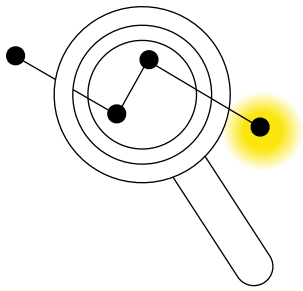
unicef for every child
office of innovation

INNOVATION NODES COMPENDIUM

VOLUME I



UNICEF's Office of Innovation has an agile business architecture that aligns with diverse partners to discover, co-create, and scale bold solutions and technologies to deliver for children today and set a new pace of social impact for coming generations.

Innovation Nodes are part of this agile structure. They are collaborative and transdisciplinary spaces to reflect, explore and create novel wisdom in new and unknown areas of potential innovation for children. These collaborations are with preeminent organizations, from research institutions to think tanks, with deep expertise and capabilities in new and unknown domains of impact on children.

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Acknowledgement

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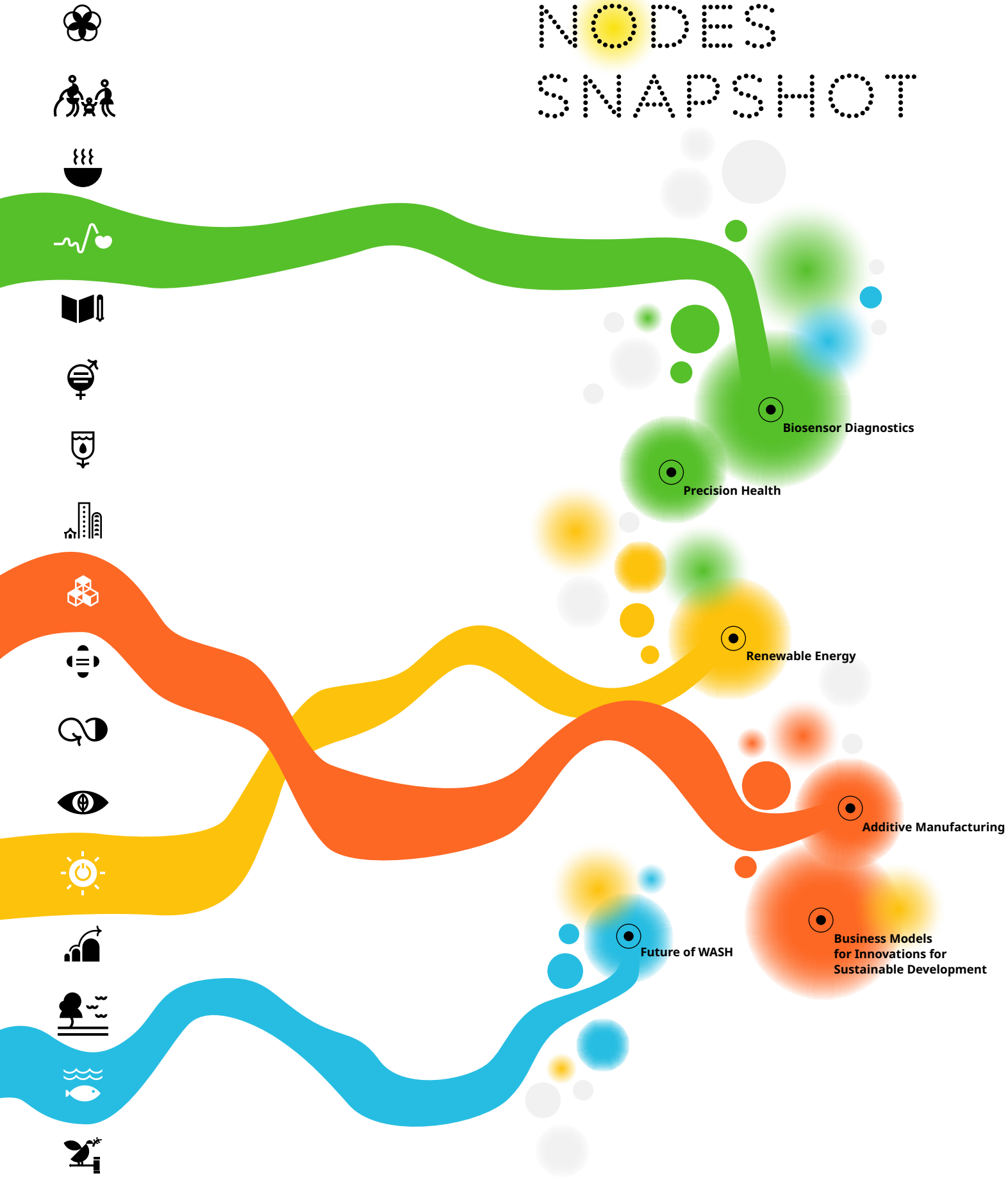
NODES SNAPSHOT



FOREWORD

Our mission at the UNICEF Office of Innovation is to co-create to discover, iterate and scale innovative solutions for every child everywhere. UNICEF defines innovation as a new or significantly improved solution that contributes to progress and accelerates results for children or young people. It is about doing new things to solve problems and improve the lives of children around the world — matching today's challenges with tomorrow's solutions.

Our Innovation Nodes play a central role in delivering on this global ambition through possibility-led innovation. The Nodes are transdisciplinary and collaborative spaces that focus on reflecting and generating novel wisdom in new and unknown areas of potential innovation for children. In line with UNICEF's Global Innovation Strategy, the Nodes help "identify gaps and opportunities and uncover unproven approaches and technologies to be explored." In doing this, the Nodes catalyze evidence-based research and innovation, illuminating new domains where UNICEF and our partners should invest to transform insight into impact for children at scale.

In the pages that follow, you'll read about the journey of discovery and impact that we and our collaborators have taken together over the past three years. This inaugural Innovation Node Compendium is designed as its own micro journey of discovery, offering you a path through which to explore and understand more about the Node approach, the Node Effect (our impact to-date), the domains we've explored so far, the knowledge we've generated and the lessons we've learned, and the collaborators we've had the privilege to work with along the way.

We hope the insights and reflections shared here spark curiosity and joy, and entice you to join us in exploring pathways to unlocking new possibilities in innovation and impact for every child.

Thomas Davin
Director, UNICEF
Office of Innovation

OVERVIEW & JOURNEY

Designing, establishing and growing UNICEF's Innovation Nodes from scratch has been a journey where you can describe the desired destination, but the map and means to get there are completely blank. In other words, a pathway of pure possibility.

The destination was titled 'Recognition and Exploration' in an Evaluation of Innovation in UNICEF Work, and further described as a systematic capability needed for "Recognizing an opportunity (new technology / approach, innovation outside [the] system)," with accompanying institutional arrangements engaging new actors including research institutions, R&D and technology firms.

The organization's Global Innovation Strategy added more detail, placing this work among new shared collaboration spaces to be created for unlocking "breakthroughs (unproven technologies or approaches, new bets and new challenges)." The not-yet established or named Nodes would anchor results in the ideation part of UNICEF's innovation framework, providing insights, exploration and R&D engagement to "identify gaps and opportunities, and expose unproven approaches and technologies to be explored."

Fast forward 3 years and this Innovation Node Compendium reflects on this possibility-led innovation journey to unlock the potential of previously unknown areas of innovation for children in underserved communities.

As for the future, our compass points to a clear true north, one stated unequivocally in the recently adopted United Nations 'Pact for the Future,' which commits to actions including on international cooperation in science, technology and innovation to bridge the gap within and between developed and developing countries.

During the past 3 years we have:

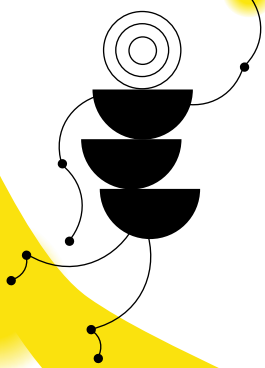
- Designed and refined a systematic and transdisciplinary approach to institutional discovery that positions children and young people centrally within science-policy-society interfaces
- Illuminated "known unknowns" and "unknown unknowns" opportunity in fields such as precision health, renewable energy, biotechnology and additive manufacturing, as well as practices like emerging business models for innovations for sustainable development
- Undertaken this work across multiple institutions with more than 80 collaborators from 25 countries, and embracing an array of disciplines across STEM, economics, media arts, design, forensics, education, medicine, business administration and more.
- Learned through continuous self-reflection about the concrete "node effects" we didn't plan for and refining our understanding of what matters so we can measure it.

Tanya Accone
Senior Advisor on Innovation and Lead for UNICEF Innovation Nodes

Billions of people, especially in developing countries, do not have meaningful access to critical life-changing technologies. If we are to make good on our promise to leave no one behind, sharing science, technology and innovation is essential.

Innovations and scientific breakthrough that can make our planet more sustainable and our countries more prosperous and resilient should be affordable and accessible to all.

Pact for the Future, United Nations, 2024, p.21



SECTION 1

WHAT ARE INNOVATION NODES?

UNICEF INNOVATION NODES OVERVIEW

Unlocking new possibilities of innovation and impact for children

Overview

UNICEF works in complex environments. Even seemingly simple scenarios involve complexity, and change processes are unpredictable — what works today may not work tomorrow. At the same time, new knowledge and practices are emerging at a rapid pace, often outside our usual field of vision.

Recognizing this challenge, UNICEF's Global Innovation Strategy aims to identify gaps and opportunities and uncover unproven approaches and technologies to be explored to deliver greater impact for every child. In a similar vein, the UN Pact for the Future underscores the critical importance of promoting the responsible and ethical use of science, technology and innovation, guided by the principles of equity and solidarity — to foster an open, fair and inclusive environment for scientific and technological development and digital cooperation. The Innovation Nodes help UNICEF deliver on this ambition.

The Nodes are collaborative and transdisciplinary spaces that aim to illuminate domains of known impact that UNICEF is aware of but doesn't fully understand, as well as emerging domains of unknown impact that UNICEF is neither aware of nor understands.

Through the Nodes, UNICEF collaborates with leading organizations to probe and explore these 'unknowns' in our work, connecting different networks of innovators — including young people themselves — to the needs of children, and exposing both blind spots and promising pathways in the process. In this way, UNICEF and its collaborators widen our radar for new opportunities in innovation for children.

Exploring the unknown

The Nodes examine realms of impact for children yet to be explored and discovered, launching new areas of expertise in emerging domains with unknown impact. They help reduce ignorance, risks, and opportunity costs and increase impact for children by catalyzing evidence-based research and innovation. The Nodes focus on two critical 'unknowns':

1 **Known Unknowns:**
These are areas we are aware of but do not fully understand. Nodes work to deepen our knowledge in these domains to uncover potential solutions.

2 **Unknown Unknowns:**
These are emerging domains with impacts we have yet to identify. Nodes aim to explore these areas, reducing uncertainty and discovering new opportunities for innovation.

The only true wisdom is knowing you know nothing.

Socrates (Plato's Apology)

We seek to strengthen our capability to listen, reflect and create new wisdom through nodes.

We have strengthened our capability to synthesize and speak about our work.

Node spaces

Since launching in 2022, UNICEF and its Node collaborators have explored a wide range of new and unknown areas of potential innovation for children, including: **renewable energy, precision health, biotechnology and biosensors, additive manufacturing, future WASH, next-generation materials.** See What have we illuminated? for more.

In addition to these domain-specific explorations, the Nodes also seek to illuminate unknown areas of innovation practice that may deliver transformative impact for children. The first example of this type of Node exploration focuses on New Business Models: studying innovative business models that can help unlock pathways for delivering impact and contributing to sustainable development with innovations identified across the thematic areas explored by the Nodes.

Figure 1: Knowns and Unknowns framework

Transdisciplinary collaborations

The Nodes operate on the premise that the complex social, economic and ecological problems facing children and young people cannot be solved from a single point of view, a singular knowledge domain or a monolithic approach. Acknowledging and owning our perspectives — along with their limitations — is essential to impactful innovation practice.

UNICEF established the Innovation Nodes to mitigate the risks of excessive self-confidence and knowledge blind spots. By championing a transdisciplinary approach to finding and developing new opportunities for children, the Nodes put intellectual humility at the heart of research and innovation.

Transdisciplinary research integrates insights from multiple disciplines to create holistic solutions. Unlike multidisciplinary or interdisciplinary approaches, transdisciplinary collaboration transcends traditional boundaries, merging diverse fields like biology, engineering, and social science. This approach enables the Nodes to foster a holistic understanding of complex problems, encourages collaborative problem-solving, and opens new avenues for the co-creation of innovative solutions tailored to the needs of children.

24+

Dozens of researchers globally have contributed their diverse perspectives to the Nodes, including from the University of Cambridge, Harvard University, the University of Technology Sydney, Rhodes University South Africa and Karolinska Institute.

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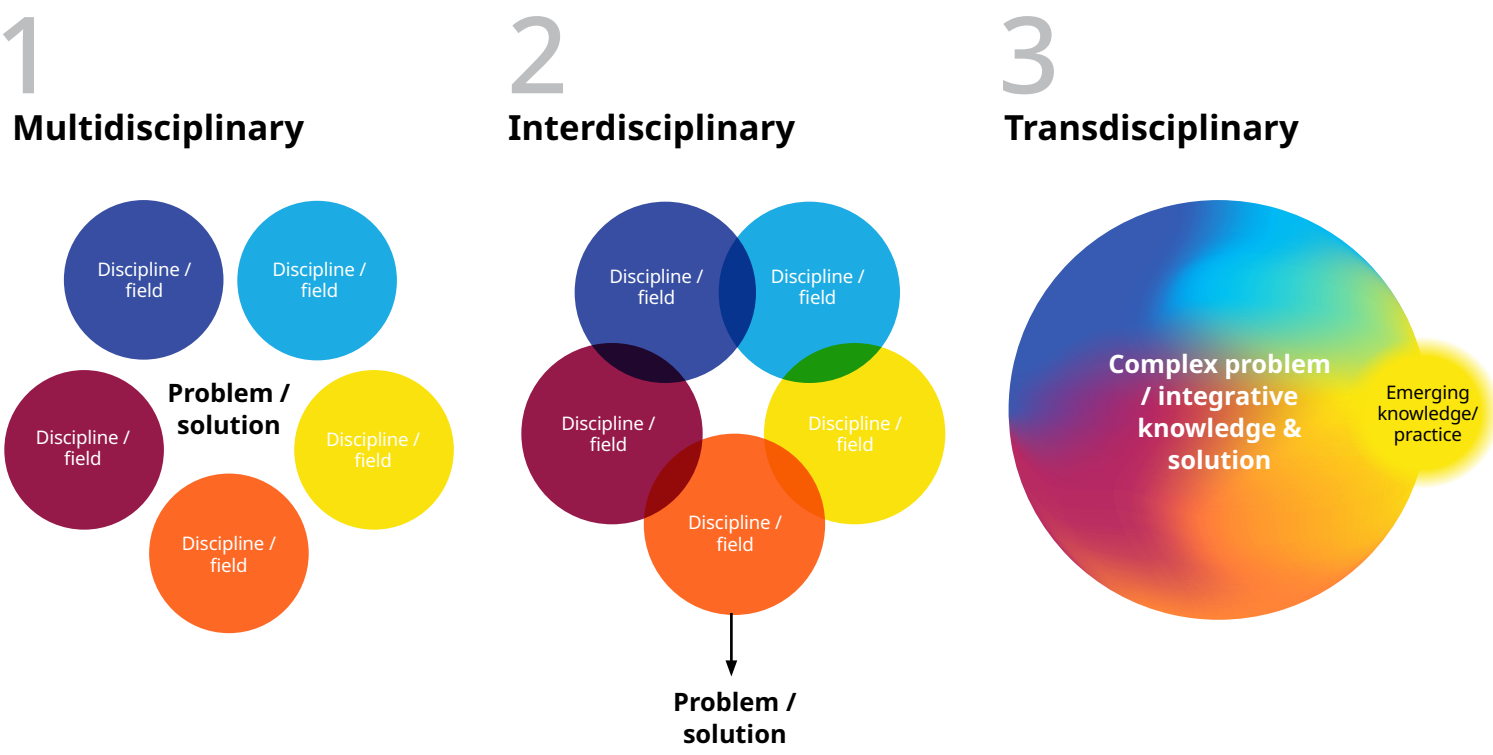


Figure 2: Collaborating across fields

Source: Adapted from McPhee, C., M. Bliemel and M. van der Bijl-Brouwer. 2018. 'Editorial: Transdisciplinary Innovation.' Technology Innovation Management Review 8 (8), p4. doi.org/10.22215/timereview/1172

Engaging and empowering youth in exploration

A key feature of the Nodes is their empowerment of young people as active participants in research and knowledge creation. Nodes meaningfully engage young people as knowledge holders by applying a transdisciplinary approach to science-policy-society interfaces, placing the innovation research agenda directly in their hands.

Young researchers are essential to exploring research and technologies in areas that UNICEF is not active in and has little expertise in. They bring invaluable perspectives — as young people whose lives will be most affected, along with future generations, by the application of or lack of access to these innovations, along with their creative and open-minded research and interrogation capacity.

Improving science-policy-society interfaces for the SDGs

Breakthroughs in science, technology and innovation (STI) are rapid, numerous and dispersed, and impact individuals and societies at all levels of development. Effective interfaces among science-policy-society stakeholders are needed for every person to realize their rights to benefit from STI. While emerging research and technologies may address challenges facing children in emerging economies, an effective and systematic approach to connect young people, researchers, development practitioners and decision makers has been missing. UNICEF has established Innovation Nodes to help build bridges across these stakeholder groups to unlock pathways of transformative change for children. Nodes meaningfully engage young people as knowledge holders by applying a transdisciplinary approach to science-policy-society interfaces.

Read more in this Case Study for the Multistakeholder Forum on Science, Technology and Innovation for the SDGs, May 2024.

66+

Some 66 young people including children and university students across four continents have shaped the topics of Node investigation and played a central role in exploring them.

From insight to impact

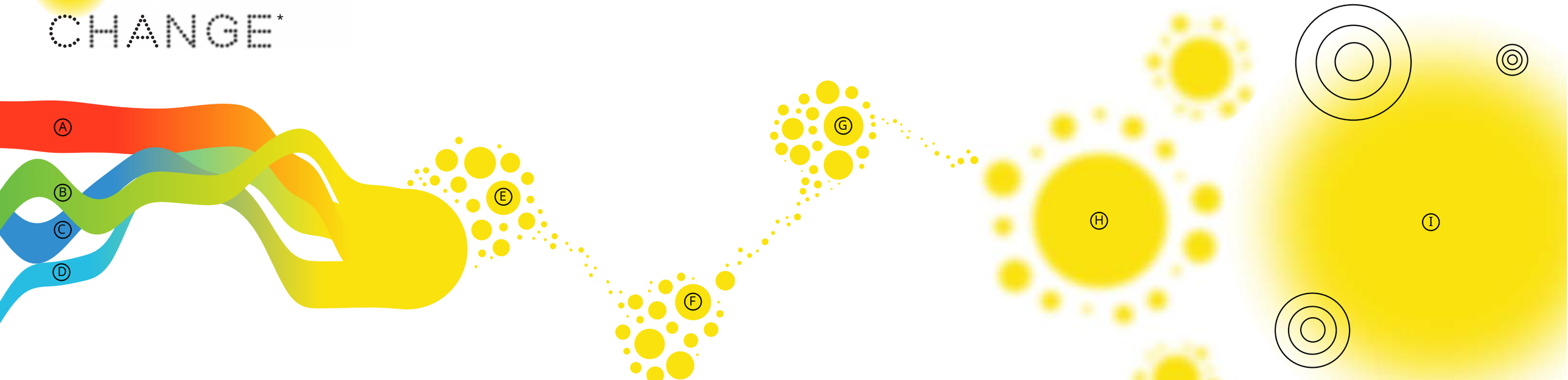
The Nodes produce a rich variety of knowledge artefacts and engagement opportunities, including in-depth insight reports, insight briefs and Connected Conversations to deliver results and drive impact. To-date, the Nodes' artefacts and engagements have:

- influenced renewable energy investments by UN operations
- catalyzed the development of a proof of concept for precision health applied at community level
- positioned UNICEF as a thought leader on new fora.

The approach of the Nodes has gained recognition across a diverse set of sectors, stakeholder groups, and platforms. To date, the Nodes have unlocked opportunities for UNICEF being featured by LinkedIn, FastCompany, SXSW, and the Meridian Institute. The Nodes model has also been spotlighted in UN case studies and events, including in the UN Department of Economic and Social Affairs' Science Technology and Innovation Forum, the UN Staff System College, UN 2.0, UN Global Pulse, and the UN Innovation Network and its toolkit.

For more detailed information, visit the UNICEF Innovation Nodes webpage.

THEORY OF CHANGE*



1 Activities

A Collaborate with preeminent research organizations & think tanks — leveraging the global research and knowledge generation infrastructure.

B Draw on diverse perspectives, knowledge & practices to probe, sense & frame complex challenges and co-create possible futures.

C Co-produce & synthesize insights on 'unknown' areas of potential innovation for children.

D Curate & share reflections, insights & research results with a broad range of audiences through multiple channels.

2 Outputs

E **KNOWLEDGE**

Contribute to knowledge stocks and flows through:

1. Narrative-based wisdom artefacts (LinkedIn blogs, Insight briefs)
2. In-depth wisdom artefacts (Insight reports, compendia, peer-reviewed papers)
3. Online knowledge 'appetizers' on novel research & innovation with potential impact on children.

F **ENGAGEMENT**

Encourage interaction with nodes through:

1. Dialogue-based wisdom artifacts (e.g. Connected Conversations, talks, webinars, conferences, fireside chats)
2. Interactive tool to help users discover & explore novel ideas and previously 'unknown' innovations with potential for children
3. Related engagement (e.g. citations, mentions, social media, engagement, requests, unsolicited outreach)

3 Outcomes

G **COLLABORATION**

Foster connection and conversation through:

1. Mutual and transformational learning as a result of a transdisciplinary approach, knowledge management and sharing
2. Catalyze collaboration with and among preeminent organizations

H

1. Increased availability of novel insights and learnings on new and previously unknown areas of potential innovation for children to the Office of Innovation UNICEF, and the broader humanitarian, development & social impact sector.
2. UNICEF recognized for thought leadership in the humanitarian, development and social impact sector.
3. Reduce risk and improve opportunity cost of decisions by evidenced distinction between areas with potential or not.

4 Impact

I Accelerating results for children through innovation and influencing the external context to create an enabling environment for others to innovate with and for children.

* Our Theory of Change is informed by: Mitchell, C., Cordell, D., and Fam, D. 'Beginning at the End: The Outcome Spaces Framework to Guide Purposive Transdisciplinary Research,' Futures 65 (2015): 86–96, https://doi.org/10.1016/j.futures.2014.10.007.

REFLECTIONS

What happens when you put young people at the heart of the innovation research agenda?

Children remain at the forefront of a transforming world[1] — with the most to gain, lose and contribute, especially through the lens of science, technology, and innovation (STI). Yet young people are not always meaningfully empowered as actors in exploring and informing the implications of STI on their lives — they are all too often invisible among the identified stakeholders[2].

The Pact for the Future[3] urges us all to do more and better, to recognize children and youth as agents of change and to use intergenerational dialogue and engagement in policy and decision-making processes to safeguard the needs and interests of future generations. As Alessandra, 17, highlights, "Enrolling young voices and perspectives guarantees that these new technologies are designed mindfully with the intention of inclusivity, while also addressing the needs of future generations." These are among the key reasons UNICEF's Innovation Nodes meaningfully engage young people as knowledge holders in science-policy-society interfaces[4].

Enrolling young voices and perspectives guarantees that these new technologies are designed mindfully with the intention of inclusivity, while also addressing the needs of future generations.

Alessandra, 17

Khazimla, 17

Young people can become pioneers of innovation through their technological literacy, Combined with their hunger to learn, question the unknown, and experiment, which allows them to develop cutting-edge solutions.

Innovation Nodes focus on generating novel wisdom in new and unknown areas of potential innovation for children that can accelerate progress for the Sustainable Development Goals (SDGs). Node collaborations are intentionally designed to be transdisciplinary and to coproduce substantive resources through intergenerational collaborations. They operate on the premise that the complex social, economic and ecological problems facing children and young people cannot be solved from a single point of view, a singular knowledge domain or a monolithic approach.

One of the distinctive approaches of the Innovation Nodes is the degree to which young people are empowered and engaged — well beyond polling their opinions or inviting their comments and contributions, we literally place the innovation research agenda in their hands. "Young people can become pioneers of innovation through their technological literacy," explains Khazimla, 17, "Combined with their hunger to learn, question the unknown, and experiment, which allows them to develop cutting-edge solutions."

Nodes deliberately seek to explore research and technologies emerging in a 3-to-5-year time horizon in areas that UNICEF is not active in and has little expertise in. In this context, young researchers bring invaluable multiple perspectives — being young people whose lives will be most affected, along with future generations, either by the application of or lack of access to these innovations, along with their creative and open-minded research and interrogation capacity.

"Our inclusion in technological development helps future-proof these innovations," highlights Eduardo, 26, "Ensuring they address not just immediate concerns but also long-term sustainability and equity issues."

Our inclusion in technological development helps future-proof these innovations, ensuring they address not just immediate concerns but also long-term sustainability and equity issues.

Eduardo, 26

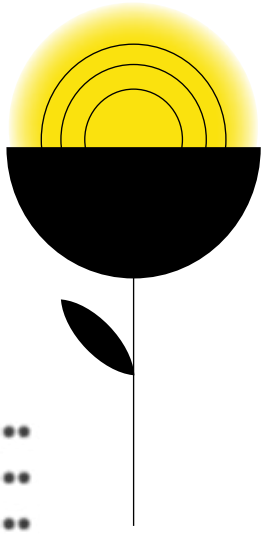
Almost three dozen young people across four continents have shaped the topics of focused Node investigation, including precision health, renewable energy, additive manufacturing, and next generation materials. They have not only influenced this innovation research agenda, but have also played a central role in exploring them and building the foundation for Innovation Node assets, such as Insight Reports and Insight Briefs.

Innovation Nodes provide an empirical demonstration that is it possible, feasible and viable to engage young people as equal collaborators in setting an innovation research agenda, researching it, and co producing knowledge assets to inform thought leadership and STI decisions that enhance social and environmental wellbeing.

Notes for 'Reflections'

1. Prospects for Children: Global Outlook
2. Quadrennial comprehensive policy review of operational activities for development of the United Nations system
3. The Pact for the Future
4. Illuminating 'unknown' domains of impact and uncovering new practices and pathways for transformative innovation for children

SECTION 2



WHAT VALUE HAVE NODES CREATED?

THE NODE EFFECT

Jayden, 16

The interaction between young people and technology professionals creates a mutually beneficial exchange, increasing innovation, inclusivity, and ethical development in a rapidly changing technological landscape.

Node outputs are the beginning of the node effect — not the end. Co-production of knowledge starts with the production of these assets, but the subsequent ripple effect is where Nodes deliver real and lasting impact.

Foundationally, as reflected in the Theory of Change, Nodes are designed to increase the availability of novel insights and learnings on new and previously unknown areas of potential innovation for children for UNICEF and system actors. These insights reduce the risk associated with unknown technologies and approaches by increasing what we know about them, their relevance, applicability and implications. This simultaneously improves opportunity cost, as we are better able to understand the value of emerging opportunities and compare them with other options. These insights better inform actions and decision making by UNICEF and others, and support UNICEF's thought leadership contributions in these areas for the humanitarian, development and social impact sectors.

Since their inception, Nodes have contributed to co-production of knowledge artefacts on new and emerging technologies and approaches, driven engagement with novel wisdom, and fostered focused transdisciplinary collaboration.

Beyond these core outputs, the Nodes have also created value in unorchestrated and unexpected ways which would not have been possible without the Node collaborations (as otherwise collaborators wouldn't have come together).

The Nodes have:

- Sparked new transdisciplinary collaborations
- Unlocked opportunities for joint exploration, research and development of new solutions
- Catalyzed investment in new solutions and approaches to deliver impact
- Positioned UNICEF as a thought leader in new fora

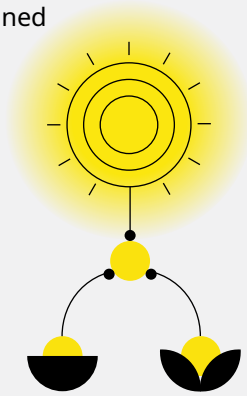
In these ways, the Nodes are accelerating results for children through innovation and influencing the external context to create an enabling environment for others to innovate with and for children.

Sparked new transdisciplinary collaborations

We did not anticipate the extent to which our work would increase the appetite across and among institutions and individuals from different Nodes to extend and expand collaboration. Inspired by our operationalization of a transdisciplinary approach, UTS and Rhodes University recognized the value of investing further in this approach and forged a new collaboration, designing, funding and delivering an in-person workshop that brought together academics from Australia and South Africa.

Catalyzed investment in new solutions and approaches to deliver impact

Insights from the Node that examined Renewable Energy informed a decision in multiple UN entities to pursue the use of thin film solar in field operations in extreme operating environments in multiple countries.



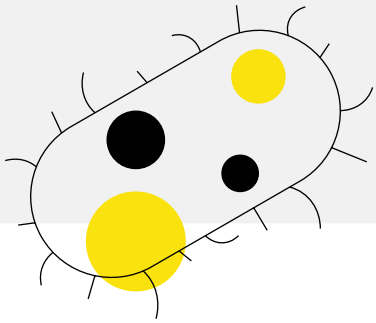
Unlocked opportunities for joint exploration, research and development of new solutions

Through the Precision Health Node, multiple existing and potential new collaborators in sub-Saharan Africa and Europe are pursuing a proof of concept implementation to demonstrate and evidence the value of an emerging approach and technology for underserved populations. Watch this space for updates as this collaboration folds.

The Biosensor Node unlocked a pathway for a private company and a university to work towards making cutting-edge, bioprinting equipment available at an open research facility where national and international collaborators across sub-Saharan Africa can access it and collaborate to do fundamental and applied research with direct societal impact.

Positioned UNICEF as a thought leader in new fora

The approach of the Nodes has gained recognition across a diverse set of sectors, stakeholder groups, and platforms. To-date, the Nodes have unlocked opportunities for UNICEF being featured by LinkedIn, FastCompany, SXSW, and the Meridian Institute. The Nodes model has also been spotlighted in UN case studies and events, including in the UN Department of Economic and Social Affairs' Science Technology and Innovation Forum, the UN Staff System College, UN 2.0, UN Global Pulse, and the UN Innovation Network and its toolkit.



THE NODE EFFECT

BIOSENSOR DIAGNOSTICS

JAN 22
Rhodes University Biotechnology Innovation Centre
Grahamstown, South Africa

JAN 22
Journal article, Malaria Journal
Ogunmolasuyi et al. A microfluidic paper analytical device using capture aptamers for the detection of PfLDH in blood matrices. (2022) Malaria Journal, 21 (1), art. no. 174

SEP 22
Journal article, Aptamers
McKeague et al., The minimum aptamer publication standards (MAPS guidelines) for de novo aptamer selection. Aptamers, 2022, Vol 6, 10-18

APR 23
Engagement, PCST Rotterdam
Public Communication of Science and Technology (PCST). Rotterdam, Netherlands, 11-14 April, 2023

MAY 23
Briefs Published

MAY 23
Report Published

SEP 23
UNICEF webinar

Q1 23
Book Chapter Fogel, R., Shaw, L. and Limson, J. (2023) "Aptamers as versatile tools for expanding the scope of sensors," Encyclopedia of Sensors and Biosensors, pp. 352–374

OCT 23
Catalyzed collaboration with bioprinting start-up and RUBIC towards making bioprinter available to Africa-based researchers via an open research facility.

SXSW

FEB 24
Journal article, Plos One Journal
Ferreira et al., 'Generation of epitope-specific hCG aptamers through a novel targeted selection approach,' Plos One Journal, 23 February 2024. doi.org/10.1371/journal.pone.0295673

JUN 24
Inspired 3 universities to fund and co-host a week-long workshop on transdisciplinary approaches for working with underserved communities

NOV 24
Communicating Discovery Science Symposium

PRECISION HEALTH

AUG-SEP 22
Harvard
Cambridge, USA

Peer Review
UNICEF and Karolinska

FEB 24
Report Published

JUL 24
Connected Conversation
on Equity, Virtual

AUG 24
Connected Conversation on Financing, Stockholm

AUG 24
Unlocking pathways to potential investment in precision health interventions for children

MAY 24
Briefs Published

MAY 24
Article Published
STI Forum

AUG 24
Emergent node collaboration with two leading research institutions—one in Europe, one in East Africa—on new node to further explore potential solutions identified in the original node

RENEWABLE ENERGY

SEP 22
Harvard
Cambridge, USA

Peer Review UNICEF and Council for Scientific and Industrial Research (CSIR)

OCT 23
Report Published

MAR 24
Engagement Reuters' Ethical Corporation Magazine uses report in its reporting on renewable energy

MAY 24
Briefs Published

MAY 24
Article Published
STI Forum

JUN 24
Connected Conversation
on Renewable Energy Innovation, Virtual

JUN 24
Connection with UNICEF and CrossBoundary to explore avenues for further collaboration

JUL 24
Interest expressed in UNICEF enabled implementation research on solutions identified through node

JUN 24
Amplification of UNICEF collaboration with Economist to a wider audience

JUL 24
Unlock exploration of potential applications of solar film by UN agencies for field operations in challenging locations

ADDITIVE MANUFACTURING

SEP 22
Harvard
Cambridge, USA

Peer Review UNICEF and Internet of Production

SEP 24
Peer Review results in localization and implementation chapters to be added

Q1 25
Report Published

NOV 24
Global Convening Promotion of node at AfriLabs for further engagement and collaboration

INVESTING IN BUILDING A TRANSDISCIPLINARY FUTURE

It was the butterfly effect meets domino effect that brought together three universities spanning the southern hemisphere on a transdisciplinary mission. That mission? Examining how transdisciplinary approaches can be applied to address the needs of underserved communities and exploring ways to embed transdisciplinary methods into higher education

The first flap of wings

The key co-organizers of this four-day workshop did not know one another until a series of Node-orchestrated events made the connections. For the inaugural SXSW Sydney, which drew almost 100,000 attendees, UNICEF proposed the work of its Node with Rhodes University Biotechnology Innovation Centre (RUBIC) for a session titled, “From Lab to Life: Social Impact-Driven Biotechnology,” and the public voted to choose it.

The Nodes team brought together its collaborators from RUBIC and the TD School at University of Technology, Sydney on the sidelines of SXSW. This initial meeting between Prof. Janice Limson (RUBIC) and Dr. Alex Baumber (UTS) created space for discussing how transdisciplinary approaches could serve as bridges between academic expertise and community needs. And the idea to take this much further was born.

Noah, 17

We need to understand emerging technologies, because we are the ones to live with their consequences, whether constructive...or destructive.

Flap, flap, flap

Independently securing the necessary resources, academics and researchers from RUBIC, UTS and University of Pretoria travelled to Makhanda, South Africa for a two-day workshop, one-day seminar and one-day panel discussion.

Attendees shared their unique 'origin stories' of transdisciplinary work at each institution as well as examples. The diverse perspectives demonstrated the adaptability of transdisciplinary approaches across contexts.

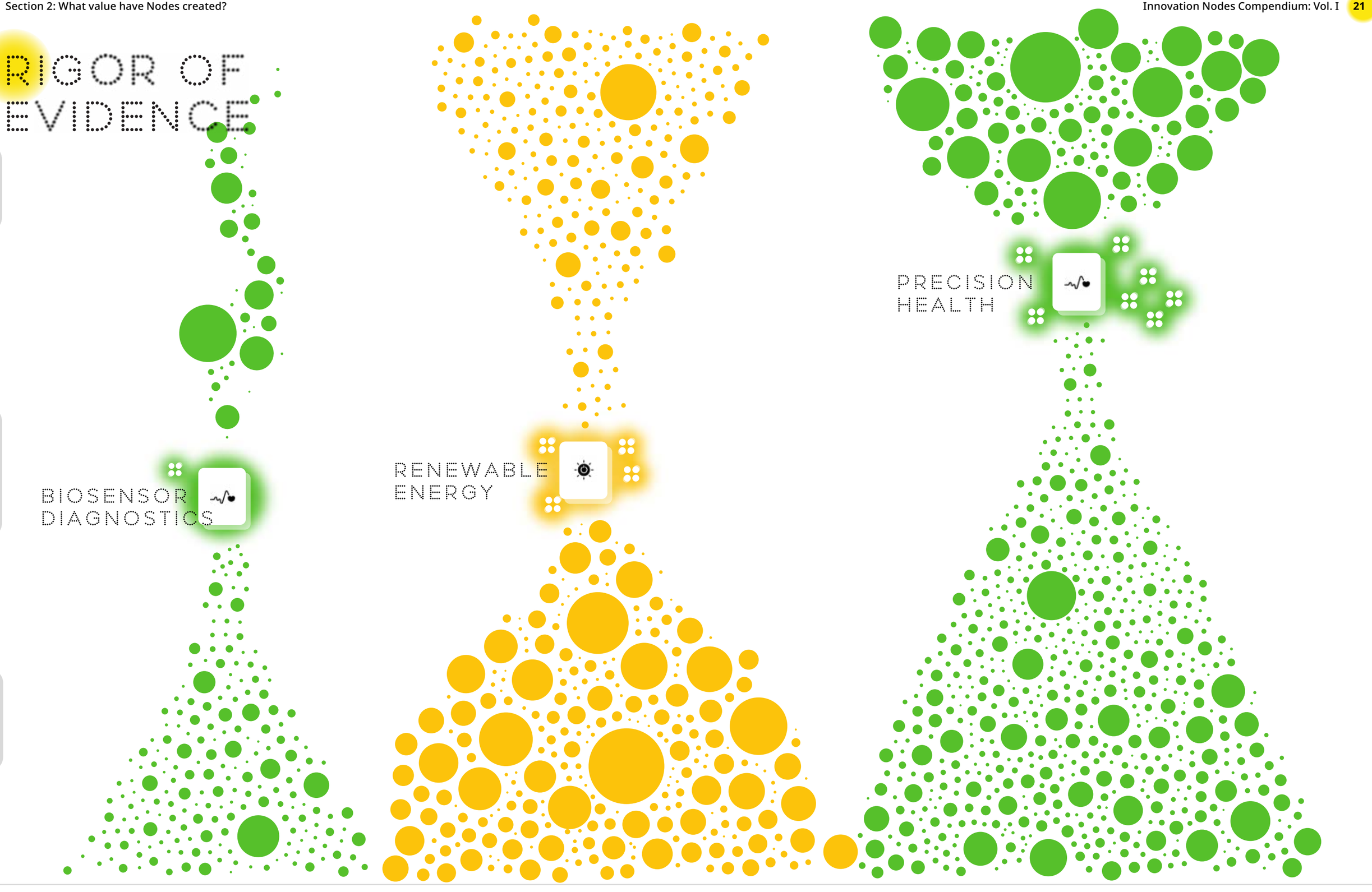
For participants, the workshop emphasized the value of integrating community engagement into research. "By focusing on transdisciplinary approaches that combine technology with social and policy considerations, this is driving more holistic and sustainable solutions to global challenges," Dr. Baumber noted. "The intersection of innovation and community trust is crucial in addressing real-world problems."

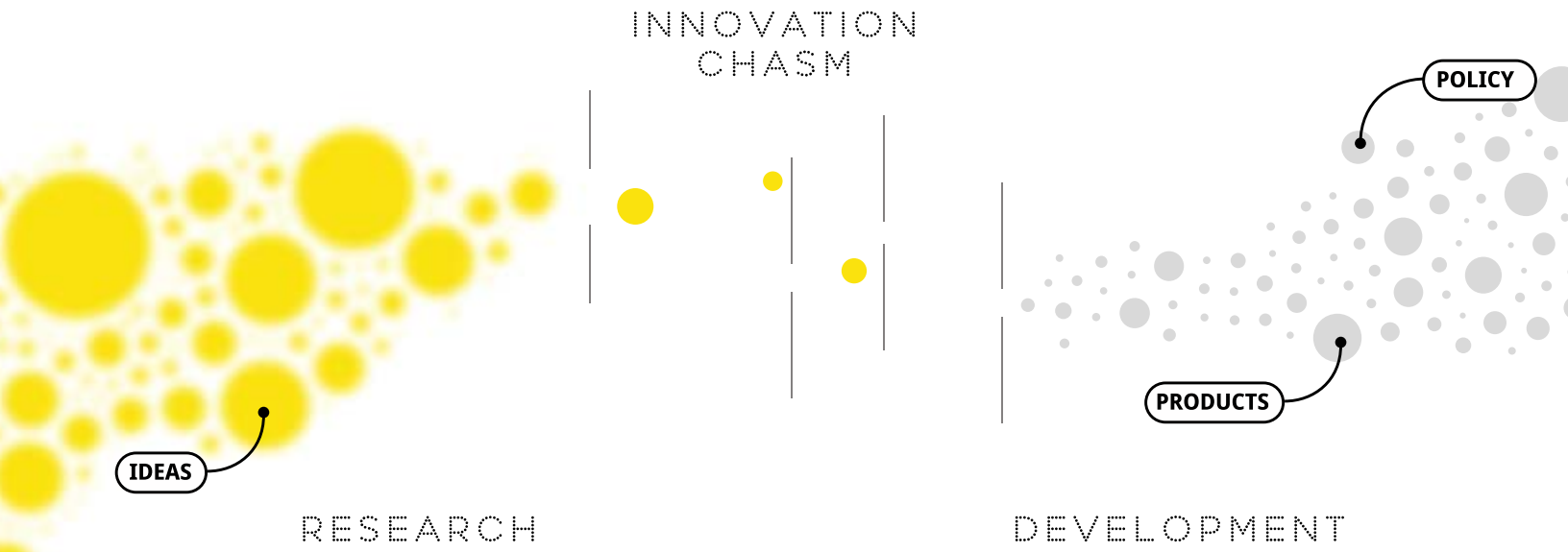
This has set the stage for future work to continue the exchange of ideas, practices, and programme to allow both universities to enhance their research and teaching methods. RUBIC and UTS plan to co-develop a teaching module on transdisciplinary approaches, expanding both universities' curricula to prepare students to identify solutions to complex social challenges. Plans for joint research projects and student exchanges, giving them hands-on experience in projects that directly benefit communities, are being explored.

This is a good example of the catalytic effect of UNICEF's Innovation Nodes — unlocking possibilities, fostering collaborative learning that crosses borders and disciplines, and reinforcing the idea that institutions can and should commit to social impact in their research and academic missions and activate scalable networks for innovation for global social impact.

"UNICEF's insight into the needs and challenges faced by communities worldwide provides a critical foundation for research," agrees Prof. Limson. "It allows us to design innovations that are not only effective but contextually appropriate."

Participants in a session at the RUBIC-UTS workshop on transdisciplinary approaches. Photo © Rhodes University


RIGOR OF EVIDENCE
BIOSENSOR DIAGNOSTICS
RENEWABLE ENERGY
PRECISION HEALTH



Partnerships such as the one between Rhodes University Biotechnology Innovation Centre (RUBIC) and UNICEF are a major step in addressing the innovation chasm.

Innovation chasm negatively affects African Science, with an insufficient amount of research directly influencing the economy or promoting healthcare for Africans.

Distinguished Professor Tebello Nyokong

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CAN YOU PUT A NUMBER ON THOUGHT LEADERSHIP?

Call it “contentious,” “pioneering,” “difficult to the point of impossible to do,” or a “holy grail-like quest about value for money,” because those are descriptors some of our informal thought partners used to characterize our efforts to quantify the value created by Innovation Nodes.

The fact that there many unknowns (and possibly a few unknowables) did not daunt our transdisciplinary team. The complexity presented a challenge for which our diverse expertise and experience provided value. This work brought together fundamental research and academic practices of developing conceptual models and testing and validating them through empirical evidence; business performance management models, concepts (OKR, ROI, CBA) and tools from the private sector; and development sector equivalents in the form of theories of change, logical frameworks, results and resources frameworks and concepts (RBM, KPIs, value for money.)

We were collectively motivated by early evidence of Node results and by the potential to articulate additional facets of the impact using a more developed, rigorous, and benchmarked method. We also wanted to better understand and characterize the returns on a limited commitment of institutional resources — 1.3 full-time equivalents split across 3 people and a small operating budget — and to unlock additional resources informed by better evidence.

Intellectual philanthropy meets intellectual capital

Bringing equal parts experts genuinely excited to grapple with complex intangibles along with a well-stocked toolbox of tried-and-tested industry standard methods for tangible elements was a team from Deloitte, which responded to our request for proposals to tackle this space with us. We gained a number of practice insights, along with a comprehensive impact assessment model to quantify the value creation potential and the production costs of knowledge products that allows for comparison between traditional and Node approaches.

Distilling data

Our datasets are limited (given Nodes started from scratch in 2022), diverse, unstructured and shallow, but also span a breadth of variables. In addition to tracking KPIs, we distill our data through aggregation, summarization and dimensionality reduction to make sense of it, identify patterns and feed opportunities.

Growth isn’t a default good

The frequent assumption that growth is good is heightened in the presence of numbers, so we’re mindful not to be driven by the easily countable (“more Nodes” or “more Node knowledge products”) per se, but intentionally optimizing for value creation.

Not all that matters can be (feasibly) measured

Our outcomes have long tail impacts. Many of the aspects we are most interested to track and measure are second order effects, indirect consequences that can become apparent over time. It is easy to measure knowledge coproduction, products and direct engagement, and we can identify useful performance metrics like a 16% improvement in cost efficiency per Node over the 3 years. But the impact we’re most interested in is measuring if and how the Node process and insights influence others’ and our own decisions, actions and investments. This is more challenging.

We’ve called this the ‘Node effect.’

Nodes by the numbers

11 Innovation Nodes collaborations

7 Covering areas of exploration

20+ Spanning different disciplines

87 Collaborators

25 Nations

Have co produced

3 Insight Reports

2 Case Studies

11 Insight Briefs

1 Policy Brief with **10** More knowledge products in progress

42,075+ People engaged

3 Across connected conversations and multiple online channels...

But that's just the start of the story...

"How" is as valuable as "what"

Part of the value created by Innovation Nodes is in the approach itself and the pursuit and learning around operationalizing a transdisciplinary approach. Research in transdisciplinary integration shows that engagement, relationships and trust created among, across and within are all factors in enabling second order effects. Other concrete assets include Node toolkits and the impact assessment model.

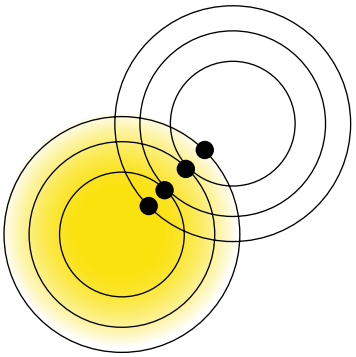
It's a wonderful life

It's a Wonderful Life' is a 1946 movie that illustrates the impact of the main character on the world around him by showing him what it would be like if he had not existed, a counterfactual tale. Nodes unlock the potential of previously unknown areas of innovation for children in underserved communities, and one of the hardest aspects to quantify is opportunity cost.

The counterfactual asks, "What would be lost if this work didn't happen?" Without these efforts, these unknown emerging technologies and approaches and their potential for children would remain unknown. Knowledge products like the Insight Report on Renewable Energy (part of UNICEF's Sustainability and Climate Change Action Plan (SCAP)) would not exist. The opportunity of bringing young people into the heart of science-policy-society interfaces and generating broader network impacts would be absent. Access to new platforms and audiences that Nodes have enabled would remain closed, such as to SXSW, LinkedIn Talent Connect Summit, and the Meridian Institute Summit. And UNICEF would have missed out on strategic positioning for the Pact for the Future, contributions to the Science, Technology, and Innovation Forum, and visibility as a good practice example within the UN Innovation Network, UN System Staff College, the UN Innovation Toolkit, UN Global Pulse, and the Secretary General's UN 2.0 initiatives.

Without initiatives like UNICEF's Innovation Nodes, children run the risk of missing out on the benefits of the possible innovations that are revealed.

SECTION 3



WHAT HAVE WE LEARNED?

WHAT HAVE WE LEARNED?

In the process of designing, building and iterating Innovation Nodes from scratch to 11 collaborations engaging 87 collaborators spanning 7 areas of exploration, here are the 10 things we've learned we can do to meaningfully contribute to global agendas, create value and put approaches into practices.

Contributing to global agendas

1 Move the mandate

Science, technology and innovation (STI) are spheres in which UNICEF also fulfills its mandate to advocate for the protection of children's rights, to help meet their basic needs and to expand their opportunities to reach their full potential.[1] We do so in part through Innovation Nodes, which deliberately engage STIs as they move from research into development[2] and ask how emerging science could be applied to benefit children and advocate for this, and identify opportunities, risks and implications.

2 Act for the pact

In the recently adopted Pact for the Future,[3] Member States committed to a variety of actions including make life-changing science, technology and innovation affordable and accessible to all through increased global, interdisciplinary collaboration. Nodes provide an avenue of moving from intention to action. Their transdisciplinary approach also provides a mechanism for intergenerational STI engagement.

3 Practice open science

Open Science[4] aims to make science more accessible, inclusive and equitable for the benefit of all and to bridge STI gaps and fulfil the human right to science. It is recognized as an accelerator for the achievement of the United Nations (UN) Sustainable Development Goals (SDGs). Innovation Nodes seek to advance Open Science principles as is evidenced in the multistakeholder transdisciplinary collaborations, to the collaboration agreements that guarantee open access to the Node assets coproduced, and the widespread sharing of these resources as common intellectual goods.

Create value through acts of illumination

Illumination in a VUCA world

In a VUCA world — characterized by volatility, uncertainty, complexity, and ambiguity — anticipatory STI insights such as coproduced Node resources, are valuable for navigating and thriving amidst constant change and turning uncertainty into opportunity. Medium-term visibility (3-10 years) and improved science, policy and society (especially young people) engagement means organizations can not only respond effectively to change but also proactively shape it, strengthening relevance, resilience and sustainability in an unpredictable landscape.

Impact through intellectual work

Nodes' evidence-based approach requires a balance of "rigor with humility". Each Node knowledge product is built on solid foundations of relevant, recent, and required knowledge. They are the compilation of an immense number of credible citations, are reviewed by experts in their respective fields, and serve as a credible primary resource for new and collective insight and information. The value of intellectual work — and intellectual philanthropy contributed to Nodes in particular — can be difficult to quantify. An independent impact assessment found Nodes demonstrated best practices and value for money, and identified further returns to be gained from strengthened support and communication, leveraging knowledge resources more, and by applying a model to quantify tangible and intangible value creation.

Unlocking outcomes through possibilities

Complementing the extensive innovative solutions that UNICEF directly supports and implements to address current challenges facing children, Innovation Nodes contributes to outcomes by focusing outward to engage a universe of other possibilities with collaborators. Nodes seek to influence thinking by deliberately injecting children into consideration in emerging research and technologies where they are absent, by unlocking unseen markets, models and opportunities, and by affecting the approaches and actions of others in domains in which UNICEF itself may not be active but which nonetheless hold promise (or pitfalls) for children.

Khazimla, 17

Young people can become pioneers of innovation through their technological literacy. Combined with their hunger to learn, question the unknown, and experiment, which allows them to develop cutting-edge solutions.

Of practice and process

7 The impact imperative

One of the initial Innovation Nodes hypotheses was that the R&D sector would also recognize value in collaborating to better identify and articulate research impact, research translation, improved community engagement, and science communication. We were uncertain as to how committed institutions and individuals would be to practicing these ideals through and with us. We have developed and continue to build a more nuanced understanding of where and how and why these elements vary and can come together in mutually beneficial collaborations.

8 Collaboration has many facets

Collaboration is the foundation of the Innovation Nodes approach. Though challenging to establish because of time, time zones, buy-in, and agreements, this type of collaboration proves instrumental in uniting diverse stakeholders to drive innovation and impact. These collaborations build links between various stakeholders, disciplines, and levels of expertise. They also foster a transdisciplinary environment that may not have been sought otherwise in a siloed world. We have learned that collaboration should not only be transdisciplinary, it should also be diverse. By this we mean including young people, indigenous intelligence, and other diverse knowledge systems, and not only just transcending traditional disciplines.

9 The proof is in the plumbing

To design and refine a replicable Nodes approach involved a lot of unglamorous trial and error! For example, codesigning an agreement with a generous group of colleagues across multiple functions, testing and iterating different models of Node engagement, and iterating ways to understand and improve our effectiveness. Our First Attempts In Learning will continue as we iterate and engage new Node collaborators, more Nodes in developing country contexts, and to refine our collaborator-agnostic models so that they continue to work well across institution types and geographies.

10 Innovation that gives us hope

Innovation is a source of hope and action, embodying change and possibility, not always as something entirely new but also as a reimagining of existing ideas. Some of the basic and applied research that Innovation Nodes explore have existed for years, however what differentiates the work of Nodes and other research is that we are seeking to understand the unique and timely applications of these innovations to generate positive impact for children. Through this work, innovation serves as a catalyst, transforming theoretical research into actionable solutions for every child.

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4. UNESCO. 'Open Science.' Paris. https://www.unesco.org/en/open-science

COLLABORATION OPPORTUNITIES

	Frameworks for freedom	Scope explorations	Sustained exploration
TYPE			
WHO	Young researchers	Senior researchers and academics	Professors to junior researchers
CHARACTERISTICS	4-6 people over multiple months with moderate structure. Open exploration characterized by high degree of ambiguity. *e.g. Explore "known unknowns" and "unknown unknowns" to illuminate potential innovation for children.*	2-5 people over multiple months to explore and probe a "known unknown". *e.g. Future WASH, New and emerging business models for innovations for sustainable development*	Multiple people. A multi-year collaboration with a center of excellence in a "known unknown", emerging domain of transformative innovation for children. *e.g. Applied biotechnology for children*
BENEFITS	• Gain insights into how young people see & relate to issues that matters to them. • Nurture the next generation of changemakers by equipping them with the skills & opportunities to lead transdisciplinary innovations.	• Encourage openness among researchers and research institutions • Increase research impact & engagement • Help build new knowledge & theories	• Encourage openness among researchers and research institutions • Increase research impact & engagement • Help build new knowledge & theories • Gain insights into how young people see & relate to issues that matters to them. • Nurture the next generation of changemakers by equipping them with the skills & opportunities to lead transdisciplinary innovations. • Enhance employability

TRANSDISCIPLINARITY

Challenging to pronounce and practice

Innovation Nodes intentionally apply a transdisciplinary approach — it best fits the why, what, who, where and how. Transdisciplinarity requires participants to challenge assumptions, including their own, encouraging mutual learning and nurturing an open, holistic and integrative ethos to knowledge co-production and innovation. It includes multiple perspectives and diverse knowledge systems — resulting in new conceptual, theoretical and methodological insights that transcend traditional discipline-specific domains and practices.[1]

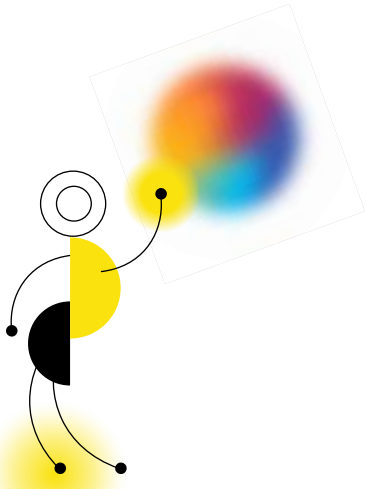
Transdisciplinarity helps Nodes better investigate how emerging technologies can meet future challenges effectively while fully engaging with the reality of unique, changing and complex variables of different communities and contexts. The approach is particularly well-suited to addressing complexity and complex sustainability challenges, which are at the heart of so much of UNICEF's work.

It is an approach that can be challenging and requires consideration.[2] For example, in the global consultation on the UN Pact for the Future,[3] Member States, stakeholders, and civil society organizations used "transdisciplinary" in an earlier version of the Pact, and opted for "interdisciplinary" in the end.

Transdisciplinary is not same as interdisciplinary or multidisciplinary, and Choi and Pak[4] explain the distinctions well:

Multidisciplinarity draws on knowledge from different disciplines but stays within their boundaries. Interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole.

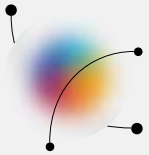
Transdisciplinarity integrates the natural, social and health sciences in a humanities context, and transcends their traditional boundaries.



We'd also be the first to admit that doing so is not easy, these are some of the challenges:

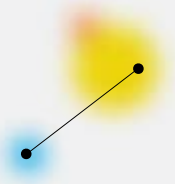
Uncertain outcomes

Transdisciplinary work is exploratory by nature, which can lead to unpredictable outcomes. This uncertainty can be hard for institutions and stakeholders.



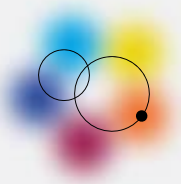
Diverse language and jargon

Different disciplines have their own terminology, concepts, and methodologies.



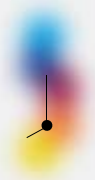
Power dynamics

Transdisciplinary approaches level the playing field across stakeholders and equally value non-traditional knowledge holders such as young people. This may ruffle those used to being accorded traditional power or traditional definitions of experts and expertise.



Institutional barriers

Organizations may be structured in a way that reinforces disciplinary silos, making transdisciplinary work harder to initiate.



Resource intensity

Transdisciplinary projects may require more time and effort than single-discipline projects, as they involve more stakeholders, consultations, and the creation of shared frameworks or models.

Notes for 'Transdisciplinarity'

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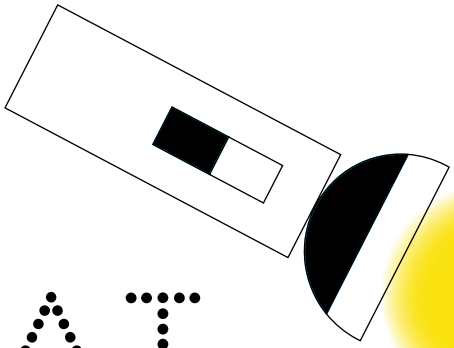

SECTION 4

WHAT HAVE WE ILLUMINATED?

Collaboration with Harvard Consulting on Business and the Environment

THE BUSINESS OF BRINGING A BIOTECHNOLOGY BREAKTHROUGH TO VULNERABLE WOMEN

The challenge

2.8 million mothers and children die at childbirth due to preventable pregnancy complications every year.[1]

95% of these deaths occur in low-and lower-middle income countries.[2]

Affordable and accurate biosensor pregnancy diagnostics can help reduce preventable maternal mortality.

Context

Too many mothers are dying as a result of complications during and following pregnancy and childbirth that mostly preventable or treatable. The major complications related to maternal deaths include severe bleeding, infections, high blood pressure during pregnancy (pre-eclampsia and eclampsia), and delivery complications.[3]

Antenatal care is an important opportunity to diagnose pregnancy-related complications during and following pregnancy and childbirth, but in many low-income countries, mothers and the community health workers who support them do not have access to affordable and timely diagnostics.

In 2014, UNICEF identified the potential of biotechnology to help address this challenge and partnered with the Rhodes University Biotechnology Innovation Centre (RUBIC) in South Africa to develop a Smart Pregnancy Test (SPT).

The SPT is highly accurate, low-cost, and resistant to temperature and humidity. It can deliver lab-quality results without the lab equipment, using samples such as urine.

UNICEF and RUBIC need a market assessment of the pregnancy diagnostic space to ensure women in low-income countries and all marginalized women will benefit from this innovation.

Findings

Innovations

- **The global pregnancy test market** is estimated at USD 1.3 billion in 2022.[4] North America and Europe are the most established markets. Asia Pacific region is the fastest growing market.
- **Potential manufacturers** to produce the SPTs exist in both LICs and HICs.
- **Potential distribution partners:** pharmacies, hospitals and healthcare providers, and online (HICs) and community health workers and Ministries of Health (LICs).
- **Options to distribute SPTs** to low-income women in HICs: government and community organizations and dollar stores based on spatial inequalities.
- **Potential distribution barriers** include: lack of "foot soldiers," product awareness and reaching small rural communities, particularly women in emergency and crisis situations.
- **Potential marketing strategies:** product personalization, brand recognition, strategic market segmentation, and 360º marketing campaign.
- **Competitive analysis and market positioning:** the SPT holds a unique competitive advantage and market position in the pregnancy test market. It is a high-end product with anticipated low production cost, which holds promise of high growth and solid market share in the future.
- **Access and cost:** the aim is to make SPT affordable for women in low-income countries and all marginalized women. Strategies such as geographic licensing carve outs or cross-subsidization could achieve this.

Method

The Harvard CBE team undertook the following activities:

- Conducted high-level research to understand the global pregancy test market
- Assessed manufacturers and distributors with suitable infrastructure, geographical reach and technical capabilities in high-income countries (HICs) and low-income countries (LICs)
- Reviewed antenatal programs and the use of 'smart' health products in LICs
- Reviewed the marketing strategies and pricing structure of industry leaders to help position the SPT in different markets
- Synthesized the findings to develop a go-to-market model for the SPT

Opportunities

For children: The SPT can contribute to a healthy birth for mother and newborn, thereby closing the maternal health gap in sub-Saharan Africa and south Asia. Further, maternal mortality impacts school participation rates.

For the international development community: Biotechnology is changing global health. The SPT strengthens the 'continuum of care' needed, before, during and after pregnancy and childbirth. The interconnection between SDG Target 3.1, SDG 4 (Quality education) and 5 (Gender equality) means the SPT has potential transformative impact for children.

For the private sector: Given the size of the pregnancy test market, the opportunity exists to implement business models that both do good and do good business throughout the biotech value chain from discovery, development, and commercialisation to market entry.

Notes for 'Biotechnology Breakthroughs'

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Collaboration with Harvard Consulting on Business and the Environment

RENEWABLE ENERGY: EMERGING TECHNOLOGIES AND INNOVATIONS

The challenge

1 in 10 people in the world are without electricity[1], predominantly in Africa and rural areas.

17.7% Is the mere share of renewable energy in total energy consumption.[2]

8 million people died from fossil fuel pollution in 2018.[3]

~1 million stillbirths a year can be attributed to fossil fuel pollution.[4]

Key takeaways

After reading this brief, you will know more about

- The challenges, including pollution, are posed by the current energy system
- What opportunities arise in the job market and humanitarian sector through renewable energy
- Which innovations in the sector help advance the transition, such as solar textile or MGA blocks

Context

SDG 7 of the 2030 Agenda for Sustainable Development calls to "ensure access to affordable, reliable, sustainable and modern energy for all". SDG 7 lies at the heart of the Paris Agreement on Climate Change.

The consumption of fossil fuels is driving environmental and climate crises globally and affecting people's health. An estimated 600,000 children under age 5 die each year from respiratory infections related to indoor and outdoor air pollution and second-hand smoke resulting from unsustainable energy practices.[5] The IPCC 2023 Synthesis Report predicts that major energy system transitions can result in rapid reductions in greenhouse gas emissions. But urgent action is needed now, the window of opportunity to enable climate-resilient development is narrowing rapidly.[6] Rapid advances in and proactive adoption of renewable energy technologies can reduce climate risks and greenhouse gas emissions (GHG)[7,8] and accelerate SDG 7 achievements.

Findings

Transitioning to our renewable energy futures

- Renewable energy is cheaper than fossil fuel in most countries. The International Energy Agency anticipates solar PV and wind will account for nearly 95 percent of global renewable capacity additions in 2027.[9]
- Researchers from Stanford University analysed the technical feasibility of energy transition in a range of different scenarios and geographies and concluded that energy for electricity, transport, and building heating or cooling can be supplied reliably with nearly 100 percent renewable energy at different locations worldwide.[10]

Innovation

- Renewable energy technologies can be found across the **three horizons of innovation.** Horizon 1 technologies are immediate opportunities to be harnessed. Horizon 2 technologies (Next Generation) are at the proof-of-concept stage. Horizon 3 technologies are future possibilities where investment in early-stage research and development (R&D) is still needed.
- Innovations in the renewable energy sector are dominated by solar technologies, with a significant rise in patent applications for solar photovoltaics (PV) in the past decade.
- Solar cell technologies are the critical enablers for solar innovations. Emerging or third-generation solar cells such as perovskite cells are predicted to overtake silicon in the solar market in the coming decade and enable innovations such as solar textiles.
- Third-generation solar cells are remarkable because of their ability to make electricity that can be 'tuned' by controlling the kinds of molecules that are produced in the manufacturing process - a breakthrough in rapid energy transfer.[11]

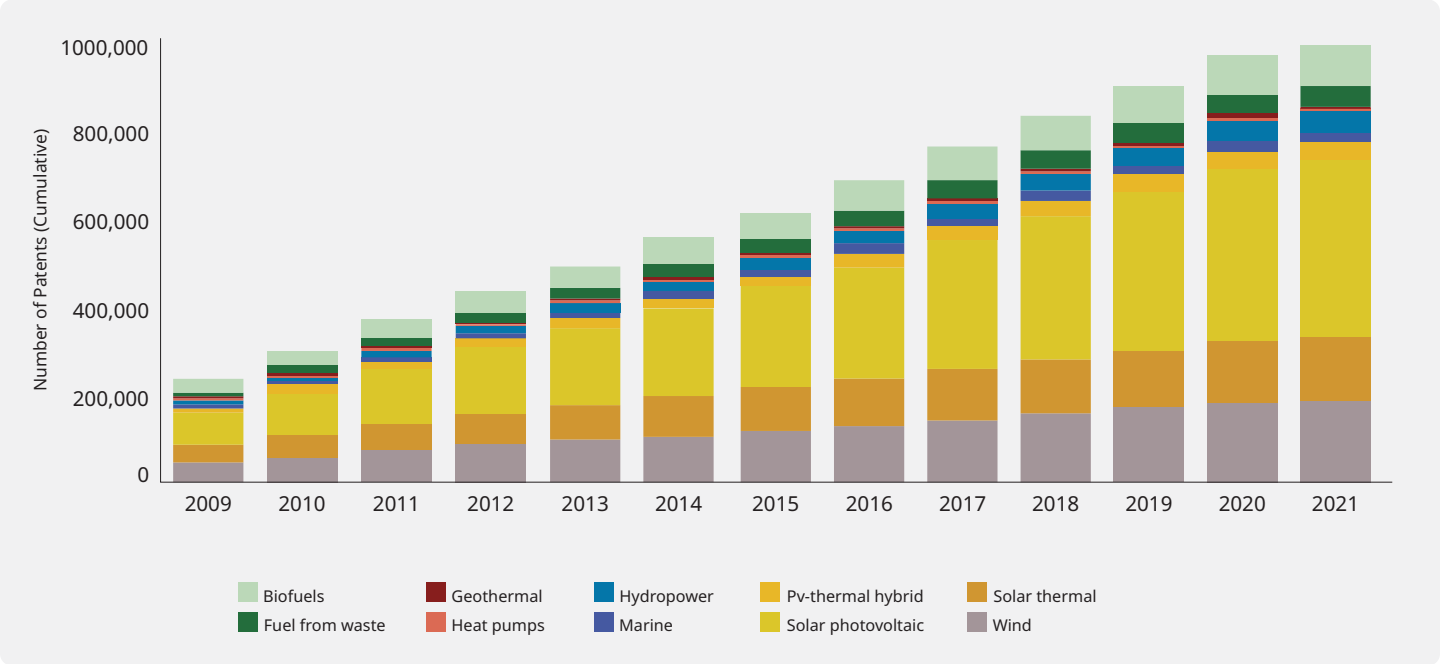

Figure 1: Renewable Energy Patents November 2022

Source: IRENA INSPIRE (www.irena.org/Inspire) based on EPO PATSTAT 2021 Autumn edition, and on the Climate Change Mitigation Technologies (Y02) classification by EPO. ©IRENA

Note: This is not exhaustive information on patents filed for renewable energy worldwide and does not represent all inventive activity worldwide. Some inventors may choose to file individual patent applications.

Innovation (continued)

- Distributed renewable energy systems, including off-grid and microgrids, are flexible, cost-effective, and modular alternatives to large-scale energy infrastructure for communities in Sub-Saharan Africa and South Asia that experience some of the world's biggest gaps in energy access.
- Quantum computing's predictive analytics capabilities can help solve the complex optimization problem of load scheduling — from power generation, transmission, and distribution to demand management - in distributed renewable energy systems.[12]
- The transition to renewables raises the need for long-duration storage. Thermal energy storage technologies such as the Miscibility Gaps Alloy (MGA) technology is a ground-breaking patented zero-carbon renewable energy storage for grid and industrial use.[13]

Impact

- Renewable energies present new employment opportunities for current and future generations. The International Renewable Energy Agency predicts the sector will create 42 million green jobs globally by 2050.[14]
- Sustainable energy solutions can empower girls and young women by increasing school attendance and opening opportunities for women to become energy entrepreneurs.
- As the transition to renewable energy accelerates, we need to address the risk of environmental and human rights impact of critical mineral extraction, development-induced displacement, and solar panel waste.

See Insight Report No. 2 for more information, including the potential of next-generation solar PV technologies and the potential applications of novel renewable energy innovations for the humanitarian and development sector.

Opportunities

- A child rights-based approach to clean, affordable, and sustainable energy can enhance services like education, universal healthcare, and safe water and sanitation.
- The acceleration of the renewable energy transition requires more investments in renewable energy innovations across multiple time horizons to adapt to changing conditions. Further, the adverse impacts on people and environment need to be managed proactively.
- The rise of new technologies such as solar PV demands innovative ways of waste management and repurposing of materials to close the loop in the material life cycle.

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Collaboration with Harvard Consulting on Business and the Environment

PRECISION HEALTH: OVERVIEW

The challenge

Despite improvements in survival and nutrition over recent decades, too many children still suffer and die from preventable and treatable diseases.

Sub-Saharan Africa and Oceania (excl. AU and NZ) have the highest regional mortality rates among 5–24-year-olds in 2021.[1]

Diarrhoeal diseases, malaria, TB, and HIV remained among the top 10 causes of child deaths in 2019.[2]

Key takeaways

- Precision health, an emergent field of healthcare, offers novel interventions to tackle persistent communicable, non-communicable, and rare diseases that affect millions of children and young people.
- Next-generation diagnostics technologies and advances in genomics, gene editing techniques, and RNA therapeutics are changing the way we diagnose and treat diseases from malaria, tuberculosis, HIV/AIDS, asthma, and childhood cancer.
- If precision health is to realize its full potential, it needs to address the risk of exacerbating current health inequalities.

Context

Health lives and well-being is a fundamental human right and a goal of the Agenda 2030 for sustainable development. Advances in life sciences, medicine, and technology offer a new model of healthcare: precision health.[3] The current model of healthcare is designed for the average patient and based on 'signs-and-symptoms'. The one-size-fits-all treatments can be successful for some patients but not for others, and some even experience negative side effects. Precision health, on the other hand, is an emerging field of healthcare that considers differences in people's genes, environments, and lifestyles and formulates prevention strategies and treatments based on their unique backgrounds and conditions.

Findings

Innovation: What is precision health?

- **Precision health** seeks to develop proactive and personalized solutions to health problems that integrate variability in genetic, behavioral, socio-economic, and environmental determinants.
- The aim is to improve the detection, prevention, and management of disease; moving from a one-size-fits-all approach to an integrated, comprehensive, and personalized approach to keep people healthier for longer.
- Precision health is characterized by the 4Ps:
  - **predictive** (identifying and understanding intrinsic and extrinsic risk factors),
  - **preventive** (addressing risk and protective health factors before the development of disease),
  - **personalized** (optimizing treatments and interventions to an individual's needs),
  - **participatory** (involving patients in decision-making processes).[4]
- Precision medicine is a sub-field within precision health.
- Precision health emphasizes the early detection and prevention of disease before it strikes while precision medicine deals with disease management and treatment after the fact.
- Precision health helps to strengthen health systems by offering holistic and personalized insights into internal and external disease factors and responses, and by introducing innovative medical products, vaccines, and technologies that improve health outcomes.[5]

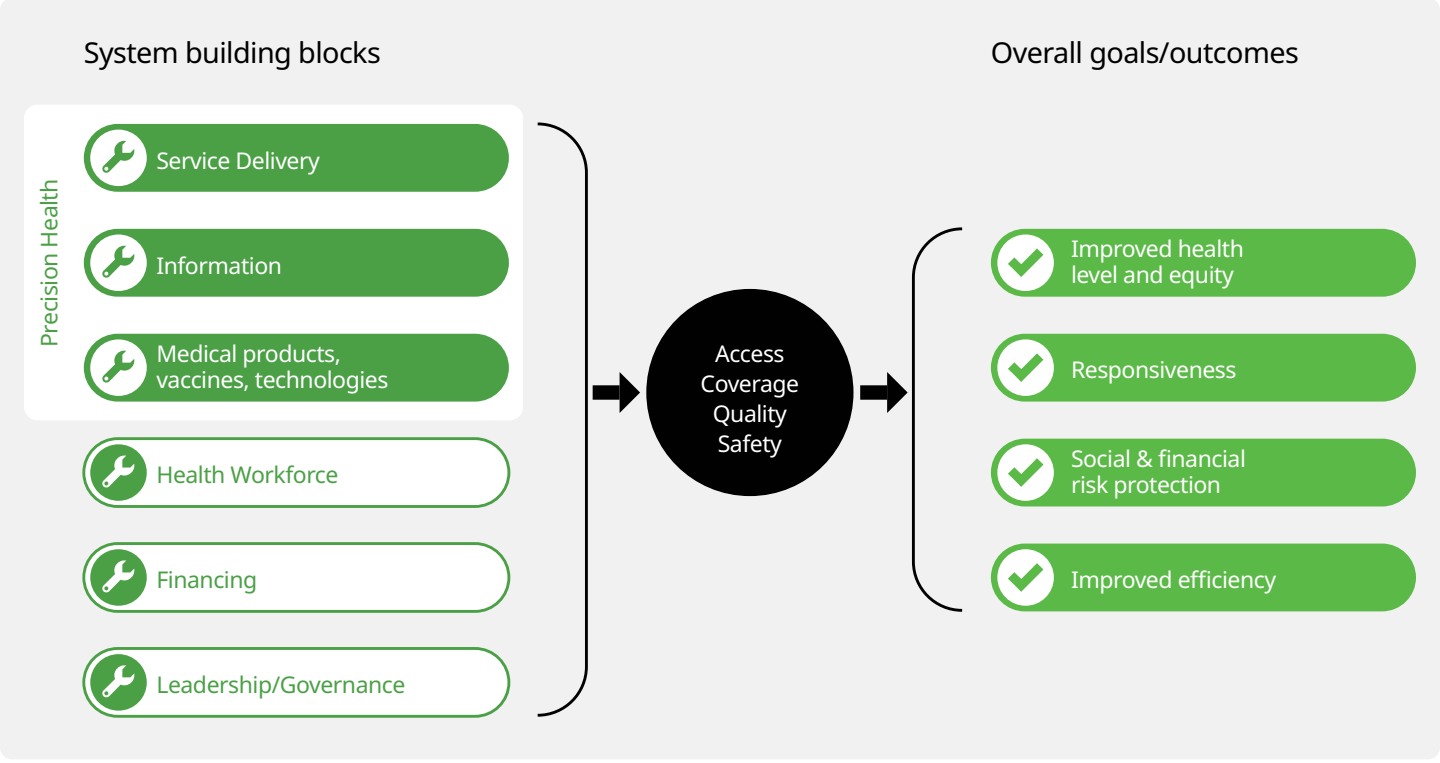

Figure 1: How precision health can contribute to health systems strengthening

Source: UNICEF

Understanding our internal and external environment

Internal

- An essential basis of precision health is knowledge about the biological systems and their interaction and evolution. The Human Genome Project and advancements in systems biology, data science, and biotechnology have unraveled the internal biological underpinnings of health and disease and enabled molecular profiling of diseases through omics technologies.[6]
- Omics is an evolving area of biology that refers to the assessment of various molecular systems such as genomics, transcriptomics, proteomics, metabolomics, epigenomics, and microbiomics, thereby paving the way for rapid health and disease discoveries.[7]

External

- Health is influenced by genetic code and post code (area code). The onset, progression, and recurrence of disease is influenced by biological information, environmental and behavioral characteristics, and the socio-economic and cultural context of individuals.

Impact

- Research in biomarkers, genetics, multi-omics, and next-generation diagnostic and wearable technologies have enabled continuous improvement in the early detection of diseases and the development of personalized prevention approaches.
- An area of research with potential transformational impact on children is genomics surveillance for large-scale virus detection, tracking, and control. Recent large-scale infectious disease epidemics have expanded the application of genomic technologies for pathogen sequencing during infectious disease outbreaks and improved the capability to track and understand pathogen transmission evolution and interaction.[8]
- Precision health enables early detection and accurate diagnosis by integrating a multitude of clinical and other data; optimized treatments to improve dosage and reduce side effects; and accelerated developments of new drugs and therapies by understanding the underlying health and disease mechanisms.
- The potential applications of precision medicine for children and adolescents include communicable diseases such as malaria, diarrhoeal diseases, tuberculosis, pneumonia, and HIV/AIDS; non-communicable diseases such as asthma, and childhood cancer, and rare diseases such as sickle cell anaemia. Many of the diseases are major health concerns for children. Some are among the top ten causes of death.
- The speed with which effective COVID-19 vaccines become available demonstrates the potential of precision health technologies to be applied to public health needs at scale globally.
- There is a risk that precision medicine could increase health inequalities as many interventions are currently very expensive. An equitable approach for precision health would consider two core principles: maximize benefits and mitigate disadvantages.

See Insight Report No. 3 for more information on precision health, including the potential applications of innovations and technologies for the humanitarian and development sector.

Opportunities

Policies and initiatives to guide the translation of genomic and other precision health technologies into the public health system would catalyze transformative change in the application and delivery of clinical services.

- The integration of a life course approach to precision health with an emphasis on unfolding health trajectories of individuals as influenced by their exposure to a range of protective and risk factors. This approach, which stresses the importance of acting early in the life course, helps to position children and adolescents at the center of precision health.
- North-South and South-south cooperation and partnerships are critical. Countries with significant capacity in precision health research should be encouraged or incentivized to collaborate with under- and unrepresented countries. These must be mutual learning experiences where equitable arrangements are made to ensure fair benefit sharing, respectful data, and sample handling. There should also be significant capacity building so that countries in the global south can lead their precision health initiatives.
- The need for business model and value chain innovations that resolve the tension between affordability and profitability. Precision health technologies and innovations are expensive and can require up to 30 years of financial and intellectual investment, all without guarantee of success. Much work is needed to develop business models and incentives that improve health equity and de-risk R&D investment.

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Collaboration with Harvard Consulting on Business and the Environment

ADDITIVE MANUFACTURING: OVERVIEW

The challenge

Traditional manufacturing methods often struggle with challenges such as material waste, high production costs, prolonged lead times, resulting in inefficiencies and environmental burdens.

Customization in conventional manufacturing is limited or of high cost and may lead to technological bottlenecks. AM opens up possibilities for localization of production and context-relevant customization.

AM holds promise in humanitarian contexts e.g. on-demand components, prostheses.

Key takeaways

- Additive Manufacturing (AM) is a revolutionizing approach that prints objects from digital models in contrast to the conventional subtractive manufacturing approach.
- AM has great potential in both development and humanitarian contexts especially as it relates to risk-reduction, preparedness, and capacity.
- AM has different types of printing processes and materials that have distinct features and impacts, enabling various applications.
- AM, applied across domains, has many benefits such as enhanced efficiencies and flexibility, reduced waste, but also faces challenges such as lack of modeling skills and standardization issues.

Context

AM is a transformative approach that builds objects layer-by-layer from digital models. The printing or fabrication of the object, commonly known as 3D printing (3DP), is a part of the AM process. Since the emergence of AM in the 1970s, 3DP is considered a useful rapid prototyping tool. A 2023 report on innovation trends in AM published by the European Patent Office shows that from 2013 to 2020, patents filings in AM grew at a rate of 26.3% annually, nearly 8 times faster than all technologies combined in the same period.[1] Evolving beyond rapid prototyping, AM is now a key component of the 4th industrial revolution or Industry 4.0,[2] and is now capable of designing and manufacturing solutions for various challenges, including disaster risk reduction and recovery, healthcare, and climate change — all areas that significantly impact the wellbeing of children.

Findings

Additive manufacturing value chain

- AM is defined by International Organization for Standardization (ISO) as process of joining materials to make parts from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing and formative manufacturing methodologies.
- The AM value chain has 5 processes: (1) Design and 3D model creation; (2) SEL file generation; (3) Machine and material selection; (4) Fabrication; (5) Post process.
- Innovations in any process along the AM value chain would grow the field of potential applications.
- Localization needs to be better explored to understand feasibility and viability.

Additive manufacturing printing processes and materials

- **AM printing processes** consist of 7 types.[3] Each is distinctive in features and impacts and is explored in the following briefs.
- **Material Jetting:** droplets of feedstock material are selectively deposited.[4]
- **VAT Photopolymerization:** liquid photopolymer in a vat is selectively cured by light-activated polymerization by a mirror.[5]
- **Binder Jetting:** a liquid bonding agent is selectively deposited to join powder materials.[6]
- **Directed Energy Deposition:** focused thermal energy is used to fuse materials by melting as they are being deposited.[7]
- **Powder Bed Fusion:** thermal energy selectively induce fusion between the particles of a plastic or metal powder one layer at a time in regions of a powder bed.[8]
- **Material Extrusion:** material is selectively dispensed through a nozzle or orifice.[9]
- **Sheet Lamination:** sheets of material are bonded to form a part.[10]
- **Materials** play a vital part for the innovation in AM applications. A wide range of raw materials is currently used for different processes, e.g., biomaterials, polymers, composites, alloys, ceramic, etc.
- The **choice of material** depends on its compatibility of AM printing process and material attributes such as layer adhesion, heat resistance, impact resistance, visual quality, load stress, ease of printing, etc.
- **Advancements** in materials with new properties open new possibilities for AM solutions. For example, hybrid materials such as composites, composed of two or more materials that are blended in various ways, create a new material with unique properties that yield benefits, such as reduced production costs and lead times and improved strength, durability, and functionality.

Additive manufacturing applications

- AM have numerous innovative applications in diverse fields, such as sustainability, rehabilitation resilience, biomedical, and humanitarian contexts. Each of the following fields is explored in detail in the report and the briefs.
- In climate change action, AM can be applied to carbon capture, renewable energy and water management.
- In improving community resilience, AM can be applied to earthquake warning, local manufacturing, and construction.
- In biomedical research, AM can be applied to drug discovery, tissue engineering and implants.
- In rehabilitation of disabled people, AM can be applied to transtibial prosthetics, hearing and vision improvement, blindness prevention.
- In humanitarian contexts, AM can be used to support supply, construction, and programmes.
- In circularity, AM has the potential to eliminate the concept of waste and shift the traditional linear take-make-waste model to a closed-loop resource model.

Impact

AM is being applied to different domain and has different strengths and weaknesses.

- **For design**, AM enables efficient and flexible optimization for product development, but faces challenges in limited 3D modeling skills and legal ambiguities.
- **For manufacturing**, AM allows for the creation of complex parts, rapid prototyping and faster user feedback, yet struggles with slower speeds for high volume production and lack of standardization.
- **For product**, AM supports the development and testing of new, highly customized products, but often results in poor surface accuracy and is not suitable for high-volume manufacturing.
- **For material**, AM reduces material usage and facilitates recycling, though it suffers from issues such as material strength, lack of standardization, and toxicity.
- **For cost**, AM reduces transportation and saves large scale factories investment, but the high initial and maintenance costs remain significant barriers, especially in low- and middle-income countries.
- **For sustainability**, AM decreases over-production and material waste, yet lacks awareness and robust sustainability metrics, and struggles with non-recyclability of multi-material products.
- **For supply chain**, AM improves its efficiency but lacks economies of scale.

Opportunities

The potential of AM is increasing due to advances in digital production technologies, advanced robotics, machine capabilities and materials such as high-performance metals and biomaterials, opening up a wide range of opportunities in the humanitarian and development sector, such as preparedness, disaster recovery, population health, sustainability, and rehabilitation, as well as risks in security and peace. Localization of AM is possible and efforts to better understand how to build this capacity (e.g. training), as well as how to geographically place technology (e.g. transport) are being explored. The following briefs will explore in detail AM's opportunities in these fields and the actions we can take to maximize the value of AM.

See Insight Report No. 4 for more information on additive manufacturing, including the potential applications of innovations and technologies for the humanitarian and development sector.

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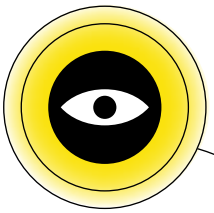
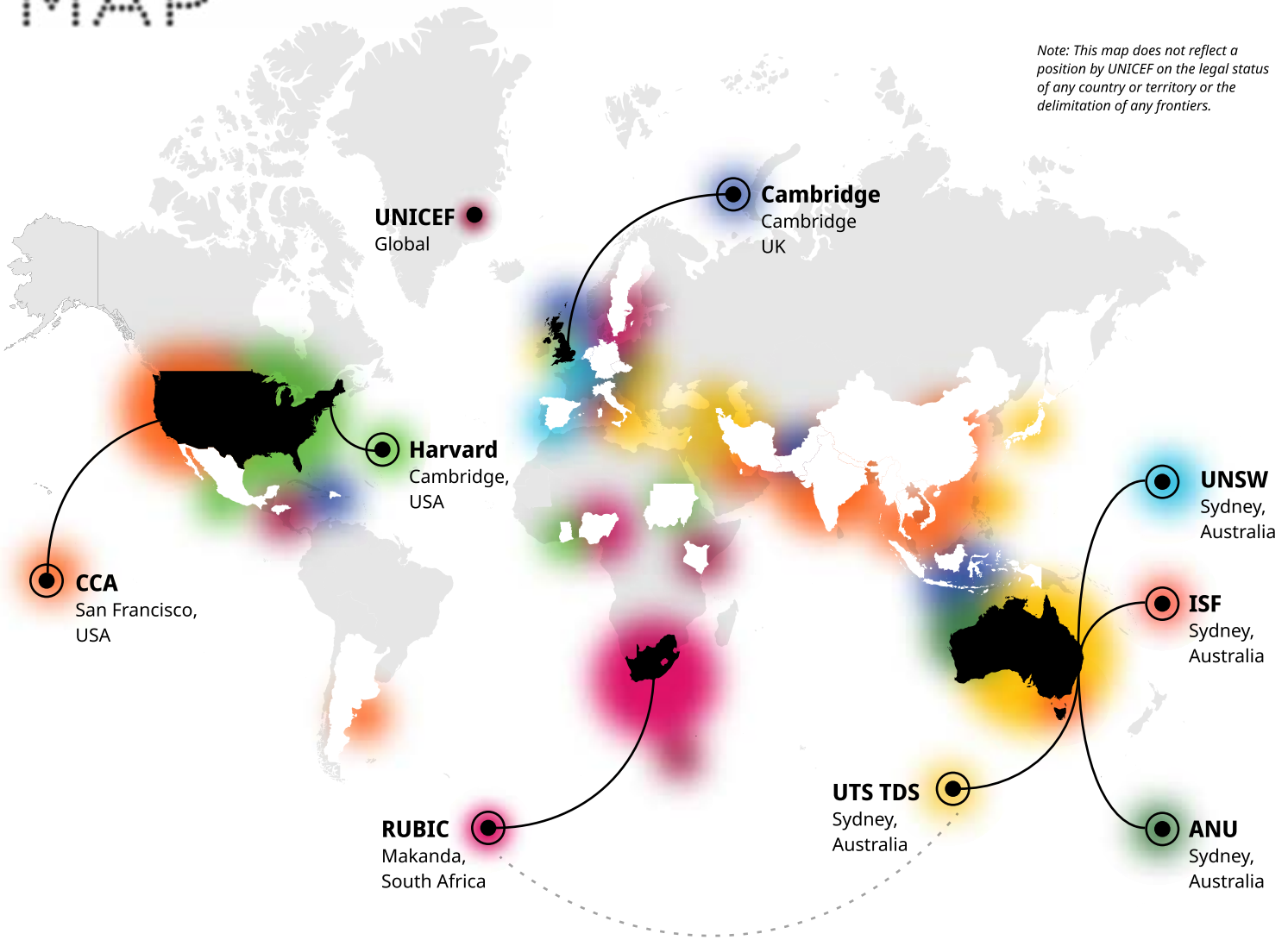
SECTION 5



WHO ARE WE EXPLORING WITH?

COLLABORATOR MAP



NODE PROFILES

AUSTRALIAN NATIONAL UNIVERSITY

Photo Credit:
ANU Photo Library

The collaboration

Collaborator: The Australian National University (ANU) is a world-leading centre for research, education and policy engagement. It is a public research institution located in Canberra, Australia.

Collaboration: The ANU College of Business and Economics (CBE) conducts research on a wide range of pressing issues in business and economics. This work has advanced knowledge, informed public and private sector practices and translated into societal benefits. CBE is committed to using its research expertise to tackle emerging issues in business and economics.

The CBE team for this collaboration includes a Professor, Lecturers and Senior Lecturers, and PhD students covering research focus areas spanning innovation, entrepreneurship, asset pricing, finance, funds management, public policy, health economics, public health, domestic and family violence, workplace gender equality, design, and actuarial studies.

This CBE collaboration began in late 2024 and is a part of the Innovation Node workstream on 'New and Emerging Business Models for Innovation for Sustainable Development'. Published literature predominantly concentrates on for-profit models[1] that aim to maximize value as it relates to profit.[2] There is comparatively limited research and evidence on business models for innovation in the social or development sectors.

This collaboration will systematically review the academic literature on business models for social impact, provide insights into business model elements and changes that relate to social impact and financial impact, and map these elements.

The impact

One of the consistent challenges facing innovation, whether in the for-profit or non-profit sector, is deriving a sustainable business model. As innovation-related activities in the social and development sectors remain primarily funded through grants, the systematic study of new and emerging business models with a particular focus on financial sustainability of innovations in these sectors holds immense value: the promise of better understanding how to do more, better, with less.

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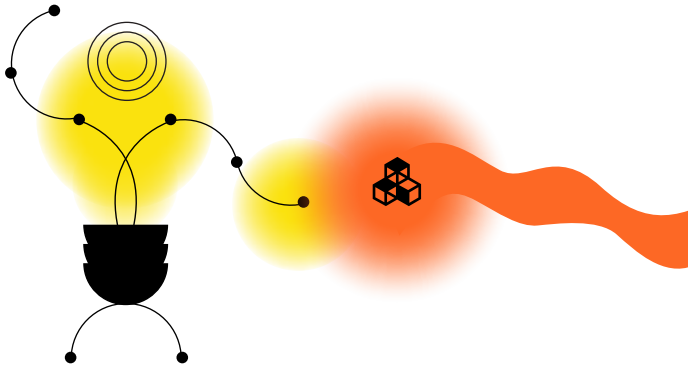

NODE PROFILES

CALIFORNIA COLLEGE OF ARTS

The collaboration

Collaborator: The California College of the Arts (CCA) is an art and design school cultivating ideas, industry, and impact. Its focus is educating its students to become global changemakers and versatile makers with inventive solutions to advance culture and society. CCA is located in San Francisco, USA.

Collaboration: CCA understands the role of artists, designers, architects, and writers in solving cultural, environmental, and economic problems. It is noted for curricular interdisciplinarity, breadth of programs, and commitment to social responsibility.

The CCA Design Division multi-year Node collaboration began in 2023. Each year, graduate students in the MDes Interaction Design program's Social Lab tackle a complex social systems challenge. The students combine creative risk-taking and the rigorous pursuit of craft and ideas to envision alternative futures and deliver inspired solutions with their community partners, ranging from global enterprises to regional non-profits and local funded start-ups.

Innovation Nodes meaningfully engage children and young people as knowledge holders by applying a transdisciplinary approach to science-policy-society interfaces, and work to strengthen the position of children and young people. There are multiple barriers to comprehending sometimes complex STIs for people of any age, and moreso children.

1. These are enshrined in multiple international human rights instruments including Article 27 of the Universal Declaration of Human Rights, and Article 15 of the International Covenant on Economic, Social and Cultural Rights. This has been reinforced in the Pact for the Future.

The impact

The design research challenge set out by Innovation Nodes in 2023 was located within the issue that while children, like people of all ages, have the right to "share in scientific advancement and its benefits,[1]" they may not be meaningfully engaged in the implications of science, technology and innovation (STI) on their lives.

Taking "biotechnology" as the subject, this design research explored how might children between 10-13 years of age come to understand "biotechnology" such that they might be better prepared to meaningfully consider in its implications for their lives. Over 6 months, a team of 4 graduate design students undertook research, derived insights, generated and tested concepts, and iterated and co-created prototypes with children in 6 countries in 5 languages.

In 2024, the focus switched to the adults in the science-policy-society interfaces, specifically to gain better insights into how researchers, policymakers and development practitioners discover, consume and share STI information. Renewable energy was the topic used for this design research, and the four-person team identified information behaviors and preferences, and developed creative concepts to more effectively connect with and leverage intermediaries and knowledge brokers in strengthened science-policy-society interfaces.

In tackling complex, real-world challenges, students are immersed in a transformative experience that sharpens their skills and deepens their understanding of systemic issues.

Professor Helen Maria Nugent, Dean of Design, CCA

NODE PROFILES

HARVARD CBE

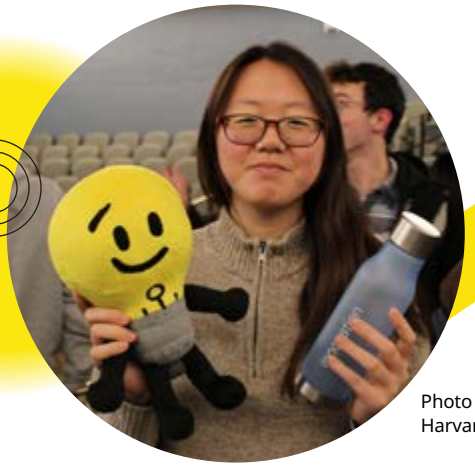

Photo Credit: Harvard CBE

The team members working on this were interested in becoming physicians, activists, politicians and businesspeople. It offered an incredible opportunity for us to... understand how research innovations lead to impactful change

Margaret Yin, Harvard CBE analyst

The collaboration

Collaborator: Harvard University is a private research university in Cambridge, Massachusetts, USA. Harvard Undergraduate Consulting on Business and the Environment (CBE) is a university-associated industry practice organization that provides strategy consulting services to organizations around the world.

Collaboration: Modeling transdisciplinarity from the outset and over multiple years, CBE brought together case teams of students spanning economics, psychology, mathematics, pre-med and health, English, business, neuroscience, integrative biology, and anthropology.

The collaborations invited students to drive the exploration of potential domains of impact and identify 'unknown unknowns' for potential further exploration. An iterative analytical process identified factors considering relevance, potential impact, effectiveness, sustainability, adaptability, scalability, social inclusion, affordability, cost effectiveness, potential risks, and negative externalities. These collaborations identified and subsequently explored a number of areas that have been released as Insight Reports.

Another Harvard CBE collaboration brought together two Nodes — both Harvard CBE and the Rhodes University Biotechnology Innovation Centre (RUBIC). This collaboration unpacked the interplay between market systems and innovation systems specifically in the pregnancy diagnostic space to better understand how emerging research in point-of-care diagnostics could go to market to benefit women in underserved communities in emerging economies. This work brought a concrete example to the broader issue of under-representation of research and development from developing countries, and access to and technology transfer of emerging science, technology and innovation across countries — both key areas subsequently identified for action in the UN Pact of the Future.

The impact

At the establishment of Innovation Nodes, Harvard CBE stepped forward to be a learning collaboration partner, helping us to test and iterate our processes and agreements; develop our models for collaboration; and to do so through multiple projects exploring an array of emerging technologies.

The results of this multi-year collaboration are in having young people co-design and co-produce our processes, templates and models of operation from the outset, as well as undertaking the analysis work informing the Insight Reports on Renewable Energy, Precision Health, Additive Manufacturing, and the Business of Bringing Next-generation Biosensor Diagnostics to Vulnerable Women.

NODE PROFILES

INSTITUTE FOR SUSTAINABLE FUTURES

The collaboration

Collaborator: The Institute for Sustainable Futures (ISF) is an independent research institute within the University of Technology Sydney. The Institute conducts transdisciplinary, project-based research in line with their vision of creating positive change towards sustainable futures. ISF researchers bring together expertise in a wide range of areas including engineering, architecture, economics, science, social science, international studies and political studies, to deliver practical and holistic solutions to complex problems.

Collaboration: This collaboration brings together one of ISF's areas of research expertise — water — with UNICEF's commitment to building, accelerating and scaling transformational climate resilient solutions for a WASH secure future through its Global Sustainable WASH Innovation Hub.

ISF has established research expertise in integrated water systems, smart buildings and digital water, the circular economy in water, energy and waste, water and wastewater planning for low- and medium-income countries, and decision-making under uncertainty. Researchers are synthesizing frontier knowledge and novel technologies and innovations that are potentially transformational climate resilient solutions for a WASH secure future of universal and equitable access to services for children, that addresses water, sanitation, hygiene, and climate resilience — addressing the ambition of Sustainable Development Goal 6.

The impact

This horizon scan leverages transdisciplinary WASH expertise to discover and highlight innovation opportunities by focusing on 'things to come', future and emerging WASH research and development and innovations that hold promise of the transformative impact for WASH, particularly for children and women in low-resource settings.

Fostering innovation in programming and advocacy for children was identified as a key change strategy to achieve the ambitious targets of the UNICEF Strategic Plan 2022-2025 to help realize the child-related Sustainable Development Goals (SDGs). The knowledge products will be assets for the UNICEF Sustainable WASH Innovation Hub, which sources, pilots and scales transformational and frontier climate resilient innovations that respond to key programmatic challenges that, if solved, will unlock faster progress for a water secure future for children and young people.

Knowledge products/output: The Insight Report, Insight Briefs and Connected Conversations and other engagements will be released in 2025.

NODE PROFILES

RHODES UNIVERSITY

Inside one of the labs at the Rhodes University Biotechnology Innovation Centre (RUBIC), Photo Credit: UNICEF

The collaboration

Collaborator: Rhodes University spans the faculties of humanities, science, commerce, pharmacy, law, and education and per capita ranks highly in terms of research outputs in Africa. The university focuses on the pursuit of excellence in teaching, research, and community engagement. The institution is located in Makhanda, South Africa.

Collaboration: The Rhodes University Biotechnology Innovation Centre (RUBIC) undertakes transdisciplinary research and learning and engages academia, industry, the private sector and communities. RUBIC's vision is to create an enabling environment for the translation of biotechnology-related research into products or processes with socio-economic value (Innovate) and to serve as the academic home for the discipline of Biotechnology through targeted programmes in postgraduate and undergraduate teaching and research (Educate) and in science communication (Communicate).

As scientists we want to do research that impacts people. Through this collaboration we feel connected now to a global drive to bring life-saving and life-changing technology to children and women in need across the world.

Prof. Janice Limson, Director, RUBIC, and South African Research Chairs Initiative (SARChI) Chair in Biotechnology Innovation and Engagement

The RUBIC multi-year Node collaboration began in 2022, building on earlier innovation work with UNICEF. The goal of this collaboration centres on research translation and science engagement around the potential of biotechnology for transformative innovation for children.

This work informs a better and more accessible understanding of emerging areas within biotechnology, what the current and potential application for the humanitarian and development sectors might be, illuminating how biotechnology might catalyze innovations to improve the well-being of children. As a concrete demonstration, market shaping of next generation, aptamer-based point-of-care diagnostics for underserved children, women and their communities is an area of focus. The Node also serves to train a new generation of biotechnology students, better equipped to address societal challenges through science and transdisciplinary approaches.

The impact

This collaboration has produced numerous resources and results, engaging expert and non-expert stakeholders alike (included below). Peer-reviewed publications and a book chapter have shared the knowledge gained in aptamer-based diagnostics with the R&D community, while Insight Reports and Briefs and Connected Conversations have engaged non-expert audiences to enhance the understanding of the field of biotechnology and its opportunities and relevance to children and communities in developing country contexts and to engage stakeholders as participants in innovation in biotechnology.

This also led to a concrete outcome — government investment to establish the DSI NanoMicro Manufacturing Facility in Paper Based Diagnostics.

Further, this Node has catalyzed actions by RUBIC with other institutions to examine how transdisciplinary approaches can be applied to address the needs of underserved communities and exploring ways to embed transdisciplinary methods into higher education to enhance research and teaching methods. Plans include a teaching module on transdisciplinary approaches, joint research projects and student exchanges.

Knowledge products/output:

'The story of aptamers: From fundamental research to applied fields of study and back again,' Communicating Discovery Science Symposium, 18-20 November 2024.

'Connected Conversation: Toward Equity in Precision Health', UNICEF Office of Innovation, 11 July 2024

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NODE PROFILES

UNIVERSITY OF NEW SOUTH WALES

Photo Credit: Dr Victor Wong/Dreamstime

The collaboration

Collaborator: The University of New South Wales (UNSW) is a public research university based in Sydney, Australia. The UNSW Business School is a leading business school in Asia-Pacific, recently named Best Business School in Australia for the third consecutive year (AFR BOSS), reinforcing its reputation for innovation, research excellence and teaching. The Business School focuses on societal impact by championing bold ideas that drive social progress and by engaging in partnerships that contribute to economic growth and social progress.

Collaboration: The UNSW team for this collaboration includes two Professors, a post-doctoral researcher, a doctoral student and research assistants spanning the School of Management and Governance and the Business Insights Institute. Together with UNICEF's Venture Fund team, the collaboration will dive into understanding sustainable business models for innovation and sustainable development through the experience and evidence from three selected start-up companies located in developing countries that have been funded via the Fund.

The impact

By systematically documenting and sharing knowledge about effective business models, these findings will benefit a wide range of organizations — such as startups, youth entrepreneurs, funders, and investors — working in the social and development sectors. This collective understanding will help drive more effective and sustainable innovations, ultimately creating lasting impact for children and communities worldwide.

Knowledge products/output: This collaboration is a part of the Innovation Node workstream on 'New and Emerging Business Models for Innovation for Sustainable Development' with knowledge products planned to be released from 2025 onwards.

NODE PROFILES

UNIVERSITY OF CAMBRIDGE

The collaboration

Collaborator: The University of Cambridge in the UK was founded in 1209 and is the fourth-oldest university in the world. It sits at the heart of one of the world's largest technology clusters and has a global reputation for innovation. The university promotes the interface between academia and business and its Judge Business School exemplifies this pursuing innovation "through inter-disciplinary insight, entrepreneurial spirit and collaboration." Cambridge Judge focuses on solving "real-world problems that have a lasting impact on society."

Collaboration: There is limited research on business models tailored specifically for innovation in the social and development sectors. Organizations in these areas often adapt models from the for-profit world to achieve social impact. There is still a significant gap in systematically understanding and designing business models that achieve financial sustainability in innovations geared towards sustainable development. Innovation Nodes has developed a multi-phased body of work and convened collaborators to address this gap and examine emerging business models for innovations for sustainable development.

A group of Cambridge Judge MBA graduate students were invited to develop the first business model case study examining government integration as a business model. Integration involves a government fully adopting and mainstreaming an innovative program such that it continues to be operated and maintained by the government.

Bringing together both their graduate studies and work experience from three emerging economies and with faculty guidance, the team undertook primary and secondary data gathering, analysis and synthesis to develop a framework to help identify when government integration would be an appropriate business model option and a preferred strategy to successfully scale and sustain an innovation.

The impact

Through this collaboration, the team from Cambridge Judge delivered an insightful report that addressed the complexity of the challenge and presented a highly feasible solution for implementation. In addition to the research and framework, the team also developed methods and recommendations from this first business case study process that is helping subsequent teams from other Node collaborators to tackle the same question but for a different business model and example.

My experience in this project gave me a completely different worldview of how to solve important problems in society, and how solving those problems requires cross-pollination of ideas from different disciplines and backgrounds.

Aria Nurfikry,
Cambridge MBA Candidate 2024

NODE PROFILES

UNIVERSITY OF TECHNOLOGY SYDNEY

The collaboration

Collaborator: The University of Technology, Sydney (UTS) is a public university of technology that is committed to research, innovation and the dissemination of knowledge of public value. As a public purpose institution, UTS is committed to supporting positive social change and applies a model of global practice-oriented learning. UTS is located in Sydney, Australia.

The university's TD School is where different disciplines come together to explore ideas that improve the way we live and work in the world. The TD School applies an innovative approach to education and research and integrates different perspectives, data, information, tools, concepts, techniques and theories from multiple disciplines to discover new ways to tackle problems together. The School offers majors in creative intelligence and innovation, data science and innovation, and an array of transdisciplinary electives.

Collaboration: Transdisciplinary teams of 6 to 7 students have engaged in multiple Node collaborations since 2023, to develop ideas and strategies that tackle complex challenges.

Coming from a science background, I was initially unfamiliar with the business and social enterprise space, but I was able to learn a lot from my peers as they drew upon knowledge from their core disciplines.

Katie Yeung, UTS, 2024

One such challenge was creative ways to explore the global innovation ecosystem, new discovery methods, and a visualization tool to facilitate new knowledge discovery. The students collaborating on this were studying Digital & Social Media, Forensic Science, Media Arts & Production, Marketing and Science in IT and gathered inputs from primary research among informants representing even more diverse disciplines and thinkers.

Another team tackled the challenge of examining and documenting a deeper understanding of social enterprise as an emerging business model for innovations for sustainable development. This team was equally diverse, bringing together students majoring in Environmental Science, Fashion & Textiles, Finance, Sport Management, Public Relations and Forensic Science.

The impact

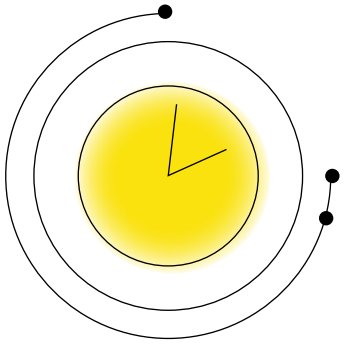
The TD School advocates that, "Transdisciplinary thinking illuminates possibilities for the future by building on multiple ways of knowing, uncovering novel approaches to the challenges of our time." This captures well the impact of these collaborations, which have informed and iterated our internal practice, as well as provided the initial level of research for forthcoming knowledge products.

The TD School is among the ecosystem of Node collaborators that have been a part of a catalytic 'node effect' as is well illustrated in the example of Investing in Building a Transdisciplinary Future.

Knowledge Products/Output: This collaboration contributed into other resources that have and will be released and has informed internal Node practices.

SECTION 6

WHAT IS ON THE HORIZON FOR NODES?



THE FUTURE OF NODES

UNICEF's Innovation Nodes are inherently **future-focused**. But what does the future of Nodes hold? As we look to the year ahead, we're energized by the prospects for sharpening our approach, enriching our network of collaborators, exploring new dimensions of the unknown, and — most importantly — **deepening our impact for children**. Here is a sneak peek at what's in store.

How will we sharpen our approach?

Being effective explorers of the unknown requires curiosity not only about what we explore but also how we do so. Efforts to sharpen our approach in the year ahead will be anchored in the learning opportunities we have identified around different Node models. We will also deepen synergies within UNICEF's Office of Innovation to further connect the Nodes with other programmes and platforms for investment, implementation, and impact at scale within the broader innovation ecosystem.

How will we enrich our network of collaborators?

We will continue to invest in diversifying our network of collaborators, forging relationships with new institutions and experts and bringing new domains of expertise into our transdisciplinary approach. Particular effort will be made to engage more collaborators in Lower- and Middle-Income Countries (LMICs). We will also explore opportunities to connect to the interest in convening collaborators across Nodes as well as others interested in this work, fostering peer-to-peer exchange, unexpected connections and more catalytic node effects.

What unknown areas of potential impact might we explore?

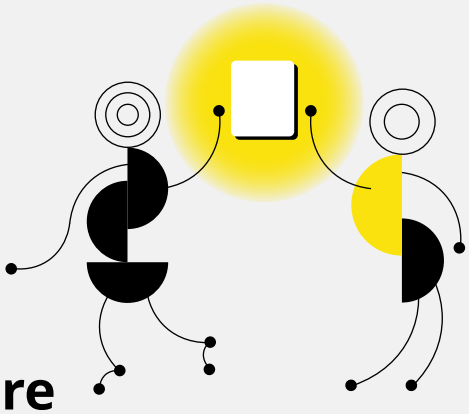
Several existing Nodes will yield knowledge artifacts to spark new insight and connections in the year ahead. These include our Nodes focused on additive manufacturing and future WASH, as well as our Nodes focused on understanding business models for innovations for the SDGs and new approaches to possibility-led innovation that contributes to healthy context. New Nodes will also take shape across a range of thematic and strategic areas of exploration (watch this space!).

What impact do we strive to have?

The Node Effect is about generating outsized impact through creative collaboration. In the year ahead, we will focus particular energy on connecting the outputs of the different Nodes with opportunities for further investment and adoption. Driving more evidence-based programming and policy rooted in innovation will remain a central component of the 'Node effect'. Finally, we will continue to invest in more rigorous measurement of the impact we have in the world in order to further demonstrate the value proposition the Nodes offer in driving impactful innovation for every child.

THE FUTURE

JOIN THE NEXT STAGE OF OUR JOURNEY



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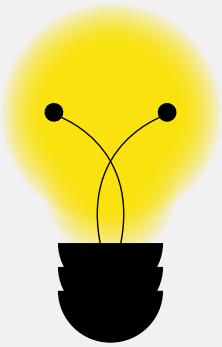

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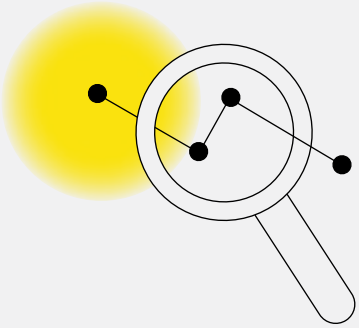
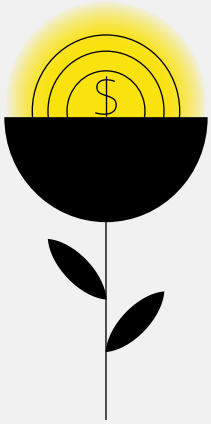


Explore



Invest

Join Nodes