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Nathu Puri Institute for Engineering and Enterprise

Annual Report 2023

Contents

Executive summary

Over the last year, the Nathu Puri Institute for Engineering and Enterprise at London South Bank University (LSBU) has delivered strongly against its strategy and has generated sustained impact in the area of engineering and enterprise across the research, education and knowledge exchange dimensions. The Institute has provided support to different parts of the School of Engineering at LSBU and this includes the teaching of degree modules, collaborative research studies and focused coaching interventions for undergraduate students.

In the academic year 2022/23, Prof. Philbin delivered two level 7 engineering modules. He delivered the Technical, Research and Professional Skills (TRAPS) module on behalf of the Division of Electrical and Electronic Engineering for MSc and final year MEng students across the School of Engineering. He also delivered the Technology Evaluation and Commercialisation (TEC) module on behalf of the Division of Mechanical Engineering and Design for MSc in Mechanical Engineering students. As a Module Tutor, Sunita Selvarajan again supported delivery of the Innovation and Enterprise module, which is an undergraduate module in the School of Engineering. Sunita Selvarajan also delivered coaching initiatives for the School of Engineering, including coaching support for a group of undergraduate students in academic year 2022/23 as well as leading a new Action Learning group coaching initiative for the School in academic year 2023/24. Both coaching initiatives are designed to improve student outcomes and especially continuation and progression levels for undergraduate students and thereby help students to realise their overall educational goals.

In terms of research outputs, over the last year the Institute has generated 12 journal articles; 1 conference proceeding paper; 2 book chapters; 1 co-edited book; 1 published book review; 1 technical magazine article; 4 journal editorials; 4 conference presentations; and 2 invited seminars. Dr. Pavan Kumar Sala successfully completed his PhD on 'Understanding How High-tech Entrepreneurs Successfully Pivot as Part of the Entrepreneurial Journey' (supervised by Prof. Simon Philbin and Dr. Safia Barikzai); and Ms. Dominika Ptach successfully defended her MRes Dissertation on '"Translating" the United Nations Sustainable Development Goals to Enable the Systemic Green Transformation of the Data Centre Industry' (supervised by Prof. Deborah Andrews and Prof. Simon Philbin). Ms. Dominika Ptach also presented her MRes studies at three international conferences, including virtually at the Nineteenth International Conference on Environmental, Cultural, Economic & Social Sustainability in Ljubljana, Slovenia; International Conference on Resource Sustainability in Surrey; and International Conference on Life Cycle Management in Lille, France.

Prof. Philbin has continued to collaborate with various international researchers. In January 2023, he visited the University of Johannesburg in South Africa as part of Royal Academy of Engineering/Newton Fund research project, which investigated how SMEs (small and medium-sized enterprises) from the food and beverage sector undergo the process of digital transformation. While in South Africa, he met with Prof. Arnesh Telukdarie and colleagues from the University of Johannesburg and later in the year the two-year research project was successfully completed. Both Prof. Telukdarie and Prof. Philbin were subsequently invited to an online meeting with the Royal Academy of Engineering to discuss the findings of the research project as well as next steps for the research area. Furthermore, several journal articles arising from the project have already been published and the digital platform developed in the project is undergoing further development to enable wider outcomes and impact generation for the research study.

In September 2023, Prof. Philbin visited the Pontifical Catholic University of Paraná (PUCPR) in Brazil to meet Prof. Fernando Deschamps, Prof. Carlos Quandt, Dr. Clarissa Rocha and other colleagues. The collaboration visit included various meetings, seminars, delivery of a three-part training course, and visits to high tech manufacturing companies in the Curitiba area. In October 2023, Prof. Philbin delivered a workshop at LSBU on 'Innovation Management and Economic Analysis for Renewable Energy Technologies' as part of the British Council's Going Global Partnership PAK-UK Education Gateway Mobility Programme for Faculty. The workshop attendees were from the Government College University Faisalabad (GCUF), Women University Multan (WUM) and the University of Education, Lahore. Prof. Philbin has also continued to collaborate and publish various research studies with Prof. Jing-xiao Zhang from Chang'an University in China and with Prof. Riaz Ahmed from Bahria University in Pakistan.

In other highlights, Prof. Philbin was appointed a Fellow of the Association for Project Management (FAPM) in March 2023 and in October 2023, Prof. Philbin commenced his term as the Interim Dean of the School of Engineering at LSBU. Prof. Philbin has continued to serve as Co-Editor-in-Chief of the Engineering Management Journal (EMJ) and as a Member of the Board of Directors of the American Society for Engineering Management (ASEM); Editorial Board Member of the Journal of Research Administration (JRA), which is published by the Society of Research Administrators (SRA) International; and as External Examiner for PhD theses at different international universities. Furthermore and in October 2023, Prof. Philbin visited the Purico Group in Nottingham where he held discussions with Prof. Nathu Puri CBE.

Looking ahead, the Nathu Puri Institute for Engineering and Enterprise is well positioned to continue creating value across the engineering and enterprise portfolio. This includes support provided to the School of Engineering on education related activities as well as collaborative research studies undertaken with colleagues at LSBU and with international partners. In this context, research outputs continue to be delivered, which is leading to impact in four key areas, namely value optimisation, sustainable development, digital transformation and engineering education. In conclusion, the Institute continues to generate value for stakeholders through embedding enterprise and wider professional practice into engineering education and industry towards the goal of enabling enterprising engineers.

Prof. Simon P. Philbin

Director of the Nathu Puri Institute for Engineering and Enterprise

School of Engineering
London South Bank University

Historical background of the institute

The Nathu Puri Institute for Engineering and Enterprise (or NPI) was launched by LSBU in 2011 following a generous donation by the Puri Foundation to embed enterprise in engineering education and industrial practice. This objective was based on the premise that although engineers require a solid technical foundation for their education and practice, they also benefit from access to a wider set of enterprise and professional related skills and knowledge. This original intent for the Institute remains valid today and was summarised succinctly by Professor Nathu Puri at the Institute's launch event as follows: *"Knowledge should be available to future engineers and engineering students so that more of them can break the glass ceiling and become entrepreneurs and our business leaders. Current demands are for engineers with a much wider knowledge base, hence this initiative today"*. The Institute was established according to the original vision of the founder, Emeritus Professor Rao Bhamidimarri.

Members of the institute

The institute currently has the following members:

- Prof. Simon Philbin, Institute Director
- Ms. Sunita Selvarajan, Project Co-ordinator and Education Support
- Prof. Deborah Andrews, Affiliated Staff *(LSBU Division of Mechanical Engineering and Design)*
- Dr. Safia Barikzai, Affiliated Staff *(LSBU Division of Computer Science and Informatics)*
- Dr. Nathan Darroch, Affiliated Staff *(LSBU Division of Electrical and Electronic Engineering)*
- Dr. Zunaib Ali, Affiliated Staff *(LSBU Division of Electrical and Electronic Engineering)*
- Dr. Heba Younis, Affiliated Staff *(LSBU Business School)*
- Prof. Jing-xiao Zhang, Visiting Fellow *(Chang'an University, China)*
- Prof. Arnesh Telukdarie, Visiting Fellow *(University of Johannesburg, South Africa)*
- Prof. Riaz Ahmed, Visiting Fellow *(Bahria University, Pakistan)*
- Prof. Fernando Deschamps, Visiting Fellow *(Pontifical Catholic University of Paraná, Brazil)*
- Dr. Clarissa Figueredo Rocha, *Affiliated Researcher (Pontifical Catholic University of Paraná, Brazil)*
- Dr. Pavan Kumar Sala, Affiliated Researcher *(LSBU Research, Enterprise and Innovation)*
- Ms. Firdaous Ennami, Affiliated Researcher *(LSBU Business School)*
- Mr. Ruthiraraja Senthooran, Affiliated Researcher *(LSBU Division of Electrical and Electronic Engineering)*
- Ms. Dominika Ptach, Affiliated Researcher *(LSBU Division of Mechanical Engineering and Design)*

The Institute is an integral part of the School of Engineering at LSBU.

Strategic profile of the institute

The vision of the Institute is to enable enterprising engineers by embedding enterprise into engineering education and industrial practice. To achieve this goal, the Institute delivers an integrated programme of work across engineering and enterprise, including education, research and knowledge exchange.

The Institute combines a local focus on supporting the School of Engineering at LSBU with a global reach enabled through various academic activities. The overall disciplinary focus of the Institute is the subject of engineering management, which involves a portfolio of activities in areas such as innovation, entrepreneurship, project management, sustainable engineering, renewable energy technologies, digital transformation and engineering education.

Education	Research	Knowledge exchange
• Embedding innovation, entrepreneurship, project management and other practices into engineering education • Enabling professional skills development for engineers to improve employment prospects • Delivery of training courses and workshops on innovation management and related areas • Providing professional coaching support for engineering students to improve educational outcomes	• Investigating the processes of project management and the role of project leadership • Entrepreneurial pivoting by tech start-ups • Investigating sustainable engineering, environmental management, and renewable energy technologies • Adoption of digital transformation by industrial companies • Professional skills development in engineering education	• Focused knowledge exchange activities and 'thought leadership' on engineering and enterprise • Close working with collaborative partners and other stakeholders to promote research and education practices • Engaging academic and professional societies to exchange knowledge and generate further impact • Working with international partners on the delivery of knowledge exchange projects and related dissemination activities

Research strategy of the institute

The research strategy of the Institute is focused on addressing management challenges, grand challenges and education challenges. In the context of the Institute, management challenges relate to the need to improve how organisations and projects utilize people, processes, and technology; grand challenges involve fostering innovation to address a major societal need; whereas education challenges relate to the need to improve the delivery of engineering education from a pedagogical perspective. These challenges require the management of complexity as well as various technological inputs and the subject of engineering management provides an ideal knowledge base to tackle such challenges. This is because the discipline of engineering management involves "the management of people, projects and organizations in a technological or engineering systems context". Research projects undertaken by the Institute include the utilization of a range of empirical research methods based on both social science and engineering science methods (quantitative and qualitative), including surveys, interviews, systematic literature review, techno-economic analysis and other methods.

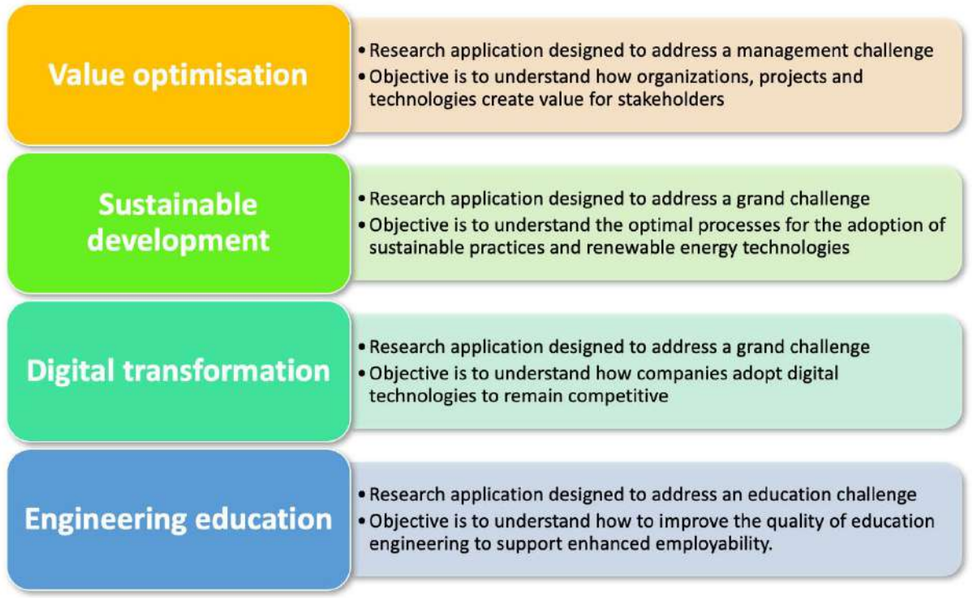
The objectives for the Institute's research programme are summarised as follows:

(i). Value optimisation, which is a management challenge focused on understanding how organizations, projects and technologies create value for stakeholders. This application area includes research on entrepreneurial pivoting and the impact of technology; project management and risk management; and studies on project leadership capabilities.

(ii). Sustainable development, which is a grand challenge focused on understanding the optimal processes for the adoption of sustainable practices and renewable energy technologies. This application area includes research on environmental management in the construction industry; measuring the sustainability performance of projects and organisations; and techno-economic analysis of renewable energy technologies.

(iii). Digital transformation, which is a grand challenge focused on understanding how companies adopt digital technologies to remain competitive. This application area includes research on open innovation and digital transformation in high-tech industrial companies; research studies on digital transformation in the built environment; and studies on enabling the digital transformation for SMEs from the food and beverage sector.

(iv). Engineering education, which is an education challenge focused on improving the quality of education engineering to support enhanced employability. This application area includes research on the development of professional skills as part of engineering education, such as communication, teamwork, decision-making, project management, ethical awareness and an appreciation of contemporary issues (e.g. sustainable development and digital transformation).



Research programme

(i). Research application area: Value optimisation

Entrepreneurial pivoting by start-ups and the impact of technology maturity

Dr. Pavan Kumar Sala has successfully gained his PhD that was focused on understanding how high-tech start-up companies successfully pivot (i.e. change direction) as part of the entrepreneurial journey. The project was supervised by Prof. Simon Philbin and Dr. Safia Barikzai. The research study considered the types of pivots available to a tech start-up company and the factors that trigger the start-up to pivot. Furthermore, the research focused on identifying the impact of technology maturity on pivoting through applying the technology S-curve model.

The qualitative research approach has been employed to understand the phenomenon of entrepreneurial pivoting of tech start-ups, including the type of pivots, factors that cause pivoting and the impact of technology maturity on pivoting. Pavan has conducted 30 interviews with high-tech entrepreneurs from the UK as part of the research study, combined with a further 27 interviews with a subset of 9 participants from the original sample as part of a longitudinal evaluation of further aspects of entrepreneurial pivoting.

The study has validated the types of pivots and the factors that trigger a tech start-up to change its direction. The research also determined that there can be a domino effect in pivoting and the value proposition of the start-up can be created and sustained through pivoting. Pavan is currently writing up his doctoral thesis.

Empirical studies on project leadership

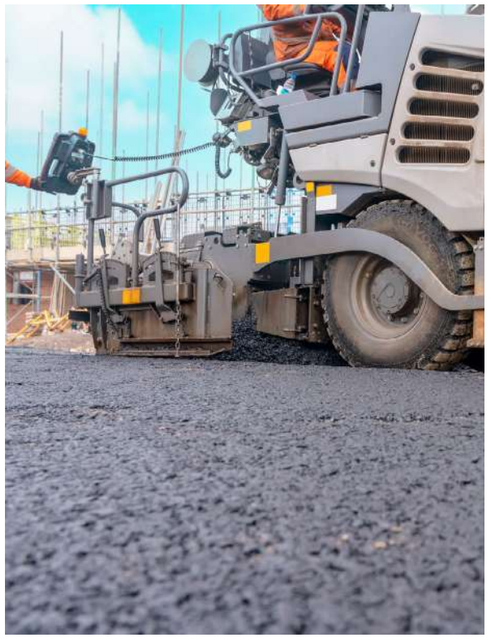
Prof. Philbin undertakes collaborative research with Prof. Riaz Ahmed from Bahria University in Pakistan. This includes several studies across the field of project management, for example, research on understanding the impact of task-oriented, relationship-oriented, and innovation-oriented leadership competencies on project success. Prof. Philbin also serves as an External Examiner for Bahria University, which involves providing external evaluation of doctoral research studies on different aspects of project management.

(ii). Research application area: Sustainable development

Innovation in the built environment

Prof. Philbin collaborates with Prof. Jing-xiao Zhang from Chang'an University in China and other international researchers on various studies associated with the built environment, construction management and sustainable engineering. This includes research on environmental management and digital transformation. In the area of environmental management, research has investigated the case of the Phnom Penh-Sihanoukville Expressway in Cambodia in order to assess the landscape ecological risk of road construction as well as research on enabling the green total factor productivity of the construction industry with the prospect of digital transformation.

Studies on digital transformation included developing a new perspective to evaluate the antecedent path for the adoption of digital technologies in major projects from the construction industry as well as research to develop a system framework for digital monitoring of the construction of asphalt concrete pavement based on IoT, BeiDou Navigation System, and 5G technology.



Sustainable design and operation of data centres

Ms. Dominika Ptach has successfully defended her MRes research dissertation on '"Translating" the United Nations Sustainable Development Goals to Enable the Systemic Green Transformation of the Data Centre Industry'. The study included a series of interviews with experts from the sector. The project developed underpinning knowledge on how sustainability can be adopted across the project lifecycle for data centres as well as practitioner derived tools and accompanying insights towards the green transformation of the data centre industry.

The project was supervised by Prof. Deborah Andrews (LSBU Division of Mechanical Engineering & Design) and Prof. Simon Philbin. The project has resulted in a book chapter titled 'Sustainable Development Goals, Circularity and the Data Centre Industry: A Review of Real-world Challenges in a Rapidly Expanding Sector' recently published by the Royal Society of Chemistry in the new book *The Circular Economy: Meeting Sustainable Development Goals* (Eds. Ghosh, S.K. & Eduljee, G.).

Sustainability risk management of renewable energy projects

Ms. Firdaous Ennami from the LSBU Business School has continued to undertake a PhD research project on investigating the sustainability risk management of renewable energy projects. The project involves empirical research to determine the optimal conditions for sustainability risk management of renewable energy projects. Recently several interviews have been carried out with practitioners working on renewable energy projects. The doctoral study is supervised by Dr. Heba Younis (LSBU Business School) and Prof. Simon Philbin.

Techno-economic analysis of renewable energy technologies

Prof. Philbin supervises postgraduate research into the adoption of various clean technologies. This includes the use of techno-economic analysis (TEA) and numerical modelling to investigate renewable energy sources (RES), such as solar and wind power generation. Recent studies on RES include an MSc research project that focused on analysis of renewable energy generation to supply power for electric buses; and an MSc research project on the analysis and numerical modelling of a hybrid solar-wind highway power generation system.

Prof. Philbin has also been co-supervising a new doctoral research project with Dr Zunaib Ali from the Division of Electrical and Electronic Engineering in the School of Engineering. The doctoral researcher is Mr. Ruthiraraja Senthooran and the project is called 'Modelling Large Scale Electric Vehicle Adoption in the Transportation System'.

Highlights

- **January 2023** – Prof. Philbin completed teaching for the 2022/23 delivery of the Technical, Research and Professional Skills module in the School of Engineering.
- **January 2023** – Prof. Philbin visited Johannesburg in South Africa as part of the Royal Academy of Engineering/Newton Fund research project with the University of Johannesburg.
- **January 2023** – Sunita Selvarajan facilitated a 'Dragon's Den' Assessment Panel for final year School of Engineering students taking part in the London Mayor's Entrepreneur Competition.
- **March 2023** – Prof. Philbin was appointed a Fellow of the Association for Project Management (FAPM).
- **March 2023** – Prof. Philbin presented a seminar at the Advance HE Virtual Sustainability Symposium.
- **May 2023** – Prof. Philbin completed teaching for the 2022/23 delivery of the Technology Evaluation and Commercialisation module in the School of Engineering.
- **June 2023** – Sunita Selvarajan completed delivery of 2022/23 individual student coaching programme for undergraduate students in the School of Engineering.
- **June 2023** – Prof. Philbin completed his first year as Co-Editor-in-Chief of the Engineering Management Journal (EMJ).
- **July 2023** – The book Tradition and Innovation in Construction Project Management was published by MDPI (Eds. Ke, Y., Zhang, J., & Philbin, S.P.).
- **August 2023** – Prof. Philbin gave a virtual seminar for the Department of Management Science and Engineering in the School of Economics and Management at Chang'an University.
- **August 2023** – Ms. Dominika Ptach presented her MRes research at the 2023 International Conference on Resource Sustainability in Surrey.
- **August 2023** – Sunita Selvarajan obtained approval from the School of Engineering to rollout the Action Learning group coaching pilot project.

- **August 2023** – Prof. Philbin completed supervision of two MSc research projects on the techno-economic analysis of renewable energy systems.
- **September 2023** – Prof. Philbin visited PUCPR (Pontifícia Universidade Católica do Paraná) in Curitiba in Brazil and was involved in various knowledge exchange activities.
- **September 2023** – Ms. Dominika Ptach presented her MRes research at the 2023 International Conference on Life Cycle Management in Lille, France.
- **September 2023** – Sunita Selvarajan sourced external Action Learning training suppliers and LSBU volunteer coach facilitators.
- **October 2023** – Prof. Philbin visited the Purico Group in Nottingham where he held discussions with Prof. Nathu Puri CBE.
- **October 2023** – Sunita Selvarajan commenced delivery of the 2023/24 'Action Learning' group coaching project and continued individual coaching of students for the School of Engineering.
- **October 2023** – Prof. Philbin commenced his term as the Interim Dean of the School of Engineering at LSBU.
- **October 2023** – Dr. Pavan Kumar Sala's viva examination was held where he successfully defended his doctoral thesis.
- **October 2023** – Prof. Philbin delivered a workshop at LSBU on innovation management as part of the British Council's Going Global Partnership PAK-UK Education Gateway Mobility Programme for Faculty.
- **October 2023** – Prof. Philbin presented a paper virtually at the 2023 American Society for Engineering Management International Annual Conference.
- **October 2023** – Prof. Philbin was confirmed as an Editorial Board Member for the Journal of Research Administration for a further year.
- **December 2023** – Ms. Dominika Ptach's viva examination was held where she successfully defended her MRes dissertation.

(iii). Research application area: Digital transformation

Digital transformation by SMEs from the food and beverage sector

Prof. Simon Philbin has collaborated with Prof. Arnesh Telukdarie from the University of Johannesburg in South Africa on a research project to investigate how SMEs (small and medium-sized enterprises) from the food and beverage sector undergo the process of digital transformation. The project was funded by the Royal Academy of Engineering and the Newton Fund as part of the Engineering X – Transforming Systems through Partnership (TSP) Programme. The collaborative research project involved a systematic investigation of the technology pathways for digitalization as well as work on identifying digital transformation best practice to develop an innovative digital platform. The project engaged collaborative network partners in South Africa to work with SMEs on digital transformation and disseminate the knowledge generated by the project.

As part of the project, Prof. Philbin visited Johannesburg in South Africa in January 2023 for meetings with the University of Johannesburg. Prof. Philbin met with Prof. Arnesh Telukdarie and Dr. Megashnee Munsamy from Johannesburg Business School and had various discussions on the project as well as discussing plans for future collaboration in this area. The completed project, which utilised systems engineering, technology analysis and business optimisation to develop a new digital platform to enable the digitalisation process for SMEs, is now being further adopted by SMEs in the Johannesburg area to enable longer term impact through economic generation and sustainable development. The collaboration has generated several research outputs, including journal articles on 'Digital Start-Up Ecosystems: A Systematic Literature Review and Model Development for South Africa'; and 'Industry 4.0 Technological Advancement in the Food and Beverage Manufacturing Industry in South Africa—Bibliometric Analysis via Natural Language Processing'.

Digital transformation through open innovation by high-tech manufacturing firms

Prof. Simon Philbin is continuing to collaborate with Prof. Fernando Deschamps, Prof. Carlos Quandt and Dr. Clarissa Rocha from the Pontifical Catholic University of Paraná (PUCPR) in Brazil. This follows on from the 6-month Visiting Researcher position that Dr. Rocha held in the NPI team at LSBU in 2019/20. The aim of this research is to analyse how R&D collaborations contribute to business innovation in Brazilian and European industrial firms in the context of Industry 4.0 and digital transformation. The research utilised the open innovation theoretical concept in high-tech manufacturing and used qualitative empirical evidence from interviews with managers of Brazilian and UK manufacturers directly involved in digital projects. The findings enable manufacturing firms to understand more about the antecedent factors in preparing for the change towards digitalisation through engaging with external actors to accelerate the operationalization of digital initiatives. The team (Rocha, C.F., Quandt, C.O., Deschamps, F., & Philbin, S.P.) have recently published a chapter called 'Understanding Digital Transformation Challenges: Evidence from Brazilian and British Manufacturers', in the new book *Designing Smart Manufacturing Systems* (Eds. Hussain, C.M. & Rossit, D.).

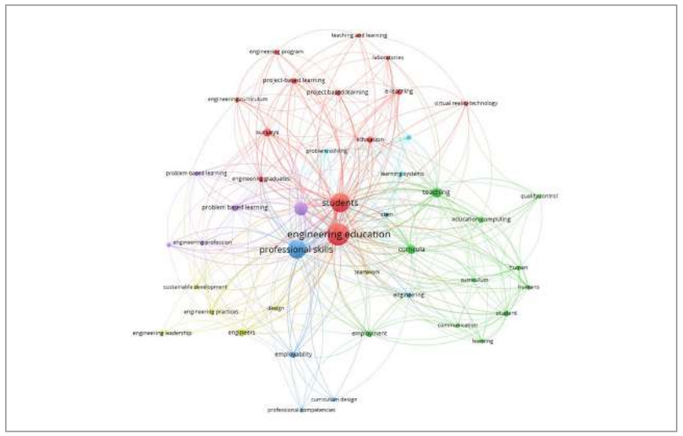
In September 2023, Prof. Philbin visited the PUCPR team in Brazil as an invited guest to participate in a range of collaborative research and knowledge exchange activities. During the week, he delivered a new 3-part course on 'Innovation Management and Entrepreneurship' that focused on technology driven innovation models – during the course the attendees had the opportunity to practice using the innovation tools and techniques from the course to evaluate a set of emerging technologies.

As part of the visit, Prof. Philbin delivered a seminar called 'From Rocket Scientist to Engineering Manager: Charting a Research Journey' for the Polytechnic School and Graduate Program in Industrial and Systems Engineering at PUCPR. During the visit the team also had visits to PUCPR industrial partners, including the high-tech manufacturing facilities at Volvo Trucks (Powertrain Production Plant) as well as visiting the high-precision manufacturing facilities at Aker Solutions (Subsea Wellhead Production Facilities), which included discussions on digital transformation in manufacturing, PMO operations and project management. While visiting Aker Solutions, Prof. Philbin gave a presentation on 'Introduction to the Nathu Puri Institute of Engineering and Enterprise at London South Bank University', which led to various discussions on different aspects of project management and digital transformation.

(iv). Research application area: Education education

Professional skills development in engineering education

Engineers benefit from having professional skills in areas such as communication, teamwork, decision-making, project management, ethical awareness, and an appreciation of contemporary issues. These skills complement the technical engineering foundation in relevant areas of science and mathematics combined with a solid grounding in engineering analysis, design and practice. However, there are continuing challenges in regard to understanding the optimal approaches for integrating professional skills and knowledge development in engineering programmes. Therefore, Prof. Philbin conducted a bibliometric review on professional skills development in engineering education, which included bibliometric analysis using VOSviewer software. The method was based on systematic searching of the extant literature, which identified 88 documents according to keyword retrieval over a 5 year period from 2018 to 2022. The documents were categorized in terms of publication metrics (such as publication year, subject area and country of origin) followed by bibliometric analysis to determine co-occurrence of keywords, co-occurrence of text, and co-authorship in terms of countries. This analysis allowed emerging trends on the publications to be identified as well as collaboration patterns, research strategies, and structure of the knowledge base related to professional skills development in engineering education.



The study derived a set of implications for engineering management programmes arising from the bibliometric analysis and content analysis. Engineering managers need to be able to draw on an integrated set of skills and knowledge across the academic discipline of engineering management combined with appropriate professional skills. Traditional teaching methods and examinations can however encounter problems when professional skills are the required learning outcomes. Consequently, experiential learning is advocated, which can be based on project-based or problem-based approaches. Furthermore, there continues to be developments in regard to the classification of professional skills as well as investigation of technology-enabled learning and other digital approaches. The study was presented at a virtual session of the 2023 International Annual Conference of the American Society for Engineering Management (ASEM) in October 2023.

Role of communication skills of engineering students on employability

Prof. Philbin also contributed to a study with Ying Wu and Lin Xu from the School of Foreign Languages, Northwest University, Xi'an in China, which focused on evaluating the role of communication skills of engineering students on employability according to the outcome-based education (OBE) theory.

Education programme

Innovation and Enterprise Module (BEng)
Sunita Selvarajan supported the delivery of the 2022/23 Innovation and Enterprise module, which is a final year undergraduate module in the School of Engineering led by Mr. Barney Townsend (Senior Lecturer in Engineering Product Design and Enterprise). As a Tutor on the module, Sunita facilitated student discussions during lectures, provided input during tutorial sessions and other tutor related activities on the module. Additionally, Sunita played a key role in coordinating the Dragon's Den style sessions for the student enterprise team and also facilitated presentations for the London Mayor's Entrepreneur Competition.

Technical, Research and Professional Skills Module (MSc/MEng)
Prof. Simon Philbin delivered the Technical, Research and Professional Skills (TRAPS) module for the School of Engineering in the first semester of the 2022/23 academic year, which was completed in early 2023. The module was delivered for 43 students from both level 7 MSc and final year MEng engineering courses. The module enables development of the skills necessary for successful completion of the research dissertation in the near-future and for professional development in the long-term future. Students are required to prepare a feasibility study report for the proposed research project and present a summary of the report as part of meeting the requirements for the module assessment. The feedback received from the 2022/23 cohort of students that participated in the module was highly favourable.

Technology Evaluation and Commercialisation Module (MSc)
Prof. Simon Philbin delivered the Technology Evaluation and Commercialisation (TEC) module for the School of Engineering in the second semester of the 2022/23 academic year. The module is part of the MSc in Mechanical Engineering. The TEC module enables students to be guided towards identifying an emerging technology idea that is evaluated for its commercial potential. Detailed analysis of a set of emerging technologies is conducted according to a prescribed algorithmic model to evaluate the business potential of the leading technology. This approach allows students to prepare the commercialisation strategy and write the business plan for the potential high-tech start-up company based on an emerging technology. The module included a guest lecture by Dr. Pavan Kumar Sala on 'Understanding how high-tech entrepreneurs successfully pivot as part of the entrepreneurial journey' and a guest lecture by Ms. Syeda Rahimunnessa (LSBU IP & Senior Student Enterprise Manager) on intellectual property. The feedback received from the 2022/23 cohort of students that participated in the module was highly favourable.

Professional coaching for student development

Individual coaching support for students
LSBU's vision is to transform lives, communities, businesses and society through applied education and insights. A key step towards achieving this vision is to provide students with practice-led learning, which fosters the development of able graduates who are ready to address business and societal challenges. Furthermore, we recognise the need to provide students with access to opportunities, and particularly those from disadvantaged backgrounds, in order to reach their academic, professional and personal goals. Within this framework, the Institute continues to provide undergraduates with professional coaching, which is a developmental initiative to support engineering students in their studies.

Following positive results from the 1-2-1 individual coaching project in academic year 2021/22, the coaching programme was rolled out in the School of Engineering in the 2022/23 academic year. Sunita Selvarajan led the programme, offering 1-2-1 individual sessions for undergraduate students. The focus of the initiative is to support students who were repeating their year of studies, struggling to complete their studies, or who had returned from interrupting their year of studies. The objective of the coaching sessions was to help the student

set specific goals, formulate action plans, monitor progress, identify barriers to change and put in place strategies to overcome challenges. Sunita met with students on the project on a weekly or fortnightly basis.

Through coaching, the students were encouraged to think 'outside of the box', build confidence, solve problems, manage their workload and attain the belief that they had the ability to keep trying, even when the hurdles were tough. The use of industry standard professional coaching tools and psychological techniques also helped embed learning, thereby allowing students to review their current thinking and behaviour and apply constructive changes in their academic and personal lives. Selected feedback from the students who attended coaching is provided below.

Student feedback #1: "Coaching helped me to understand how to navigate roadblocks and set goals for myself. For example, self-confidence in my belief that I can do it. The encouragement that I received, looking at my past achievements; positive reminders of what I was able to achieve and how I might be able to achieve again".

Student feedback #2: "Coaching kept me accountable to reach my goals. Back in November, my marks were low. I thought "I can do better than what I got". My coach encouraged me. Coaching has enabled me to see things different, for example how to approach clients, situations, problems etc. When you have the support with someone and share, it helps you to keep going and improve more. Coaching helped me to aim high".

Student feedback #3: "Coaching made a remarkable difference in my life. It profoundly changed my mind set and perspective on both my professional and personal goals. Firstly, it provided me with invaluable guidance and support, helping me gain clarity on what I truly wanted to achieve. Through coaching, I learned to set realistic and achievable goals, breaking them down into actionable steps. This newfound clarity gave me a sense of direction and purpose that I hadn't experienced before".

Group coaching through Action Learning

Alongside the ongoing 1-2-1 coaching programme, the Institute has also forged a collaboration with LSBU's Teaching, Quality and Enhancement (TQE) team to plan the delivery of a group coaching pilot for the 2023/24 academic year. The purpose of this project is to continue to provide intervention support to a larger cohort of students. A group coaching methodology called 'Action Learning' was identified. Branded internally as the "Yes, I Can" programme, Action Learning is an educational and problem-solving coaching approach that combines action and reflection. The programme commenced in semester # 1 of academic year 2023/24 and is scheduled to continue into semester # 2. Sunita Selvarajan coordinates delivery of the programme along with inputs from Hayley Pazmino Guevara (Access and Participation Programme Manager, Teaching Quality and Enhancement) and Dr. Benjamin Lishman (Associate Dean – Education and Student Experience, School of Engineering) as well as other colleagues from across the School.

An Action Learning 'set' or session comprises of up to six students and one facilitator working together in a group setting, where students collaborate with each other to develop innovative solutions to academic or personal issues while enhancing their learning and personal development. In addition, the programme aims to provide students with real-world skills and techniques, such as listening carefully, asking open questions, setting measurable and realistic action plans. Early indications from students participating in the "Yes, I Can" Action Learning initiative have been favourable.

Publications, conference and seminar presentations

1. Journal paper – Kayser, K., Telukdarie, A., & Philbin, S. (2023). Digital Start-Up Ecosystems: A Systematic Literature Review and Model Development for South Africa. *Sustainability, 15*(16), 12513.

2. Journal paper – Telukdarie, A., Munsamy, M., Katsumbe, T.H., Maphisa, X., & Philbin, S. (2023). Industry 4.0 Technological Advancement in the Food and Beverage Manufacturing Industry in South Africa—Bibliometric Analysis via Natural Language Processing. *Information, 14*(8), p. 454.

3. Journal paper – Zhang, J., Hu, R., Cheng, X., Christos, V., Philbin, S.P., Zhao, R., & Zhao, X. (2023). Assessing the landscape ecological risk of road construction: The case of the Phnom Penh-Sihanoukville Expressway in Cambodia. *Ecological Indicators, 154,* 110582.

4. Journal paper – Wu, Y., Xu, L., & Philbin, S.P. (2023). Evaluating the Role of the Communication Skills of Engineering Students on Employability According to the Outcome-Based Education (OBE) Theory. *Sustainability, 15*(12), 9711.

5. Journal paper – Ke, Y., Zhang, J., & Philbin, S.P. (2023). Tradition and Innovation in Construction Project Management. *Buildings, 13*, 1537.

6. Journal paper – Zhang, J., Zhang, M., Ballesteros-Pérez, P., & Philbin, S.P. (2023). A new perspective to evaluate the antecedent path of adoption of digital technologies in major projects of construction industry: A case study in China. *Developments in the Built Environment, 14,* 100160.

7. Journal paper – Li, H., Peng, X., Zhang, J., Ballesteros-Perez, P., Philbin, S.P., Li, Z., Tang, X., & Cheng, J. (2023). Enabling the green total factor productivity of the construction industry with the prospect of digital transformation. *Environment, Development and Sustainability,* pp.1-28. doi.org/10.1007/s10668-023-03165-5.

8. Journal paper – Han, J., Li, T., & Philbin, S.P. (2023). Does low-carbon pilot policy in China improve corporate profitability? The role of innovation and subsidy. *Innovation and Green Development, 2*(2), 100050.

9. Journal paper – Ahmed, A., Philbin, S.P., & Paracha, O.S. (2023). Investigating the Impact of Task-Oriented, Relationship-Oriented, and Innovation-Oriented Leadership Competencies on Project Success in Pakistan: A Moderated Model of Multi-Dimensional Senior Management Support. *Engineering Management Journal,* doi.org/10.1080/10429247.2023.2186681.

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11. Journal paper – Telukdarie, A., Dube, T., Matjuta, P., & Philbin, S. (2023). The opportunities and challenges of digitalization for SME's. *Procedia Computer Science, 217,* 689-698.

12. Journal paper – Ndzimakhwe, M., Telukdarie, A., Munien, I., Vermeulen, A., Chude-Okonkwo, U.K., & Philbin, S.P. (2023). A Framework for User-Focused Electronic Health Record System Leveraging Hyperledger Fabric. *Information, 14*(1), 51.

13. Conference paper – Philbin, S.P. (2023). Bibliometric Review of Professional Skills Development in Engineering Education: Implications for Engineering Management Programs, *Proceedings of the American Society for Engineering Management (ASEM) International Annual Conference and 44th Annual Meeting,* Denver (CO), USA (Virtual Session).

14. Book chapter – Ptach, D.I., Andrews, D., & Philbin, S.P. (2023). Sustainable Development Goals, Circularity and the Data Centre Industry: A Review of Real-world Challenges in a Rapidly Expanding Sector, in *The Circular Economy: Meeting Sustainable Development Goals,* Ghosh, S.K. & Eduljee, G. (Eds.), Royal Society of Chemistry, p. 252-285, ISBN: 978-1-83767-069-7 (Hbk), PDF ISBN: 978-1-83767-198-4 (PDF), doi.org/10.1039/9781837671984-00252.

15. Book chapter – Rocha, C.F., Quandt, C.O., Deschamps, F., & Philbin, S.P. (2023). Understanding Digital Transformation Challenges: Evidence from Brazilian and British Manufacturers, in *Designing Smart Manufacturing Systems,* Hussain, C.M. & Rossit, D. (Ed.), Elsevier (pp. 187-210), ISBN 978-0-323-99208-4, doi.org/10.1016/B978-0-32-399208-4.00016-7.

16. Edited book – Ke, Y., Zhang, J., & Philbin, S.P. (Eds.) (2023). *Tradition and Innovation in Construction Project Management.* MDPI: Basel, Switzerland (pp. 436), ISBN 978-3-0365-8114-9 (Hbk), ISBN 978-3-0365-8115-6 (PDF), doi.org/10.3390/books978-3-0365-8115-6.

17. Book review – Philbin, S.P. (2023). Book Review: How Big Things Get Done by Bent Flyvbjerg and Dan Gardner. *Engineering Management Journal.* doi.org/10.1080/10429247.2023.2231455.

18. Technical magazine article – Desmarais, D., Kennedy, D., & Philbin, S.P. (2023). The muddled middle of management, *Industrial Management,* July/August Issue, 12-19.

19. Journal editorial – Smith, B., Cross, J., & Philbin, S. (2023). Editor's Introduction. *Engineering Management Journal, 35*(4), 331-332.

20. Journal editorial – Smith, B., Cross, J., & Philbin, S. (2023). Editor's Introduction. *Engineering Management Journal, 35*(3), 207-208.

21. Journal editorial – Smith, B., Cross, J., & Philbin, S. (2023). Editor's Introduction, *Engineering Management Journal, 35*(2), 101-101.

22. Journal editorial – Smith, B., Cross, J., & Philbin, S. (2023). Editor's Introduction, *Engineering Management Journal, 35*(1), 1-3.

23. Conference presentation – Ptach, D.I., Andrews, D., & Philbin, S.P. (2023). UN Sustainable Development Goals in the Data Centre Industry. Interviews with Data Centre Experts, Nineteenth International Conference on Environmental, Cultural, Economic & Social Sustainability, 1-3 February 2023, Ljubljana, Slovenia (Virtual Session).

24. Conference presentation – Philbin, S.P. (2023). Insights and Practice on Embedding Sustainability in Engineering Education, Advance HE Virtual Sustainability Symposium 2023: Top-down or bottom-up?., 20 March 2023.

25. Conference presentation – Ptach, D.I., Andrews, D., & Philbin, S.P. (2023). “Translating” UN Sustainable Development Goals for an All-round Data Centre Industry Green Transformation, 2023 International Conference on Resource Sustainability (icRS 2023), 7-9 August 2023, Surrey, UK.

26. Conference presentation – Ptach, D.I., Andrews, D., & Philbin, S.P. (2023). Investigating Sector-Relevant SDGs and Opportunities for Increasing Sustainability Maturity of the Data Centre Industry According to the Triple Bottom Line, 11th International Conference on Life Cycle Management 2023 (LCM2023), 6-8 September 2023, Lille, France.

27. Invited Seminar – Philbin, S.P. (2023). From Rocket Scientist to Engineering Manager: Charting a Research Journey, Polytechnic School and Graduate Program in Industrial and Systems Engineering, Pontifical Catholic University of Paraná (PUCPR), Curitiba, Brazil.

28. Invited Virtual Seminar – Philbin, S.P. (2023). Application of Engineering Management to Address the Sustainable Development Challenge, Department of Management Science and Engineering, School of Economics and Management, Chang’an University, China.

Collaborative partners and professional society engagement

- American Society for Engineering Management (ASEM), USA
- Association for Project Management (APM)
- Bahria University, Pakistan
- Chang’an University, China
- Institute of Advanced Research Gandhinagar, India
- Institution of Engineering and Technology (IET)
- Pontifical Catholic University of Paraná (PUCPR), Brazil
- Royal Academy of Engineering
- The Puri Foundation
- Society of Research Administrators (SRA) International, USA
- University of Johannesburg, South Africa

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