PATTERNMAKERS

Inspiring AUSTRALIA Queensland

August 2022

Impact Evaluation: Inspiring Australia Queensland 2017-2021

Final Report

Acknowledgments

This report was prepared for Inspiring Australia Queensland by research agency Patternmakers.

The authors would like to acknowledge the individuals involved in this research project, including case study participants and Inspiring Australia staff.

Inspiring Australia Queensland and Patternmakers acknowledge the traditional owners of the land and the contribution of the Aboriginal and Torres Strait Islander peoples of Australia past, present and future.

About Inspiring Australia Queensland

Founded in 2010, Inspiring Australia's goal is to improve the communication, appreciation and understanding of scientific knowledge in Australia. Responding to a growing disparity between technical knowledge held by the STEM workforce and the general public's understanding of science, it aims to make science accessible, approachable, and even fun.

Inspiring Australia Queensland is the Queensland chapter of Inspiring Australia, responsible for managing programs in the state that contribute to the national objectives. These include QLD-based events for National Science Week, a network of STEM Hubs across regional QLD, and Seed Grants to support community-based science and science outreach.

About Patternmakers

Patternmakers is a research agency specialising in culture, creativity and community. We believe in the power of insight to help good causes reach more people and deliver even greater impacts. For any questions, please contact Tandi Palmer Williams, Managing Director on tandi@thepatternmakers.com.au.

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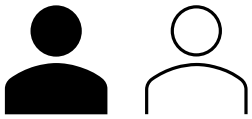
Reach



1 in 2

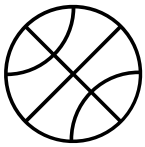
adults in Queensland are aware of National Science Week, making it one of the highest profile science events in the State, according to a survey of 1,200 people by Kantar public[1]

18%

of adults surveyed say that someone in their household participated in National Science Week in 2021, up from 8% in 2018[2]

170,000

twitter users were reached through a social media 'takeover' campaign in 2021, which profiled top scientists in QLD



5,000

people attended an IAQ-sponsored Firebirds game in 2019, highlighting links between sport and science for a mainly young female audience

Impact

Inspiring

young people – e.g., by influencing study and career choices, as demonstrated by the **Firebirds** and **Future Earth** case studies

Platforming

STEM role models – e.g., by showcasing scientists from under-represented groups, as demonstrated by the **Indigenous Science Experience at Logan** and **Firebirds** case studies

Supporting

regional science – for instance, building the capacity of regional STEM organisations, as demonstrated by the **Cobb+Co** case study

Busting myths

about trades and industries – for instance, by showing that the trades are STEM careers, as demonstrated by the **Tec-NQ** case study

[1] According to a 2021 report by Kantar Public for the Office of the Queensland Chief Scientist, n=1.200. Data was weighted to 2011 ABS Census data to ensure the sample was representative of age, gender and location statistics in Queensland. The results are statistically significant at a confidence interval of 95%.
[2] Ibid.

Summary

This report examines the impact of IAQ from 2017 to 2021

During the period 2017 to 2021, Inspiring Australia Queensland (IAQ) invested $144,000 each year to support STEM engagement in the state – with $75,000 devoted to National Science Week (NSWk).

Ahead of a new funding period beginning in 2022, it commissioned a series of stakeholder interviews, data analysis and 5 case studies to evaluate its impact and identify learnings for the future.

IAQ is seeding science activity across the state, leading to important outcomes for event organisers and participants

In 2021 alone, 258 NSWk events took place across Queensland – including 25 online-only and 227 in-person or hybrid activities. Despite two years heavily impacted by the pandemic, IAQ has continued to achieve its objectives, funding 57 NSWk Seed Grants and 6 Regional STEM Hubs from 2017-2021.

Although some events were delivered online or cancelled, overall the NSWk brand gained traction in the public imagination, doubling its reach between 2018 and 2021.

Exploration of 5 case studies shows that the model is powerful in seeding new STEM initiatives and allowing organisations to grow their ambition and scale. Exciting possibilities are evident in terms of education, and industry and regional development.

There is a case for stronger strategic planning and evaluation, to ensure the program rises to the challenges of the time

Looking more broadly, there are some concerning trends - for instance, public interest in science has decreased from 68% to 60% and young people are among the most likely to be disinterested. Nationally there are signs Australia is not keeping pace on STEM education and job-readiness, and women and First Nations people continue to be underrepresented in STEM fields.

Meanwhile, visibility of IAQ outcomes in these areas is low, and a clear program logic or 'Theory of Change' is needed to establish strategic priorities and support evidence-based planning and decision-making.

There is a strong case for additional investment, and cultivation of industry partnerships could allow Seed Grants to expand to multi-year initiatives, which would be powerful in accelerating impact, particularly in areas of strategic importance to QLD STEM. Greater coordination and knowledge-sharing at the regional, state and federal level could help maximise impact – and stronger administrative and evaluation processes will be needed to meet the needs of new partners.

Key findings

Need for the program

The need for programs like IAQ appears to be increasing, as Australia faces worsening STEM outcomes in some areas

STEM is a crucial part of Australia's economy, but there are concerning trends regarding STEM education and job-readiness in Australia, underscoring the need for IAQ to continue and even leverage greater investment in future.

A STEM education toolkit by the Department of Education, Skills and Employment suggests that Australian school students' results in science and maths subjects are on a downward trend. An international benchmarking study by ACER found that, while Queensland students continue to perform about the OECD average, their performance in mathematical and scientific literacy has decreased over time. Mathematical literacy decreased by 30 points between 2003 and 2018, while scientific literacy decreased by 17 points between 2006 and 2018.

Furthermore, women and First Nations people continue to be underrepresented in STEM education and employment – restricting the size and diversity of Australia's talent pool.

There are concerns that if educational outcomes don't improve, Australians will not be job-ready for the careers of the future. The demand for STEM skills is highly unlikely to diminish – and the need for programs like Inspiring Australia Queensland could even be heightened in the future.

Activities

Inspiring Australia Queensland invests $144,000 each year to support STEM engagement in the state – with $75,000 devoted to National Science Week

Inspiring Australia Queensland is responsible for managing two funding steams, both of which contribute to STEM engagement in the state:

- **Targeted STEM Engagement** ($69,000) is allocated according to a project plan determined at the beginning of each year. Among other kinds of targeted STEM outreach, it supports six **Regional STEM Hubs** in Cairns, Rockhampton, Townsville, Gympie, Gladstone and Darling Downs – each of which receives between $5,000-$7,000 in funding in each year.
- **National Science Week (NSWk)** events ($75,000) are managed and promoted by the National Science Week Coordinating Committee, with $25,000 dedicated to developing the primary NSWk event for the state. A further $40,000 is made available to STEM organisations across Queensland in the form of 'Seed Grants' – designed to help organisations across the state grow in capacity and ambition. $5,000-$10,000 is invested in marketing and communications activities to promote the QLD NSWk program to the public.

Key impacts

18% of Queenslanders participated in National Science Week in 2021, with digital events helping to increase the event's reach

According to a survey of 1,200 Queensland residents aged 18+ by Kantar Public for the Office of the Queensland Chief Scientist, NSWk has broad awareness among Queenslanders – and around half of respondents had heard of National Science Week in 2021 (48%, a statistically significant increase from 42% in 2018).

1 in 5 (18%) respondents aged 18 reported that someone in their family participated in National Science Week events in 2021. This was a significant increase from 2018, when 9% of respondents indicated someone in their household had participated. The digital availability of events appears to have made them more accessible – with around 1 in 5 people participating doing so online.

The sample was designed using quotas from all of Queensland's regions – and was weighted to 2011 ABS Census data to ensure that the results were representative of the QLD population in terms of age, gender and location.

Major National Science Week events have reached up to 5,000 people in-person and 170,000 people online

Of the major events organised by the NSWk Coordinating Committee, live events like the Queensland Firebirds Game have spread the IAQ message to up to 5,000 people - while a Twitter Takeover allowing STEM experts to answer questions and promote their research garnered 170,000 impressions.[3]

A 2019 National Science Week survey, designed by University of Sheffield Masters Student Milly Giggs and administered digitally to 125 attendees of NSWk events, found that 9 in 10 respondents agreed that NSWk events 'made them want to learn more about science', and similar numbers agreed that they 'learnt something new about science today'.

Although these results may vary from event to event, there are signs that NSWk is achieving its goal of making science accessible and appealing for many attendees.

'Edutainment' appears to be a powerful strategy – with participatory, gamified and non-conventional approaches to science learning demonstrating that science can be entertaining, accessible and fun. Demonstrations, hands-on experiments, challenges, contests, problem-solving activities are among the range of activities used to engage audiences with many different kinds of science – including robotics, forensics, Virtual Reality, conservation, zoology and coding, among others.

NSWk Seed Grant activity is reaching Queenslanders in schools, libraries and other public spaces

Seed Grant activity is successfully reaching Queenslanders across the state, with case studies suggesting funded activity can engage students and community members in STEM in novel and interesting ways.

Patternmakers' analysis of Seed Grant acquittal data shows that around 30% of funded activities were in-school programs, while 20% were showcases or fairs (see Chapter 2 of this report for more details).

The most common targeted beneficiaries for these events were young people in regional areas (28%) and the general public (28%).

[3] According to Twitter, an 'engagement' includes any time a user is served a Tweet in timeline or search results.

Overall, half of Seed Grant activity took place in regional areas, with some years (2018-19) seeing a greater proportion of regional programs and others (2021) favouring metropolitan activity.

Supported by Inspiring Australia QLD, 6 Regional STEM Hubs are offering opportunities for networking and regional development

During the period 2017 to 2021, 6 Regional STEM Hubs were based in locations across regional QLD, with a goal of inspiring community collaboration and grassroots science engagement in key regions.

Networking – both informal and formal – appears to be a real strength of the hubs, and many have formed robust cross-sector partnerships with universities, tourism partners and local businesses.

Leveraging their regional networks and relationships, STEM Hubs have been able to deliver local events that appeal to community members or speak to community science needs. For an example, Cobb+Co museum has used its position as 'the centre' of the Darling Downs Hub to host 'After Dark' and 'Science of Brewing' events with popular appeal.

In a next chapter for some Hubs, the Office of the Queensland Chief Scientist's revamped 'Partner Up Queensland Regional Science and Innovation Network' (the 'Network') will be piloted in three host locations where IAQ Hubs are based – and it is anticipated there will be significant crossover between the two programs.

Case studies demonstrate the broad range of impacts occurring through IAQ investment

Five funded activities were explored in detail to understand how exactly IAQ funding supported the activity and what outcomes were achieved.

The set of resulting case studies show that the nature and extent of outcomes vary from activity to activity, for instance:

- Tec-NQ's Open Day used IAQ funding to show prospective students that the trades are STEM careers
- An Indigenous Science Experience helped students at Logan schools appreciate Indigenous Australia's long history of science innovation
- Cobb+Co Museum's role as 'the centre' of the Darling Downs STEM Hub helped the organisation grow its networks – and reach more Toowoomba residents with science

- IAQ's organising committee partnered with the Firebirds to reach young women and girls at a netball game and demonstrate the possibility of a STEM career
- A 'Future Earth' panel at Marsden State school utilised young STEM leaders to show high school students the career possibilities related to climate solutions.

Challenges and opportunities

A multi-year approach to NSWk planning could help IAQ gain momentum and adopt more ambitious long-term strategies

Overall, there are signs that delivering National Science Week on a year-to-year basis is limiting the ability of the program to be strategic about long-term impact.

Short turnarounds for delivering Targeted STEM Engagement project plans and NSWk events can limit the scale and scope of IAQ activity – and it appears that the 'wheel is being reinvented' when resources could be better spent building on what came before.

Among other things, a three-year contract for the IA manager (matching the three-year cycle for hosting the program at an organisation) is vital to enable stronger forward-planning and development of strategic partnerships.

A set of agreed goals and KPIs are also necessary to help the program move forward in a way that is consistent, intentional, and aimed towards cumulative impact.

With science accessibility a priority for IAQ, there are opportunities to ensure its work better serves underrepresented groups

IAQ is committed to reaching groups that are underrepresented in science – and some NSWk major events have been successful at targeting groups, such as women/girls in STEM.

However, Patternmakers' analysis of Seed Grant acquittals (described in Chapter 4) found that only small amounts of activity are being targeted towards underrepresented groups. Based on the event descriptions provided in acquittals, it appears that roughly 4% of the total number of Seed Grants were specifically aimed at activating women/girls in STEM, while only 2% were targeting First Nations peoples.

There are opportunities to be stronger on First Nations engagement in particular, and invest in culturally-responsive programs, like the Indigenous Experience at Logan featured in the case studies.

Similarly, the geographical diversity of Seed Grants has varied over years – and since the pandemic, metropolitan organisations have received the largest share. The need for virtual delivery of events in 2020 and 2021 means that funding may have favoured larger organisations in the cities, with more technical capability.

Mapping the Seed Grants geographically also suggests there may be a concentration in South-East Queensland, compared to other areas – and some stakeholders say it's harder to have visibility on activity elsewhere in the state.

There's an opportunity to grow the scale of Seed Grant funding through industry partnerships - helping meet demand and assist organisations to meet STEM challenges

Events supported by Seed Grants deliver outcomes across multiple portfolios – including manufacturing, education, and tourism - and there's potential to build upon this cross-sector impact to build strategic relationships and leverage additional funding for activities.

At present, applications for Seed Grants are outstripping available resources by a factor of 5 to 1 – and, as suggested above, there's a risk that underrepresented groups could be the ones missing out.

Furthermore, there's a chance that one-off 'seed' funding won't always promote sustainable activity. While some stand-out grantees have gone on to become commercially viable, or secured funding at the National level, others may require additional support – and there are opportunities to diversify the pathways available to them. For example, multi-year investment could give Seed Grantees a pathway to aspire to, and raise the ambition of projects.

As Queensland Science faces new challenges related to industry, sustainability, conservation and more, there may be opportunities to leverage evidence about community-based responses – and seek support from motivated industry partners.

It is clear that the Hubs network has a lot of potential, but visibility of outcomes is sometimes poor – and a paid Hubs coordinator could help communicate impact

Through the Hubs, IAQ has a mechanism for empowering community leaders and stimulating science activity at the grassroots level. The visibility of outcomes, however, is sometimes poor. The current acquittal process doesn't seem to be providing the complete picture, and a different feedback mechanism may be necessary.

It's important to be realistic about what can be expected from a volunteer regional workforce – and review whether the number of Hubs and amount of funding is optimal. Research by the Foundation for Regional and Rural Renewal shows that the volunteer workforce was severely affected during the pandemic, with around a third of volunteers reducing their hours, and reporting feeling 'frustrated' and 'overwhelmed'.

One option for consideration is to create a paid regional STEM Hubs coordinator role, to help relieve the strain on volunteers and strengthen IAQs regional connectedness and impact. Ideally based in North or Western QLD, this role could provide a voice for the regions by communicating impact and also identifying needs and opportunities.

Stronger tracking of trends and evaluation practices will help IAQ gain momentum and accomplish its goals

In 2018, University of Sheffield Masters Student Milly Giggs conducted a dissertation around the evaluation of science programs and Inspiring Australia. She found that there was an evident need for more robust and systematic tracking of impacts and outcomes.

As a program dedicated to science engagement, there needs to be a clearer program logic around what IAQ events are aiming to accomplish, and what measures of impact are realistic. Putting in place an evaluation framework based on these principles will help IAQ better monitor accomplishments and identify weak points.

The ability to clearly identify IAQ's role in the STEM ecosystem and 'tell a story' about its impact will be key to growing the program's reach – whether that will be through delivering more intentional activity or supporting industry partnerships.

An evidence-based approach to the program could help grow its impact even more

As Inspiring Australia looks ahead to a new funding cycle, there's an opportunity to draw upon a growing evidence base around STEM education and outreach to make decisions about the next iteration of the program.

For example, according to some stakeholders, there has been a shift to a more complex model around young people's decision to pursue scientific subjects and careers – recognising that there are multiple individuals (for example parents, teachers, peers), environments (schools, community settings, science centres and museums) and decision points (childhood, adolescence, early adulthood) that affect whether a person will develop an interest in science.

There's an opportunity to use this understanding of this decision-making ecosystem to inform program planning – such as a more deliberate targeting of decision points and the use of repeat or multi-year interventions.

Furthermore, making information available about best-practice science outreach to Seed Grant decision-makers, Seed Grantees and program planners could also help the program have a more consistent and evidence-based outlook.

Allowing Seed Grantees to respond to a strong 'Theory of Change' in their applications and acquittals will ensure the best, most outcome-focused applicants float to the surface – and also give IAQ a clearer before-and-after picture of impact and reach.

With these opportunities in sight, there is good potential for IAQ to continue growing its impact and work with others to fulfil the potential of STEM for Queensland and Australia.

Key opportunities

Immediate actions

- **Review the application and acquittal forms** to help gather stronger insights into potential and actual outcomes from Seed Grant recipients, and capture diversity indicators.
- **Implement a three-year agreement** for the IA Manager to align with the host organisation/funding term and ensure long-term focus.
- **Develop an evaluation plan** for the 2022 NSWk event led by the IAQ organising committee, to capture outcomes after the event.
- **Share best practice insights** about science outreach with applicants and decision-makers and support continuous improvement at events.

Medium-term opportunities

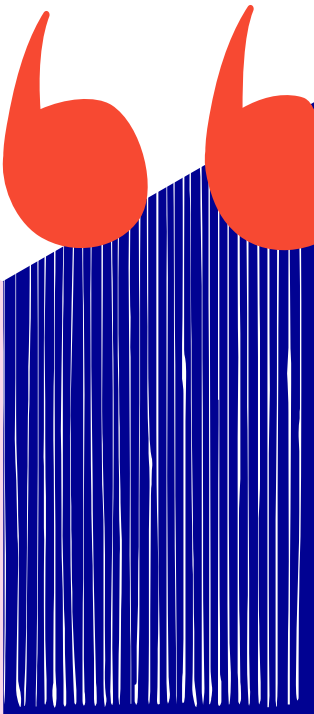
- **Develop a three-year plan** for IAQ, with components including:
    - **Brand strategy** – seek advice and clarify which brand will be the primary outward-facing identity to prioritise in digital communications (IAQ or NSWk QLD) – and how the different platforms will work together.
    - **Digital marketing strategy** - to grow the reach of IAQ/NSWk over time, including key digital events and social media strategies.
    - **Theory of change** for IAQ, including the NSWk event, the Seed Grants and the regional STEM Hubs, based on evidence about industry and societal needs, and referencing the evidence base about decision points for young people, influencers in their lives, and underrepresented groups.
    - **List of goals and strategic priorities**, referencing the National Strategy for Engagement with the Sciences, and agreeing on KPIs and targets.
    - **Partnership strategy**, identifying cross-portfolio opportunities and potential industry partners.

- **Program of events**, ensuring a multi-year approach to identifying potential NSWk events and building on outcomes over time.
- **Knowledge sharing strategy,** to share insights among the stakeholders at different levels, including the national program, other states/territories, IAQ organising committee, reference group, past and future applicants and participants.

- **Share and promote the 3-year plan**, ensuring that the contents are shared and understood by all stakeholders (e.g., ensuring that Seed Grant applicants will be directed to respond to strategic priorities in their applications).

Long term opportunities

- **Secure partnerships** to grow program resourcing, including:
  - **Expand resourcing** for regional coordination, to support the work of the regional STEM Hubs and enhance visibility of regional outcomes (ideally based in North or Western QLD).
  - **Expand resourcing** for the organising committee's National Science Week event, to ensure greater strategic oversight of the major event .
  - **Expand funding for Seed Grants** to offer multi-year funding and strengthen the pathways for promising events to grow over time.
- **Offer training** on program logic/theory of change to build capacity among the IAQ coordinating committee and Regional STEM Hubs, to assist with evaluating Seed Grant applications and planning evidence-based events.



‘That’s what I like about the Firebirds event. You’re engaging with people who don’t expect to engage with science.

You’re targeting an audience that’s not a science-seeking audience.’

1 Introduction

Background

About Inspiring Australia

Founded in 2010, Inspiring Australia's goal is to improve the communication, appreciation and understanding of scientific knowledge in Australia. Responding to a growing disparity between technical knowledge held by the STEM workforce and the general public's understanding of science, it aims to make science accessible, approachable, and even fun.

According to Inspiring Australia's websites, its national objectives are to:

- build an awareness and appreciation of science
- celebrate the excitement of science and scientific discovery
- enhance the focus on capability and skills
- improve science communication skills.

In support of these objectives, Inspiring Australia manages National Science Week (NSWk), a coordinated celebration of STEM – with events held in schools, museums, libraries, universities and public spaces across the nation.

It also administers grants and prizes supporting community and citizen science participation, and facilitates networks aimed at developing science awareness and activity in regional areas.

About Inspiring Australia Queensland

Inspiring Australia Queensland is the Queensland chapter of Inspiring Australia, responsible for managing programs in the state that contribute to the national objectives. These include QLD-based events for National Science Week, a network of STEM Hubs across regional QLD, and Seed Grants to support community-based science and science outreach.

Inspiring Australia Queensland is hosted by a Queensland-based organisation whose goals are aligned with IA's objectives, with the host organisation changing every three years. The host organisation is responsible for organising its own National Science Week events in addition to supporting NSWk activity across the state. It also supports other community science activity, including that of the Regional STEM Hubs, throughout the year.

From 2019-2021, it was hosted by Queensland Museum, and overseen by a reference group made up of representatives from Inspiring Australia (National), the Office of the Queensland Chief Scientist, Queensland Museum, the Department of Environment and Science, the Queensland STEM Education Network, Queensland Tourism Industry Council, the Department of Education, Advance Queensland and James Cook University. It is currently managed by CSIRO Queensland.

About the evaluation

This document presents the results of an Impact Evaluation from research agency Patternmakers, commissioned by Inspiring Australia Queensland to assess the impacts of IAQ activity.

With a new funding period beginning and a change of host organisation underway, the time is right to reflect on Inspiring Australia's successes and challenges and equip the new host organisation with evidence-based insights for IAQ's future.

The primary focus of this report is IAQ activity under the previous host organisation, Queensland Museum (2019-2021). However, due to disruptions caused by the pandemic in 2020 and 2021 – including the virtual delivery of National Science Week in 2020 - the report also draws on data and case studies from 2017-2018 to establish a more typical picture of IAQ activity.

The primary evaluation question for the project was: how is IAQ having an impact and how could its impact be even greater in the future?

Priority areas for the evaluation included:

- Evaluation of IAQ activity, including major National Science Week (NSWk) events, NSWk Seed Grants, and regional STEM hubs against IAQ's objectives
- Analysis of the impact of IAQ on the Queensland STEM ecosystem, including individuals, organisations, and communities – including groups traditionally underrepresented in science like women, First Nations people, CALD people and people from regional/remote areas
- Focused insights for current and future host organisations – and identifying major success factors and barriers to greater impact thus far
- Strategic opportunities for IAQ to expand upon and/or optimise impact.

Methodology

Data was collected from conversations with over 20 stakeholders and data analysis of 50 Seed Grant projects

Data was collected from a range of stakeholders, IAQ Reference Group and Coordinating Committee members, Regional STEM Hub members, and past-and-current IAQ grantees, through:

- Depth interviews with 10 stakeholders, Regional STEM Hub managers and Reference Group members
- A virtual focus group with 5 Coordinating Committee members
- Email surveys provided to Regional STEM Hub managers
- 5 case study interviews to capture the range of activity supported
- Desktop analysis of IAQ annual reports, surveys, and past evaluations
- Tableau and Microsoft Excel analysis of SmartyGrants data from 50 Seed Grant projects.

Case studies were selected using a mixed quantitative and qualitative approach

Case studies were selected using a mixed quantitative and qualitative approach. Coordinating Committee members, Regional STEM Hub managers, and the IAQ Manager were invited to put forward suggestions for 'standout' grantees in interviews and focus groups. These suggestions were investigated and supplemented with analysis of acquittal data from 2017-2021.

Case studies were selected to capture the broad range of activities supported by the Inspiring Australia, aiming to achieve a balance in terms of:

- **Relationship to Inspiring Australia,** including events organised by the National Science Week QLD Coordinating Committee; Seed Grants awarded for events in the National Science Week; and events/activities hosted or supported by the QLD Regional STEM Hubs

- **Type of activity,** including in-school educational programs, out-of-school education or 'edutainment', 'Science After Dark' events, virtual events, demonstrations and workshops

- **Type of science,** including food science, sports science, manufacturing/industry, physics, biology, chemistry, virtual reality, and robotics
- **Scope of activity,** with a balance between events that accessed a larger breadth of people and those who reached smaller numbers in greater depth
- **Demographic and geographic diversity,** with an aim to ensuring the equal representation of Women in STEM, First Nations science and events in remote/regional QLD

After consulting with the IAQ manager on a longlist of 14 case studies, a final 5 case studies were selected with reference to the above factors.

‘We need to inspire people to demand more science – to have people, businesses, and community-makers saying we need answers to these questions.

We need to help the community articulate problems in scientific ways. As a young person, if you hear people calling for a specific kind of knowledge, you might be inspired.’

2 Summary of activities

Funding model

Inspiring Australia Queensland invests $144,000 each year to support STEM engagement in the state – with $75,000 devoted to National Science Week

Inspiring Australia Queensland is responsible for managing two distinct funding steams, both of which contribute to STEM engagement in the state.

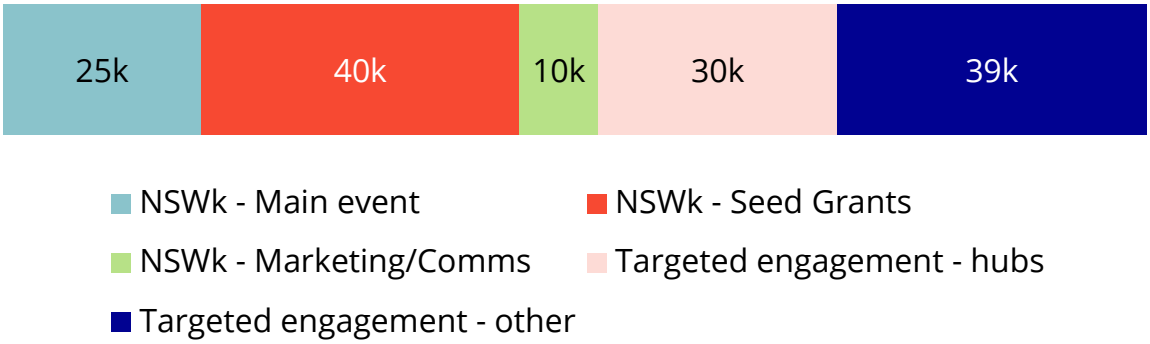
Firstly, **Targeted Stem Engagement** ($69,000) is allocated according to a project plan determined at the beginning of each year. This plan identifies key ideas, concepts and targets for engagement (for example, reaching underrepresented groups in STEM). This funding also supports 6 **Regional STEM Hubs** in Cairns, Rockhampton, Townsville, Gympie, Gladstone and Darling Downs – each of which receives between $5,000 and $7,000 in funding in each year. These Regional Stem Hubs aim to provide networking opportunities for people working in STEM in the regions and to promote STEM in their local communities.

Secondly, $75,000 is invested in **National Science Week (NSWk)** each year, across three key streams:

- $25,000 is managed by the National Science Week Coordinating Committee to develop the primary NSWk event for the state
- $40,000 is made available to STEM organisations across Queensland in the form of 'Seed Grants' – designed to help organisations across the state grow in capacity and ambition
- $5-10,000 is invested in marketing and communications activities to promote the QLD NSWk program to the public.

An additional strategy for science engagement associated with Inspiring Australia is the **Science Clubs**. These are self-sustaining, volunteer-run clubs aimed at promoting science activity across the state, which are not directly funded by Inspiring Australia under the new agreement, and were considered outside the scope of this analysis.

Figure 1: Approximate breakdown of Annual Inspiring Australia Queensland Funding



Inspiring Australia is hosted by an organisation and coordinated by an IA Manager in each state/territory

Inspiring Australia is a federal program for science engagement, operated by the Australian Government's Department of Industry, Science, Energy and Resources (Oz Industry). Questacon is the 'host' organisation for Inspiring Australia at the national level, and functions to advise the state/territory chapters and provide governance and coordination country-wide.

In each state or territory, a host organisation is responsible for managing Inspiring Australia funding and realising the national objectives. This host organisation changes every three years.

An IA Manager, employed on a yearly contract, is responsible for coordinating Inspiring Australia activity in each state – working with the host organisation and NSWk Coordinating Committee to determine the project plan for the year; to promote, plan and execute NSWk events; and to manage the Regional STEM hubs. This role reports to the Inspiring Australia Reference Group.

In QLD, Inspiring Australia was hosted by Queensland Museum from 2019-2021. The program is currently in a caretaker arrangement with CSIRO for 12 months, while the guidelines for the program are re-written by Oz Industry.

National Science Week

The National Science Week Coordinating Committee has delivered three major science engagement events since 2019, reaching 5000 people in person and an estimated almost 300,000 people online

Each year, the National Science Week Coordinating Committee has successfully delivered large-scale events to broad audiences – with some adjustments necessary in 2020 and 2021 to accommodate lockdowns and Covid-19 restrictions in Queensland.

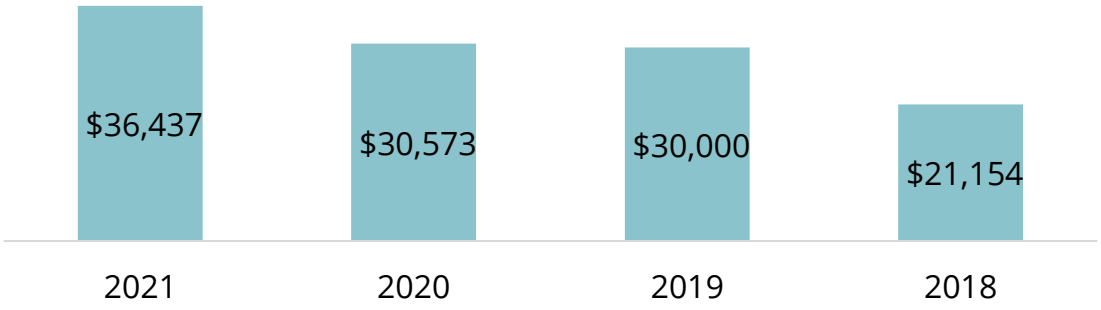
In the primary period of interest for this Impact Analysis, 2019-2021, the NSWk committee planned the following events:

- A 'sports science' activation in partnership with the Queensland Firebirds (Netball) in **2019**. At a Firebirds game at Nissan Arena, IAQ staff set up stalls on the forecourt and performed a half-time court 'takeover' and interview with the Queensland Chief Scientist – reaching 5,000 in-person attendees and 102,000 online audiences, largely made up of girls and their families.
- 'Future Earth,' a **2020** virtual event exploring the possibility of creating sustainable futures through science. It involved three live streamed conversations – including one panel with youth leaders delivered in schools – as well as Q&As with STEM experts and citizen scientists, and reached over 10,000 digital audiences.
- In **2021**, planned in-person events were cancelled to lockdowns in South-East Queensland, and a digital 'Twitter Takeover' and STEM interview series were conducted instead – reaching over 170,000 people.

National Science Week Seed Grants have supported over 50 schools, businesses, councils and communities across the state to deliver their own NSWk activities

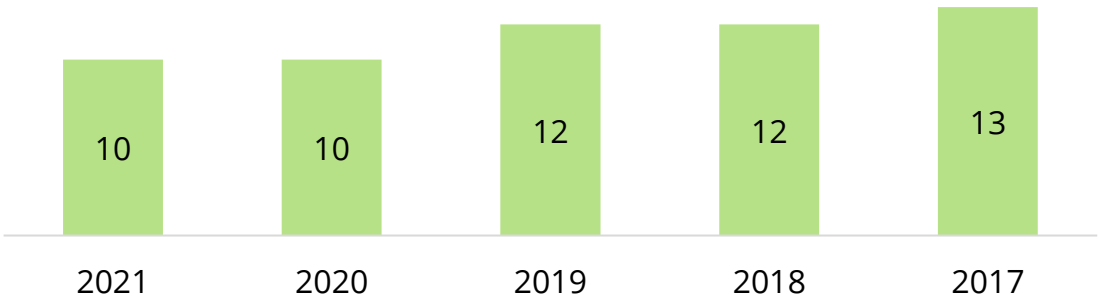
Between 2018 and 2021, Inspiring Australia Queensland invested a total of $118,000 to 'seed' STEM activity in schools, businesses, councils and communities across Queensland.

Figure 2: Total Seed Grant funding, 2018-21



Looking at the entire period (2017-2021), National Science Week Seed Grants have been awarded to a total of 57 grantees.

Figure 3: Number of Seed Grants by year, 2017-2021

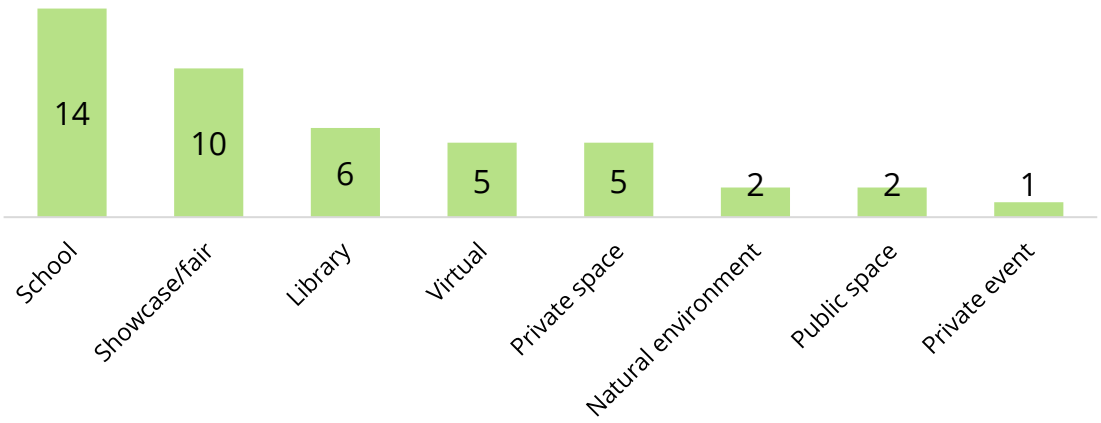


Around 30% of Seed Grant activities were delivered in schools, while 20% were delivered at showcases or fairs

Analysis of 45 available Seed Grant acquittals shows that roughly 30% of funded activity took place in schools, 20% at showcases or fairs, and 13% in libraries. A further 11% of events were delivered virtually (most of them in 2020 and 2021), or took place in a private environment like a business or ticketed workshop. For the details of this analysis, see Appendix 2.

Two funded events took place in natural environments – such as a community cruise of the Moreton Bay delivered by the Moreton Bay Environmental Education Centre – while another two took place in large public spaces - Dreamworld and Westfield Garden City Shopping Centre.

Figure 4: Seed grants by location of delivery



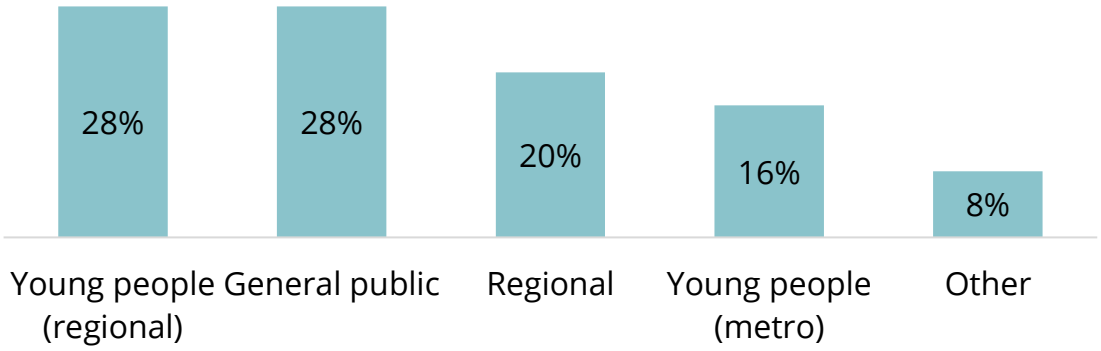
The most common beneficiary for these events were young people in regional areas (28%) and the general public (28%)

These acquittals were also coded on the basis of their primary beneficiary – with possible beneficiaries including general public, regional Queenslanders, regional young people, metro young people, First Nations people and women.

Patternmakers found that events were most commonly targeting the general public (28%) or young people in regional areas (28%). 1 in 5 were targeting regional communities, but were not specifically aimed at young people. Another 16% were aimed at young people in metro areas.

Note that this analysis is based on the coding of limited information available in grant acquittals, and that many grants likely belong to multiple categories – or deliver incidental benefits to other beneficiaries.

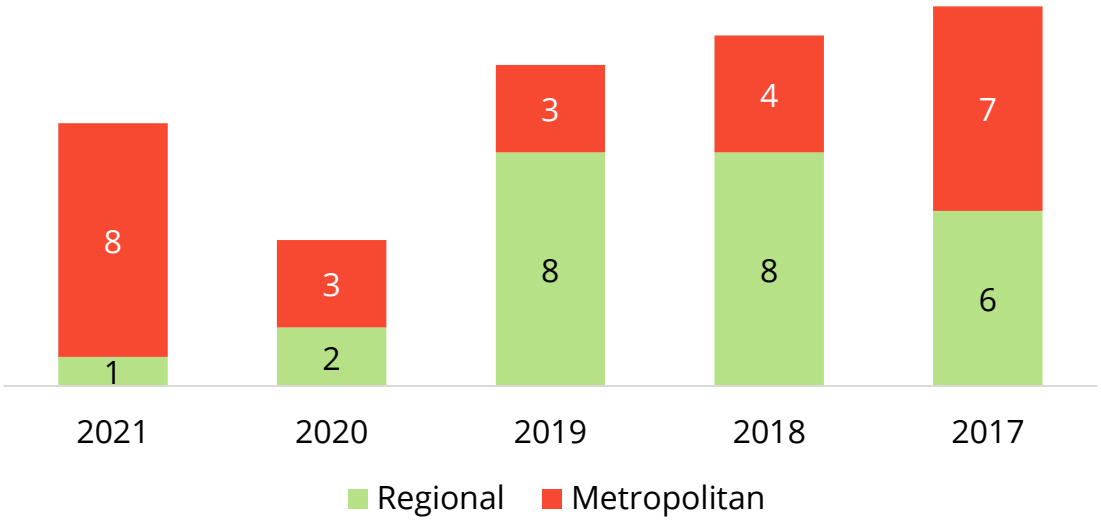
Figure 5: Seed grants by primary beneficiary



Overall, half of Seed Grant activity took place in regional areas, with some years (2019-18) skewed towards regional programs and others (2021) favouring metropolitan activity

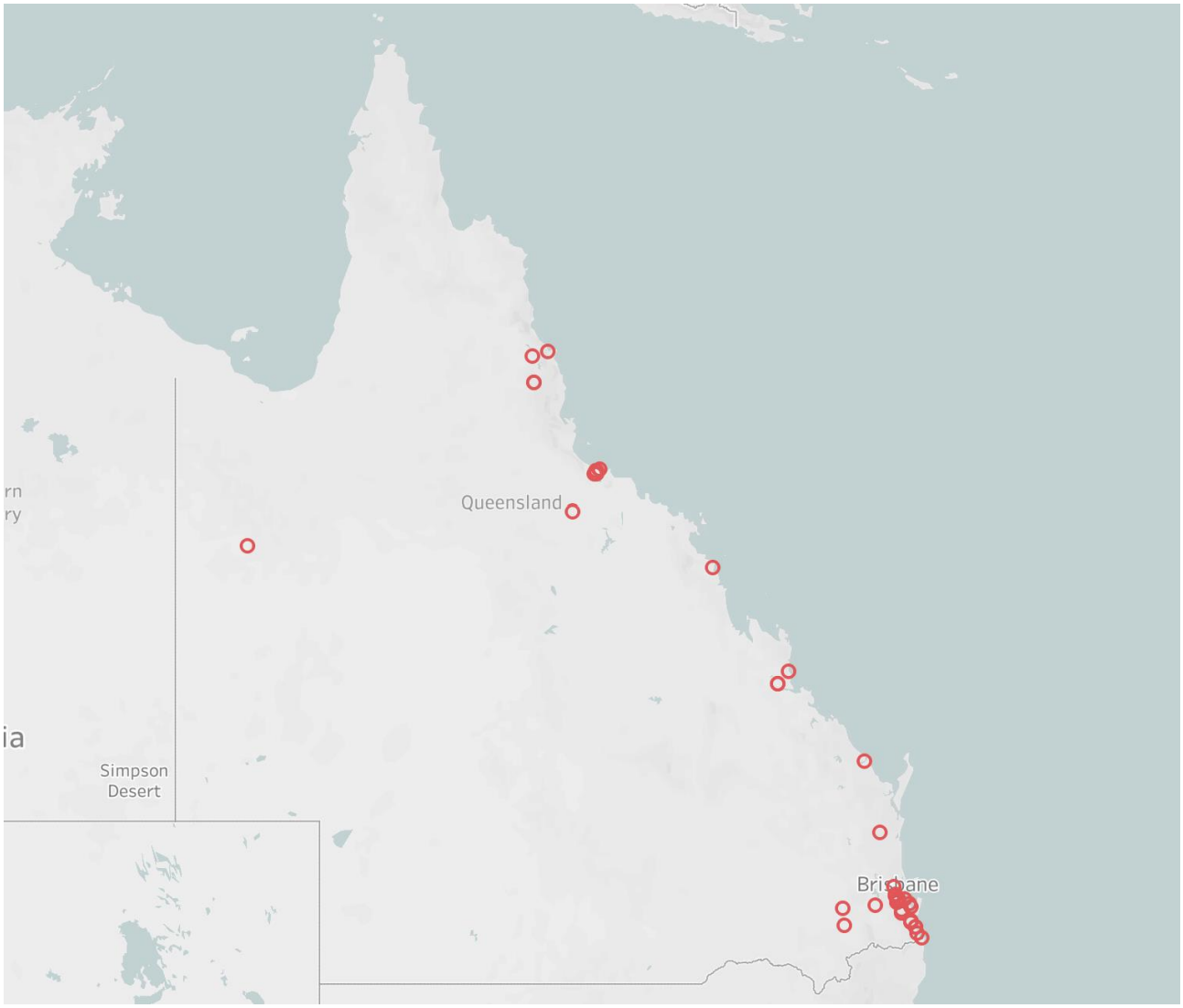
Overall, the Seed Grants are equally likely to support regional and metropolitan activity – although the geographical distribution of grants varies by year. Note that the locations of grant recipients (as provided in acquittals) may not directly correspond to the location of the event/activity – for example, if a Brisbane-based company delivered a regional program.

Figure 6: Regional/metropolitan status of Seed Grant recipients



Mapping the physical coordinates of Seed Grant recipients in Tableau shows that from 2017-2021, the majority of Seed Grant activity was concentrated in Brisbane and the state's South-East. There was very little activity in remote/outback Queensland.

Figure 7: Geo-Mapping of IAQ Seed Grant Recipients



STEM Hubs

STEM Hubs are based in 6 locations across regional QLD

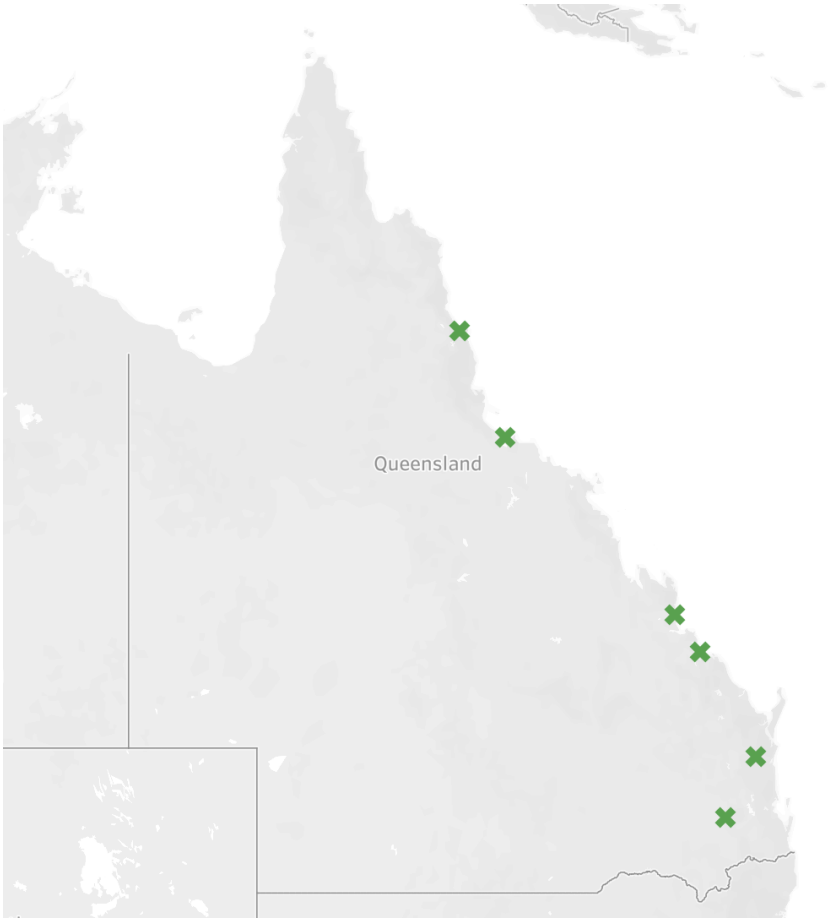
From 6 locations across regional QLD, STEM Hubs are operated by volunteers from STEM-related organisations. These hubs receive funding from Inspiring Australia Queensland but

operate mostly autonomously to deliver networking opportunities, events, expos and community science programs in their areas.

The Hub regions and their associated organisations are:

- Cairns, The Makers Organisation
- Darling Downs, Australian Association for Environmental Education
- Gladstone, Boyne Island Environmental Education Centre, Department of Education
- Mary River Catchment Coordinating Committee, Gympie
- UpCycle CQ, Rockhampton
- Science Townsville State High School, Townsville

Figure 8: Regional STEM Hub locations

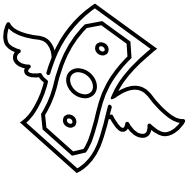


3 Case studies

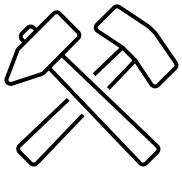
Five case studies were identified in consultation with stakeholders and substantiated with interviews and desktop research. Together, they show the range of activities supported by IAQ funding, and their impacts. They are:

Name of Event	Event Type	Headline
Tec-NQ Open Day	Seed Grant Event	Tec-NQ Open Day used IAQ funding to show prospective students that the trades are STEM careers
Cobb+Co Museum	Regional STEM Hub / NSWk Host	Cobb+Co Museum's role as 'the centre' of the Darling Downs STEM Hub helped the organisation grow its networks - and reach more Toowoomba residents with science
Indigenous Science Experience at Logan	Seed Grant Event	An Indigenous Science Experience helped students at Logan schools appreciate Indigenous Australia's long history of science innovation
Firebirds Activation	NSWk Coordinating Committee Event	IAQ partnered with the Firebirds to reach young women and girls at a netball game and demonstrate the possibility of a STEM career
Future Earth Panel	NSWk Coordinating Committee Event	A 'Future Earth' panel at Marsden State school utilised young STEM leaders to show high school students the career possibilities related to climate solutions

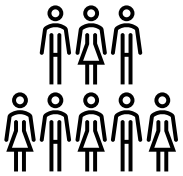
Tec-NQ Open Day used IAQ funding to show prospective students that the trades are STEM careers



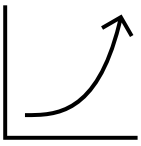
$7500 was provided by IAQ for Tec-NQ to reach students across North Queensland and promote the trades as a viable post-school pathway



2 open days were delivered: one in-person 'try-a-trade' demonstration and one virtual tour

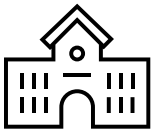


300 people attended the 2019 Open Day, where support from IAQ sent a 'strong message' that the trades are STEM careers



The 2019 Open Day may have contributed to the 19% increase in full-time apprentice enrolments and 7% increase in school enrolments seen the following year

The 2020 virtual tour now acts a resource for prospective students who live remotely and don't have opportunities to visit Tec-NQ in-person



The Open Day is now part of Tec-NQ's annual operations, with support from diverse funding sources

PATTERNMAKERS

Inspiring AUSTRALIA Queensland

The context

- Tec-NQ is a registered training organisation, senior secondary school and boarding school – offering students training and educational options ranging from senior schooling to full-time apprentice training, pre-employment programs and school-based apprentice training. Students have the opportunity to complete their Queensland Certificate of Education (QCE), receive certificates in Business or Information, Digital Media and Technology, or to become certified in their chosen trades.

- Townsville, where Tec-NQ's main campus is based, is a major industrial centre with an estimated annual economic output of $34.310 billion. Manufacturing and construction are two of the region's major output industries, with many small-to-medium enterprises also supporting mining activity. Jennifer Trybula, Manager of Strategic Projects at Tec-NQ, says 'there's a huge demand for trade qualifications in Townsville' – with every qualification offered by TEC-NQ recognised among the national skills shortages identified by the Australian Government.

- However, Jennifer says, 'Townsville is notorious for the brain drain' – and losing locally-educated individuals to more populous areas is 'a huge problem' for the region. In 2019, an ABC article on the issue identified fewer opportunities for education and STEM employment in Queensland's North, compared to the South-East – while, on the flip-side, industry spokespeople and academics reported difficulty filling STEM positions in Townsville due to a dwindling talent pool.

- Tec-NQ helps connect Townsville's young people to industry partners and employers – and introducing students to Tec-NQ is helping to fight the 'brain drain'. In 2020, Tec-NQ reported that 90% of its graduates planned to reside in the Townsville community, and were in work related to their trade pathway. Jennifer says that 'the fact that we're growing our own, who have every intent to stay here, and invest their lives here, is incredibly important.'

- Jennifer says the school offers a 'tremendous opportunity' for students in North Queensland. 'Traditionally,' she says, 'you left school at the end of Year 10 to take up an apprenticeship. But the trades are becoming more technical, demanding better communication skills, better maths skills, a higher mechanical aptitude. The majority of students who come to Tec-NQ have come through school and worked out that they're looking for something more practical than traditional academic pathways.'

- A report on Australia's STEM Workforce released by the Office of the Chief Scientist shows that, although STEM careers are frequently associated with university education, the vocational education and training (VET) sector provides more than two thirds of Australia's STEM workforce. Furthermore, according to the Office of the Queensland Chief Scientist Perceptions and Attitudes to Science Report, in 2021 40% of respondents believed that 'a career in science is only for high performing students'.

The opportunity

- Through Inspiring Australia Queensland, Tec-NQ saw an opportunity to connect its educational pathways with the sciences – to show prospective students and Townsville's general public that the trades are viable, skilled STEM pathways. She says, 'people have no idea that the trades are STEM careers. One of the trade offerings we have is engineering – literally the third letter in STEM. It's incredibly important to let students know that they don't have to go to university to get a career in STEM. And, vice versa, that if they're thinking at a young age that they're going to do a trade, they can't just give up on maths and science. They need to study STEM subjects.'

The activity

- In 2019, $2500 in IAQ Seed Grant Funding supported an open day for prospective students, their families and the general public. Visitors participated in try-a-trade activities, demonstrations and presentations, led by qualified tradespeople – designed to highlight the relationship between STEM and the trades. For example, a CNC plasma cutter was used to create keychains with participants' names, and participants took part in hands-on activities like operating a diesel engine and in wire-stripping.

- In 2020, $5,000 in IAQ Seed Grant funding allowed Tec-NQ to host a virtual tour of its manufacturing and electrical workshops. Animation and video content allowed the public to 'walk-through' their facilities and explore technologies like augmented reality, a CNC milling machine and plasma cutter, robotics, 3D printing, a structural light scanner and PLC's.

The outcomes

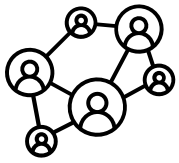
- For its 300 attendees, the 2019 Open Day sent a strong message about the relationship between the trades and STEM – helping correct the assumption that the trades are not a part of the sciences. Jennifer says that 'support from IAQ was a connection to STEM.

I'm very passionate about driving home the message that the trades are very much STEM-based careers. Receiving Inspiring Australia funding really made that statement.'

> *'When STEM started being used extensively in education - particularly with the message that 90% of future careers are going to be in STEM - it was very important that students know that just because they weren't inclined to study academically, those careers were very much accessible to them.'*

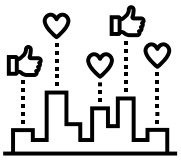
- The 2019 Open Day successfully promoted the trades as a viable STEM career for young people in Townsville – illuminating an alternative pathway for students who might otherwise have left school. The following enrolment year, full-time apprentice enrolments at Tec-NQ increased by 19%, and school enrolments increased by 7%. It would be difficult to causally attribute these enrolment numbers to the Open Day alone – but when asked whether she believes that the Open Day had an influence, Jennifer responded that 'it was an enormous open day, the biggest one we ever had. As far as enrolments go, the following year was the first year we had a waiting list.'
- The virtual tour supported by IAQ in 2020 is now embedded on Tec-NQ's website homepage, and is a 'key resource' for boarding students – who come from as far west as Mornington Island and as far north as Thursday Island – and 'don't have the capacity to pop in for a tour, like a day student.' Jennifer says the virtual tour is 'incredibly important' for making Tec-NQ accessible to students from regional remote areas.
- After being seeded in 2019, the Open Day is now part of Tec-NQ's annual operations, with another event planned for later this year – with Jennifer seeking support for this and other Tec-NQ activity from diverse funding sources.

Cobb+Co Museum's role as 'the centre' of the Darling Downs STEM Hub helped the organisation grow its networks – and reach more Toowoomba residents with science

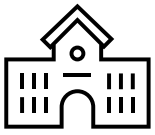


Cobb+Co is one of four museums in the Queensland Museum network, and 'the centre' of the Darling Downs regional STEM Hub

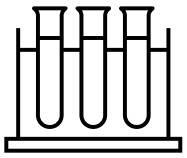
Cobb+Co is a major attraction for Toowoomba, the largest city on the Darling Downs



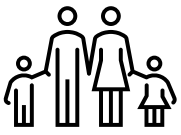
Four National Science Week major events were delivered at Cobb+Co from 2018-2021, inspiring STEM interest among attendees



There are 86 schools in Toowoomba and 8,000 jobs in Toowoomba's education sector – showing the importance of creating a talent pipeline



Cobb+Co sees its mission as teaching the region's young people to love learning and pursue science knowledge – and has used its status as a Hub to create networks and be a community STEM leader



'Edutainment' has helped Cobb+Co engage a broad cross section of the Darling Downs community

PATTERNMAKERS

Inspiring AUSTRALIA Queensland

The context

- Located in Toowoomba, Cobb+Co Museum is part of the Queensland Museum Network and is home to the National Carriage Collection, featuring nearly 50 vehicles from the horse-drawn era – such as farm wagons, delivery carts and the landau (a luxury four-wheeled carriage). With a diverse range of exhibitions and events – from heritage trade workshops to wildlife shows, to chemistry and robotics demonstrations – Cobb+Co has become a major attraction for the regional city, and a hub for local science outreach. In fact, IAQ stakeholders describe Cobb+Co as 'basically the centre' of the Darling Downs Hub.

- Education is an important driver of Toowoomba's diverse economy, responsible for over 8,000 jobs as of 2014/15 – around 10% of the total number of employed residents (80,851). There are 178 primary and secondary schools in the area, in addition to major tertiary providers such as the University of Southern Queensland, and TAFE Queensland Southwest. Nicknamed the 'education capital', Toowoomba has a relatively high share in primary, secondary and tertiary education compared to the rest of the state. Cairns, for example, which had a slightly greater population as of 2021, has 56 schools.

- Tony Coonan, Learning Officer at Cobb+Co, says the museum's ambition is to cultivate a love of STEM learning in Toowoomba's young people, and encourage them to capitalise on the region's educational opportunities, rather than looking elsewhere.

> *'Even though Toowoomba's a big regional centre, it's important that people here know that you can be anywhere and achieve your goal. You can stay in your area and interact with the world, and be on the cutting edge.*
>
> *There should be no reason, for example, why you shouldn't run an international robotics company in Roma, in the South-West of Darling Downs.'*

- Tony believes that instilling a love of learning about the sciences at a young age is vital to maintaining a STEM-engaged population. He says 'These fields move so fast. As soon as you learn something, there's something new to learn. A love of learning is the source of it all. It's really great when you talk to older parents who are adaptable and changing and learning, but so many become stagnant. If you instil it in kids at a young

age, it becomes part of their make-up.' However, many museums and educational venues remain inaccessible and unappealing to regional young people.

- Cobb+Co is working to make science more accessible, including by offering free entry to Toowoomba residents. Tony says, 'we've also done lots of work with community groups, ATSI groups, disadvantaged groups, kids at risk. For kids with autism and deaf and blind people, we've provided sensory experiences like touching taxidermized animals, feathers and starfish. We really promote these programs – if people can see you're accessing and doing work with groups that are disadvantaged, it rams home the idea that we are spaces for everybody.'

The opportunity

- Through its status as a STEM Hub, its ongoing relationship with Inspiring Australia and its role as a host for National Science Week, Cobb+Co saw an opportunity to take on a leadership role within Darling Downs. It has used its experience delivering successful 'edutainment' programs to demonstrate to the wider community that science can be interesting, entertaining, and fun – to show that 'going to the museum isn't just for the privileged, or the snob element. It's just a normal thing to do.'

> *'When I was a kid, it wasn't a hard decision between footy and the museum. Now it's entertaining, it's fun. We're in the edutainment era. We're learning new tricks all the time to make education fun.'*

The activity

- Cobb+Co is a touchstone for the Darling Downs Regional Hub - with Tony drawing upon the formal and informal networks he developed as Learning Officer to bring people working in the regional STEM space together. He says, 'When it comes to Hub events and functions, Cobb+Co is here as a ready-made resource. They always come back to Cobb+Co. We've got the spaces and the staff to support those events.'

- As part of the Queensland Museum network, Cobb+Co has played a pivotal role in National Science Week, hosting annual NSWk events for the Darling Downs community. These include workshops in heritage skills like blacksmithing, opportunities to dress-up and role-play with old-fashioned clothes, coaches and replica animals, and 'After Dark' events with live music, holograms, light/liquid nitrogen demonstrations, drones, robotics, 3D printing and a science show.

The outcomes

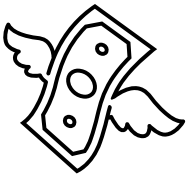
- As 'the centre' of the Darling Downs STEM Hub, Cobb+Co has taken on new responsibilities through its relationship with IAQ – including Tony becoming Secretary of the Hub's Managing Committee – and firmly established itself as a community leader in STEM engagement. Tony says this has helped grow the reach and relationships of the museum, allowing it to reach more people across the region with STEM events. He says, 'Part of our job is to initiate events like World Science Festival and NSWk. We say, Cobb+Co's doing this, we advertise through the STEM hub, and we encourage others to do the same. Over time, our database of people grew bigger and bigger.'

- The success of the Darling Down's Hub (among other factors) has led it to be selected for the Office of the Queensland Chief Scientist 'Partner Up Queensland Regional Science and Innovation Network', described in more detail in Chapter 4. Carolyn Cooke, IA Manager, says, 'Toowoomba is a very tight knit community, and the staff at Cobb+Co are so engaged. They're very interested in history and supportive of science. I think that's one of the reasons why the Darling Downs Hub has been so successful.'

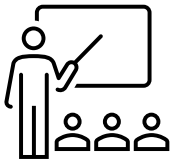
- Events like Curious and Curiouser in 2018, supported by Inspiring Australia Queensland, have yielded successful anecdotal examples of community outreach – with Tony saying, 'I've had people come up to me at After Dark events and say, I'm just a brickie, and I love this stuff. Even in my field now, they're getting into robotics. Another bloke is a builder, and he's come to learn about 3D printing because in Fiji, after the cyclones, they're digitally printing whole houses.'

- Similarly, The Science of Beer and Brewing, an event managed by the Darling Downs STEM Hub in 2020, 'was one of the more interesting, more successful things we've done. A lot of school teachers came – it's appealing, it's accessible, and it fits in with the school curriculum.'

An Indigenous Science Experience helped students at Logan schools appreciate Indigenous Australia's long history of science innovation

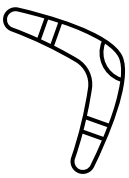


$5,000 in funding from IAQ enabled free, online Indigenous STEM sessions for students from Logan primary and high schools



303 students from low socio-economic and high ATSI-population schools attended a digital Indigenous Science showcase by First Nations scientists

4 schools participated - 3 primary schools, Berrinba East State School, Kingston State School, Woodridge North State School, and 1 high school, Park Ridge State High School



Years 5, 6 and 7 students were educated about Boomerang Physics, Bush Medicines to Space Innovations, and Native Stingless Bees

7 out of 10 students say they enjoyed the activities – although some say they would have preferred an in-person delivery

NISEP has formed an ongoing relationship with Park Ridge State High School, with plans to deliver its student-led STEM mentoring program at the school in the future

PATTERNMAKERS

Inspiring AUSTRALIA Queensland

The context

- The National Indigenous Science Education Program (NISEP), Macquarie University, is a collective of Aboriginal Elders and community members, STEM organisations, and university and school staff, committed to celebrating Indigenous science and helping Indigenous students take on leadership roles in academic contexts. Having run an in-person Indigenous Science Experience event in Redfern, Sydney, since 2012, they planned to bring the experience to Logan, South-East Queensland, in 2021.

- Logan is home to a number of schools with a high proportion of Aboriginal and Torres Strait Islander students, many of them from low socio-economic-status households. Dr Emma Barnes, Program Manager at NISEP, says when it comes to educational opportunities for these students, 'cost is a major factor. We know that for some students we work with, even a $2 bus fee may be prohibitive. Even though it feels like Logan is reasonably close to Brisbane, travel and access to transport can be a barrier for families in Suburban areas.'

- Furthermore, Emma says many students haven't had opportunities to learn in-school about Indigenous Science in a best-practice, culturally-appropriate way. She says that, for Indigenous Students, opportunities to learn about First Nations science from Indigenous scientists can build pride in their STEM knowledge and heritage. For non-Indigenous students, who aren't often educated in Indigenous knowledges, it can increase awareness of the long history of First Nations science in Australia and the rich cultural and STEM knowledge held by Indigenous Peoples.

The opportunity

- Furthermore, there's evidence to suggest that late primary school students are the age group at greatest risk of losing engagement with STEM. Through an IAQ Seed Grant, Emma and her team saw an opportunity to 'deliver an event to students that would typically miss out' in Logan's schools – while also targeting students who were most likely to be influenced by this event to consider STEM as a worthwhile study and career endeavour.

The activity

- IAQ provided $5000 to support free, online Indigenous STEM sessions for students from Logan primary and secondary schools – with the Indigenous Science Experience

co-funded by the Office of the Queensland Chief Scientist and Queensland Government. Schools were provided with hands-on activity kits to 'follow along' with sessions such as Boomerang Physics (and making carboard 'roomerangs') with Paul Craft from Burragun Aboriginal Cultural Services; Bush Medicines to Space Innovations with the Yaegl Elders and David Corporal from Boeing Research and Technology - Australia; and Native Stingless Bees with Alex Ibarra from Indigibee.

The outcomes

- Both NISEP staff and participating teachers report high levels of student engagement with the event, and a new or increased awareness of the long history of First Nations science.

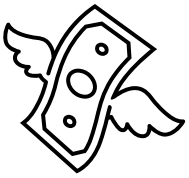
> *'Thank you for the STEM incursion, our Jarjum were thoroughly engaged. The delivery was perfect, the presenters were informative and the overall feedback from our students was great. Looking forward to the future interaction between our campus and yours.'*
>
> *Teacher, participating school*

- Student surveys found that 7 in 10 students enjoyed the event – and qualitative feedback suggested that those who were neutral or otherwise were mostly responding to the virtual delivery, rather than the content itself. One teacher reported, 'Thank you for hosting us for the session. We found it interesting and engaging! Feedback from students to us was that they would have loved a face-to-face session instead of online but we appreciate that we were still able to hold this online!'

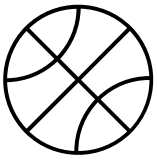
> *'It was important that we framed these traditional knowledges as not just in the past, but now. How essentially, science is ongoing in those areas. It hasn't stopped and isn't in the past. It's something that's kept going. The general sense from school students is that they were very keen to take in that information.'*
>
> *Dr. Emma Barnes*

- Dr Barnes says that the relationships built during the delivery of the online event has led to an ongoing partnership with one participating school, Park Ridge State High School. There are plans to engage First Nations students at Park Ridge to become STEM mentors and perform science demonstrations for younger students – a NISEP learning technique which has been shown to cultivate autonomy, responsibility and interest in STEM in First Nations students.

IAQ partnered with the Firebirds to reach young women and girls at a netball game and demonstrate the possibility of a STEM career



5,000 Firebirds attendees interacted with IAQ representatives outside the Queensland Netball Centre – and watched the interim Queensland Chief Scientist, Paul Bertsch, be interviewed by the game's MC

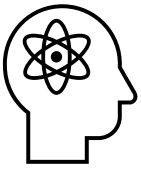


Three Firebirds studying psychology, exercise physiology and occupational therapy were interviewed to promote NSWk on the Firebirds' social media, websites and on-court TVs

Two Year 10 STEM Ambassadors were responsible for interviewing the Firebirds – with one ambassador, Emily Philips, saying the event contributed to her choosing a STEM career

Only 27% of the university-qualified STEM workforce and 8% of the VET-qualified workforce are women

The Department of Industry suggests that role models play a critical role in helping women's progression through STEM careers – particularly at primary school age



By showcasing Firebirds studying in science-related fields, IAQ demonstrated to young women and girls that they could pursue STEM careers

PATTERNMAKERS

Inspiring AUSTRALIA Queensland

The context

- Women are significantly underrepresented in STEM fields – making up 27% of the university-qualified workforce, 8% of the VET-qualified workforce, and 22% of STEM managers. Although there are a number of complex factors contributing to this disparity, key influences include negative stereotypes about STEM and gender, lower self-confidence and anxiety towards maths subjects, and, critically, the absence of female role models.

- Research by Oz Industry suggests that strategies to encourage STEM participation by women and girls include effective, positive messaging about women in STEM careers; connecting female students to STEM professionals; and engaging families and parents. Parents are considered key influencers during early education; while peers, educators and role models are considered key influencers at primary school age.

The opportunity

- By partnering with the Firebirds, the Inspiring Australia Queensland Coordinating Committee saw an opportunity to reach a young, female audience – and promote the idea that STEM is a viable and attainable pathway for women. By leveraging the Firebirds as role models – who were already looked up to by many young female attendees for their sporting achievements – they saw an opportunity to send a strong, positive message about inclusion and equality in science.

The activity

- In 2019, IAQ sponsored the Queensland Firebirds versus the Adelaide Thunderbirds netball game at the Queensland State Netball Centre (QSNC).

- In the lead up to the game, two Year 10 girls from the Department of Education's STEM Ambassadors program interviewed three Firebirds players: Laura Clemesha, a Masters of Psychology student; Jemma Mi Mi, a Bachelor of Clinical Exercise Physiology student; and Mahalia Cassidy, an Occupational Therapist. The video interviews were used by the Firebirds marketing team to promote NSWk on their websites, social media channels, and large screen TVs during the game.

- IAQ also had an on-court presence – with Professor Paul Bertsch, Interim Queensland Chief Scientist, interviewed by the game's MC at half-time. The Coordinating

Committee also set up a marquee on the external concourse, asking attendees to write an interesting science fact or 'what they loved about science' on a post-it note and providing science-themed merchandise.

> *'I'm a netball player myself, and I support the Firebirds. It meant a lot to hear that they as sports players had a connection to science. As someone who always looked up to them, it made me realise that these people are just day-to-day Aussies who have their own lives.'*
>
> *Emily Phillips, STEM Ambassador*

The outcomes

- Emily Philips, one of two STEM Ambassadors who interviewed the Firebirds, says the event was a turning point in her STEM career – pointing to the power of role models to influence young women in STEM. She says, 'I'm now at QUT studying Sports and Exercise Science. Before I was chosen for the Department of Education's STEM Ambassadors, I'd never considered going into anything related to science. My mind was so much more open to doing something STEM-related after meeting the Firebirds. It's crazy to think that I'm in uni now, doing something with a massive science component, and I couldn't have it without going through the initiative, and meeting those players.'

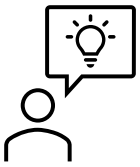
- Although the 'deeper' outcomes accomplished by the STEM Ambassadors program were limited to its two participants, the Firebirds event also provided a willing and open audience for the IAQ message. One coordinating committee member says, 'the major objective was awareness. We want to make sure that those young girls go away and have a conversation with their parents about it, watch our social media, realise there's a lot of science in sport, think about pursuing STEM subjects. We had really good interactions with the girls and families on the concourse – they were very receptive. Asking them, "what do you love about science?" helped us increase awareness of National Science Week.'

A ‘Future Earth’ panel at Marsden State school utilised young STEM leaders to show high school students the career possibilities related to climate solutions

265 participants attended ‘The Future in their Hands’ in-person and online, including 100 students at Marsden State High School and 165 online

3 young panellists and one moderator discussed how they’d found creative solutions in the face of climate change

60% of young people are ‘very’ or ‘extremely’ worried about climate change – and 45% say this anxiety affects their daily lives



87% of young people don’t feel listened to by leaders in government when it comes to climate change

The panel showcased the different career pathways involved in combating the climate crisis

Giving them realistic goals and role models empowered young people to believe they could make a difference

PATTERNMAKERS

Inspiring AUSTRALIA Queensland

The context

- According to a global study of 10,000 young people, including 1000 Australians, from the University of Bath, 59% feel 'very worried' or 'extremely worried' about climate change, and 45% say these feelings affect them in their daily lives. Over half (57%) of young Australians believe they have fewer opportunities than their parents, and 43% are hesitant to have children because of the threat of climate disaster. Similarly, Mission Australia's 2021 Youth Survey Report found that, after COVID-19, young people saw 'the environment' as the second-most pressing national issue (38%) – with comments from respondents suggesting the threat of climate change is taking a psychological toll.

- The University of Bath study says climate anxiety can as a chronic mental health stressor – and that 'factors known to protect against mental health problems include psychosocial resources, coping skills, and "agency" to address and mitigate stressor.' In the context of climate anxiety, they say this would involve 'having one's feelings and views heard, validated, respected, and acted upon, particularly by those in positions of power and upon whom we are dependent, accompanied by collective pro-environmental actions.'

- However, according to the Our World Our Say Youth Survey Report, only 13% of Australian young people feel they're listened to by leaders in government when it comes to their views on climate change. In order to protect against eco-anxiety and its negative mental health consequences, young people need to be empowered, shown that their voices are heard, and offered pathways for meaningful action and change. At present, however, very few young Australians feel that their anxiety around climate change is being listened to or acted upon.

The opportunity

- For National Science Week 2020, the IAQ Coordinating Committee saw an opportunity to present young people with three young climate changemakers in STEM careers – and to demonstrate that there are realistic, attainable pathways in STEM through which young people can make a difference in the climate crisis.

> *'I think young people talking to young people is so important. They always hear from the Jeff Bezos and Elon Musks of the world. For a young person sitting in the classroom, they think, "they're so established, they've had so much experience, I could never do that."*
>
> *I think it's so important to showcase microinfluencers to young people – people who are five or ten years out of high school. Young people can look at these microinfluencers and say, I could be where they are.'*
>
> *Scott Millar, 21-year-old CEO of Bop Industries*

The activity

- In 2020, the IAQ Coordinating Committee organised 'The Future is in Their Hands: Tread softly, with purpose and courage' – a panel event hosted at Marsden State High School to an audience of Years 7-10 students and streamed online to 6 other schools. The panel was moderated by Scott Millar, the 21-year-old CEO and founder of Bop Industries, and included three young changemakers: Rachell Angeles Hansen, World Economic Forum and Global Shapers Gold Coast Founding Curator; Jessica Atherton, Data61 CSIRO; and Joel Lindsay, Queensland Committee President, United Nations Association of Australia Young Professionals.

The outcomes

- A total of 265 students from 7 schools, including 100 students attending in-person at Marsden State, viewed the 'Future is in their Hands' event – which offered them different pathways to and strategies for engaging with climate issues. Scott Millar, moderator, says, 'it showed the students that these STEM professionals were all making a difference in their own way. They weren't going to the extremes, but they were doing their part. There are lots of young people who think "I'm just a student, how can I make a difference?" But some of the biggest leaps forward come from the kind of work these panellists are doing.'

- The panellists helped make the many facets of STEM careers visible to young people - with Scott saying the audience of Year 7-to-10's are 'starting to think about careers, pathways, and subject selection' and primed for these kind of interventions. Scott says, 'When we think of STEM, we often think lab coat, goggles, research all day every day. Or a hard-core coder. But we had four people from very different backgrounds, working in very different parts of the STEM sector. We're showing young people that STEM can be so many things to so many different people. Careers will never be linear. Many people on panel didn't know what they wanted to do when they started out.'
- Marsden State students were given the opportunity to engage with the panellists and ask questions – further contributing to the panel's emphasis on providing young people with a sense of agency and control. Scott says, 'The main theme of the questions was sustainability, focused on climate change and litter. They were also curious about our panel's career pathways. There were the funny questions – what has been your coolest or weirdest experience? And then they were interested in the social conscience – how are we as young STEM professionals making a difference?'
- Rather than contributing to eco-anxiety, the panel placed an emphasis on solutions and hope – with Scott's first question being, 'what are you excited about right now?' Scott says that 'getting students excited, getting them asking questions, getting them to put their hands up with they agree with something or disagree with something else' is key to getting young people thinking and engaged around climate solutions.

4 Impact

National Science Week

Through NSWk events and Seed Grants, IAQ is making science accessible and fun, with 6 in 10 using 'edu-tainment' techniques

In keeping with Inspiring Australia's goals, National Science Week events and Seed Grants place emphasis on the ways in which science can be entertaining, accessible and fun.

For example, analysis of the Seed Grant acquittals reveal that at least 6 in 10 events are using some form of 'edu-tainment' as their primary strategy – with almost all events incorporating fun or quirky science in some way or another. Stand-out examples include hands-on demonstrations like slime-making and robotics, classic 'wow factor' chemistry experiments like Elephant's Toothpaste, 'battles of the brain' and trivia nights, and forensic science 'murder mysteries'.

Other events are cultivating a sense of healthy competition among participants, such as Upper Coomera State College's 'Gold Coast Science and Engineering Challenge', involving students from 9 different schools and hosted at Dreamworld.

This approach appears to be helping science learning gain purchase among attendees. A 2019 National Science Week survey, designed by University of Sheffield Masters Student Milly Giggs and administered digitally to 125 attendees of NSWk events, found that 9 in 10 respondents agreed that NSWk events 'made them want to learn more about science', with another 7 in 10 saying the events 'made science more relatable to their lives.'

Participants were also highly likely to recommend NSWk events to a friend – with 78% 'strongly agreeing' with this statement.

IAQ is enabling people of different ages and backgrounds to engage with science in different ways

There is a wide range in the ages groups who can be engaged with 'fun science' – with one event by Stories Galore teaching elderly participants at Townsville Library to program musical keyboards. The event organiser reports, 'One of my highlights was when a 70-year-old lady fist

pumped the air and "whooped" when she made her PlayDoh keyboard meow for the first time.'

One Coordinating Committee member says,

> 'I tend to see science from a very technical and sophisticated perspective. It's lovely to see the sheer joy and engagement from the other side, the beginning of the pipeline. It's very special.'

In addition to opening the door to engagement, there's evidence to suggest that an emphasis on 'edutainment' can result in better learning outcomes - research by Judy Willis, a neurologist and former teacher, suggests that novelty and pleasurable associations while learning can improve information transmission and retention. However, the key to lasting impact is ensuring these positive impressions and memorable encounters translate into continued learning and interest – rather than simply being a gimmick.

Committee-organised National Science Week events are reaching up to 5,000 people in-person and up to 170,000 online – some of whom might not otherwise engage with science events

The National Science Week Coordinating Committee's main yearly events are reaching people on a considerable scale. Of the major events organised by the NSWk Coordinating Committee, live events like the Queensland Firebirds Game have spread the IAQ message to up to 5,000 people - while a Twitter Takeover allowing STEM experts to answer questions and promote their research garnered 170,000 impressions.[4]

In-person events are often delivered in a 'pop-up' fashion, and are reportedly communicating to audiences who otherwise might be unaware of, or disengaged with, STEM events. One Coordinating Committee member says,

> 'That's what I like about the Firebirds event. You're engaging with people who don't expect to engage with science. You're targeting an audience that's not a science-seeking audience.'

[4] According to Twitter, an 'engagement' includes any time a user is served a Tweet in timeline or search results.

However, some say the virtual delivery of events has made it harder to encounter this 'non-science-seeking' audience, saying,

> 'It was a bit disappointing the last two years, due to the pandemic. The first year we did everything online and livestreamed the events. It wasn't as successful as if it would have been if we'd had a live audience.'

It is worth noting that, overall, NSWk events are (by necessity, due to their size) taking a breadth-rather-than-depth approach. Both the Firebirds forecourt pop-up and the Twitter Takeover, for instance, rely on short, incidental contact to build positive impressions and lay the groundwork for future engagement.

Although it's difficult to say within the scope of this analysis the extent to which this 'next step' is occurring, there is anecdotal evidence to suggest that some individuals have found their STEM pathways 'transformed' by an IAQ event (see, for instance, the Firebirds case study).

IAQ activities are demonstrating that STEM is a broader and more diverse field than many people realise, vital to all industries

Another important function of National Science Week and the events supported by Seed Grants is broadening the public's understanding of what, exactly, STEM is.

According to the most recent Office of the Queensland Chief Scientist Attitudes and Perceptions to Science Survey, the primary association that Queenslanders have with 'science' continue to be school science subjects like Chemistry, Biology, and Physics, as well as research and experiments. Some less frequently mentioned aspects of STEM included the social sciences, data, computers and technology, environmental science, health and medicine.

It's therefore important that NSWk is demonstrating that STEM has a broad remit – extending from sport to fashion to food (the intended topic of the 2021 NSWk main event was 'Future Food: With a Serve of Science', cancelled due to lockdowns).

One example of a NSWk event that highlights 'non-standard science' is 'STEM with Style': a 2021 workshop teaching young people how to upcycle their clothes by incorporating wearable tech – for example, creating a party dress that lights up to the beat of the music. Another is 'The Science of Beer and Brewing' - a 2020 NSWk event organised by the Darling Downs Regional STEM Hub, hosted at a brewery, which explored the science of hops, the role of different yeasts, and how to 'brew a greener future' using algae.

There are promising signs that Seed Grant funding is encouraging STEM organisations to grow in ambition and scale

In so far as they are designed to 'seed' activity rather than support repeated events, there are indications that the Seed Grants have been successful. For instance, the overwhelming majority of Seed Grant recipients have only been funded once (92%), while only 8% have received repeat funding – Blackheath & Thornburgh College, Fitzroy Basin Association, Heatley Secondary College, and Tec-NQ. None have received funding more than twice.

However, without the scope to perform longitudinal follow-up on funded organisations, it is difficult to know which programs have grown into sustained activity. There are certainly exemplary organisations who have gone on to achieve commercial viability – such as Brisbane-based organisation Street Science, which provides private science demonstrations and education. After receiving a Seed Grant from IAQ, Street Science grew in scale and ultimately received Inspiring Australia National funding to deliver programs around the country.

Some of the strongest IAQ events exist across multiple portfolios – delivering educational, economic and industry outcomes

As the case studies demonstrate, IAQ-funded events are delivering outcomes across multiple portfolios – contributing to social impact, educational benefits, economic outcomes, and the creation of a talent pipeline for industry.

For instance, Cobb+Co is using its relationships with Inspiring Australia to educate young regional Queenslanders about science in a way that is approachable and exciting; while Tec-NQ aims to address a national skills shortage by emphasising that the trades are STEM careers. Programs like the Indigenous Science Experience at Logan aim to address the disparities in educational outcomes for First Nations students; while events like the Firebirds activation are demonstrating to young women and girls that careers in STEM are feasible and rewarding for people of all genders.

There's an opportunity to better communicate and leverage these cross-sector impacts to establish partnerships with industry, as explored in Chapter 5.

IAQ is utilising role models and thought leaders to encourage participation – but there are opportunities to support more of this activity, particularly for underrepresented groups

There is ample evidence to suggest that the presence (or absence) of role models plays a pivotal role in the decision to pursue a STEM career.

This is particularly true for groups which are underrepresented in STEM. For example, research by Oz Industry suggests that female role models are crucial to young womens' decisions about whether STEM careers are a viable option – and in fields like physics and engineering, 80% of women perceive a lack of female role models to be a barrier.

Across multiple events, IAQ has successfully leveraged role models to encourage science engagement. One repeat strategy is to create opportunities for dialogue between young people and scientists, STEM professionals and other high-profile individuals.

This model was used successfully in 2019 with the Firebirds activation - when Year 10 STEM ambassadors interviewed Firebirds players in science-related fields of study - and again in 2021 for the STEM Interview Series. By bringing girls in STEM into contact with women who are more progressed in their STEM careers, IAQ increases the visibility of women in STEM and provides opportunities for networking and mentorship.

Another success story is the 'Future is in their Hands' event in 2020, which gave voice to three young changemakers for a panel around climate change, climate anxiety and sustainable solutions for the Earth's future. This event was conducted at Marsden State High School to 100 Year 7-10 students and streamed to 165 other students across the state – giving Marsden State students opportunities to interact with and ask questions of these young leaders.

However, there are also opportunities to make more of the power of role models. For instance, coding of Seed Grant acquittals suggests that only around 1 in 5 Seed Grant events made use of peer role models, or 'celebrity' scientists, to drive engagement.

One stakeholder says,

> 'I think we need heroes to illustrate the point we're trying to make – particularly young people. It's more effective if they're relatable, if people can see themselves. We need young people to share their passion with the next cohort, to show that they're actively involved in something or remedying something, advancing something.'

Hubs

Hubs are inspiring community collaboration, grassroots science engagement and networking

The Hubs appear to be doing important work at the grassroots level to engage regional communities with science. Networking – both formal and informal – appears to be a real strength of the Hubs, and they are successfully fulfilling their intended function of bringing STEM leaders together, creating exchanges of ideas and opportunities for collaboration.

One Hub Manager reports,

> 'We're using our Hub as an exemplar of how we can build connections across Queensland. Rather than everyone going out and pushing their own barrows, we get together ad hoc and think about what we can we do better as a collective.
>
> You don't know what you don't know, until you sit next to someone in a room. In regional areas, it's hard to carry off an event alone. You can find people who can row the boat and get different oars. Partnerships, alliances, networks, innovative ideas about professional development.'

One such event is the NSWk 'Science of Brewing Beer' event hosted in Toowoomba. Another annual Toowoomba-based event, the 'Environmental Education Expo on Earth Day', pre-dates the creation of the Darling Downs Hub but has been bolstered by Hub networks – with one stakeholder saying, 'it started as a pop-up and has grown and grown. This year we're hoping to get the Chief Scientist to speak.'

Similarly, the Gladstone Stem Hub manager reports,

> '[The best part of our Hub are] the relationships, support and engagement between the various sectors in our network from Tertiary Education (CQUniversity), through to Industry (Gladstone Ports Corporation), to Citizen Science Groups (Tangaroa Blue, Harbour Watch, Coral Watch, Gladstone Air Quality Group etc), to specialist education providers (Boyne Island Environmental Education Centre), to local Government (Gladstone Libraries), and Local Schools (Several from both the Primary and High School space, both EQ and independent).'

However, some Hub managers say there could be more opportunities for knowledge-sharing between Hubs, as well as just within each regions. One says,

> 'The network we have at the moment needs to ramp up. I know there are people operating in different parts of the state. I want to know what they're up to, give them an opportunity to showcase their work.'

The Office of the Queensland Chief Scientist's Partner Up Network is building upon the foundations laid down by the Hubs to meet community needs

In 2022, the Office of the Queensland Chief Scientist announced a revamp of the Partner Up Queensland (PUQ) Regional Science and Innovation Network – a state-wide approach to science engagement, centred around regional hubs. Three of twelve potential hub locations are being piloted in Gladstone, Toowoomba and Townsville – with the program designed to build upon the IAQ STEM Hubs.

According to the OQCS Website, the aim of this program is to:

- to enable individuals and community groups to participate in activities developed by the network hubs and by science and innovation champions within their local or regional communities
- have an engagement program developed by each hub, offering meaningful impact
- focus on best-practice science and innovation engagement activities, education and translation of research for local communities
- enable collaboration between various science stakeholders including government, researchers, industry experts, local businesses, education providers and Queensland community groups.

In the cases where IAQ STEM Hub organisations are selected as Partner Up hosts, the Partner Up Network will strengthen their existing infrastructure by contributing to a project office, as well as delineating formal roles and responsibilities for staff.

The Partner Up Network is a strong example of how successful IAQ Hubs can capacity-build regional organisations and lay the groundwork for new programs and opportunities, creating a foundation for further investment in the regions.

Digital Channels

A targeted marketing campaign has grown IAQ's emails subscribers by over 200% - providing a new avenue to communicate with the public

Since January 2020, IAQ's email subscriber database has grown from approximately 700 people to 2,140 as of time of writing – offering IAQ the ability to communicate with and market to a receptive audience.

In the lead up to the 2020 NSWk, the Coordinating Committee invested approximately $1,000 to engage Aruga, a media and public relations firm, to carry out a targeted marketing campaign involving media releases, radio, print and digital media, and online competitions with 'giveaways'. The result was a 248% growth in email subscribers, allowing IAQ to stay connected with individuals across the state as its program went virtual.

IAQ has 5,518 followers across multiple channels – but a dual brand identity may be diluting its message

Currently, IAQ has two social media brand identities – Inspiring Australia Queensland, which has 431 followers on Facebook and 126 on Twitter, and National Science Week Queensland, which has 4505 followers on Facebook and 456 on Twitter.

As noted by IAQ stakeholders, there's an opportunity to consolidate these two identities to avoid diluting IAQ's digital presence, and to avoid confusion around the relationship between Inspiring Australia and National Science Week.

Given that so much of in-person IAQ activity targets young people, there may be opportunities to tweak social media outputs to better appeal to a younger demographic

A key audience for IAQ activity is young people – but the current selection of social media channels, and the content produced by IAQ, could be tweaker to better target at a younger demographic.

Scott Millar, 21-year-old CEO of Bop Industries, a science education company which aims to inspire, engage and empower Gen Z, says of IAQ's social media outputs that:

'Truthfully, Facebook is pitched a bit old. TikTok would be amazing. You could have scientists doing really cool things, explaining things in a succinct, catchy way. Dr Karl does this really well. There's a really cool drag queen in the United States who does science demos too. Young people are looking for quick, palatable bite size content.

From Insta perspective, there's a really interesting opportunity to do Good News Stories, where you highlight awesome things happening in the week. As a young person, a lot of us don't follow mainstream media anymore – the 24/7 news cycle is too much. More positive news stories are something young people are looking for.'

Attitudes and Perceptions to Science

According to the Queensland Office of the Chief Scientist, both participation in and awareness of National Science Week increased significantly from 2018-2021

According to Queenslanders' Perceptions and Attitudes to Science, a survey of 1,200 Queensland residents aged 18+ by Kantar Public for the Office of the Queensland Chief Scientist, NSWk has broad awareness among Queenslanders – and around half of respondents had heard of National Science Week in 2021 (48%, a statistically significant increase from 42% in 2018).

1 in 5 (18%) respondents aged 18 reported that someone in their family participated in National Science Week events in 2021. This was a significant increase from 2018, when 9% of respondents indicated someone in their household had participated. The digital availability of events appears to have made them more accessible – with around 1 in 5 people participating doing so online.

Although causal attribution is impossible, IAQ may also be moving the needle on important metrics like recognising the importance of science to the economy, awareness of Citizen Science, and recognising the importance of STEM education – all of which increased between 2018 and 2021.

The sample was designed using quotas from all of Queensland's regions – and was weighted to 2011 ABS Census data to ensure that the results were representative of the QLD population in terms of age, gender and location.

Critically, however, the proportion of the public interested in science has decreased from 68% to 60% - suggesting that the overall picture may be more complex

On one key metric, however – interest in science – Queensland has gone backwards since 2018, with this proportion falling from 74% in 2016 and 68% in 2018 to 60% in 2021.

According to the report, young people aged 18-24 are the most likely to be disinterested (29%) – along with people over 75 (29%) – suggesting that it's vitally important to target young people with science engagement, as many NSWk events do.

Combined with the broader picture, described in the Needs and Issues Appendix, of falling participation rates in some STEM school subjects, it's clear that there are strategic opportunities to expand upon IAQ's activity – explored in more detail below.

5 Challenges and Opportunities

Seed Grants

Seed Grants are outstripping demand by a factor of 5 to 1 - and only a small proportion of Seed Grants are explicitly targeting women/girls in STEM and First Nations science

There appears to be high demand for Seed Grants, with success rates ranging from 21% to 27% - consistent with a national average of approximately 21% for STEM grants in general, according to the Australia Research Council.

Given that supply outstrips demand, closer attention may need to be paid to whether the current distribution of funds aligns with IAQ's strategic goals. For example, IAQ has a clear ambition to reach groups currently underrepresented in STEM. There has been strong action on, for example, the representation of girls in STEM at many NSWk events, including the Firebirds activation. Similarly, the Seed Grant-supported event 'Indigenous Science Experience at Logan' was highly successful and sets a promising blueprint for further action in this area, as described in the Case Study above.

However, the qualitative coding of Seed Grant acquittals described in Chapter 2 found that only roughly 4% of Seed Grant activity was specifically aimed at activating girls in STEM, while roughly 2% were targeting First Nations peoples.

Closer tracking of diversity metrics across grants – for example, including a 'beneficiary' field in the application and acquittal forms, or nuancing the 'target audience' field to collect this information – is necessary to provide greater visibility of problematic trends. From there, the decision could be made as to whether quotas are necessary.

There are opportunities to be stronger on First Nations engagement and prioritise culturally-responsive programs

As the success of the 'Indigenous Science Experience at Logan' demonstrates, there's an opportunity to increase IAQ's investment in the area of First Nations science – but it's worth noting that to be successful, this activity needs to be culturally-appropriate and best-practice.

The Australian Council of Learned Academies suggests that effective STEM education for First Nations peoples will involve the creation of culturally responsive curricula, establishing real-life career pathways, engaging parents and family members, and integrating Indigenous knowledges.

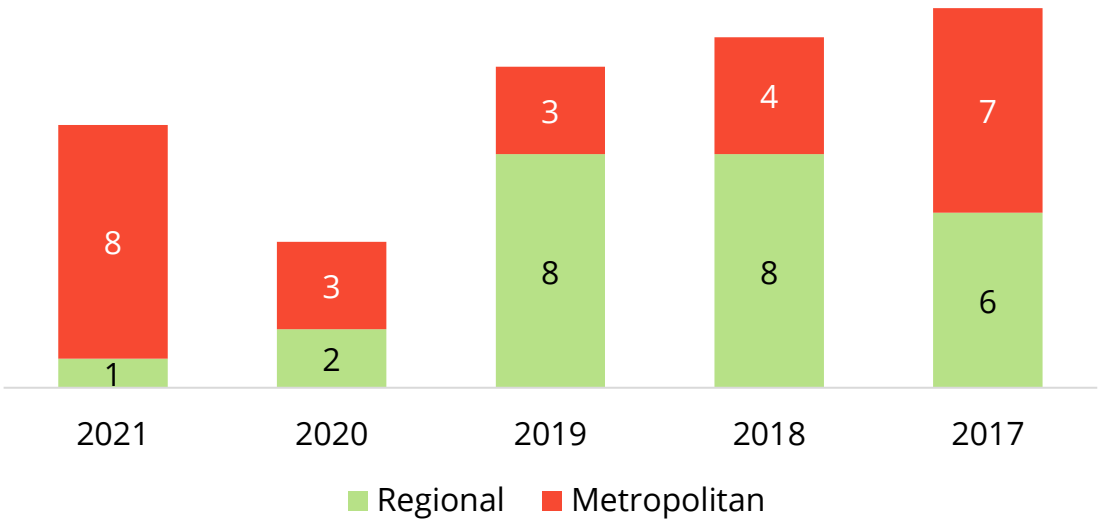
One stakeholder says,

> 'When you're doing an event with First Nations participants, it's so important that the events are presented by First Nations peoples. We made sure all our First Nations presenters were paid, which is surprisingly not something everyone considers. These are everyday people who need to put food on the table, and who don't have a lot of spare time.'

The geographical diversity of Seed Grants has varied over years – and more action in Outback/Remote QLD could be necessary

As noted in Chapter 2, there are various trends relating to the geographic distribution of IAQ activity. In 2021, Seed Grant funding became more concentrated in metropolitan areas – perhaps due to the virtual delivery of events, with larger metropolitan organisations more likely to be technically equipped to deliver activity online. Geo-mapping of grantees and feedback from stakeholders also suggests that IAQ activity has a tendency to concentrate in South-East Queensland.

Figure 9: Seed Grants by regional/metro delivery



It is also worth noting that there has been little-to-no Seed Grant activity in Outback/Remote Queensland. Although the population in this area is proportionally smaller than other regions of QLD, it is also where, according to the Office of the Queensland Chief Scientists' Perceptions and Attitudes to Science Survey, belief in the positive impact of science is lowest – and it might be that need in these areas is greatest. As of 2021, as many as 42% of people in outback/remote QLD did not agree that science has a positive impact on society (compared to around 25% in all other areas).

One member of the coordinating committee says,

> 'The reason it's important to have activity in the regions is that in South-East Queensland we have everything – the State Library, UQ, so many activities. Up the East Coast, there are also activities, but it's the more remote and smaller regional towns that need the funding to run events – because those communities don't have as many opportunities to be involved in STEM or meet scientists.'

Once again, more robust monitoring of trends over multiple years is necessary to allow IAQ to address any inequities, should they become evident longitudinally.

Regional STEM Hubs

IAQ is helping empower community leaders – but there are risks associated with relying on a volunteer workforce

A strength of the Hubs is the autonomy and flexibility they provide regional community members. However, it can be difficult to rely on a volunteer workforce to deliver reliable, long-term activity – particularly throughout the pandemic.

For example, the 2021 Heartbeat of Rural Australia study by the Foundation for Regional Renewal (FRRR) explored the effects of the pandemic on not-for-profits and community groups in regional areas.

It found that retaining volunteers and paid staff became more difficult over the course of the pandemic, with approximately a third of responding organisations reducing volunteer hours. In many organisations, paid staff were working longer hours to compensate. Vital income had been lost from funders and supporters, and many organisations have been unable to run events.

Indeed, one Hub manager reports that the biggest challenge they face is,

> 'Time & Human resources. So many of the people and organisations that facilitate Science/STEM events in our region already work full-time in demanding professions, many with families, and time is a precious resource. The funding of the STEM Hub administration officer's role certainly assisted to 'cover' this gap - without the role communication between network members and promotion of Science and STEM based opportunities would be much more limited.'

A stronger feedback mechanism between the Hubs and IAQ may be necessary to maximise impact

Given the resource limitations associated with volunteer delivery, and the geographic distance between the Hubs and the host organisation, it can be difficult for IAQ to maintain visibility of Hub activity.

While there are evidently strong accomplishments taking place at many of the Hubs, it is clear that stronger communication of outcomes between the Hubs and IAQ is necessary to maximise impact and identify areas for growth. At present, it is difficult to measure longitudinal impacts or clearly demonstrate return on investment – a trend that holds for other NSWk activity as well.

Increasing opportunities for networking between Hubs and IAQ may help increase responsiveness, but it is also worth considering whether a volunteer workforce is sufficiently resourced to communicate at the necessary level of detail. Acquiring external funding to support paid roles could be a consideration for future – as explored in greater detail below.

National Science Week

The year-to-year delivery of National Science Week is not allowing for long-term planning

There are signs that delivering National Science Week on a year-to-year basis – with limited forward-planning or overarching goals over multiple years – is limiting the ability of the program to provide long-term impact.

Both the 2020 and 2019 reports describe short lead times impacting the scope and scale of NSWk activity, particularly the main event organised by the Coordinating Committee. For

instance, in 2019, funding for National Science Week was only secured in June (two months before National Science Week), forcing the committee to rely on activities that could be implemented within a short timeframe – and to choose Seed Grantees capable of managing the rapid turnaround.

Furthermore, many decisions around the execution of NSWk events are at the discretion of the IA Manager, who is employed on a yearly contract. High turnover in this role can create disruptions to planning, trend-tracking and strategic focus, as new IA Managers bring different approaches to the role. A contract that is more aligned with the 3-year funding agreement would help bring more stability and consistency to operations.

One Coordinating Committee member reports,

> 'We haven't thought years ahead, we really just work year to year. There are operational reasons why it's difficult to forward plan.'

Creating thematic through-lines across NSWk events and conducting repeat interventions in specific areas could help bring more depth, rather than breadth, to IAQ activity.

According to some stakeholders, there's a shift to a more complex model around young people's decision to pursue scientific subjects and careers – recognising that there are multiple individuals (for example parents, teachers, peers), environments (schools, community settings, science centres and museums) and decision points (childhood, adolescence, early adulthood) that affect whether a person will develop an interest in science.

There is something of a misalignment between the complexity of this model and the year-to-year approach taken to planning National Science Week events. An understanding of this complex decision-making matrix needs to be accompanied by an equally multi-faceted approach to engagement and participation – one that acts on multiple domains and at multiple time points.

There is clearly ambition within the Coordinating Committee and Reference Group to reach for long-term impact through multi-year planning – but changes to the approach may be necessary to make this possible.

Opportunities

Greater coordination and knowledge-sharing at the regional, state and federal level could help maximise impact

Some IAQ stakeholders lack clarity about the national organisation's goals, particularly over the long-term – and there's a real appetite for knowledge-sharing, brainstorming and collaboration across IAQ's different chapters and ancillary organisations.

Multiple small interventions help place control in the hands of communities and local leaders – but there may be times when more coordinated effort is necessary.

If all IAQ activity could be conducted with a view towards meeting the broader objectives at the national level – with the necessary tweaks made at the state, regional and local levels – it could help deliver a more concentrated and coordinated impact.

Understandably, some stakeholders are concerned about disrupting the balance between autonomy and clarity by providing too much direction from the top-down. But there are clear opportunities for formal networking and better communication of IA's vision.

Similarly, stronger tracking of trends and evaluation practices will help IAQ gain momentum and accomplish its goals

At the state-wide level, too, clearer goal-setting and the establishing of KPIs is necessary to help IAQ maintain consistency over multiple years and achieve its overarching goals.

A necessary foundation to putting these measures into place is stronger trend-tracking and evaluation of impact.

A recurring theme from the learnings above is that troubling trends only become evident over multiple years, or that short-term vision is impeding the ability of IAQ to achieve outcomes on a large-scale.

In 2018, University of Sheffield Masters student Milly Giggs conducted a dissertation around the evaluation of science programs and Inspiring Australia found that there was an evident need for more robust and systematic tracking of impacts and outcomes. Giggs designed a survey to be used across IAQ events – however, use of this survey was discontinued from 2019 onwards.

At a fundamental level, there needs to be a clearer program logic around what IAQ events are aiming to accomplish, and what this impact would look like in practice.

The ability to identify success stories will be key to securing industry partnerships and growing IAQ's remit even more.

There are signs that Seed Grant funding is encouraging STEM organisations to grow in ambition and scale – and industry partnerships could allow for multi-year funding as a next step

The success of many IAQ Seed Grant events shows that there's real potential among Queensland's STEM organisations to lead the charge in science engagement and participation.

However, in order to ensure that Seed Grants are really 'seeding' sustainable activity, it is necessary to highlight pathways for these organisations to develop further – including opportunities for multi-year funding and works of scale.

While there's currently larger-scale funding available from Inspiring Australia National, there's a yet-unrealised opportunity to capitalise upon the cross-portfolio impacts of many Seed Grant projects - ties to, for example, manufacturing, sport, and education – and form relationships with industry. These partnerships could be key to growing the QLD funding pool.

Making the case to potential funders, however, will require much stronger and more robust communication of impact and return on investment – bringing us back to the point above.

Similarly, external funding for a 'Hubs coordinator' role could help strengthen the STEM Hubs network and better communicate impact

Similarly, if IAQ were able to leverage its success stories for partnerships with industry, there could be an opportunity to strengthen the Hubs network by appointing a 'Hubs coordinator'.

With Australia's regional population growing faster than the cities for the first time since the early 1980's, and half of Queenslanders living in the regions, regional development is currently a major priority across a number of portfolios. Indeed, research by the Australian Housing and Urban Research Institute states that growing regional economies 'should be supported by long-term planning and coordinating government and private sector investment' – and there's an opportunity to capitalise on this sentiment to secure support.

As described above, it can be difficult for IA Managers and other staff to maintain visibility of Hub activity – and often times, the volunteer workforce is ill-equipped to communicate impact. This 'Hubs coordinator' position would be based regionally, allowing them to leverage local knowledge and relationships. They could also direct inter-Hub collaborations and knowledge-sharing opportunities.

Networking and cross-sector relationships have already been shown to be an integral part of what the Hubs do – and formalising some of these partnerships could be a key step to strengthening IAQ's activity in the regions.

The need for the program may only increase – and IAQ has the opportunity to rise to the challenges of the time

With the demand for STEM skills unlikely to decrease, concerns around science education and job-readiness growing, and 'wicked problems' like climate change demanding STEM-based solutions, there are challenges and opportunities ahead.

The need for programs like Inspiring Australia Queensland could be heightened in the coming years – and there's a chance for IAQ to rise to the challenges of the time, continuing to grow and clarifying its goals and focus.

There are exciting signs that IAQ has the ability to deliver strong outcomes and reach broad a cross-section of Queensland's population. Capitalising on the program's existing strengths and fostering new partnerships will be vital to continued impact.

Overall, the evidence suggests that IAQ has a unique role to play in Australia's STEM ecosystem – one that will only become more important as Australia meets the challenges of the future.

> You don't know what you don't know until you sit next to someone in a room. In regional areas, it's hard to carry off an event alone. You can find people who can row the boat and get different oars. Partnerships, alliances, networks, innovative ideas about professional development.

Appendix 1: Needs and Issues

The below sets out the case for Inspiring Australia and other STEM promotion programs, detailing the needs and issues currently faced by Australian Science and Queensland Science in particular.

Science in Australia

STEM is a vital economic engine for Australia - and science engagement and skills development is a vital part of the government's vision for the country's future

STEM is a major economic engine in Australia, contributing to at least 40% of the country's real gross value in 2020-21, across diverse industries such as mining (10.6%), health care (8.2%), construction (7.3%), professional, scientific & technical services (7.5%), manufacturing (5.9%), and education & training (5.1%). Given that many other industries rely on technologies or practices developed by STEM, its true contribution is likely to be much greater.

Trends over the past decade suggest that STEM is a growth industry in Australia, and that, compared to other occupations, STEM careers are more resilient in the face of economic disruption. Research by the National Skills Commission showed that between 2015 and 2020, prior to the pandemic, employment in STEM occupations grew by 17.7%, 1.5 times faster than non-STEM jobs. During the pandemic, employment in STEM occupations fell only by 1.9% - a much more stable rate than the 7.0% decrease seen in non-STEM jobs.

Furthermore, there are signs that many of the occupations of the future will be STEM-based, or demand transferrable STEM skills. Research by PwC suggests that 44% of current jobs are at risk of being disrupted or made obsolete by advances in technology – and that developing STEM skills is necessary to 'future-proof' Australia's workplace.

Indeed, the Department of Industry, Science, Energy and Resource's National Statement for Science states that supporting STEM education, employment and innovation is essential to:

- Australia's ability to compete in international markets
- creating new opportunities for industries

- supporting high living standards.

However, there are signs Australia is not keeping pace on STEM education and job-readiness

Despite the vital importance of STEM to Australia's economy and future, there are worrying indications that STEM education is lagging behind the country's ambitions for the sciences.

According to new research from the Australian Mathematical Sciences Institute (ASMI), high school maths enrolments dropped to 66% in 2020, compared to enrolment rates between 71-73% over the past decade. Enrolment in intermediate maths dropped from 23.3% to 17.6%, and enrolment in higher level mathematics is below 10% for the first time since the study began.

According to the same ASMI study, around 40% of Year 7 to 10 mathematics students are taught by out-of-field teachers without specialist training in maths or maths education.

A STEM education toolkit by the Department of Education, Skills and Employment suggests that Australian school students' results in science and maths subjects are on a downward trend.

In 2003, Australia ranked lower than 5 countries in mathematical literacy in an international comparative study by ACER, the Programme for International Student Assessment (PISA). In 2018, it ranked behind 23 – with 1 in 5 students failing to achieve the international baseline for mathematical literacy.

There are fears that many secondary school graduates are inadequately prepared to enter tertiary education and career pathways in STEM - and that there will be flow-on skill shortages and recruitment challenges in STEM fields.

Women and First Nations people continue to be underrepresented in STEM education and employment

Furthermore, there are clear signs that women, First Nations peoples and other diverse groups are being underserved by Australia's STEM educational-and-occupational system, which is often referred to as a 'leaky pipeline'. These individuals often face disadvantage and bias, both implicit and explicit, when pursuing an interest in STEM, even from an early age – and are more likely to find exit points in the trajectory from early education to senior STEM careers.

According to the government's Advancing Women in STEM Strategy, women and girls report being less interested and confident in STEM subjects, participate in STEM education at significantly lower rates than male students, are poorly represented in the STEM-qualified workforce (making up only 29% in 2020), and earn less than their male counterparts.

Similarly, ATSI students are less likely to express interest in STEM-related careers, and are underrepresented in tertiary enrolments. Research from the Department of Education, Skills and Employment shows that ATSI students are more likely to perform below the international standards for mathematics and science, compared to non-ATSI students.

Queensland Science

Queensland science is a rich and growing field, with strong connections to tourism, defence and industry

According to the Queensland Government's Department of Environment and Science, Queensland has a strong culture of scientific inquiry and innovation, and is a hub for STEM activity across a wide range of domains - from biotechnology, to agriculture, to advanced manufacturing.

Queensland's innate geographic and bio-diversity means the natural sciences have flourished in the state - with QLD considered a leader in tropical research, including reef preservation, food security and agricultural productivity, and bio commodities.

The state's wealth of natural landmarks means there's a strong reciprocal relationship between QLD science and the tourism sector – with preservation, conservation and sustainable visitation being shared priorities across the tourism and STEM sectors.

QLD is also an aviation and aerospace research hub in the Asia-Pacific region, supported by the Queensland Defence Science Alliance. The state excels in aircraft maintenance, training and simulation, logistics and unmanned vehicle R&D facilities – and there are more than 4,500 direct jobs in aircraft manufacturing and repair across the state.

Furthermore, the state is a large global exporter of raw and refined commodities, and is recognised internationally for its mining research and use of robotics, satellite imaging and 3D visualisation to support the mining industry.

However, Queensland will also face unique challenges in the coming years – and there are fears that QLD students aren't adequately equipped to tackle the complex STEM problems of the future

As QLD's STEM sector continues to grow and develop, there will be father opportunities to innovate and capitalise on the state's strengths.

A skilled and job-ready STEM workforce will be necessary to identifying sustainable solutions and further advancing the cause of QLD science. However, the same PISA study cited above found that Queensland students' performance in mathematical literacy decreased by 30 points between 2000 and 2018 – while their performance in scientific literacy decreased by 17 points.

It's vital to continue supporting young Queenslanders' interest in science and promote science education – and to draw Queensland's future scientists from the thus-far underutilised talent pool of women, First Nations peoples and other diverse groups.

In the coming years, the state will face challenges due to its unique geographic and demographic features.

According to a factsheet published by the Queensland Government, more than half of Queensland's residents live outside of greater Brisbane – a high proportion compared to many other states and territories, where rates of urbanisation are higher.

Already, the state experiences a relatively high frequency of climate events such as floods, droughts, heatwaves and bushfires, particularly in rural areas. Climate change is likely to make these events more frequent and more severe. Tropical cyclones in the north are expected to decrease in frequency but increase in intensity, while rainfall is expected to reduce in the south-east.

STEM-based solutions will be essential to managing climate risk and limiting adverse impact – and supporting scientific education and literacy, public interest in science, and science investment will be key to ensuring QLD is equipped to meet these challenges.

Appendix 2: Seed Grant Analysis

The below table shows Patternmakers' qualitative coding of Seed Grant acquittals, used to classify events by categories like setting, beneficiary, demographics and strategy. Note that this analysis was based on short descriptions provided by grantees, and may fail to account for features of funded activity not detailed in the acquittals. The resulting analyses should be treated as rough estimates for reflection and strategizing.

Year	Organisation Name	Event Name	Setting	Beneficiary	Demographic group/s	First Nations	Women in STEM	Regional	Diversity	Strategy
2017	Mackay Regional Council	Robot Revolution: Codename - "Playtime"	Library	Regional	General public			Y		Edutainment
2017	Blackheath & Thornburgh College	Rural Futures	Showcase/fair	Regional	Regional			Y		Edutainment
2017	Minden State School	Minden SS Science Fair	School	Regional Young People	Young people			Y		Challenge/ contest
2017	Fitzroy Basin Association	FLOW on the Go	School	Regional Young People	Young people			Y		Edutainment
2017	Heatley Secondary College	Heatley Secondary Primary Fair	School	Regional Young People	Young people			Y		Edutainment
2017	Heatley Secondary College	Primary School Fair	School	Regional Young People	Young people			Y		Edutainment
2017	The Science Nation	Battle of the Brains	Private space	General public	General public					Challenge/ contest

2017	Griffith University	Launch of QLD National Science Week- Future Proof your career with science	Public space	General public	General public			Edutainment
2017	Fitzroy Basin Association	Central QLD National Science Week Launch	Showcase/fair	General public	General public			Edutainment
2017	AIP QLD	Physics in the pub	Private space	General public	General public			Edutainment after dark
2017	Fiftysix Creations	Fiftysix Opportunity Workshop (Science Intensive)	Private event	Young people	Young people			Challenge/ contest
2017	Upper Coomera State College	Gold Coast Science and Engineering Challenge	Public space	Young people	Young people			Challenge/ contest
2017	Woodridge State High School	A culinary journey through the world of science	School	Young people	Young people	Y		Food
2018	Bundaberg Regional Libraries	Fingerprint Mystery	Library	Regional	General public		Y	Challenge/ contest
2018	Tablelands Libraries	FutureMakers Night at the Library (originally called Science Fest for grant application)	Library	Regional	General public		Y	Edutainment
2018	James Cook University	2018 National Science Week at the Tanks: PechaKucha Evening	Showcase/fair	Regional	General public	Y	Y	Leaders
2018	Rockhampton Regional Council Libraries	VR Fun @ the Rockhampton Cultural Festival	Showcase/fair	Regional	General public		Y	Workshop
2018	Blackheath & Thornburgh College	Rural Futures: Game Changers and Change Makers	Showcase/fair	Regional	Regional		Y	Challenge/ contest

2018	Gympie Central	Gympie Steam Day	School	Regional Young People	Young people		Y	Challenge/ contest
2018	Young People Ahead Youth & Community Services Inc.	Mount Isa Science Fair	Showcase/fair	Regional Young People	Young people; regional		Y	
2018	St Patrick's College Townsville	#STEM Like a Pat's Girl	Showcase/fair	Women in STEM	Female students	Y	Y	Workshop
2018	Stories Galore	STEM for Seniors	Library	Elderly	Elderly			Workshop
2018	QuestaGame	The Great Aussie BioQuest	Natural environment	General public	General public			Challenge/ contest
2018	City of Gold Coast Libraries	Science Spectacular	Library	General public	General public			Leaders; edutainment
2018	Moreton Bay Environmental Education Centre	Inspiring Champions for Moreton Bay Community Cruise	Natural environment	General public	General public			Science tourism
2019	Taranganba State School	Mission Moon - Science Week Event	Showcase/fair	Regional	General Public		Y	Edutainment
2019	Tec-NQ	Tec-NQ Open Day	Showcase/fair	Regional	General Public		Y	Edutainment
2019	Clifton State High School	Clifton State High School 2019 STEMfest	School	Regional Young People	Young people		Y	Challenge/ contest
2019	Thuringowa State High School	Upper Ross STEM Festival	School	Regional Young People	Young people		Y	Edutainment
2019	Faculty of Science, The University of Queensland	Regional STEM Careers Roadshow - Emerald, Roma and Longreach	School	Regional Young People	Young people		Y	Leaders

2019	Trinity Bay State High School	Glancing with the Stars	School	Regional Young People	Young people	Y		Leaders
2019	The University of Queensland	Science Inquiry in Rockhampton and Bundaberg (Pokemon)	School	Regional Young People	Young people	Y		Workshop
2019	Northern Gulf Resource Management Group	Gulf Kids Environment Day	School	Regional Young People	Young people; regional	Y		Edutainment; food
2019	Narangba State School	Inspire Science Expo	Showcase/fair	General public	General Public			Edutainment
2019	Albany Hills State School	A night of Science excellence	School	Young people	Young people			Leaders
2019	Coomera Springs State School	STEM X	School	Young people	Young people			Workshop
2020	Tec-NQ	Virtual Open Day	Virtual	Regional Young People	Young people	Y		Edutainment
2020	integratedSTEM Pty Ltd	STEAM Technology Showcase: Live	Virtual	Regional Young People	Young people	Y		
2020	Australian Society for Parasitology Inc.	Parasites Online for NSWk 2020	Virtual	General public	General public		Y	Leaders
2020	Junior Engineers	7 Day Free Access to CODEFLIX During Science Week	Virtual	General public	General public			
2020	Kaea Pty Ltd t/a She Maps	Drone Week	Virtual	Young people	Young people			Leaders
2021	Tablelands Regional Council	Science After Dark: Night at the Library	Library	Regional	General public	Y		Edutainment after dark

2021	Macquarie University	Indigenous Science Experience at Logan	Virtual	First Nations	First Nations Students	Y		Edutainment
2021	Queensland University of Technology	The National Science Week Great Barrier Reef Science Celebration, Citizen Science Challenge and Ultimate Holiday Adventure Prize	Virtual	General public	General public			Challenge/ contest; science tourism
2021	Shark Ecology Australia, Griffith University	Into the Depths of the Fascinating World of Whales, Sharks and Jellyfish	Private space	General public	General public			Edutainment
2021	The Create Lab	Professor Tech: Intro to Awesome (Extended Reality)	Private space	General public	General public			Edutainment
2021	Redland Museum Inc.	Switch on to Science	Showcase/fair	General public	General public			Leaders; edutainment
2021	Gold Coast Innovation Hub	Stem with Style	Private space	Women in STEM	Young people		Y	Workshop
2021	Victoria Point State High School	Bee Roadshow	School	Young people	Young People			Edutainment
2021	Outdoors Queensland Ltd	Nature Play QLD Webinar Getting Kids Engaged with Nature and Contributing to Science	Virtual	Young people	Young people			Edutainment

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