



Institute for
Mathematical Innovation

The Institute for Mathematical Innovation Annual report for 2023/24

Institute Mission

The IMI will assert a focussed central vision to deliver world-class research with global impact, generating real-world solutions that add significant value to the University and society. IMI will build on, and amplify, the University of Bath's uniquely strong mathematical positioning, cultivated over decades and accelerated in recent years, particularly in multi-disciplinary, data-driven mathematical modelling with real-world applications.

IMI aspires to be recognised not only for its achievements in securing funding for key and major research projects but also for the tangible impact these projects have on solving real-world challenges. It will collaborate with CDTs, research centres, and the University's strategic research and innovation areas through joint project development and shared ownership, delivering clear academic and societal added value.



Table of Contents

Institute Mission	1
Director's Summary of the year	3
Leadership Structure and Governance.....	5
Revenue Overview	7
Institute Five Year Strategy	9



Director's Summary of the year

MIRA Expansion

The IMI's successful grant applications and funding streams have enabled the growth of the Mathematical Innovation Research Associates (MIRAs) team from four to ten. We welcomed **Jehan Alswali, Ben Ashby, Daniel Burrows, Fillipe Georgiou, Abdalaziz Hamdan, Laura Lisboa, and Chris Rowlatt** to the team, exceeding the target of 85% salary return.

Introduction of MIRIs Programme

In response to increased demand, IMI introduced the **Mathematical Innovation Research Assistant (MIRI)** position, focusing on short-term projects. This year, we hosted ten PhD internships from the department of Mathematical sciences and **SAMBa**, contributing significantly to their research and the SAMBa CDT's successful renewal bid through valuable in-kind contributions.

Operational Enhancements and Leadership Transition

To address our growing operational needs, **Myla Watts** was appointed Operations Officer, bringing much-needed stability and expertise to the team. A key leadership transition occurred as **Tristan Pryer** was appointed Director, with **Tom Burnett, Luca Zanetti, and Ben Walker** as Deputy Directors. Ben Walker has since left the University of Bath, but his contributions during the transition were invaluable.

Grant Successes

IMI has been part of several significant grant successes, with funding from **EPSRC, MRC, Leverhulme, and Innovate UK**. These sources have been instrumental in supporting the Institute's mission (see Figure 2 for detailed breakdowns). Exemplar high-impact research bids and projects were secured with MIRAs contributing their expertise:

- Mathematically modelling tuberculosis: using lung scans to map infection, and a hybrid individual-based model to simulate infection and treatment – MRC fellowship (£2mill)
- AI for Collective Intelligence (AI4CI) – AI hub (£9.6mill)
- Reducing cannabis harms through state-of-the-art tools for quantifying use, dose-related guidelines for safer use, and evidence-based drug policy – Future leader fellowship (£1.4mill)

Consultancy Projects

IMI secured 12 consultancy projects over the year, worth a total of £636k in income.

Conference and Symposium Leadership

IMI played a leading role in organising key events, including the **British Mathematical Colloquium** and the **London Mathematical Society – Bath symposia**. These events fostered valuable academic collaborations and was an excellent promotion of IMI's role in mathematical research.



Research Themes and New Initiatives

IMI has established five core research themes that drive collaborative research efforts within the university and with external partners:

- **Environmental Extremes**
- **Radioprotection**
- **Mathematics Capacity Building in Africa**
- **Clinical Trials**
- **Quantum Technologies.**

Each theme fosters partnerships across multiple university faculties, creating a foundation for impactful collaboration.

National Expansion and IMI Spinouts

IMI's model has inspired the creation of similar initiatives at **Warwick** and **Heriot-Watt**, marking the first steps toward a national network of mathematical innovation institutes. These spinouts will foster collaboration and personnel exchange across institutions.

Network Plus Grant Development

IMI is developing a **Network Plus grant** to integrate MIRAs with the national **RTP framework**. This aligns with the national agenda and is being developed in collaboration with the **KE Hub** and **Warwick**.

Impact Case Studies

We have allocated part of our budget to support the development and evidence-gathering for impact case studies from within the Mathematical Sciences department, further strengthening the impact of our research as well as the departmental REF offering.

Support for ECRs and Return to Research

IMI continues its commitment to supporting ECRs and individuals returning to research. We are pleased to welcome **Jehan Alswali**, who joined us as a **Daphne Jackson Research Fellow**, focusing on re-establishing her research career.



Leadership Structure and Governance

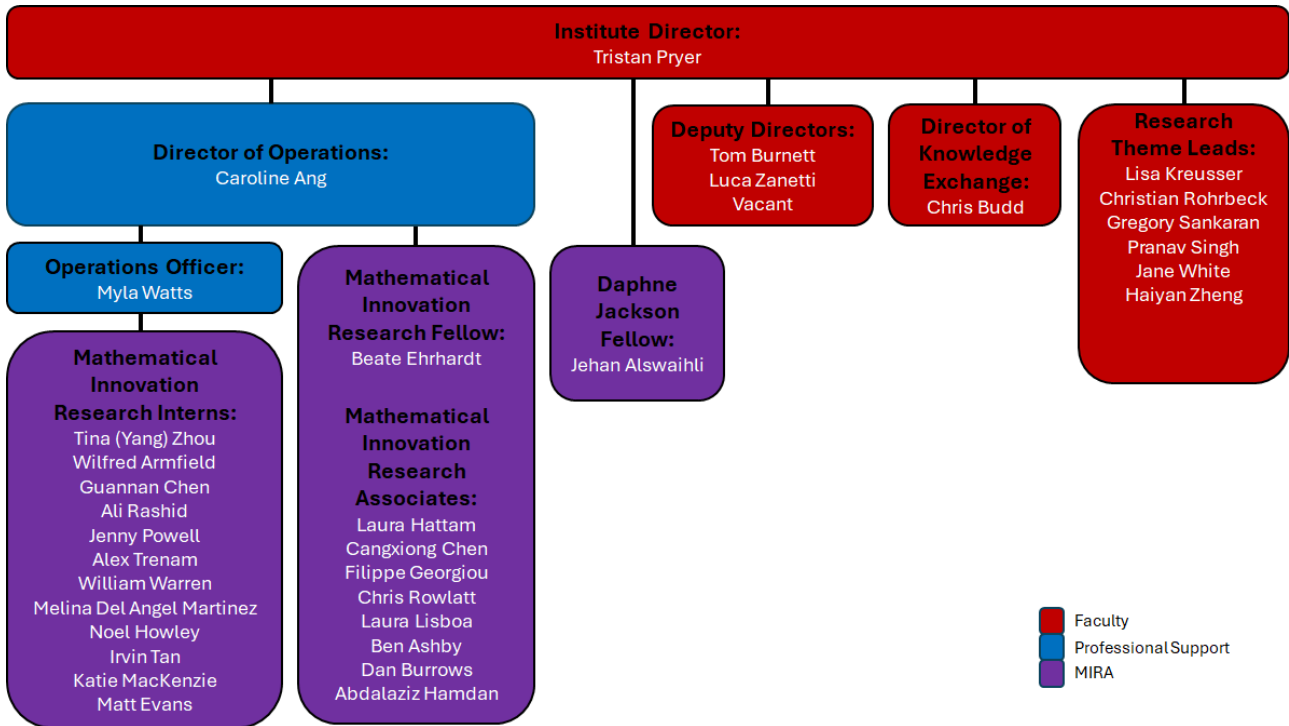


Figure 1: Management structure of the institute.

The primary governance of the IMI is managed by the Director and three Deputy Directors. Currently, the IMI leadership team was composed of the following, all of whom have some workload associated to the Institute:

- **Director - Tristan Pryer**, responsible for the overall leadership, strategic direction, and academic vision of the Institute.
- **Deputy Directors - Tom Burnett, Luca Zanetti**, responsible for supporting the Director in key areas of the Institute's activities and development.
- **Director of KE - Chris Budd**, whose role is to ensure that the Institute aligns with national KE strategy.
- **Director of Operations - Caroline Ang**, overseeing the smooth delivery of all operational activities, ensuring that IMI functions effectively and efficiently in its core research and external engagements.
- **Operations Officer - Myla Watts**, serving as the primary point of contact for internal and external stakeholders, coordinating communications, and providing administrative support across all levels of IMI's projects and collaborations.



Governance Mechanisms

IMI operates under two principal governance mechanisms, ensuring accountability, strategic alignment, and effective delivery of its objectives:

- **External Advisory Board** - This board includes distinguished figures from academia, industry, and governmental organisations. Its role is to provide critical challenge and support to IMI, ensuring the Institute remains aligned with national and international priorities in mathematical sciences, and continues to play a role in shaping the future of the discipline.
- **Internal Governance Board** - Comprised of the IMI Director, Deputy Directors, Director of Operations, Director of KE, the Theme Leads and MIRAs, this board meets bimonthly to review ongoing projects, operational matters, and strategic initiatives. The Internal Board is responsible for steering IMI's internal activities and ensuring that the Institute's research themes and goals are being met. It provides a platform for cross-theme collaboration, ensuring the integration of IMI's initiatives within the broader university landscape.

The governance framework allows IMI to be responsive and adaptive to emerging challenges and opportunities within mathematical sciences.



Revenue Overview

This section highlights the IMI's financial performance.

The university's internal metrics track income streams across all research activities and are used to measure different institutes against the university set KTPs. These metrics reflect:

- **Research Income** - The total amount generated from various sources.
- **Collaborative Research Income** - Income derived from partnerships and joint projects with other institutions and organisations.
- **Consultancy and Contract Research Income** - Revenue incurred from consultancy work and contract-based research.

Figure 1 presents a breakdown of research income over the past three years, illustrating significant growth across these categories.

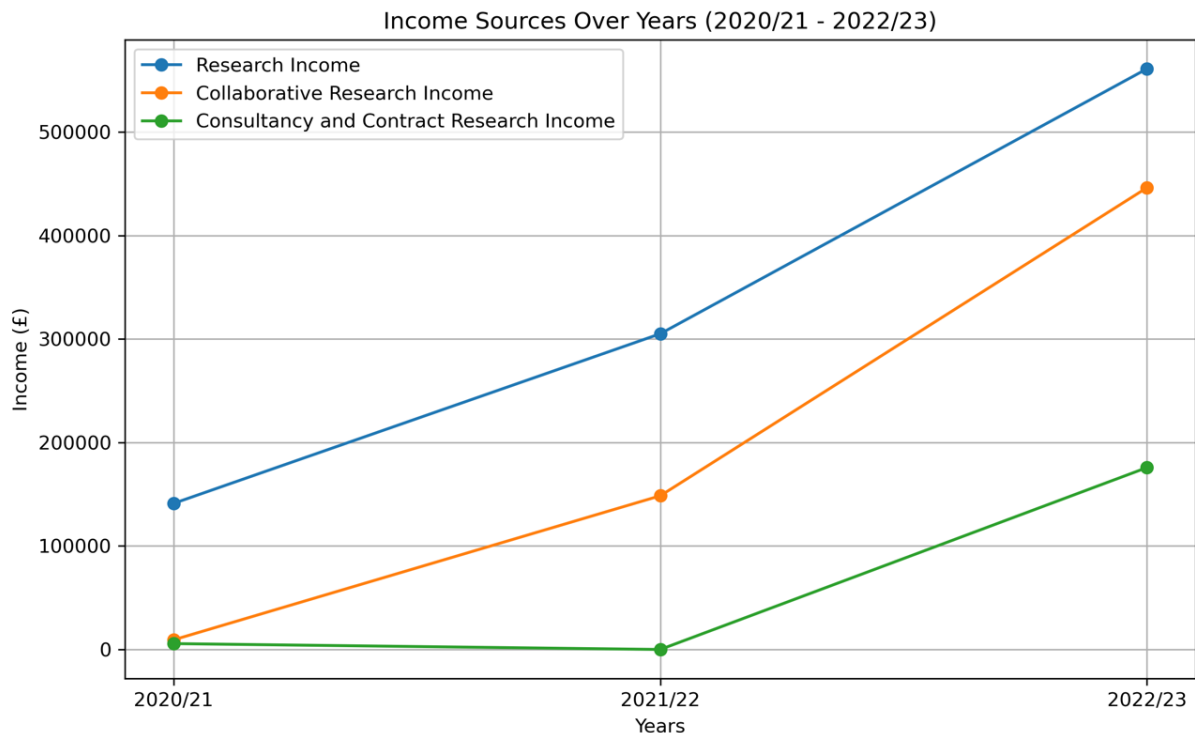


Figure 2: Data from Bath finance on different university income metrics.

At IMI, to give more granular information on our income, we track our research funding based on projects that have a **MIRA/MIRI costed** into the grant. This approach ensures that we capture the true scale of IMI's impact by highlighting where our research expertise is directly involved in externally funded projects.

IMI's research portfolio is diverse, spanning multiple sectors and funding bodies. Figure 2 highlights our projects, their value, and the corresponding funders. The breadth of IMI's research portfolio demonstrates our ability to attract funding from both national and international research funders and industrial partners.

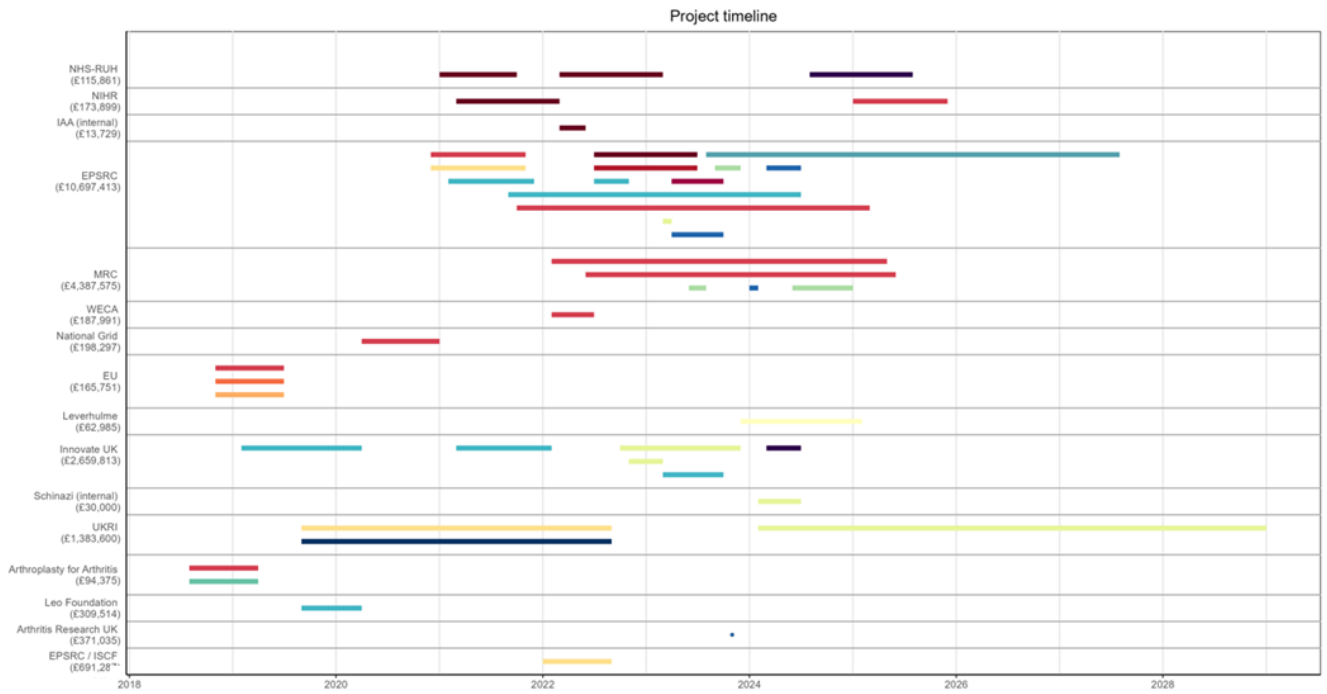


Figure 3: IMI secured funding. Funders and magnitude secured included.



Institute Five Year Strategy

The strategic aims of the Institute

Pillar 1 – The Institute will innovate by enabling added value to academic excellence. It will establish contextual mathematical credibility within the physical sciences, engineering and social sciences through the quality of research that it hosts.

Pillar 2 - IMI will add mathematical impact to the University, industrial and outward facing partnerships, naturally laying the foundation for future impact case studies.

Pillar 3 - IMI will lead the development of a global network of similar institutes/centres of excellence to enhance the other three pillars of activity.

Pillar 4 IMI will become the first UK institution to drive forward the concept of postdoctoral training through its IMI research fellows.

The IMI will generate synergy across campus, supporting development, delivery, publication and motivating growth via:

- Calculated risk taking, in collaboration with other centres and institutes.
- Strategic spending prioritised to leverage added value.
- Generation of growth in research income and research quality through “grant-drives”.
- Leading and innovating, aiming to drive large scale, long-term opportunities, rather than reacting to specific calls.
- Focusing on larger projects; avoiding a low impact scattered approach.
- Having a core team jointly delivers on the vision and prioritises capacity building and fosters an ethos of career development, empowering others to grow and succeed alongside them.

The IMI vision continues to align with the University's research themes of Health & Wellbeing, Sustainability, and Digital

This highlights its commitment to addressing important global challenges and contributing to the University’s efforts to tackle pressing issues faced by society.

Health & Wellbeing. IMIs expertise in mathematical modelling and data-driven research is being applied to developing new approaches to understanding and solving health problems. The Institute has research themes in healthcare technologies focussing on developing new models and techniques in personalised precision medicine as well as post COVID recovery.

Sustainability. IMIs expertise is already being used to develop new mathematical models and data-driven approaches to address environmental issues from climate change to sustainable resource management. The Institute has research themes developing new models to understand the impact of different energy sources on the environment and to evaluate the feasibility of alternative energy solutions.

Digital

In synergy with the other points, IMIs core research focusses on developing new mathematical models and algorithms to support digital technologies, such as machine learning and artificial intelligence and quantification of the accuracy and efficiency of these technologies, evaluating their impact on society.



The IMI will continue to support interdisciplinary research by creating opportunities for researchers from different disciplines to collaborate and share their expertise through:

- **Joint Research Projects**

By bringing together experts from different fields, broad interdisciplinary research projects lead to new insights and solutions to complex problems. IMI will identify funding for project development through grant drives, e.g., Call2Arms and Power of 3.

- **Interdisciplinary Workshops and Conferences**

The Institute fosters collaboration by bringing together researchers from various disciplines through initiatives like the BMC, LMS-Bath Symposium series, think tanks, study groups, and participation in SAMBa ITTs.

Interdisciplinary Training Programs

The Institute equips researchers with skills for interdisciplinary work through initiatives like bespoke training for industry partners (e.g., Mayden), Narrative CVs, industry collaboration for ECRs, grant and fellowship writing sprints. These programs enable researchers to better understand diverse perspectives and collaborate effectively.

Research Enabling Activities

The Institute contributes research development and management support to IMI-associated interdisciplinary research proposals and projects. This includes five successful programme grants lead by PIs in the departments of Mathematical Sciences (Maths4DL, MathRad), Mechanical Engineering (People-Led Digitisation), Psychology (CRIISP) and Health (High Impact Chronic Pain). IMI also provide administrative support for workshops and symposia organised by IMI Fellows.

The IMI supports collaboration by promoting and facilitating partnerships and collaborations with other academic institutions, research organisations, government agencies, and private sector organisations providing:

- **Networking Opportunities**

The Institute organises events like conferences, seminars, and workshops, along with the MIRA jamboree and scoping sessions with partners such as Terra Quantum, PepsiCo, and DSTL. These bring together researchers and industrial partners from various regions, fostering new collaborations, idea exchange, and relationship building with organisations.

- **Research Funding Opportunities**

The Institute provides small grant funding opportunities for researchers to collaborate on research projects with partners from other regions and countries. These help to support the development of new partnerships and collaborations and to encourage cross-border research projects.

- **International Exchange Programs**

The Institute will develop an international exchange program that allow researchers to spend time at partner institutions in other countries. These can cement international research collaborations and promote the exchange of ideas and knowledge between researchers from different regions and countries. Through this support the Institute promotes a truly global research community.



The IMI supports the achievement of impact from research by promoting and facilitating the translation of research findings into tangible benefits for society.

Engagement with Stakeholders

Through networking, training and research drives the Institute encourages researchers to engage with stakeholders, including industry, government, and research laboratories, to understand their needs and to identify opportunities for the application of their research findings.

Impact Assessment

The Institute will support researchers evaluating the impact of their research findings. This is already being done through the REF impact case study reading group.

Impact Development

The Institute plans to embed researchers within stakeholders to drive collaboration, including Innovate UK AKT with Mayden and A4I projects with Neuville Grid.

The IMI is developing supportive research culture through:

- **Career Development**
The Institute supports its researchers by providing training and development opportunities, such as professional development courses, mentoring programs, and research collaborations. This forms part of our **postdoctoral training pillar**. The Institute also provides support for our Mathematical Research Associates to pursue career development, for example the promotion of B. Erhardt to Senior Mathematical Research Associate, to help them achieve their career goals.
- **Collegiality**
The Institute encourages researchers to work together, share ideas and knowledge, and collaborate on projects. We provide opportunities for researchers to participate in events and activities that foster a sense of community and promote collaboration and communication between researchers.
- **Open Research**
IMI expects researchers to share their data, results, and methods openly and transparently using open access journals, pre-print servers, and data repositories encouraging researchers to make their research outputs available to the wider research community.
- **Research Design**
The Institute provides training and development opportunities through its academic fellowship route. All incoming Fellows outside of mathematics are paired with a mathematician fellow who supports development of research projects to ensure proposals are cutting edge. This ensures mathematics is embedded into the core of research, facilitating ground up project development.
- **Research Ethics & Integrity**
The Institute embraces REI activities and integrates with the SAMBa CDT provision of training for all core staff, further supporting staff development.
- **Research Recognition**
The Institute ensures work of its researchers is promoted through various channels, such as academic journals, conferences and stakeholder events. The Institute provides opportunities for researchers to receive recognition for their achievements, such as awards and promotions, and supports the development of policies and procedures to recognise research excellence.