

Te Ara Paerangi Submission - A niche perspective from a group of Research Software Engineers

Submission from

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Why we are making this submission

Georgina Rae - In my capacity as the New Zealand eScience Infrastructure (NeSI) Science Engagement Manager, I have been privileged to be involved in the development of the New Zealand Research Software Engineers (RSEs) community, alongside a group of my peers and colleagues. I also lead a team of Research Software Engineers at NeSI providing in-depth support to various research groups across the country. Research Software Engineers are a critical part of our research ecosystem. This submission is based on my experiences in this role over the last seven years.

Nooriyah Lohani - In my role at NeSI as research communities advisor I have had the opportunity to interact with the RSE community in New Zealand and Australia. Over the last 3 years as part of my role at NeSI I have had the opportunity to see the RSE community grow and co-chair the Australia / NZ RSE steering committee to lead the community building and advocacy efforts. Being an RSE myself, I spent a few years working to support researchers achieve their research goals using computational methods at the University of Auckland and understand the need for these roles in research today alongside the challenges of not fitting into the traditional research roles.

Chris Scott - I work for NeSI at the University of Auckland as a Research Software Engineer, collaborating with researchers around New Zealand through NeSI's Consultancy service.

Maxime Rio - As a data scientist at NIWA and data science engineer at NeSI, I have the opportunity to play an active role in supporting my research colleagues, either as a technical associate to their project or as a trainer in the domain of digital skills. I consider myself a member of the New Zealand RSE community.

Wolfgang Hayek - I have been working as an RSE at NIWA for the last seven years and was, until recently, a member of the NeSI consultancy team. It has been great to see the RSE community grow so significantly in this time. My role as manager of the Scientific Programming group at NIWA includes supporting RSE career progression and leading RSE recruitment.

Growing demand for computational research, the RSE community's work, and sharing knowledge between research institutions has helped us a lot with developing RSE career opportunities.

Callum Walley - I work at NeSI in an applications support role. My work includes writing and delivering training, developing and maintaining software as well as direct researcher support.

We are making this submission out of our own volition. Comments are our own and not necessarily representative of our organisation or employee's position.

What is a Research Software Engineer and where have they come from

NeSI has been a supporter of both the international and national Research Software Engineers community for many years. The community started in the UK in 2013 - "a growing number of people in academia combine expertise in programming with an intricate understanding of research. Although this combination of skills is extremely valuable, these people lack a formal place in the academic system." People taking this non-traditional post-PhD career path (many times unknowingly) were struggling in their careers for a variety of consistent reasons

- A lack of recognition for what was often their key output - research software (compared to more traditional outputs such as journal articles) and therefore a lack of career progression
- Job precarity given the fixed term nature of their appointments (often as Post-Docs)

The community came together around a new role - the Research Software Engineer - someone who is developing code for research purposes. They weren't necessarily a full Software Engineer, and their academic CV did not resemble an academic - they were somewhere in the middle. People in these roles will often have a variety of job titles: Post-Doc; Lecturer; Computational Scientist.

In New Zealand the same group of people exist. At the last international RSE survey (2018), 37 NZ-based people working in research identified as Research Software Engineers (although we know the number of RSEs is actually much larger).

- 91% were males, ranging in age from 25-54 years old
- A majority of respondents work in the computer science and biological science domains
- A majority of respondents said they wanted to spend more time than they currently do on developing software and research, and less time on management tasks and teaching
- When asked to rate (from highest to lowest) what motivates them to be an RSE, the respondents selected (in this order):
 - a desire to work in a research environment
 - the freedom to choose their own working environment
 - a desire to advance research

- I want to learn new skills
- Opportunity to develop software
- Flexible working hours
- Ability to work across disciplines
- Salary and Opportunity for career advancement

By coming together as a community with a shared role title - Research Software Engineer - we now understand their role and contributions in different research groups and organisations far more clearly. We are starting to see some institutions forming centralised teams of RSEs to support the organisation's researchers (e.g. University of Otago, NIWA). Having a label means the role is now becoming a career - something which is required in many digitally driven research groups. By developing a community around this group they are able to build their own support networks; share learnings both around the work they do but also how to succeed as an RSE in the research workforce.

What does good look like for the Aotearoa / New Zealand research sector?

1. Research Software is considered a first class research output
2. Being a Research Software Engineer is a recognised career pathway with appropriate opportunities for career progression

This entire submission should be considered relevant to Area 5 - Workforce. We have also split the response across other relevant sections for broader consideration.

Te Ara Paerangi Area Two - Te Tiriti, Mātauranga Māori me ngā wawata o te Māori / Te Tiriti, Mātauranga Māori, and supporting Māori aspirations

As a group of pākehā people we feel that responses to this section should be led by Māori.

The only message that we want to share is that the Research Software Engineers workforce in New Zealand has a significant lack of diversity in various dimensions. This includes a lack of Māori Research Software Engineers. To enable any Te Tiriti-led activity in the Research Software Engineering space, the community will need to grow and nurture Māori Research Software Engineers.

Te Ara Paerangi Area Three - Te tuku pūtea / Funding

8. Do you think a base grant funding model will improve stability and resilience for research organisations, and how should we go about designing and implementing such a funding model?

Base grants are an opportunity to fund the critical foundational data and software not linked to specific science targets

Research Software / Research software infrastructure are often critical underpinning tools for multiple research targets. Some Aotearoa examples of such software are [R](#) (for statistical modeling) out of the University of Auckland and [Cylc](#) (for complex workflow management) out of NIWA. Both are domain agnostic yet provide significant benefit to a variety of researchers and contribute to various research impacts (R is often used in genomics work; Cylc in climate modeling).

An important consideration in this context is that it is often very difficult to fund RSE work on foundational software and software infrastructure through science grants, which are usually dedicated to specific science targets and require output such as science results and journal papers. Even if software is acknowledged as an output, it can be hard to justify spending money on necessary software maintenance. The development, use and maintenance of foundational software would be a natural beneficiary of the proposed base grant funding.

Te Ara Paerangi Area Four - Ngā hinonga / Institutions

10. How can institutions be designed to better support capability, skills and workforce development?

Appropriate performance review structures for non-traditional research career pathways
It is critical that institutions acknowledge and celebrate the diverse skill sets that make up their leading research teams and contribute to their research outcomes. Many research organisations have a standard 'researcher' performance review approach which rewards traditional research outputs such as journal articles and patents but not necessarily the full suite of outputs which has led to the research impact output itself. For Research Software Engineers whose job title may well be 'Post-Doctoral Fellow' write and maintain the research code base this is detrimental for their careers.

Solution - Institutions need to ensure that their performance review mechanisms truly judge based on the performance they need from their staff, not an outdated and ‘traditional academic’ mechanism relying heavily on publications. For RSE’s specifically, ensure that the diverse requests of a RSE/researcher’s time are captured in the performance review criteria so that they can have career progression if it is less traditional

Training and skills development activity need to be resourced and recognised

Institutions need to understand that with the ongoing digital transformation which we are currently going through, universities alone will not be able to churn out enough researchers with the required skills around computational thinking, coding, data science (for example) to meet Aotearoa’s research impact aspirations. Instead institutions need to look within their current workforce as well. Upskilling of the current workforce is often talked about but is largely under-resourced. For this digital transformation, Research Software Engineers are regularly leaned on to deliver training to upskill their colleagues, regardless of whether it is in their job description, often at the detriment to their research workload. While many enjoy the work and see the benefit in training colleagues, it is rare for it to be part of the position description / performance review programme.

Solution - Institutions need to properly resource any digital transformation activities, particularly in terms of human capital. Where researchers are expected to contribute to training activities this should be rewarded through their performance review framework.

Te Ara Paerangi Area Five - Te hungu nahi rangahau / Workforce

We can look to the work done by the International RSE community as an example of what good can look like for workforce development - particularly in providing an alternate pathway to the traditional Professorial track.

14. How should we include workforce considerations in the design of research Priorities?

Identify key non-traditional research roles necessary for programme success

As research programmes are crafted around chosen Research Priorities, it is important that resources are put aside for work supporting the impactful development, use and maintenance of research data and research software. In some cases this will be undertaken by ‘traditional researchers’, but in many cases the domain researchers will not have the depth of knowledge in research software engineering to deliver the impactful science they aspire to. [NeSI’s](#)

[Consultancy service](#), which pairs up RSEs with research groups to enable and enhance their research through upskilling, code and workflow development and optimisation, data science engineering, etc., is highly sought after and many research groups would aspire to have full time capacity in this area of expertise. Developing a project team with these skill sets early in the piece will set the research programme up for success. Examples where this is currently done well in Aotearoa are QuakeCoRE and NIWA's climate modeling area - both having specific investment into RSE roles to deliver science impact.

Solution - Encourage institutions to identify resource requirements for research data and research software in their science plans and allow funding to cover contributions from these non-traditional research roles.

15. What impact would a base grant have on the research workforce?

Base funding would provide more job security for RSEs making existing research roles more desirable (despite the known disparity between public and industry research roles). This would help with retention of researchers in RSE roles / career pathways who have skills highly sought after in industry.

Te Ara Paerangi - Area Six - Te hanganga rangahau / Research infrastructure

17. How do we support sustainable, efficient and enabling investment in research infrastructure?

Investment into research infrastructure cannot focus on hardware alone

Throughout the Te Ara Paerangi consultation process I have heard a number of voices repeat that the infrastructure cannot be considered purely a hardware investment, rather it is the people wrapped around the hardware that genuinely improve the research impact. Many of the people that are wrapped around the NeSI supporting researcher's to do excellent research are Research Software Engineers - oftentimes PhD qualified domain scientists who we have managed to attract to NeSI based on the allure of helping multiple research groups to make the most of various pieces of technology to either 'do their research' or 'do their research better'. Additional hardware alone will not enable more researchers to do 'better research'. For more researchers to tap into advanced research compute (whether these are new researchers into existing research domains leveraging advanced research computing power; or domains new to

the technology), we will need more Research Software Engineers to support design of appropriate services, user support and training, and advanced support with projects to efficiently undertake their research on the hardware.

Solution - Investment into hardware needs to be matched with investment into the people / the workforce (including Research Software Engineers) to support researchers to leverage the infrastructure.

RSEs / Researchers need to know that their infrastructure is going to be there in the future

The RSE community is one of the major user groups of NeSI (as a research infrastructure). Our compute and data services are a critical tool in their toolkit for delivering impact in their research area. It is a significant task to get up and running on advanced research compute (e.g. training to learn new platform, updating workflows to efficiently use new platform, porting code so that it will run on new platform), so when there is ambiguity over whether the infrastructure is available to your research group, or going to be funded in the near term, you are going to be averse to investing your time in the transition. This may lead to seeking out expensive alternatives or curbing your research ambitions to 'fit' within the technology you have locally.

Solution - Timeframes of research infrastructure investment need to signal to researchers that the infrastructure is going to be around long enough to justify them using it.

Resources

Here are some additional resources from international groups looking at the challenges of Research Software and being a Research Software Engineer to support this submission

- UK RSE Society - <https://society-rse.org/>
- Research Software Alliance - <https://www.researchsoft.org/>