MAPPING COLLABORATION

A Social Network Analysis of Collaboration between CSIRO and Swinburne

CSIRO–SWINBURNE COLLABORATION

Collaboration is about "social relations and processes that take place when individuals come together to achieve something new".[1]

In 2016, The Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Swinburne University of Technology signed a Strategic Research Agreement (SRA), adding a formal layer to their strong collaboration.

CSIRO is Australia's national science research agency, whose research aims are to 'assist Australian industry, further the interests of the Australian community and contribute to Australia's national [economic and social] objectives, and then to facilitate the use of such research'.[2]

Similarly, Swinburne's Strategic Plan 2025 with key pillars of 'research with impact' and 'innovative enterprise', also highlight the importance of connections and relationships to industry, community and also research organisations.[3]

Put simply, collaboration is a critical component to both organisations in achieving their broader goals. "Innovation generally occurs more rapidly and with greater intensity in situations in which there is a higher degree of collaboration".[4]

Over the four years since the signing of the SRA, CSIRO and Swinburne have gone on to deliver a number of joint initiatives that are creating impact. These include: three senior joint research appointments; established co-located and collaborative research capability in Silicon Valley and Melbourne; a growing number of international joint industry embedded PhD students; and increased student exchange through work placements at CSIRO and CSIRO staff studying at Swinburne.

As part of a broader effort to understand and strengthen the current relationship between CSIRO and Swinburne, this research project was commissioned. What makes this project different is that it uses an innovative technique known as social network analysis (SNA) to visualize and statistically analyse these collaborative relationships. This also provides a baseline to see if strategic interventions boost the collaboration over time.

Importantly, the formal strategies put in place through the SRA provide greater opportunities for informal connections and networks to develop between CSIRO and Swinburne, and enable collaboration.

WHAT DID WE FIND?

Trust, alignment, available resources, and boundary spanners are key to success:

• CSIRO and Swinburne share a high level of trust in one another's capabilities.

• CSIRO and Swinburne are strategically aligned, with shared benefits and objectives, values, complementary skills and work ethics all helping to create an overall environment of working together towards a common goal.

• With the availability of shared resources, CSIRO and Swinburne have access to skilled and experienced personnel.

• Boundary spanners can be seen as strategically positioned individuals who facilitate collaboration and distribute information across cultural, social or organisational boundaries. They create social connections that enable new combinations of ideas and resources which potentially lead to innovation. They are vital to a successful partnership.

Specifically, boundary spanners in the CSIRO–Swinburne collaboration are likely to hold a leadership position, be a woman, a CSIRO employee currently studying at Swinburne and/or hold a shared appointment.

Collaboration takes many forms, and the combination of the different forms and perspectives contributes to cross fertilisation of ideas and enables the creation of new and useful knowledge by combining existing knowledge. Collaboration between CSIRO and Swinburne is extensive and occurs through many channels including official business, research collaboration, student supervision, contracts, among others.[1, 5]

1. Katz, J. S. & Martin, B. R. 1997. What is research collaboration? Research Policy, 26, 1-18.
2. Science and Industry Research Act 1949, Part II, Available at https://www.legislation.gov.au/Details/C2012C00352, accessed 12th August 2019
3. Swinburne University of Technology, 2017, Strategic Plan 2025, available at swinburne.edu.au/about/strategy-initiatives/2025-strategic-plan accessed 12th August 2019
4. Australian Research Council, 2003. ARC Submission to Research Collaboration Review, Canberra: Australian Government Publishing
5. Melin, G. 2000. Pragmatism and Self-Organization: Research Collaboration on the Individual Level. Research Policy, 29, 31-40.
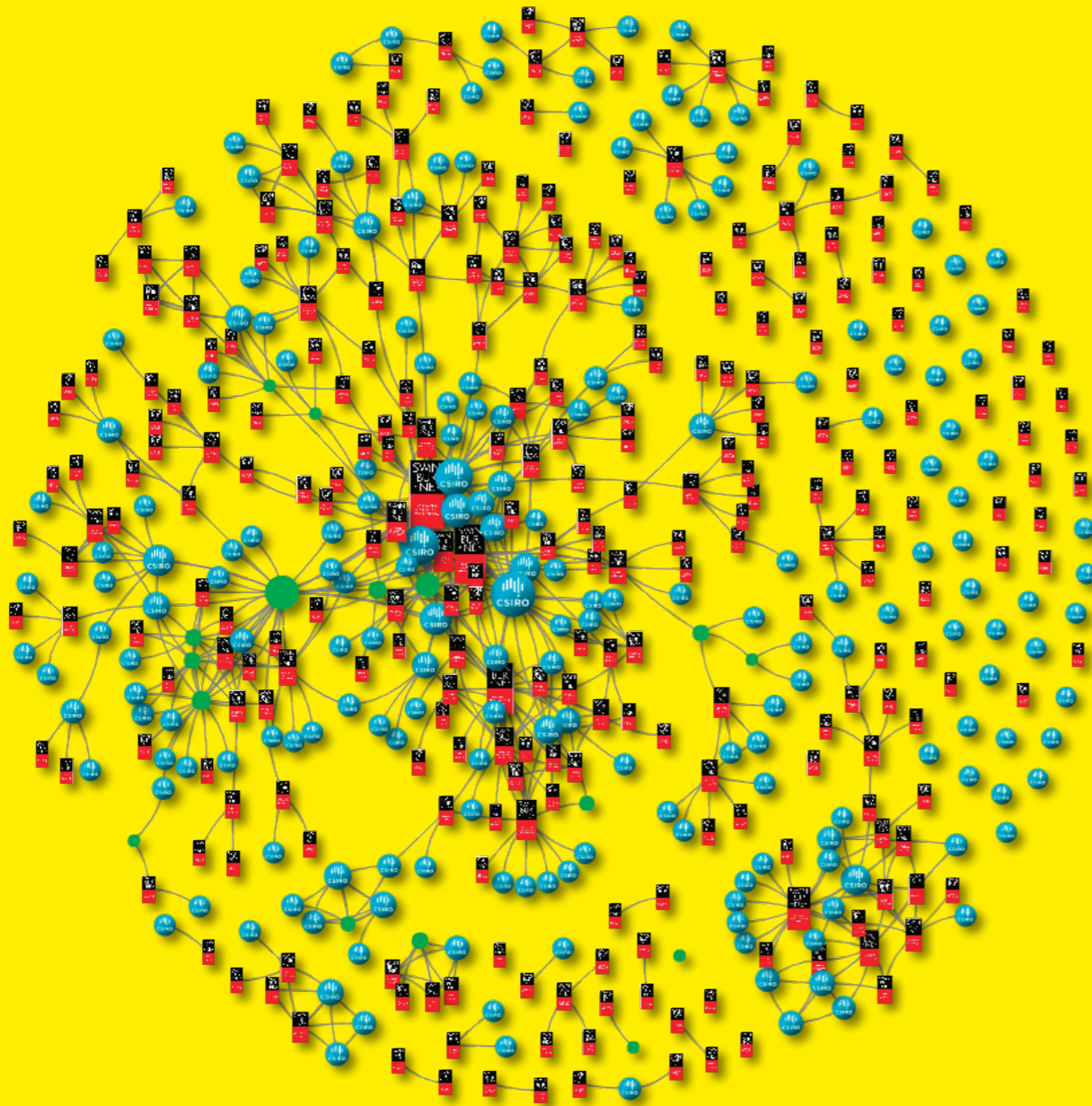
WHO ARE THE PROMINENT BOUNDARY SPANNERS IN THE CSIRO–SWINBURNE COLLABORATION?

Sally McArthur (Swinburne–CSIRO) and **Keith McLean** (CSIRO) were identified as boundary spanners with many connections. What do they have to say about the CSIRO–Swinburne collaboration?

Sally McArthur

Professor of Biomedical Engineering, CSIRO-Swinburne Shared Appointment

Sally McArthur is a Professor of Biomedical Engineering and has a shared appointment with CSIRO in Biomedical Manufacturing. Her personal research couples materials, surface engineering, physical science, analytical chemistry and biochemistry.

Professor McArthur is part of a team at Swinburne exploring new ways to link industry and academia to create a new generation of entrepreneurial, innovative and internationally connected graduates capable of driving the medical and manufacturing sectors forward in Australia and internationally.

Her CSIRO–Swinburne Shared Appointment role focuses on the development of 3D tissue model systems as new in vitro test platforms for the biomaterials, pharmaceutical and medical/bio technologies sectors.

> **We need more joint appointments. I think we need more people who are working both ways and they shouldn't be only on a research basis.**
>
> **Labour mobility is huge, you cannot underestimate that in all of our relationships.**
>
> **It is about being a voice in that community, and it's not that we get something from CSIRO it's that they get something from us as well. That's the classic situation of symbiosis; one will die without the other, because the capacity and the demand isn't there.**

LEGEND

- 🔵 CSIRO
- 🔴 Swinburne University of Technology
- ---- Collaboration through contract
- —— Collaboration through supervision
- --- Future collaboration
- —— Collaboration through official business
- ---- Collaboration through workshop
- —— Research collaboration
- ---- Other collaboration

Keith McLean

Director, Manufacturing CSIRO

Keith McLean has a PhD in industrial microbiology from the University of Aberdeen, Scotland where he developed expertise in biofouling and bacterial surface interactions. Following spells in industry and industrial postdoctoral fellowships in New Zealand and Australia he joined CSIRO in 1989 working on surface modification and charactisation for ophthalmic and other polymeric biomaterials applications.

Dr McLean became Director of CSIRO Manufacturing in July 2014 and he leads 400 scientists and engineers developing solutions for high-tech Australian manufacturing, with a directed focus on research in Biomedical Manufacturing; Chemical and Fibre Industries; Metals Manufacturing and Innovative Manufacturing.
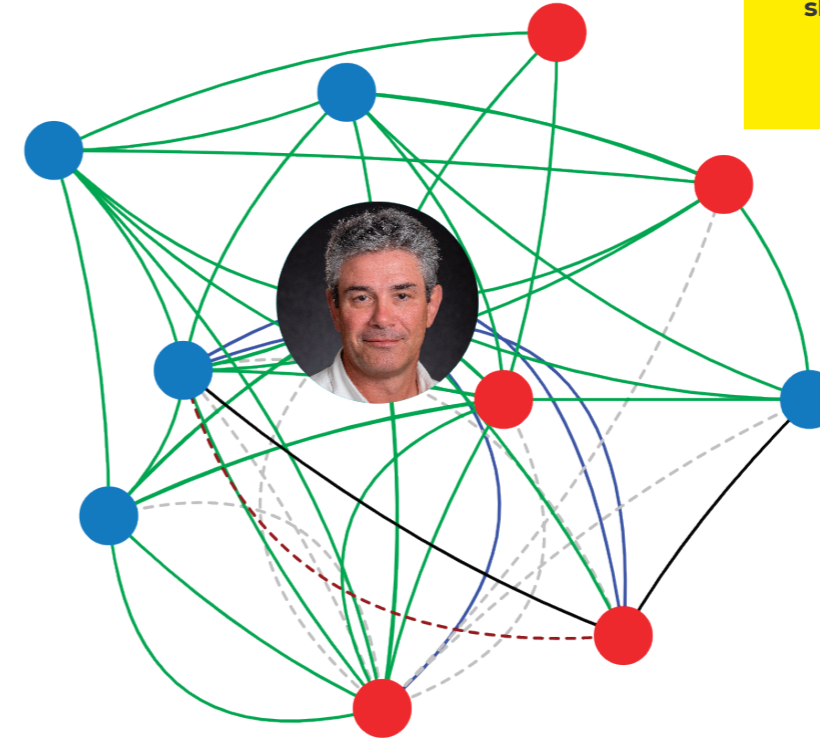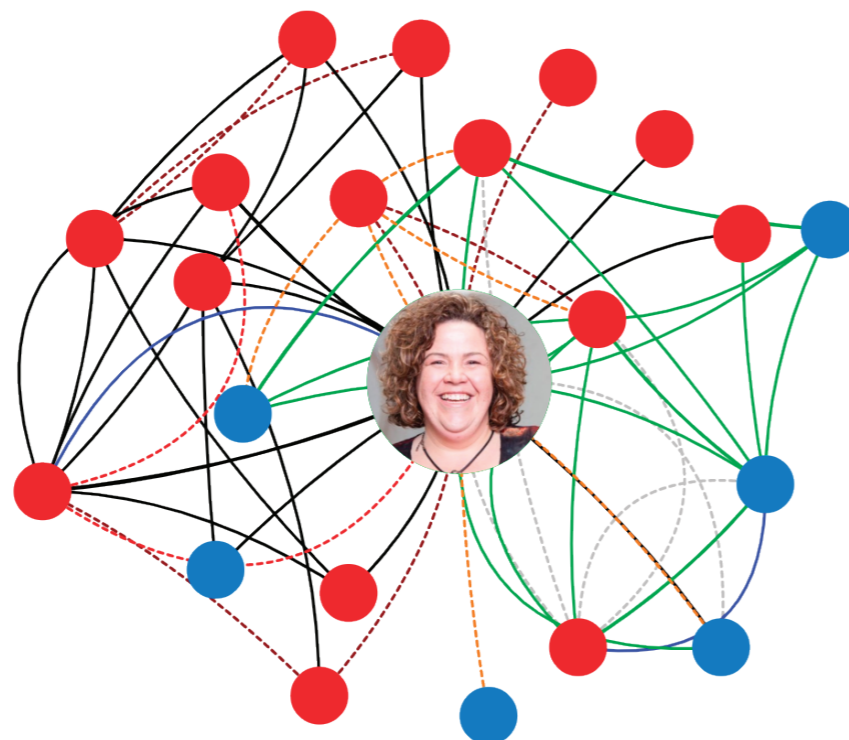
> **Our CSIRO Science Leader Sally is 100% Swinburne appointment, but she spends 50% of her time at CSIRO and that is key to bridge building across our organisations.**
>
> **Jointly supervised students are equally important. You want them to have a good experience in both the university and at CSIRO and you want them to be advocates for both organisations going forward.**
>
> **Networking is important but I think it's become vital. In fact, it's probably not necessarily the science networks [that are important]. It's other networks, it's about how you tap into people in industry, how you tap into people with business development skills, how you understand markets.**

SWINBURNE'S SOCIAL NETWORK RESEARCH LAB

Swinburne's Social Network Research Lab is a recognised world-leader in the methodological development and application of cutting-edge statistical models for social networks called exponential random graph models.

These network models provide unparalleled insights into the relationships and social processes within and across organisations by identifying network patterns that the eye cannot see. Understanding the reasons why people are connected to others gives decision makers an evidence-base to pursue strategic, targeted and economically sound directions for the organisation by making visible hidden social structures.

Our clients include: Boeing Aerospace Australia, Siemens, Victorian Department of Premier and Cabinet, UAP, and the Australian Football League (AFL).

Speak to us about how we can work with your organisation by emailing Professor Dean Lusher on dlusher@swin.edu.au
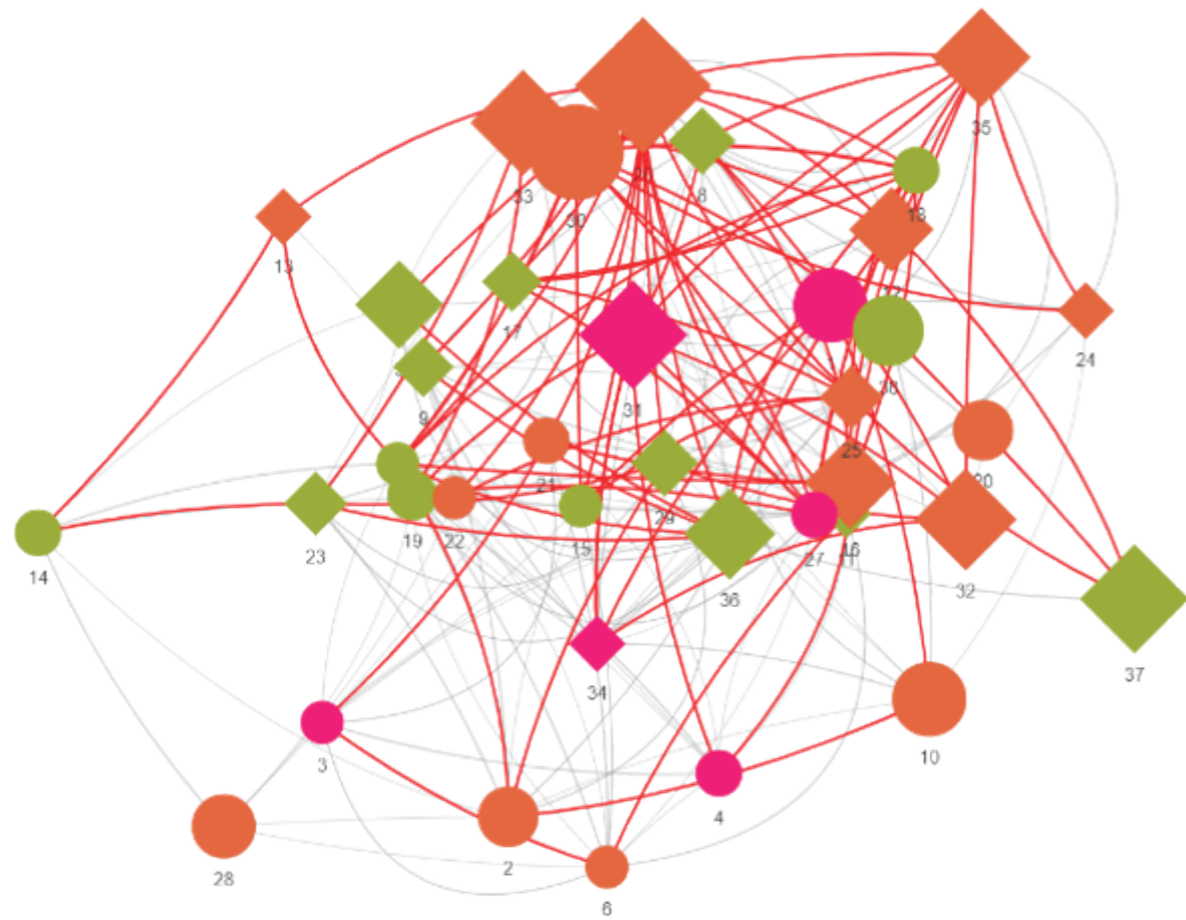
SOCIAL NETWORK ANALYSIS
A SET OF TOOLS FOR MEASURING COLLABORATION

Social network analysis (SNA) is a general approach to analysing social systems of interconnected social entities, with a focus on the "patterns and implications of these relationships".[6]

A network consists of a set of nodes and a set of ties that connect them. Network nodes (or actors) can be people, groups, teams, organisations, or some combination of these. Notably, actors can have attributes – for example knowledge level, knowledge type, experience, various motivations, and personality types. Network ties can be any sort of relationship – for example, collaboration, advice, trust, or knowledge transfer.

The visualisation of networks is perhaps the most recognised and appealing aspect of social network analysis. Network visualisations (or graphs, or maps) can quickly and clearly demonstrate a range of complex information in pictorial form.

However, while simply inspecting pictures and visualisations of these networks can be informative in its own right, these networks often hold repeated patterns that are difficult to see with the naked eye.

To aid the process of recognising prominent patterns within collaboration networks, various forms of analysis can be performed such as community detection, identifying brokers, and measures of cohesiveness. Further, a state-of-the-art statistical techniques such as exponential random graph models (ERGM) can be used to identify the key drivers and underlying substructures that help networks form.[7]

6. Wasserman, S. & Faust, K. 1994. Social network analysis: methods and applications, New York, Cambridge University Press.
7. Lusher, D., Koskinen, J. & Robins, G. 2013. Exponential random graph models for social networks: theory, methods, and applications, Cambridge, Cambridge University Press.

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