between three and four months.)**

Although Daphne completed the course she was not able to append BA after her name. The University of Cambridge did not grant degrees to women until 1948.

## Map Making

*Junior Commander Portway, blonde, five-feet-three, sturdy and shy, does not get much time for sport these days. She joined the ATS as a private just over a year ago after gaining a geographical Tripos at Cambridge. With Junior Commander Shirley Carpenter she now holds one of the only two surveying posts in the ATS.*

**(*Dundee Evening Telegraph* 17 November 1944.)**

*The London Gazette* lists those given commissions as second subalterns in the ATS on 19 November 1943. Miss Shirley Carpenter and Miss Daphne Laura Maud Portway are listed. They were aged, respectively, twenty-one and twenty-two. The rank of second subaltern is equivalent to second lieutenant in the regular army. Both were promoted shortly after to junior commanders, the equivalent of captains.

Maps were required in great quantities for all branches of the military during the hostilities. Knowledge of geographical features could mean the difference between the success and failure of an operation. As one example, take the case of invasion by sea. Apart from the disposition of defences, natural obstacles and surface conditions, the beach gradient is a factor to be considered. Given that the beach will be under enemy control, it can only be observed remotely (although frogmen were successful in some instances with obtaining off-shore data and sand samples). The problem of determining beach gradient was solved by William Washington Williams (1901-1995), a Cambridge geographer with the Royal Engineers. His **"comparative tide photographic method"** used a series of aerial photographs taken at high and low spring tides, and four intermediate levels. It later became known as the waterline method.

The D-Day landings, designated Operation Overlord, began in the very early hours of 6 June 1944. Not many months after came newspaper reports of two ATS officers who had **"... vital secret work to do in preparing for D-Day."** *The Manchester Evening News* weighed in with the caption **"Girl's Secret Map Work to Smash Enemy"**. Daphne and Shirley Carpenter are described as being **"responsible to an army officer for the work of 60 sappers."** They had been involved with surveys for the landings and worked long hours overseeing the preparation and packing of the vital maps. It is interesting that Shirley makes no mention of this work in her letter to the Royal Geographical Society in 1986 (see later).

Daphne & Shirley worked under conditions of security that required a level above that of top secret, and the girls must have been subjected to stringent background checks. All documents relating to the landings that could give any clues as to **"where and when"** were stamped with BIGOT, the code for this higher status of secrecy. One interpretation of the acronym BIGOT is British Invasion of German Occupied Territory, another is that is came from the reversal of To Gib (to Gibraltar). There was, of course, a small army of people collecting information on the terrain of Europe, and a corresponding small army putting it all together.

## In the Army

At the end of WWII, the occupation and administration of the Rhineland came under the jurisdiction of the British Army of the Rhine. The BAOR consisted of several branches of the military, which included the Royal Engineers. Buildings at Bad Oeynhausen, a spa town about 50 miles from Hanover, were requisitioned for the HQ. This also provided the base for Daphne and the survey team. One duty involved re-establishing triangulation pillars (trig points) that had been demolished by warfare.

During a lecture tour with the BAOR, Donald Portway had made the acquaintance of David Montgomery, son of Field-Marshall Montgomery. So when David became an engineering undergraduate at Cambridge, the Field-Marshall was persuaded to present the inter-varsity boxing prizes. Montgomery stayed overnight as the guest of Donald Portway. In one of the few references to Daphne in *Militant Don*, he says: **"Next morning my daughter, then a major with the R. E. Survey at the War Office, got a lift in Monty's car, but only on the condition that she wore uniform."**

From a record held at the National Archives we know that Daphne was involved with the Maps and Charts Sub-Committee of the Army Advisory Committee. The document is a review of committee meetings held between August 1948 and April 1952 prepared by Major D. Portway, Women's Royal Army Corps. The formation of the Women's Royal Army Corps on 1 February 1949 included most of the women in the Army. Daphne came under the WRAC on 1 February 1950. A *London Gazette* notification of 29 November 1955 records that Captain Portway had moved from

the Active List to the Regular Army Reserve of Officers with the honorary rank of major.

There were several notable events in 1957. Donald received a CBE and also an invitation to take up a professorship in mechanical engineering at the University of Khartoum at age 70. Before departing, Donald gifted his house at 33 Millington Road to Daphne. The land had been acquired from King's College in 1924. With a frontage of 100 feet it had enough space for an orchard next to the house. The investiture ceremony for the CBE at Buckingham Palace gave the opportunity for a group photograph with the family dressed in their finery (Figure 7).

*Figure-7: Outside Buckingham Palace, July 1957: Sofia, Donald and Daphne (Militant Don).*

## Shirley Carpenter

Shirley Carpenter came from Sandal Magna, a suburb of Wakefield, born there on 19 August 1922.

Wakefield Girls' High School provided her secondary education. She started at the University of Cambridge in 1941 and after the war returned for her MA degree. It is likely that she met her future husband, James Pearson Hewitt, at the University. They married on 29 July 1950 at St. Helen's Church, Sandal Magna.

The subsequent career of Mrs Shirley Hewitt is revealed in a letter to the archivist at the Royal Geographical Society.

*Dear Mrs Kelly,*

*I heard from Barbara Debenham* [Barbara Lempriere Debenham, Frank Debenham's daughter] *– and also did read some notice in the Newsletter – that you are compiling a formal contribution of British Geographers in the Second World War. I read Geography at Cambridge and served with the Royal Engineers (one of only two women) in various survey sections. Perhaps some details may be of interest for the account. I am a Fellow of the Society and although still have my London address ... now spend a lot of time down on the coast. Since the war I have been engaged in cartographic work as General Manager of a small mapping firm attached to a publisher and for the last few years have been self-employed.*

*Yours sincerely,*
*Shirley Hewitt (Mrs).*

(Letter dated 21 March 1986, in the collection of the Royal Geographical Society.)

It is entirely possible that the unnamed **"small mapping firm"** is Geographical Projects Ltd. If Shirley used her maiden name then she can be linked via a book called *Atlas of Discovery* published in 1973, cartographic editor Shirley Carpenter and maps by Geographical Projects Ltd. There is another indicator of a connection. Shirley lived in Frank Debenhams house in 1946 when he directed a project to develop construction methods for accurate surface relief models. This led to a patent application by Geographic Projects Ltd (Improvements in or relating to the production of relief models of surfaces), naming Debenham as the inventor.

Shirley Hewitt died 27 November 2003. She is buried with her husband James at the parish church of St. Mary The Virgin, Felpham, Bognor Regis.

## Sports

For most of Daphne's life she had a passion for tennis, apparently playing from the age of four. Sometimes she competed against, or partnered with, her father. At the Bungay Lawn Tennis Tournament they played together in the mixed doubles the month before war broke out. There was certainly an element of rivalry between them. A regular arrangement to swim around the pier at Southwold, Suffolk usually saw Donald in the lead, but not for want of trying by Daphne. At Cambridge she joined the women's tennis team,

competing against Oxford. A double blue in tennis and squash crowned her sporting activities at Cambridge.

The army afforded Major Portway ample opportunities to continue her competitive sports. She regularly won army women's tennis singles and doubles, and was undefeated in the women's squash championship. One year she bagged the Rhine Army badminton title, confessing later that she preferred games that were more physically demanding.

Another sport attracted our Miss Portway. The spell in Germany had added skiing to her list of army championships. In 1958 she joined the Down Hill Only Ski Club (DHO), founded by British skiers at the Swiss mountain village of Wengen. Her membership lasted for almost forty years.

News of Daphne's tennis achievements travelled the globe. An item in the Winnipeg Free Press for July 1975 reported **"Miss Daphne Portway has won a County Tennis Championship for the 8th time at age 54."** Not that this achievement had escaped the notice of her skiing friends closer to home. The 1975 DHO Journal commented:

*Tucked away on an inside page of the Sunday Express, we saw that a frequent skiing colleague, Daphne Portway, had won her eighth County Tennis Championship in Cambridgeshire. We thought it worth a mention to remind people that two weeks a year skiing does not necessarily leave one prostrate for the remainder of the year, and to congratulate Daphne, who, we hope, wore her DHO badge for the tournament.*

Daphne regularly competed in the Women's British Open Squash Championship, held at the Lansdowne Club in London. There are records that she entered every competition from 1949 to 1969, with the possible exception of 1951. Daphne didn't achieve the same success with squash as she did with tennis, often losing in the first or second round.

## Later Life

On the occasion of her 1975 win in the county championships, Daphne revealed some of her day-to-day activities to the *Cambridge Evening News*. She maintained the house at Millington Road while looking after an ailing Donald and a collection of ten (in total) dogs and cats. She never had more than six hours of sleep. Practice occupied 2 hours, four times a week at the grass tennis court in the garden. She liked driving and used to cover about 30,000 miles a year. In the army she had a spell as a driving instructor. To keep up her squash, Daphne ran the Cambridge Ladies Squash Club.

Donald Portway died 19 March 1979, leaving an estate valued at £242,082. He couldn't resist ending his will:
**"Lastly I desire my body to be cremated and the ashes scattered, it being my opinion that too much fertile land in our small country is devoted to the useless purpose of providing graveyards."** His death, and of Sofia in 1984, left Daphne quite well-off. As mentioned, the house at 33 Millington Road had been given to her in 1957. Also, Sofia had owned the Bezant home called **"The Valley House"**, Mettingham, sold and added to the coffers.

An article by Daphne for the DHO Journal places her in the Alps with a party of skiers during March 1980. The group climbed up to the Lötschenlücke, a mountain pass in the Bernese Alps at 3153 m height. Since the two-hour climb is physically demanding, participants needed a mental distraction. Daphne says of this: **"All climbers have their own pet method of getting themselves to the top, some sing or hum, but I count paces so that percentages of the total can be estimated – this time it was more than 13,000 to the top!"** It does not appear that Daphne made any further contributions to the *DHO Journal.*

After the competitive skiing while in the army, this sport came as a purely recreational enjoyment and like her other physical activities continued for many years. She once told a newspaper reporter, when in her 50s, that age doesn't matter as long as you keep fit, although she told another reporter **"I don't do anything to keep fit"**.

Daphne Portway died intestate on 31 July 1998, with probate granted to her cousin Michael. She had been playing tennis at home when she collapsed. Newmarket auctioneers Vost's were tasked with valuing the contents of Daphne's house, an exercise that gave unexpected rewards.

*Country Life* published an article in March 1999 with the title **"A buffet made for Bacchus"**. The buffet described in the magazine is an item of furniture with a marble top, five cupboards and a drawer. Its design is due to the architect William Burges and its decorative, painted panels by Nathaniel Westlake. What made this particular sideboard newsworthy was the fact that it had last been seen at the London International Exhibition of 1862, and now rare enough to have excited the art world. After 136 years it had turned up at 33 Millington Road, home of the recently departed Daphne. An eagle-eyed valuer from Vost's discovered the piece **"... partially obscured by cobwebs in the best tradition of such discoveries."** The price-tag for the buffet turned out to be £195,000 (£234,000 with 20% buyer's premium). A possibility is that Donald acquired the cabinet without knowing its value when, shortly after his marriage, he went on a shopping spree for household furniture at a number of public auctions.

There were other valuable items in the estate. A water colour of St Catherine's College, Cambridge by Richard Bankes Harraden (1778-1862), sold for £1300. Presumably, Daphne's book collection also passed through the hands of Vost's. Sixteen years later her copy of Climate resided on a shelf at a Felixstowe bookshop, waiting for a buyer to walk in.


**Bibliography**

1. *Anon, "Frank Debenham", Transactions of the Institute of British Geographers, No. 40 (December 1966), pp. 195-198.*
2. *Hewitt, Shirley, "Obituary - Frank Debenham", Journal of Glaciology, Vol. 6, Iss. 45 (1966), p. 458.*
3. *Maddrell, Avril, "The 'Map Girls'. British Women Geographers' War Work, Shifting Gender Boundaries and Reflections on the History of Geography",Transactions of the Institute of British Geographers, New Series, Vol. 33, No. 1 (January 2008), pp. 127-148.*
4. *Portway, Daphne, "Goppenstein 1980", Down Hill Only Journal (October 1980), pp. 20-12.*
5. *Portway, Donald, Militant Don (London: Robert Hale Ltd, 1964).*
6. *Stoddart, D. R., "A Hundred Years of Geography at Cambridge", The Geographical Journal, Vol. 155, No. 1 (March 1989), pp. 24-32.*
7. *Genealogical sources: Ancestry.co.uk, Findmypast.co.uk*
8. *The book: Kendrew, W. G., Climate: A Treatise on the Principles of Weather and Climate, 2nd edition (Oxford: Clarendon Press, 1938).*



## Acknowledgements

Many thanks to:
Helen Cornish, Director of Development and Communications, Stephen Perse Foundation, Cambridge
Catherine Melia, DHO Honorary Secretary
Jan C. Turner, Deputy Librarian, Royal Geographical Society.



## Author:

**Alan Gall, FIScT** has been IST Archivist since 2004. Originally a laboratory assistant, he has worked in industries concerned with edible oils, food additives, polymer stabilisers, electroplating and explosives. He is currently a company director involved with magnetic materials, electrical engineering and general mechanical engineering. Contributions to the Journal began in 2003 with an article on the Manchester University technician William Alexander Kay.

# IST Membership

## Join the Institute of Science & Technology: Be Part of Something Bigger

Are you ready to connect, grow, and stand out in your field? Membership with the IST is open to specialist, technical, and managerial staff across diverse industries such as science, engineering, technology, artificial intelligence, creative industries, healthcare, education, and more, both in the UK and internationally.

Whether you're working in research, education, industry, or local government, IST membership provides a unique opportunity to advance your career, build your professional reputation, and join a community of like-minded individuals driving progress in their fields.

## Why Join the IST?

By becoming a member, you're helping to build a thriving, supportive community while gaining access to resources that will elevate your career. Membership benefits include:

- **Career Development:** Enhance your professional standing with IST support and guidance.
- **Knowledge Growth:** Stay on top of industry trends and sharpen your skills with access to resources and networking opportunities.
- **Expanded Networks:** Build valuable connections with peers, mentors, and leaders across the technical community and sector.
- **A Unified Voice:** Together, we're stronger. IST members represent a powerful, collective voice advocating for technical and specialist professionals.

Plus, IST membership is an investment in your future that won't break the bank.

Our fees have remained good value for money in a time of higher costs and changing economy, making this the perfect time to join!

## Membership Grades and Application

The IST offers five grades of membership, from Student to Fellow, with the grade you are awarded based on your qualifications and experience. Applying is simple:

- Download the Membership Application Form available at https://istonline.org.uk/membership.
- Submit your completed form, along with copies of relevant qualifications, to the memberships email or by post to our Sheffield office.
- Once your application is reviewed and accepted, you'll receive confirmation of your grade and instructions for payment.

**Membership Fees for 2025:**

- Student: no charge
- Affiliate: enquire with us (for organisations)
- Associate (AssocISctT): £44
- Member (MISctT): £57
- Fellow (FISctT): £71

**Retired or unemployed members receive a 50% discount on fees.*

IST membership fees are also eligible for UK tax relief, so you can claim back some of your costs directly with HMRC!

## Ready to Join?

Complete your application today and take the first step toward a brighter, more connected future. Together, we can help you achieve your ambitions and amplify the impact of technical and specialist professionals.

For reinstatement of lapsed memberships, or to learn more, visit istonline.org.uk/membership or contact us at memberships@istonline.org.uk.

Let's build the **future - together**.

# 2024 Technical Conference at Lancaster University

## Technicians - Inspiring, Innovating and Creating

Many Thanks To Our Key Sponsors

*Figure-1: A busy exhibition-networking space for delegates at this years conference, with a range of scrumtious refreshments and food!*

On 10th September 2024, professionals from across the UK gathered at Lancaster University for the IST Annual Technical Conference. Held at the university's state-of-the-art facilities, this year's theme, "Technicians Inspiring, Innovating and Creating," highlighted the invaluable contributions of technical staff across various sectors.

*Figure-2: Lancaster University Coat of Arms.*

This marked yet another successful in-person event, building on the momentum of recent years. Delegates were thrilled to network and exchange insights while enjoying Lancaster's vibrant campus and exceptional facilities. The weather was a little bleak, but the lunch made up for it.

*Figure-3: Delegates asking questions with the 'throw-ball' in the Keynote talks.*

### A Warm Welcome to Lancaster

The day began with a warm introduction from Terry Croft MBE, IST Chair, followed by a heartfelt welcome from Dr. Helen Sharman CMG OBE, IST President and Chair for the day. Lancaster University's Deputy Chief Executive (Operations), Nicola Owen addressed the audience, expressing gratitude for the technical community's often-unseen contributions to research, education, and innovation.

## Inspirational Keynote Speaker

The first keynote speaker, **Professor John Amaechi OBE CSci, FIScT**, delivered a thought-provoking session on 'Professional Registration – What's in it for me?' His insights and experience set the tone for the day. Attendees appreciated the practical advice, with comments like:

> *"John Amaechi's opening keynote speech was one of the best I have heard at a conference"*
>
> *"It was very impactful and empowering for me to want to be recognised for the skills that I have acquired. As a technician, it is easy to feel stuck but this talk helped me feel that I have the power to un-stick myself"*
>
> *"Excellent speaker with good humour and enthusiasm as well as excellent advice/information"*

## Morning Interactive Workshops

The morning was filled with an array of workshops designed to spark ideas and foster collaboration. The first session included:

- Challenges face by AI Practitioners – led by Marie Oldfield and Murrary Webster
- Creative Practitioner Registration Insights – shared by JP Ashton-Kinlin
- Safety at 50: Navigating Workplace Health and Safety Since 1974 – with Natalie Kennerley, Naomi Bates, Tiziana Denaro and Alex Sleat
- A Technical Perspective – our experience of running sustainability projects in research laboratories – presented by Hannah Briers and Richard Gammons
- I'm not a Teacher, I'm a Technician... or am I – led by Sarah Youde, Peter Bentley and John Baum
- Design and Operation of Class I, II and III Microbiological Safety Cabinets – by Key Sponsor **Contained Air Solutions**

Attendees shared their appreciation:

> *"This was an interesting talk, and was good to see the work that IST have been doing in my area of digital media and alike colleagues"*
>
> *"It was very interesting to see this topic being at the forefront and even though I don't work in this area, I learnt things"*

The second session included:

- Whither Large Language Models (LLMs) – led by Richard Saldanha
- The Challenges for Creative Arts Technicians in HE – by Graeme Shaw and Davd McBride
- Health Innovation at Lancaster – with Glyn Jones
- Experimenting with Extreme Cold – led by Richard Haley
- Papyrus Mental Health Training and Support – with Christine Shaw
- Selling Unwanted Laboratory Equipment – by Key Sponsor **UniGreenScheme**

*Figure-4: Workshop attended by delegates.*

Attendees shared their appreciation:

> *"I found the workshop very informative and a useful support aid in life alongside work"*
>
> *"Very useful for my line of work (sustainability), interesting to learn about repairs, the speaker was very open in answering questions"*

## Networking and Exhibitor Space

As always, we know how important networking is (especially with food, therefore there was plenty of time to see colleagues old-and-new, and to meet our fantastic sponsors and exhibitors.

*Figure-5: Delegates finding more out about the fantastic range of sponsors, exhibitors and career zone supporters attending.*

## Afternoon Interactive Workshops

After a networking lunch, delegates explored session three workshops on:

- We should be arguing about unit tests – led by Sarah Wise
- Technical Services' role in delivering capital projects in MMU – shared by Morvarid Randjbar, Leighton Moody and Evan Wilson
- Lancaster's Journey to Net-Zero Carbon – delivered by Paul Morris, Georgiana Allison, Anna Cockman and Avery Chong
- Research Technical Professional Pathway at the University of Liverpool – 18 months on – led by Jan Brett
- Technical Career Pathways: a clear route to progression – shared by Sara Bacon and Ian Tidmarsh
- Chemical and Safety Sheet Management – by Key Sponsor **SISO Software**

The sessions received enthusiastic feedback:

> *"Nice to discuss an innovative idea with others from institutes across the UK"*
>
> *"Gave a good overview of the software, always good to know what packages are out there"*

## Awards and Celebrations

A highlight of the day was the IST Awards Ceremony, where new Fellows were recognised for their contributions. Honourees included:

**Dr James Fox, FIScT** (University of York)
**Murray Webster, FIScT** (University of Gothenburg)

The winners of the 2024 Image Competition were also announced.

First Place – **Phil Faulks**
Second Place – **Chloe Tait**

Well done to all from the IST and the technical community.

*Figure-6: Lancaster Technician Showcase.*

## Closing Keynote and Reflections

The final keynote, was a little different and we were lucky enough to have a panel session on 'Technical Careers' led by our President Helen Sharman. The panel had six individuals who represented each career step from apprentice to Head of Facility. The engaging narrative and chance for audience participation left the audience inspired.

*Figure-7: The Technical Panel led by Helen Sharman.*

The Technical Panel was made up of:

1. **Jessica Fisher**, Chemical Engineering Technician (Lancaster University)
2. **Paola Foulkes**, Laboratory Technician (Cardiff University)
3. **Annette Ryan**, Senior Technician & Safety Officer (Lancaster University)
4. **Richard Keogan**, Technical Specialist & Associate Lecturer (University of York)
5. **Natalie Kennerley**, Technical Services Manager (Manchester Metropolitan)
6. **Dan Fower**, Head of e-Lab (OrganOX Ltd)

The session received some great feedback:

> *"Technicians in various fields sharing their experiences, goals and motivation and it was very inspiring"*
>
> *"It was good to see technicians representing the keynote as it shows that the IST are doing well to represent technicians from all areas"*
>
> *"I thought this was a good way to discuss some key topics and a much more engaging way of doing it"*

## Looking Ahead

As the day concluded, Terry Croft thanked attendees, sponsors, and exhibitors for their invaluable support. The IST Executive shared their excitement for next year's conference, expressing hope to see familiar and new faces at the 2025 event.

The Lancaster conference left delegates invigorated, with a renewed sense of pride and purpose. Many thanks go to the Conference team and Lancaster team, including IST Fellow John Dwyer for their part.

**Thanks all and see you next year in Birmingham 2025**

*Figure-8: Image Competition winners; 1st Place - Phil Faulks (Left), 2nd Place - Chloe Tait (Right). Both accepted their prizes. Well done.*

## Many Thanks To Our Conference Speakers

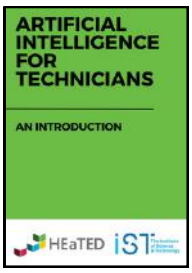
## Many Thanks To Our Exhibitors and Supporters

# HEaTED News

## Higher Education and Technician Educational Development

Artificial Intelligence is a key buzz word in all walks of life currently. HEaTED are pleased to be ahead of the game in partnering with the Institute of Science & Technology (IST) to deliver two courses covering this subject for Technical Professionals in HE.

With Dr Marie Oldfield CStat, CSci, APAI, FIScT, SFHEA, chair of the IST AI Group we have developed an introductory course - Artificial Intelligence for Technicians - An Introduction, consisting of short bite size online live sessions spanning 10 hours of CPD. The outcomes of this course will enable technicians to understand the risks when engaging with AI, have a risk-based awareness and approach to analysis involving AI, be able to challenge and question AI, have an understanding of the behavioural aspects and influence of AI systems and finally be aware and able to use best practices when implementing AI.





We have also developed a longer, more in depth 20-hour course which not only covers the ethics around the use of AI, the types, and accountability with future legislation, but also leads to Entry Level Accreditation with the IST. Delegates who complete this course will be able to use the letters RTechAI as an easily identifiable standard of learning. The Accredited course cost also **includes 1 year membership** with the IST and payment for the Accreditation process, representing real value for money.

We are keen for delegates to be flexible in accommodating learning time around their work schedule so we are operating a waiting list system for sign up. Please register your interest and you will also be invited to join the IST AI network. We will then arrange dates convenient for all to attend.

We have also teamed up with UK RAS STEPS who are a community driven research technology platform to support research technicians involved with robotic and automated systems (RAS). Their aim is to foster collaborative and inclusive research by technicians to promote professional development and raise the profile of RAS technicians whilst also promoting responsible innovative practices across the UK. They are offering training funding of up to

**£1,000**

per institution which can be used to pay for either of our AI courses. Take a look at their website - UK RAS STEPS for more information to find out how you could apply for funding support.

We have also been busy behind the scenes at HEaTED working on accrediting our HEaTED courses. We have been working with the CPD Accreditation Service to independently check and verify our course content and delivery. While we receive fabulous feedback for our courses, we also wanted to ensure our course content was relevant and accredited from an independent perspective. Please look for the CPD Certification logo on our website and course brochures. Please also look for those accredited with the Royal Society of Chemistry, which is a further validation of quality for our HEaTED courses.

Another service unique to HEaTED is our course credits. These can be bought in batches of 10 or more and they represent over a 25% saving on the already reduced HEaTED member rate for our courses. While many Higher Education institutions are facing funding cuts, this is an ideal way of maximising your training budgets, so please take a look at our website for further details and drop us a message with our enquiries email.

In the new year we have cohorts for our Leadership Development Programmes; our Technical Leaders Programmehelps existing leaders enhance their effectiveness in leading and contributing to strategic change initiatives. Our Stepping into Technical Leadership Programme is designed to develop the skills that will help delegates to successfully make this transition into leadership. These differ from our usual courses as they take place over a 5 month period with a mix of online and onsite learning.

Finally as we approach the festive period, we would like to wish all our partners and clients of HEaTED a very Happy Holidays with a peaceful and positive start to the new year.


# Empowering Women in Tech

## Breaking Barriers and Building Futures

The Institute of Science & Technology (IST) is proud to provide a safe space in the Women in Tech Group, an initiative dedicated to supporting and empowering women in scientific and technical careers.

**Our mission is clear:** to advance the knowledge, interests, and impact of women in tech while breaking down barriers and inspiring the next generation of female leaders in STEMC (Science, Technology, Engineering, Mathematics and Creative Industries).

Women continue to face unique challenges in technical fields, from navigating workplace biases to overcoming impostor syndrome. The Women in Tech Group seeks to address these challenges head-on, creating opportunities for personal growth, professional development, and community building.

### What We're Offering

Our group is designed to provide resources, inspiration, and a strong network of support.

Here's what you can look forward to:

- Insightful Talks and Workshops: Dive into topics like Overcoming Barriers to Analytical Careers, Leadership and Negotiation Skills, and Impostor Syndrome.
- Showcase Events: Celebrate the achievements of women in STEMC and highlight promising young professionals making strides in the field.
- Career Guidance: Gain valuable advice through career talks and workplace support initiatives.
- Networking Opportunities: Build connections with like-minded professionals and mentors.
- CPD Benefits: Earn Continuing Professional Development credits through our events and resources.

### A Focus on Young Women in Tech

A key part of our mission is to inspire more young women to pursue careers in STEMC. By fostering curiosity, confidence, and capability, we aim to encourage the next generation to enter and thrive in these exciting fields.

### Exciting Events Planned

We're kicking off the year with a range of professional and informative events, tailored to empower women at every stage of their careers. Whether you're just starting out or are an established professional, our community offers something for everyone.

### Join Us

Together, we can create a more inclusive and supportive future for women in tech. If you're passionate about advancing women's roles in science and technology or are seeking support in your own journey, we invite you to join the Women in Tech Group. Let's work together to build a brighter, more equitable future.

Stay tuned for event announcements and opportunities to get involved. If you'd like to learn more or get involved, reach out today!

# Not working in science or science technology?

## Join the Creative Registration Framework: Be Recognised as a Professional in the Creative Industries and Technologies

**Create. Innovate. Collaborate.** Working together for a brighter world.

For the first time, professionals in the creative industries and technologies can gain the professional recognition they deserve, thanks to the Creative Registration Framework, a groundbreaking initiative by Creative UK and the IST.

This framework, endorsed by Creative UK, brings parity of professional accreditation for creative technologists, aligning their expertise with that of professionals in science and engineering sectors. Just as scientists and engineers earn respect through professional registers, this new framework honours creative professionals for their competence, knowledge, skills, attitude, social responsibility, and professional integrity.

### Why Register?

Becoming registered under this framework is more than a title; it's a statement of your professionalism and impact in the creative world.

Benefits include:

- **Recognition:** Showcase your expertise and dedication as a professional practitioner in your field.
- **Career Advancement:** Enhance your credibility and stand out in the competitive creative sector.
- **Community:** Join a growing network of creative technologists shaping the future of the industry.

### Who Is It For?

The framework has launched with a mid-career register for creative technologists in Higher Education, with plans to expand to:

- Early career professionals.
- Senior technical professionals.
- A broader range of creative sectors.

This exciting initiative has been developed in collaboration with leading institutions, including the University of Manchester, Brunel University London, ScreenSkills, and more.

### Want to Learn More?

The future is bright for creative professionals - don't miss your chance to be part of it. Join our creative registers mailing list to stay updated on the framework and how you can become registered.

Take the first step toward professional recognition and let your expertise shine.

# The Turing Institute: Project ExplAIn

## Advancing Explainable AI in Decision-Making

Artificial intelligence (AI) is transforming decision-making across industries, but its growing influence has raised pressing concerns about transparency, accountability, and fairness. The Alan Turing Institute's Project ExplAIn addressed these issues by equipping organisations with tools and frameworks to make AI-supported decisions more understandable to affected individuals and stakeholders.

## Key Objectives

The project aimed to enable organisations to deliver explanations of AI decisions that are tailored to the context in which they are made. Recognising that different sectors; such as healthcare, finance, or criminal justice, require diverse approaches, the project advocated for flexibility and precision in explanation delivery. To achieve this, it promoted a principles-based governance model that prioritised four key elements:

- **Transparency:** Organisations must disclose how and where AI systems are used, offering clear insights into their decision-making processes.
- **Accountability:** Ensuring appropriate oversight of AI systems and providing contact points for human review when needed.
- **Contextual Awareness:** Selecting explanation methods that align with the domain-specific and situational impacts of AI use.
- **Ethical Reflection:** Assessing how AI impacts societal well-being and individual rights at every stage of its deployment.

## Explanation Framework

A core contribution of Project ExplAIn is its classification of explanation types. These include:

- **Rationale:** Simplified reasons for a decision, tailored for non-technical audiences.
- **Fairness:** Measures to ensure equitable treatment by the AI system.
- **Safety and Performance:** Steps taken to validate the reliability of AI models.
- **Impact:** An analysis of the decision's consequences for individuals and society.
- **Data Transparency:** Clarifications on the data used to train and operate the AI system.

The project highlighted the importance of "layering" explanations to avoid overwhelming users with technical details. This involves prioritising critical information upfront while providing more complex insights separately for those who need them.

## Practical Implementation

To bridge the gap between theory and practice, the project has developed practical resources, including workbooks and workshops. These tools are designed to help organisations implement the guidance effectively and adapt it to their specific operational contexts. Engagement with diverse sectors ensures that the project's recommendations are not only theoretically sound but also pragmatically viable.

## Broader Impacts

Project ExplAIn represents a significant step towards embedding ethical principles into AI governance. By making AI systems more interpretable and trustworthy, it addresses public concerns and fosters confidence in automated decision-making. The project also sets a standard for international collaborations on explainable AI, reflecting the UK's leadership in this critical field.

Through initiatives like Project ExplAIn, the Alan Turing Institute continues to demonstrate its commitment to advancing AI technologies that align with societal values and ethical principles.

# Breaking Barriers and Promoting Inclusivity in Research Centres

Promoting equality, diversity, and inclusion (EDI) has become a core focus across UK research centres, as institutions increasingly recognise the critical role that inclusivity plays in driving innovation, collaboration, and social impact. Through targeted initiatives, policy reforms, and community engagement, research centres are fostering an environment that supports individuals from all backgrounds.

## Addressing Systemic Barriers

Many UK research institutions are tackling systemic challenges that have historically hindered participation from underrepresented groups. Programmes like the Athena SWAN Charter, which supports gender equality in STEM fields, and the Race Equality Charter aim to dismantle barriers for women, ethnic minorities, and other marginalised communities. These frameworks encourage organisations to set measurable goals, monitor progress, and share best practices.


## Enhancing Accessibility

Research centres are adopting inclusive practices to ensure accessibility for individuals with disabilities. For instance, the use of assistive technologies, flexible working arrangements, and redesigned physical spaces has enabled greater participation. Initiatives like the Disabled Students' Allowance and partnerships with charities such as Scope have also helped researchers with disabilities thrive in academic environments.

## Building Diverse Talent Pipelines

A key focus has been on expanding opportunities for early-career researchers from diverse backgrounds. Programmes such as the UK Research and Innovation's (UKRI) Future Leaders Fellowships are designed to support researchers from all demographics, fostering an equitable talent pipeline. Outreach activities, including partnerships with schools in underserved areas, inspire young people from underrepresented communities to pursue research careers.

## Inclusive Research Practices

Promoting inclusivity is not limited to internal policies but extends to research methodologies. UK research centres are increasingly involving diverse communities in co-designing studies, ensuring that research outputs address real-world challenges equitably. For example, the Turing Institute has led initiatives that integrate inclusive AI design principles, reducing biases in data science applications.

## Celebrating Cultural Awareness

Cultural awareness programmes, such as unconscious bias training and diversity workshops, are now standard in many research institutions. Events celebrating cultural and religious diversity, such as Black History Month, Pride, and International Women's Day, foster a sense of belonging and respect among staff and students.

## Measuring Impact

The emphasis on evidence-based EDI strategies has prompted institutions to use data to track their progress. Reporting frameworks, such as those required by the Gender Pay Gap and Research Excellence Framework evaluations, provide transparency and accountability, ensuring that inclusion remains a priority.

Despite these advances, challenges persist, including addressing intersectional inequalities and embedding lasting cultural change. Through holistic strategies and a shared commitment to breaking barriers, UK research centres are setting a global standard for inclusivity in academia and beyond.

These efforts not only enrich the research landscape but also pave the way for a more equitable and innovative society.

# Decoding the Mysteries of Twister Formation and Tracking

Tornadoes, often referred to as "twisters," are among the most enigmatic and destructive phenomena in nature. Their violent winds can reach speeds of over 300 mph, leaving a trail of devastation in their wake. Despite their ferocity, understanding the mechanisms behind tornado formation and improving tracking methods remain significant challenges for meteorologists. Recent advancements, however, are shedding light on these mysterious whirlwinds.

Tornadoes typically form during severe thunderstorms, particularly those involving supercells; large rotating storm systems. Key ingredients include warm, moist air near the surface, cooler, drier air above, and wind shear, which causes horizontal rotation in the lower atmosphere. When this rotation is tilted vertically by a thunderstorm's updraft, it can spawn a tornado.

Although the general conditions for **tornado formation** are well understood, predicting their exact occurrence remains elusive. Researchers are delving deeper into the microphysics of storms, including the role of downdrafts and pressure drops that precede a tornado's touchdown. Advanced simulations are providing valuable insights into how these dynamics interact to unleash these powerful vortices.

Historically, **tornado tracking** relied heavily on eyewitness accounts and rudimentary radar systems. Today, cutting-edge technologies are revolutionising how we detect and monitor these storms. Doppler radar has become indispensable, allowing meteorologists to identify rotational patterns within storms with increasing precision. Additionally, mobile radar units and drone-based sensors are enhancing on-the-ground tracking capabilities.

One of the most exciting breakthroughs is the use of AI and machine learning to analyse weather data in real time. These systems can process vast amounts of information, identifying subtle patterns that may signal a developing tornado. This advancement has the potential to improve warning times dramatically, giving communities critical minutes to seek shelter.

UK researchers, including those at the University of Reading and collaborations with international counterparts, are contributing to the global effort to decode tornado formation. Studies on European tornadoes, which differ from their North American counterparts, are revealing insights into the broader behaviours of these storms under varying climatic conditions.

Furthermore, as climate change influences weather patterns, understanding how tornado activity might shift geographically and seasonally is becoming increasingly urgent. Research suggests that warmer temperatures may expand tornado-prone areas, underscoring the need for continuous innovation in forecasting and preparedness.

By combining advanced meteorology, innovative technology, and global collaboration, scientists are making significant strides in demystifying tornadoes. These efforts not only enrich our scientific understanding but also provide critical tools for safeguarding communities against one of nature’s most formidable forces.

# Ocado’s Machine Warehouse: The Next Generation of Automation

Imagine a vast warehouse bustling with activity, not from human workers but from thousands of meticulously coordinated robots. This is no futuristic fantasy; it’s the reality inside Ocado’s automated warehouses, where cutting-edge technology is redefining how groceries are picked, packed, and delivered to customers across the UK.

At the core of Ocado’s system is a hive-like grid structure known as **"The Grid."** Here, swarms of autonomous robots zoom across a multi-layered framework, retrieving crates of groceries stored below. These bots move at lightning speed, using advanced AI algorithms to communicate and avoid collisions. It’s a ballet of precision and efficiency, with robots capable of fulfilling thousands of orders daily without missing a beat.

## How Does It Work?

The warehouse's efficiency hinges on a combination of robotics, AI, and state-of-the-art engineering. Products are stored in bins stacked within the grid. When an order comes through, the system determines the optimal route for the bots to retrieve the required items. With robots moving at speeds of up to four metres per second, Ocado claims their system is five times faster than traditional manual picking methods.

At the packing stations, human workers collaborate with machines, assembling orders for delivery. This seamless integration of human and machine expertise ensures quality control and speed.

Ocado’s warehouses aren’t just marvels of engineering; they are a testament to the transformative power of automation. Their technology minimises waste, optimises storage space, and reduces costs. Furthermore, the energy-efficient design, combined with reduced human error, enhances sustainability; a growing concern in the logistics sector.

These concerns are driven by increasing awareness of environmental issues and the logistics sector's role in carbon emissions and resource management.

*Credit: https://retailgazette.co.uk/blog/2023/12/ocado-robot-arms/*

Ocado isn’t keeping this technological innovation to itself. The company has licensed its platform to international retailers, including Kroger in the US and Sobeys in Canada, showcasing how British ingenuity is influencing global markets.

## What’s Next?

Ocado is continuously iterating on its systems, exploring opportunities like drone deliveries and further AI-driven enhancements. Their goal is not just efficiency but the creation of an entirely new standard for the grocery supply chain.

With Ocado’s robotic warehouses at the forefront, the future of shopping is fast, precise, and thrillingly automated. As we stand on the brink of a technological revolution, it’s clear that Ocado is leading the charge, turning science fiction into everyday convenience.

*Credit: https://esmmagazine.com/ocados-world-rise-machines*

# How AI is Revolutionising Game Development

AI is revolutionising game development by enhancing both the development process and the player experience. Below are key areas where AI is making transformative impacts:

### 1. Game Design and Content Generation

AI is enabling the automatic generation of game assets, such as landscapes, levels, and characters. Procedural generation, powered by AI, helps developers create expansive game worlds with minimal manual effort. For example:

- Procedural World Generation: Games like No Man's Sky use algorithms to create vast, unique universes, ensuring players always encounter fresh content.
- Character Design: AI tools assist in generating lifelike NPCs (non-player characters) with detailed animations and behaviours, reducing the workload for artists and designers.

### 2. Advanced NPC Behaviour

AI is improving the realism and responsiveness of NPCs. Machine learning techniques allow NPCs to learn from player behaviour and adapt dynamically, creating more engaging and unpredictable gameplay. For example, in Middle-earth: Shadow of Mordor, the Nemesis system uses AI to generate unique enemies that remember and react to player interactions.

### 3. Improved Game Testing

AI algorithms automate quality assurance (QA) processes by identifying bugs and testing game mechanics. This reduces the time and resources needed for manual testing while ensuring more robust game performance. Tools like AI-based bots simulate gameplay to detect issues efficiently.

### 4. Personalised Player Experiences

AI analyses player data to create customised experiences. This can involve:

- Dynamic difficulty adjustment to suit individual player skill levels.
- Tailored narratives based on choices, ensuring replayability and deeper immersion.

### 5. Enhanced Graphics and Realism

AI is transforming graphics with tools like NVIDIA's DLSS (Deep Learning Super Sampling), which enhances image quality without demanding higher computational power. AI is also used in creating lifelike textures, lighting effects, and realistic physics simulations.

### 6. Voice and Dialogue Systems

Natural Language Processing (NLP) is advancing how players interact with games. AI-driven dialogue systems enable meaningful conversations with NPCs, breaking free from pre-scripted responses. Games like The Sims incorporate AI to make character interactions more organic.

### 7. Game Design Democratisation

AI-powered tools like Unity's AI tools or Unreal Engine's MetaHuman Creator allow smaller studios and indie developers to create high-quality games by simplifying complex processes. This democratises game development and reduces entry barriers.

### 8. Augmented Reality (AR) and Virtual Reality (VR)

AI enriches AR and VR gaming experiences by enhancing motion tracking, object recognition, and spatial awareness, enabling more immersive gameplay.

### Conclusion

AI is reshaping every facet of game development, from design and testing to player engagement. By reducing development costs, enabling innovation, and enhancing realism, AI is paving the way for a new era of gaming. As technology evolves, we can expect even greater integration of AI into game development, leading to experiences that are more personalised, immersive, and engaging.

# Partners and Collaborators

National Technician Development Centre PARTNER AFFILIATE

TMU TECHNICAL MANAGERS in Universities

ubma University Biosciences Managers' Association

Creative UK

Science Council

Technician Commitment

## Representation on / Collaborating with

UK Govt. Register of Learning Providers: 10096163

BSI ART/1
AI Standards and Policy

IEEE P7015 Standards for Data and AI Literacy, Skills and Readiness

Scottish AI Alliance

Alan Turing Institute

StudyTec Technology Solutions

Responsible AI Institute

## A Personal Thank You from the New Editor

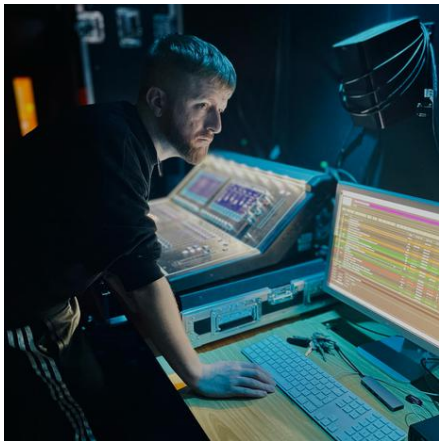
I would like to extend my heartfelt thanks once again to everyone who contributed to this year's edition of **The Journal**. We have received a significant number of contributions, and I hope this level of engagement continues in the future. Many thanks to all authors.

I would also like to express my gratitude to the Editorial Board and the core IST team for their invaluable peer-reviewing efforts; in particular James Fox, Nigel Cook, Alan Gall, Joan Ward, Terry Croft and Helen Sharman. The attention to detail and critical analysis applied to each article have been exceptional, significantly enhancing the overall quality of the 2024 winter edition.

As Editor, it is impossible to manage every aspect alone, and the support from those who have peer-reviewed or submitted articles is deeply appreciated.

Your dedication has been instrumental in producing a publication of such high standard.

*Thank you!*



Digital / **AI**
Engineering
Science
Creative

Production: Ashton Industries Ltd

**The Official Journal of the Institute of Science & Technology**

The Professional Body for Specialist, Technical and Managerial Staff

**ISSN 2040-1868**

7th Floor, 2 Pinfold Street, The Balance, Sheffield, S1 2GU

T: 0114 553 1401 office@istonline.org.uk

www.istonline.org.uk