

The Challenges Facing Open Access Nanofabrication Facilities

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ABSTRACT

Under the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS), previously isolated centers of excellence have been united to form the Australian National Fabrication Facility (ANFF), which provide researchers with access to state-of-the-art nanofabrication facilities. The NCRIS funding also supports a cohort of expert technical staff to enable user access to the increasing complex instrumentation. Despite this, key challenges facing ANFF have included the recruitment and retention of suitably qualified staff. Sources of ongoing operational funding at the end of the NCIRS period are also a concern. Hence the organisational strategy must be to position ANFF as an employer of choice

Keywords: multi-user facilities, nanofabrication, staffing profile

1 INTRODUCTION

Over half of Australia's 39 universities are undertaking some form of nanotechnology research. Programs span a broad range encompassing both bottom-up bio-nano and advanced materials development to top-down photonics and nanoelectronics. Historically, Australia has fostered internationally recognized centers of excellence in a range of disciplines, including quantum computing, medical bionics, and photonics and optical science, each with associated nanofabrication facilities. However, these centers have operated in isolation and access has been limited to members of the host institution.

Funding of major research infrastructure in Australia falls under the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). The Strategic Roadmap, first released in 2006, recognizes the economic and efficiency benefits of taking a collaborative approach to establishing infrastructure. Nanofabrication was identified as one of the sixteen priority funding areas, leading to the establishment of the Australian National Fabrication Facility (ANFF) in 2007. ANFF links 20 participating institutions to provide researchers with open access to state-of-the-art fabrication facilities. Further, the facilities provide the collaborative hub for the multi-disciplinary teams that nanotechnology requires.

2 THE AUSTRALIAN NATIONAL FABRICATION FACILITY

As a national facility, ANFF provides a cohesive structure for interactions with stakeholders, including Australian researchers, industry, host institutions and funding partners.

ANFF is headquartered in Victoria at the purpose-built Melbourne Centre for Nanofabrication (MCN). The participating institutions are organized into seven Nodes. In some cases the grouping is based on location, for example, six universities and the Commonwealth Science and Industrial Research Organisation (CSIRO) based in Melbourne form the Victorian Node. Other groupings are based on research synergies. The OptoFab Node includes universities in Sydney and Adelaide, together with an industrial partner. The Node offers specialist services in the micro processing of both planar and bulk optical materials, such as, silica, lithium niobate and polymers to provide a range of microphotonic technology platforms for applications including telecoms, biotechnology, industrial processing, and security.

The Nodes draw on the existing infrastructure and expertise. Each offers a specific area of capability including advanced materials, nanoelectronics & photonics and bio-nano applications. The network offers unique opportunities for multi-disciplinary programs.

3 ACCESS MECHANISMS

ANFF users include students, publicly funded researchers and industrial clients from across Australia and overseas. A measure of success for each Node is the extent to which they attract users from outside their host institution.

ANFF operates with a national Access and Pricing Policy that seeks to minimize barriers to accessing major research infrastructure for meritorious work. The mechanisms are described in the ANFF Access and Pricing Policy, which is available from the website www.anff.org.au. Researchers are able to either work at the ANFF under expert guidance, or to contract for specialized products to be fabricated at a reasonable cost. By coordinating the user request process across the Nodes the most appropriate facilities can be identified. In some cases, multi-node projects are required.

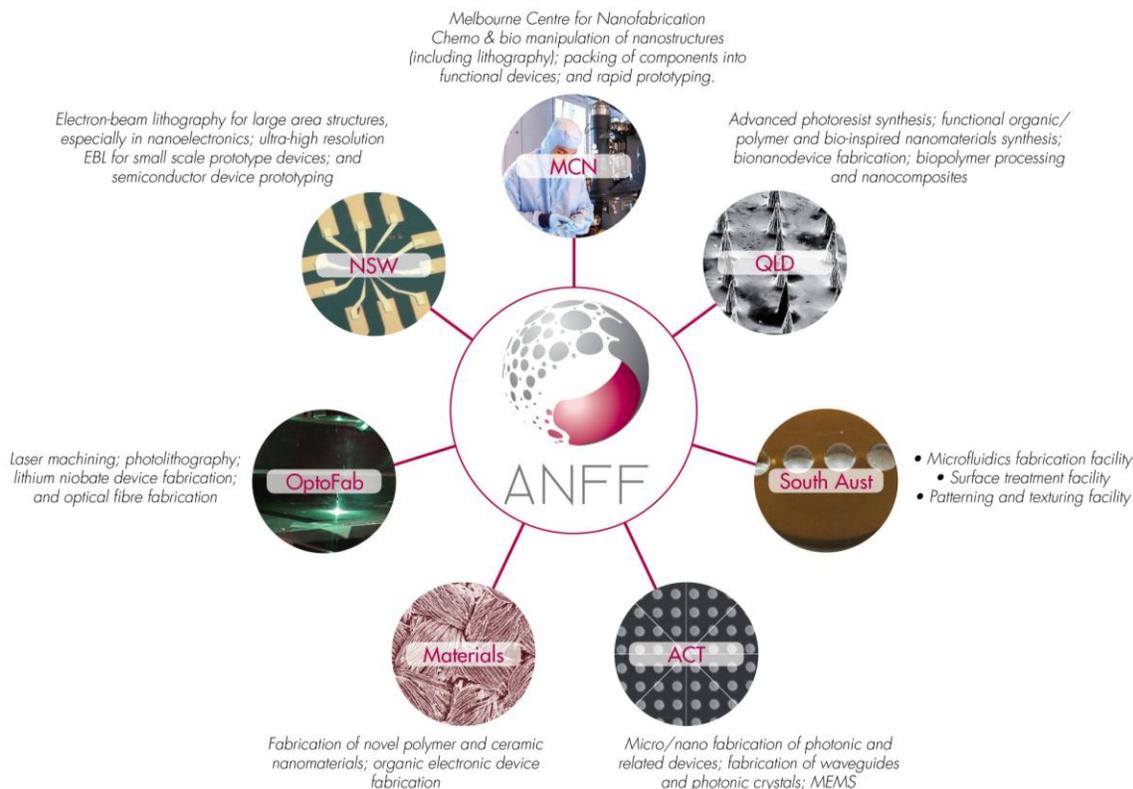


Figure 1: Each of the seven ANFF nodes offer a specific range of expertise.

4 CHALLENGES

The major challenges facing ANFF in the next 3-5 years have been identified as shortages of operational funding and suitably qualified staff.

4.1 Operational Funding

User charges for all NCRIS facilities are based on a **marginal costing** scheme. This means that the Nodes may charge each user the additional costs that their use of the facility has incurred, for example, a contribution towards the cost of chemicals or specialty gases. Under the ANFF Access and Pricing Policy, students receive a discounted rate. All publicly funded researchers are charged the same rate, regardless of their host institution. Theoretically, under a marginal costing scheme, operating costs for the facility can be recovered from the users. However, whilst a national network provides a major advance in the facilities available, historically, the funding framework has not included paying for access to these facilities. Typically, users do not include these costs in grant applications. As a result, the Nodes are unable to charge true marginal costs. To date, NCRIS funding has covered the majority of operational costs and salaries.

The appropriate balance of user fees and grant support for a given facility is dictated by the local context and will vary with time. Under NCRIS, both capital and operating

costs are considered eligible expenditure. However, subsequent government funding has been restricted to the *creation and development of research infrastructure*; operational costs for the facilities must be met from other sources. Hence the access cost structure for internal/external and industry users must be balanced to ensure maximum utilization by publicly funded researchers whilst providing an adequate income stream.

4.2 Facility Staffing

Fundamental to the success of a facility is the cohort of highly qualified technical staff. A distinguishing feature of the NCRIS program is that it has provided funding for technical staff and over 30 new appointments have been created within ANFF. However, staff recruitment and retention have provided significant challenges.

A number of Australian universities offer undergraduate and postgraduate studies in nanotechnology. A feature of the programs is the range of specialist courses to prepare students for a variety of scientific professions. Despite this, recruitment has been a major challenge for the Nodes.

An international recruitment program has been required to fill the positions. The response to advertising varied by Node and this is thought to be a combination of the Node's location and the core strengths, with positions involving the life sciences being easiest to fill. Many of the successful

applicants were working outside Australia at the time of the interview.

Following from a protracted recruitment program, the staff retention rate has been worse than expected. The primary reason identified for staff leaving the facility has been to pursue independent research careers. Initially, it was feared that the uncertainty attached to the short-term funding contracts would cause staff to seek new positions in the final years of the NCRIS program. In some cases, contracts extending beyond the NCRIS funding period were necessary for recruitment. However, the length of contract has not been cited as a major concern. Instead, there has been a mismatch between the requirements of a user support role and staff expectations of a university-based appointment.

The Australian university sector uses two pay scales for staff: general staff, including technicians, and academic staff, for all research and teaching appointments. To attract suitably qualified staff with sufficient experience to oversee instrument purchase and commissioning, it has been necessary to offer a number of positions on the academic scale. Hence, the staff profile across the ANFF includes both technical and research appointments. Metrics for the two groups are very different, with research staff judged on their publications and grant success.

The metrics for a national facility include the number and type of users; the amount that flagship instrumentation is used; and the outputs from the facility, including papers and patents. Clear tensions exist between the performance indicators for a research staff member and metrics for a multi-user facility, for example the number of papers published versus number of external users supported.

5 RECOMMENDATIONS

It is important to understand the funding models used internationally, the lessons learned must be translated into funding policy over a longer period. Users must be encouraged to include access costs for major research facilities in grant applications.

In contrast, strategies to address staff retention must be designed and implemented immediately. Improved retention requires changes to the staffing profile and thus begins with recruitment. Nodes have differed in their structures and in some cases all appointments have been on the academic scale. Given that the initial procurement and construction phase is well advanced, the emphasis of the roles changes from the specification and commissioning of systems required for facility establishment to operation and process modification required to meet user needs. Hence, an adjusted staffing profile with a greater range of positions is possible.

It is essential that all applicants understand the organizational objectives and the scope of the role, particularly that it is not a suitable pathway for a research career.

Further, positions must be structured to ensure the appointment continues to add to the incumbent's resume. The formation of an Australian national network provides opportunities for inter-state staff exchanges. This enables training in new techniques and increases the skill base. The development of peer networks is also expected to increase job opportunities. Nationally we have achieved a critical mass that cannot be supported in a single institution.

The scale of Australia's commercial nanotechnology activities to date limits employment opportunities. However, it is anticipated that access to ANFF's state-of-the-art facilities will promote growth in the sector creating a positive cycle of demand.

It is necessary to recognize that most technical staff appointments will be for a period of up to three years. As an organization, ANFF must ensure that the appointments are intellectually rewarding and staff complete their tenure with increased skills equipped to take up another position in the network or in Australia's growing nanotechnology industry sector.

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