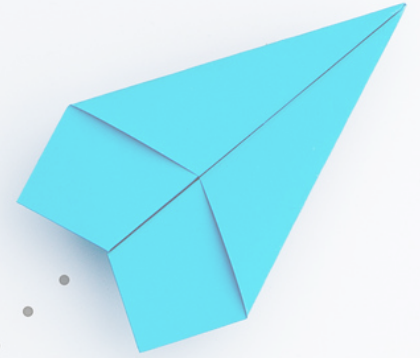


FOR PRE-UNIVERSITY SCIENTIST INNOVATORS

Young Innovators Programme

Digital Summit 2020



HOSTED IN OXFORD, UNITED KINGDOM
30 MAY – 1 JUNE 2020

Officially accredited:



KNOWLEDGE
COLLECTIVE

DISCOVER SUSTAINABLE SOLUTIONS



Contents

3	Welcome
4	Need-Led Innovation
5	Innovation Industry
6	Design Thinking
7	Schedule
8–14	Sustainable Projects
15	Team



From the Directors

We warmly invite you to participate in the Young Innovators Programme (YIP) Digital Summit 2020. In light of recent circumstances surrounding Covid-19, now a global pandemic declared by the WHO, we have decided to postpone this year's Summit in Oxford. We believe that the health of our students and teachers are of utmost importance.

Adapting to the rapidly shifting needs of our students, we have decided to bring our programme onto a digital platform for a Digital Summit. The core ethos of YIP remains unchanged. This summit will be a unique experience for pre-university students who are interested in exploring careers in science, research, and innovation.

It's hard for ambitious student to find important challenges to work on, become passionate about, and dedicate themselves to. As such, we teach relevant skills, provide mentors and guidance, and create a collaborative environment to help students tackle the pressing challenges of tomorrow.

We are directors of Enterprise Process Labs at the University of Oxford (Mathematics, Physical, and Life Sciences Division), a programme to train graduate students and early career researchers in the methodologies of Need-Led Innovation (NLI) as applied to complex problems in the areas outlined by the UK Industrial Strategy.

It is our belief that the core essence of these methodologies can be distilled, taught, and practiced by pre-university students. It is with these hopes that we created YIP. We would like you and your students to join us in this journey!

Sincerely,
Ti Xu, DPhil
Erfan Soliman, DPhil, FHEA
Saru Ranjan, MBBS



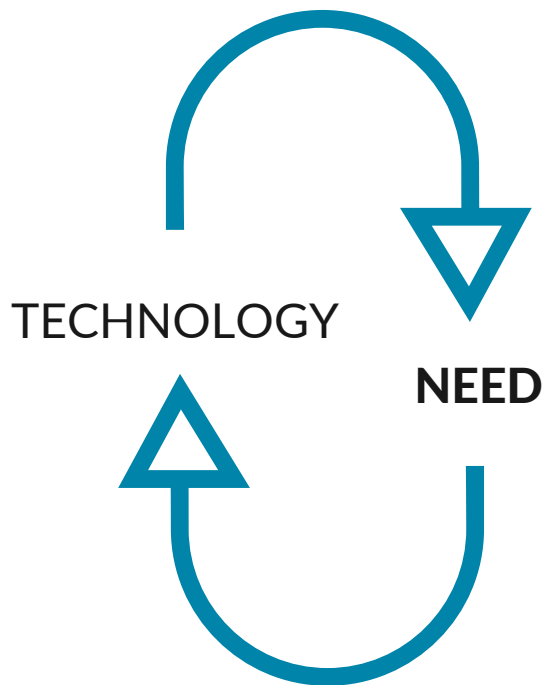
Accreditation: Discovery Level

We are pleased that our Young Innovators Programme has earned official CREST accreditation at the **Discovery Level** from the British Science Association. Successful graduates of our programme will receive official certificates from Crest Awards.

CREST is the British Science Association's scheme for STEM project work that inspires young people to think and behave like scientists and engineers. CREST is a nationally recognised scheme for student-led project work in the STEM subjects (science, technology, engineering and maths). This scheme is a consistent and high standard of assessment and moderation, achieved via a network of industry experts from the STEM and education sectors. It has been running since 1986.

Need-Led Innovation

TECHNOLOGY PUSH



NEED PULL

We often see innovations in the sciences and in industry to be discovery-driven. For example, across laboratories in universities and

STARTING POINT

throughout the biotechnology and pharmaceutical industries, scientific breakthroughs have been the trailhead for major product developments in the familiar lab-to-consumer route.

Over the past decade, however, a focus on need-based or need-led innovation has emerged as an alternative strategy for innovation.

Influenced by the spread of design thinking across campuses and corporations, innovators are beginning to focus on developing a deep understanding of user needs as the starting point of the invention process.

YIP has a particular focus on sustainable innovation. The World Business Council for Sustainable Development believes that this can be achieved by addressing innovative opportunities that reflect changing social expectations and support a transition to greater sustainability.

A well-characterised need is the DNA of a great invention.

–Paul Yock

Innovation Industry

The 'greatest' innovations in history in the public eye are usually innovations such as the light bulb, airplane, motor car, refrigerator, computer, or fossil fuels. However, these innovations have contributed greatly to the environmental degradation of the planet. There is an interesting and challenging interplay between sustainability and the need for sustainable innovations.

Creativity and innovation capacity are poised to be the skills of the future. Knowledge is becoming easier to access; today we can find anything about any topic on YouTube or Google. As the flow of knowledge is becoming more evenly distributed in society, the question becomes what do we do with it. The UK Government's Industrial Strategy named the creative industries as a priority sector in 2017.

One of the quickest growing jobs in the C-suite these days is the chief innovation officer. Twenty years ago this position was virtually unheard of, but by 2017, 29% of Fortune 500 companies had a senior innovation executive.



Chief Creative Officer



Global Director of Innovation



Chief Innovation Officer



Head of Innovation Programmes



Chief Innovation Officer



Director of User Experience

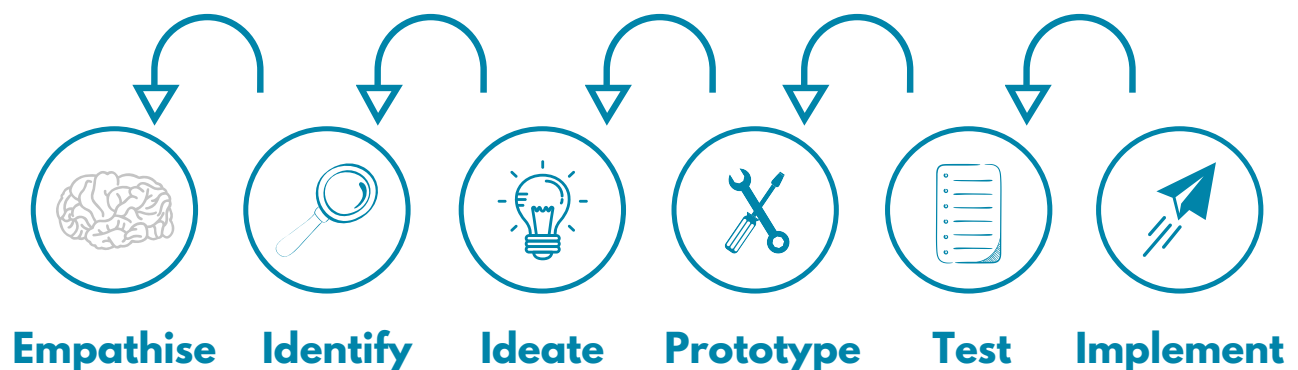
Design Thinking

Design thinking is an iterative process through which we seek to understand the user, challenge assumptions, and redefine problems in order to identify alternative solutions that might not be apparent with our initial understanding.

Design thinking begins with understanding the people for whom we're designing the solution. It helps us observe and develop empathy with the target user, by re-framing the problem in human-centric ways, creating many ideas in brainstorming sessions, and adopting a hands-on approach in prototyping and testing.

The process integrates observation, collaboration, and iterative prototyping within a strategy that drives towards the ultimate goal of refining and honing in on a design solution—an inherently reductive process. The design researcher is expected to bring back and represent the voice of the target users (amongst other stakeholders). In the context of innovation processes currently taught, the kinds of questions design thinking asks are embedded within a framework that focusses its gaze towards the consumer, with the aim of uncovering 'hidden' behaviours and 'unmet needs.'

Design thinking is an integral component of need-led innovation as it emphasises a careful and thorough understanding of the problem or unmet need before any solution is developed.



All times are given in UTC/GMT+0 Coordinated Universal Time

Day 1

8:00 Introduction

Programme Introduction:
meet and mingle amongst your
peers; team building exercises
and team formation

9:00 Morning Lectures

NLI Methodologies

Design Thinking

11:00 Break

13:00 Afternoon Lectures

Sustainable Development Goals

Overview of the UK Industrial
Strategy

Q&A Session on STEM Careers

16:00 Day Break

Independent Research Time

All times are given in UTC/GMT+0 Coordinated Universal Time

Day 2

8:00 Design Process

Supervised Research Time

Empathise

Identify

Ideate

Prototype

Test

13:00 Guest Speaker

Professor Peter Dobson, OBE

Former Director of the Oxford
Begbroke Science Park

14:00 Programme Finale

Presentations: each team
present their project to a
panel of judges

16:00 Awards Ceremony

Fees

We use a tiered pricing system starting at **£195** per fellow for the two-day course, and we provide discounts on a case-by-case basis for a variety of reasons (e.g. if you are a state-funded school in the UK or if you are an independent school within the UK/EU).



FAQs

Digital Summit Structure

The Digital Summit will be hosted on a trusted platform such as Zoom. Lectures will be held in large rooms for all delegates to attend. There will be smaller breakout rooms for teams. Teachers, speakers, and lecturers will be able to join individual rooms and engage with individual teams on a free-flowing basis.

CREST Accreditation

Students who wish to gain CREST accreditation will be required to complete pre-summit readings and reach necessary milestones for their projects. These work packages and more details will be made available for those students who register their interest with us at the time of programme registration.

School Teachers

We welcome school teachers to join us in the Digital Summit! Teachers will be able to join *gratis*.



Sustainable Development Goals

The Sustainable Development Goals or SDGs are a collection of 17 global goals designed to be a 'blueprint to achieve a better and more sustainable future for all.'

YIP has a mission to guide the young minds of today to think about the needs of the world tomorrow.

The following are high impact areas which we have selected as starting points from which students can begin their journeys—trailheads.

#2 Wind turbines (on shore)

#4 Plant-rich diet

#6 Educating girls

#32 Ships

#54 Walkable cities

Source: Project Drawdown



Wind turbines (on-shore)

Wind energy is at the crest of initiatives to address global warming in the coming three decades. Today, 314,000 wind turbines supply nearly 4% of global electricity, and it will soon be much more. In 2015, a record 63 gigawatts of wind power were installed around the world. The wind industry is marked by a proliferation of turbines, decreasing costs, and heightened performance. In many locales, wind is either competitive with or less expensive than coal-generated electricity, and it has no fuel costs and no pollution. Ongoing cost reduction will soon make wind energy the least expensive source of electricity, perhaps within a decade. Onshore wind farms have small footprints, typically using no more than 1% of the land they sit on, so grazing, farming, recreation, or conservation can happen simultaneously with power generation.

IMPACT: An increase in onshore wind providing 3–4% of world electricity to 21.6% by 2050 could reduce emissions by 84.6 gigatons of carbon dioxide. At a cost of \$1.23 trillion, wind turbines can deliver net savings of \$7.4 trillion over three decades of operation. These are conservative estimates. Costs are falling annually and new technological improvements are already being installed, increasing capacity to generate more electricity at the same or lower cost.



Plant-rich diet

Shifting to a diet rich in plants is a demand-side solution to global warming that runs counter to the meat-centric Western diet on the rise globally. That diet comes with a steep climate price tag: one-fifth of global emissions. If cattle were their own nation, they would be the world's third-largest emitter of greenhouse gases. Plant-rich diets reduce emissions and also tend to be healthier, leading to lower rates of chronic disease. According to a 2016 study, business-as-usual emissions could be reduced by as much as 70% through adopting a vegan diet and 63% for a vegetarian diet, which includes cheese, milk, and eggs. \$1 trillion in annual health-care costs and lost productivity would be saved.

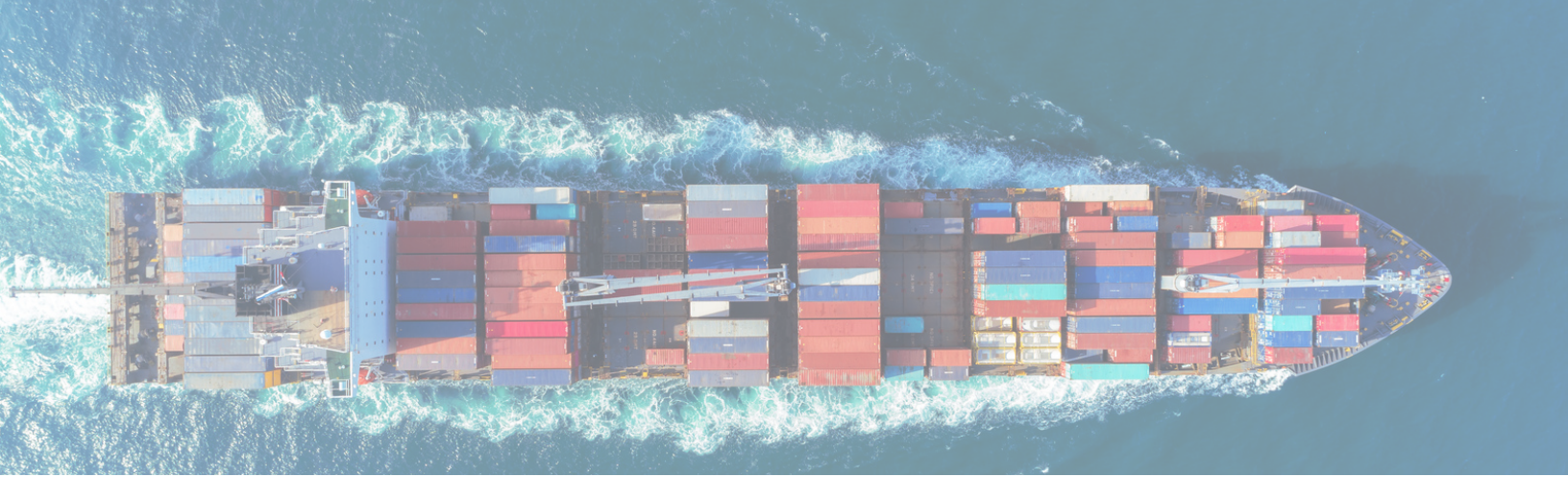
IMPACT: Using country-level data from the Food and Agriculture Organisation of the United Nations, if 50% of the world's population restricts their diet to a healthy 2,500 calories per day and reduces meat consumption overall, we estimate at least 26.7 gigatons of emissions could be avoided from dietary change alone. If avoided deforestation from land use change is included, an additional 39.3 gigatons of emissions could be avoided, making healthy, plant-rich diets one of the most impactful solutions at a total of 66 gigatons reduced.



Educating girls

Education lays a foundation for vibrant lives for girls and women, their families, and their communities. It is also one of the most powerful levers available for avoiding emissions by curbing population growth. Women with more years of education have fewer and healthier children, and actively manage their reproductive health. Educated girls realise higher wages and greater upward mobility, contributing to economic growth. Education also shores up resilience and equips girls and women to face the impacts of climate change. They can be more effective stewards of food, soil, trees, and water, even as nature's cycles change. Today, there are economic, cultural, and safety-related barriers that impede 62 million girls around the world from realising their right to education.

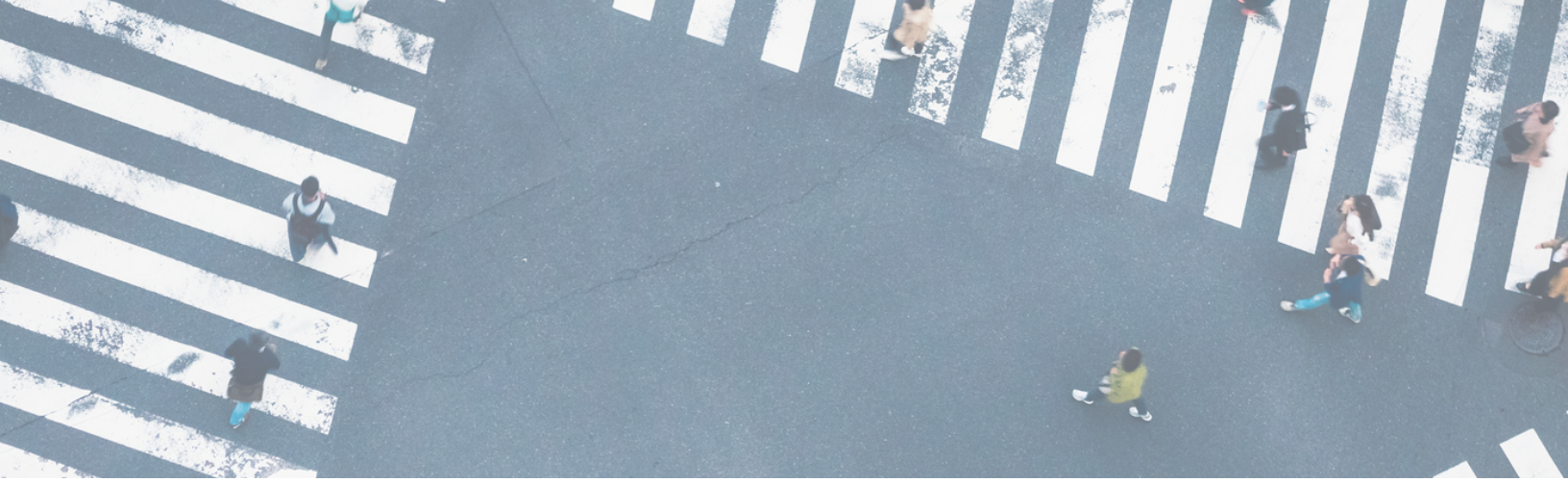
IMPACT: According to the United Nations Educational, Scientific, and Cultural Organisation, by closing an annual financing gap of \$39 billion, universal education in low- and lower-middle income countries can be achieved. It could result in 51.48 gigatons of emissions reduced by 2050. The return on that investment is incalculable. We ask students in the UK to draw upon their own experiences, reflect, and think creatively about what helps them learn and how they might create new environments through technology (or other means) that enhance and democratise education around the world.



Ships

More than 80% of global trade, by volume, floats its way from place to place. 90,000 commercial vessels—tankers, bulk dry carriers, and container ships—make the movement of goods possible, transporting more than 10 billion tons of cargo in 2015. Shipping produces 3% of global greenhouse gas emissions. Forecasts predict that this figure could be 50% to 250% higher in 2050. Because of huge shipping volumes, increasing shipping efficiency can have a sizeable impact. Efficiency begins with ship design and on-board technology. Fuel-saving innovations include: flat extensions, called ducktails, at the rear of ships that serve to lower resistance, as well as compressed air being pumped through the bottom of the hull in order to create a layer of bubbles that 'lubricate' passage through the water.

IMPACT: With an efficiency gain of 50% across the international shipping industry, 7.9 gigatons of carbon dioxide emissions can be avoided by 2050. That could save \$424 billion in fuel costs over thirty years and \$1 trillion over the life of the ships.



Walkable cities

Walkable cities prioritise two feet over four wheels through careful planning and design. They minimise the need to use a car and make the choice to forego driving appealing, which can reduce greenhouse gas emissions. According to the Urban Land Institute, in more compact developments ripe for walking, people drive 20–40% less. Walkable trips are not simply those with a manageable distance from point A to point B (perhaps a ten- to fifteen-minute journey on foot). Infrastructure for walkability can include: density of homes, workplaces, and other spaces. Wide, well-lit, tree-lined sidewalks and walkways. Safe and direct pedestrian crossings. Connectivity with mass transit. Today, too many urban spaces remain no- or low-walking ones, and demand for walkable places far outstrips supply.

IMPACT: The six dimensions of the built environment—demand, density, design, destination, distance, and diversity—are all key drivers of walkability. As cities become denser, and as city planners, commercial enterprises, and residents invest in the '6Ds', 5% of trips currently made by car can be made by foot instead by 2050. That shift could result in 2.9 gigatons of avoided carbon dioxide emissions and reduce costs associated with car ownership by \$3.3 trillion.

YIP Team



Ti Xu, DPhil, is a physicist by background. He earned his DPhil degree in magnetic resonance imaging physics (Lincoln College, University of Oxford, 2017). He has work experience in education, healthcare innovation, and venture capital. He is particularly passionate about teaching and supporting the next generation of scientist-innovators; he is currently a UK STEM Ambassador 2019–2022. Within the University of Oxford, he is an Enterprise Fellow, supporting graduate students and researchers with the tools for entrepreneurship. He is one of the programme managers of Enterprise Process Labs, an innovation programme aimed at training ambitious students and early career researchers on Need-Led Innovation methodologies and design thinking.

Erfan Soliman, DPhil, FHEA, is an engineer and educator with experience in curriculum design, product development, and business. He completed his DPhil degree in biomedical engineering (Christ Church College, University of Oxford, 2017), and he wears multiple hats at the University as a stipendiary lecturer at Somerville College, a researcher in the Natural Interactions Lab, and an EIT Health liaison working on the establishment of an Institute for Need-Led Innovation. As a former Enterprise Fellow, he also supports graduate students and early career researchers in the establishment of translational projects and spin-out companies. Concurrently, he is one of the programme managers of Enterprise Process Labs.



Saru Ranjan, MBBS, is a medical doctor with experience and a passion for entrepreneurship, technology, and innovation. He has pursued these interests by co-founding multiple businesses, undertaking venture capital due diligence and strategy consulting work, providing business development for health technology startups, and supporting the UK National Health Service (NHS) with innovation implementation. He was an Oxford University Biodesign Healthcare Innovation Fellow 2017–2018. Today he is a member of the NHS Clinical Entrepreneurs Programme, a national innovation initiative within the NHS to train and to develop clinical innovators.

