COVID-19 disruption to research and research training in Australia

Gender and Career-Stage Inequalities

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This article surveys available evidence of disruptions of the COVID-19 pandemic to Australian university-based research and to the research training pipeline, considering both the long-term implications of this disruption, as well as the disproportionate impacts on higher degree research candidates, early-career researchers and women academics with carer responsibilities. Drawing on existing global and local research studies, media reports, internal institutional documents, policy and advisory documents, data from the Department of Education, Skills and Employment, the Australian Bureau of Statistics and the Australian Research Council, the article argues that specific targeted management interventions and federal policy changes will be needed for the equitable and sustainable restoration of research capacity in the challenging funding environment beyond 2022.

Keywords: Australian research; research capacity; COVID-19 impact on research; responses to COVID-19; women and early-career researchers

Introduction & Background

Building on the previous edition of AUR with its focus on COVID-19 impacts on Australian universities (Roffee & Kimberley, 2022), this article considers the long-term effects of the continuing pandemic on the research pipeline from postgraduate to early career to established researcher stages, and with particular reference to gender equity. There are strong indications of an ongoing and significant impact of the disruptions caused by the COVID-19 pandemic on Australian universities' research capacity and performance, albeit unevenly distributed across different disciplines and among diverse academics according to gender, carer status and career stage. As the editors of the Journal of Higher Education Policy & Management have recently noted, 2022 is not yet 'post-pandemic' for Australia's higher education system (Bentley & Graham, 2021). The ramifications of this impact for Australia's knowledge landscape over the next three to five years will likely depend upon both federal policy and institutional interventions to regenerate capacity throughout the research-training and career pipeline, while addressing the disproportionately severe detriments incurred by early-career researchers (ECRs), women academics with carer responsibilities, and research degree research (HDR) candidates compared to the academic cohort as a whole.

In its first section, this article sketches the Australian university funding landscape during the global COVID-19 pandemic, examining available evidence of an overall decreased research capacity in Australian universities since 2020. It considers the extent to which Australian universities appear to have attempted to preserve research capacity in their determinations of cost-saving measures faced as they

were with the budget deficits brought about by the pandemic-related international border closure.

Next, the article considers whether loss of research capacity has disproportionally affected early-career researchers and women academics, particularly those who are carers, and considers evidence of the impacts on research degree completions and wellbeing.

The final part of the article questions whether these various impacts may be expected to lower Excellence in Research for Australia (ERA) ratings in certain disciplinary fields and not others, or to lower international rankings for Australian institutions over the coming years, and critically examines the prognosis of an automatic return to pre-existing research capacity and performance measures after the pandemic.

The conclusion proposes management strategies and government policy changes that may help to regenerate research capacity sustainably and equitably in key areas most likely to result in downstream improvements in research performance measures.

Methodologies and Sources

This narrative article is based on a review of 41 existing global and local peer-reviewed works of scholarship, 11 media reports, 24 institutional and organisational policy or external consultant advisory documents, three datasets from the Department of Education, Skills and Employment (DESE), two from the Australian Bureau of Statistics, and three from the Australian Research Council (ARC). It is informed by the researcher's primary disciplinary expertise in global historical medical humanities and gender studies and by their emergent practical and scholarly expertise in research governance and management. It is informed by the ethical values of distributed and connected leadership (Bolden *et al.*, 2015; Hayward, 2015), and of research mentoring and enabling (Phillips & Denison, 2015), which underpin its perception of university workers and students as more than mere resources to be managed, and instead as effectively constituting the university itself.

Results

Several higher education researchers in Australia proposed in 2020 that the impacts of the COVID-19 pandemic risked long-term damage to national research capacity (Croucher & Locke, 2020; Johnson *et al.*, 2020; Littleton & Stanford, 2021). In May 2020, a report prepared for the federal government by the Chief Scientist, Dr Alan Finkel, in collaboration with 13 academic and scientific leaders, predicted that Australia's research workforce would be severely impacted for several years after the pandemic, that it would likely have a disproportionate impact on women and early-career researchers, and that it would result in losses in industry innovation – given that universities in Australia conduct 43 per cent of all applied research – with the consequent detriments to the entire economy (Australian Academy of Science, 2020). Experts evaluating the impact of the pandemic measures on Australian universities in 2020 estimated a reduction in the university research workforce of 11 per cent (some 5,100 to 6,100 researchers), inclusive of research degree candidates, research assistants, academics and research leaders (Larkins & Marshman, 2020).

University research capacity in Australia was bound to be impacted by the pandemic-caused student enrolment losses, given that it was estimated that at least 20 per cent of university research was funded by neither external grants nor directly by the federal government but was instead subsidised by student fees (Wells Advisory, 2021; Larkins & Marshman, 2020). In their increasing turn towards a model of a corporate enterprise, Australian universities have become increasingly reliant on international student income to sustain research and remain viable with decreased federal support, while benefitting from unrecognised free labour that many academics commit regularly in excess of their official work hours (Blackmore, 2020).

In 2016 revenue from international student income for universities in the state of New South Wales (NSW) first exceeded that of all other income sources, including that from domestic students, prompting the assessment of this arrangement as a 'regional concentration risk to future revenues' by the Audit Office of NSW (2016, p. 33). International student fees in Australia before the pandemic were 27.4 per cent of total student fees (Ferguson & Spinks, 2021) and during the pandemic between 2019-2021, new international student enrolments halved (Wells Advisory, 2021). National expenditure on research stood at 1.79 per cent of GDP before the pandemic, well above the OECD average of 1.49 per cent, but it dropped to a mere 0.48 per cent in 2020 (Bebbington, 2020).

The connection between the pandemic budgetary impacts from the loss of international students and research capacity is particularly suggested by the substantial overlap between some of the more research-intensive universities being among those suffering the greatest deficits due to their high international student load before the pandemic (Wells Advisory 2021), especially the Australian National University (ANU) (which suffered a loss of 17.4 per cent), the University of Melbourne (a 7.8 per cent loss), and the University of New South Wales (an 8 per cent loss) (Larkins & Marshman, 2021). Europe's U-Multirank (funded by a combination of corporate and European Union (EU) income), reported in 2021 that Australian and UK universities suffered the largest global losses of income during the COVID-19 crisis, losses of 21 per cent and 14 per cent respectively, due to the

high levels of international student income both countries relied upon, noting that research-intensive universities in both countries were the hardest hit because they have also tended to be the most attractive to international students (U-Multirank, 2021). As education scholar Jill Blackmore notes, the 'precarious arrangement' of Australian universities prior to the pandemic became fractured by COVID-19 both through the loss of international student income, and because of the new and often untenable workload demands placed on an already over-hours academic workforce (Blackmore, 2020).

Many Australian university executives do appear to have sought to avoid detriments to research capacity, devising multiple strategies to mitigate budgetary losses apart from academic redundancies, including halting infrastructure development, reducing operating costs and executive salaries, freezing new hiring, mandating banked leave purchases for staff, and drawing on financial reserves, including property sales (Marshman *et al.*, 2020; Thomson, 2020; Australian Property Journal, 2020). Still, most universities also sought redundancies of continuing and fixed-term academics as a cost saving measure to offset 2020 and 2021 budget deficits, citing as reasons the impact of the pandemic border restrictions on international student enrolments, and not being supported by the federal JobKeeper program. The largest number of redundancies of continuing and fixed-term academics (not including casual staff) occurred at the University of New South Wales (-726 full-time equivalent (FTE)), Monash (-628 FTE), RMIT University (-583 FTE), while several others dissolved around 400 full-time positions, including University of Technology, Sydney (-489 FTE), La Trobe (-482 FTE), ANU (-470 FTE) and Griffith (-428 FTE) (Hare, 2022).

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In February 2021, the peak body of Australian universities, Universities Australia, announced that universities nationally had lost a total of 17,300 jobs (both academic and professional) and an estimated AU$1.8 billion in revenue due to the COVID-19 pandemic thus far, with ongoing deficits predicted into 2021, and referred to the long-term detrimental impact this would have on Australia's 'knowledge reservoir' (Universities Australia, 2021). Academic job-losses initially most heavily impacted casual teaching academics who are not an especially significant group for research outputs and grant success (though they may become so over their ongoing development).

However, full-time continuing and fixed-term teaching/research and research-only academic jobs were also lost. This contrasted with the practice in the US system where tenured academic staff were most often given a temporary pay reduction to offset the budget deficit produced by the pandemic measures, although untenured staff were summarily dismissed there as well (Woolston, 2021). It also contrasted with the practice in both the UK and especially in continental European universities where budget impacts were both smaller than in Australia and where universities were far more supported by state income assistance programs than in Australia.

The European University Association in May 2020 reflected on the likely impact of the COVID-19 pandemic and drawing on the lessons of the 2008 global financial crisis, recommended new financial rescue packages prioritising research and innovation 'as fundamental areas for future development' (European University Association, 2020, p. 6). In practice, the EU countries do appear to have preserved all permanent academic jobs during the pandemic, though it was predicted that many unsecured positions would not be converted into permanent roles (Matthews, 2020).

This international comparison is significant for its suggested consequence for Australian universities' performance in international rankings, such as those conducted by the Times Higher Education (THE), Quacquarelli Symonds (QS), the Shanghai Academic Ranking of World Universities (ARWU) and others. These bodies compare universities worldwide, often based on research citations sourced from Scopus and on reputational surveys (Barron, 2017). If Australian research capacity and publication output have been damaged disproportionately relative to other OECD countries, it is likely that our universities' international rankings will suffer for several years to come, even assuming repair of the damage inflicted on research capacity. Wells advisory modelling for TEQSA (Australia's 'Tertiary Education Quality and Standards Agency') notes that the roughly 20 per cent reduction in Australian research outputs they estimate during the pandemic will not be immediately evident in international rankings but will likely result over the next few years from 2022-2025 in a 35 per cent drop in QS ranking across Australian universities (Wells Advisory, 2021).

Many teaching/research academics in universities around the world lost research time during the pandemic lockdowns in transferring course offerings to online form and in the increased need for home-support of their children's schooling – a burden that was disproportionately born by women academics (Radecki & Schonfeld, 2020). But the effect of

this on research capacity is likely less than that resulting from the loss of many entire academic research positions as also occurred in Australia due to management responses to the loss of international student income and due to the omission of universities from the JobKeeper allowance provided by the federal government to other industries.

Anthony Welch notes that the impacts of COVID-19 on higher education systems have been highly uneven globally, and while Australia, Canada, UK and New Zealand all relied heavily on international student income which was disrupted by the pandemic, both the UK and Canada provided compensation to universities to support research activity in the face of lost international student income; but Australian universities both were the most reliant of all nations on international student income, had the longest border closures, and less government compensation for lost income relative to the rest of the Anglosphere (Welch, 2022).

There are divergent accounts of the number of total academic jobs lost in Australia to date (Wells Advisory, 2021; Littleton & Stanford, 2021; Norton, 2022a). However, a consideration of the specific kinds of positions lost suggests it is likely that early-career academics have been disproportionately impacted relative to established researchers. Among the continuing academic jobs abolished in 2020-2021, by far the largest category were teaching/research academics, representing 1,837 full-time positions, or 5.9 per cent of total full-time academic jobs. Casual teaching-only positions were even more heavily targeted, causing financial distress to many individuals. But from the perspective of how research capacity was impacted, the casual teaching staff dismissed represented only 324 full-time equivalent (FTE) staff, although 245 FTE research-only staff were also dismissed (Norton, 2022b).

Casual employees are often also hired in Australian universities to replace the teaching duties of continuing academic staff on competitive research grants via 'teaching-relief' items in grant budgets; thus, casual staff contribute indirectly to the support of high-quality research even when they are themselves only teaching. The largest group of full-time academic redundancies in Australia were among Lecturer-level teaching/research staff (referred to in Australia as Academic Level B), representing 1009 positions (Norton, 2022b). It may be assumed that full-time teaching/research and research-only academics occupying Academic Levels C-E (referring to senior lecturers, associate professors and professors, respectively) are those most likely to generate high research outputs and competitive grant success, as these levels tend to correlate with mid-career and senior academics with established research track-records. It may be then that Level B teaching/research academics were targeted for redundancy because their loss was assumed to be less damaging for an institution's research capacity, or simply because they constitute the largest category of continuing academics (ARC, 2021).

However, data from the Department of Education, Skills and Employment (DESE) on academic positions indicates that while Level B did see the largest decrease between 2020-2021 (-6.1 per cent), redundancies were also significant at Level C (-3.6 per cent) and at Levels D/E (-3.7 per cent), suggesting that research capacity was indeed reduced substantially across the university sector. DESE data indicate that younger academics were by far the most affected. Moreover, Level A (Associate Lecturer) positions were also significantly dissolved (-3.9 per cent) (DESE, 2021, Table 1.2), which may indicate a loss of research capacity even more than Level B. The Higher Education Industry Academic Staff Award excludes the use of Level A fixed-term contracts for teaching-only staff (Fair Work Ombudsman, 2020), and in practice, many Level A positions are postdoctoral Research Associate roles, though Level B salaries are sometimes also assigned to fixed-term Research Fellow contracts. The COVID-19-related budget cuts in universities in Australia, the US and the UK have been observed to target research postdoctoral positions heavily due the insecurity of these roles in most systems globally (Gilbert, 2021). While the loss of more junior Level A and B researchers may not be as significant for citations metrics, ERA rating and international rankings (relative to senior research staff), it may still represent a significant loss of capacity to execute research, particularly if Research Associates and Fellows are embedded within collaborative group projects where they have a critical role. The current centrality of postdocs in scientific research, despite the image of them as junior scientists, was acknowledged in a 2014 report of the US National Centre for Biotechnology Information (National Academies, 2014). Indeed, in many science, technology, engineering and mathematics disciplines in Australia, and in some social science disciplines, Level A and B researchers, as well as research degree candidates, are often embedded in this fashion in large group projects (National Academies, 2014). The loss of these researchers, along with disruptions to research degree candidatures, may thus continue to exert long-range detrimental effects on Australian universities' research outputs.

Because the upcoming 2023 ERA refers to publications in the period 2016-2021, it is likely that some research groups in many universities will see a reduced rating that reflects the negative impact on research capacity and outputs during 2020-2021, unless the disruption is taken into account by ERA assessors. The reduction in research outputs may continue beyond 2022, resulting in impacts on the subsequent ERA as well. Some field of research (FOR) codes will undoubtedly be more affected than others. Internal data from some universities indicates a more than 50 per cent reduction between 2020-2021 in Non-Traditional Research Outputs (NTROs) in creative practice disciplines where live performance is a key output (School of Humanities and Communication

Arts, Western Sydney University, 2021). This reflects the general pandemic reduction of entertainment arts and creative industries in Australia which the Australian Bureau of Statistics estimates to have been a 11.4 per cent between 2019-2020 (Australian Bureau of Statistics, 2021; and Eltham & Penninton, 2021). Impacts on STEM research (in science, technology, engineering and mathematics) is uneven as well. As the authors of a 2022 article in the journal PLoS One have shown, the pandemic has resulted in a decrease in non-COVID-related biomedical research publications of 10 to 12 per cent, and reduction in non-COVID-related clinical trials of 24 per cent (Riccaboni & Virginer, 2022). Given the high citation rate of COVID-related scientific publications during the pandemic, biomedicine-related FOR codes in Australian universities (which are citation-assessed in the ERA) may receive higher ERA ratings, while international rankings will likely change little since the rerouting of medical research toward COVID – the 'covidisation' of research – is a global phenomenon (Pai, 2020). Nonetheless, the capacities of medical researchers, especially women with carer responsibilities, have also been impacted at every stage of the research-training and early-career pipeline (Matulevicius *et al.*, 2021; Johnson *et al.*, 2021).

At stake in Australian executive management decisions to down-size the number of academic staff, faced with the budget deficits relating to the pandemic measures, was the question of whether to reduce whole areas of low performing research or student enrolment, or to reduce a percentage of staff in many areas. The latter would be likely to have detrimental impacts on research rankings and ratings in multiple disciplines, especially in the ERA where critical mass in assessed FOR codes tends to produce higher ratings, certainly in citation-based disciplines, but also in the peer-review disciplines, due to the possibility it provides to select only the very highest quality pieces of scholarship for the 30 per cent peer-review sample. Based on analyses of the historic UK Research Assessment Exercise (RAE – now called the Research Excellence Framework, REF), a branch of mathematical socio-physics proposes that high research quality assessment is most common in a specific critical mass number of individuals in a research group, which varies between disciplines (Kenna & Berche, 2011). International ranking systems include both reputational and metric output measures, and so are also likely be impacted by reduced research productivity and critical mass. This being so, Australian research may be particularly disadvantaged due to its disproportionate losses of full-time academic positions during the pandemic relative to other OECD countries.

Because the loss of undergraduate students was what caused the dramatic budget deficit in Australian universities in the first instance, it is possible that change executives may have been inclined to target discipline groups with low undergraduate student enrolments, rather than those with low research performance, resulting in research capacity impacts being poorly predicted or even measured post-hoc. Academics involved in teaching large student cohorts could not easily be dismissed without causing immediate staffing problems for those teaching programs, thus aggravating curriculum provision that was already disrupted by the precipitous demand for online-only pedagogy. Some institutions clearly targeted low-enrolment areas of undergraduate teaching at the cost of high-quality research and research degree provision, the most striking example being the University of Western Australia which unusually dissolved its entire research discipline of Anthropology and Sociology, abolishing eight full-time teaching/research positions and converting twelve others to teaching-only positions, with the administration citing low undergraduate student numbers as the reason rather than poor research performance (Styles, 2021; Campus Morning Mail, 2021). Indeed, the University of Western Australia's Anthropology and Sociology field of research (FOR) codes (1608 and 1601) had each achieved a rating of 4 (above world standard) in the 2018 ERA (ARC, 2019). But with few remaining research-employed staff now left to publish under these FOR codes, the university will undoubtedly receive a downgrade in future ERA ratings, if they proffer these codes for assessment at all: A clear loss to the Australian research landscape.

Beyond the university sector, disproportionate pandemic impacts on women's work of all kinds have been observed throughout global economies, including throughout the higher education sector. A UK study conducted by the Institute for Fiscal Studies in 2020 reported women workers of all kinds to have been more commonly furloughed or made redundant than men. They also found working mothers to be commonly undertaking nine hours per day childcare during the pandemic lockdowns (Andrew *et al.*, 2020). From 2020 Australia's Workplace Gender Equality Agency (WGEA) warned that the COVID-19 pandemic was impacting women more than men because they were more often frontline healthcare workers, were disproportionately burdened with increased carer responsibilities, faced greater financial precarity, and were more exposed to domestic violence during the lockdowns (WGEA, 2020). A report commissioned by the Grattan Institute in 2021 also found Australian women to have absorbed a far greater burden from the COVID-19 pandemic lockdowns, both because of the gendering of job losses, and because women assumed the lion's share of increased unpaid domestic labour (Wood *et al.*, 2021).

There is now a vast and still-growing body of evidence indicating that pandemic lockdowns and the need to transform face-to-face teaching offerings rapidly to online among teaching/research academics had a disproportionate impact on women academics' research outputs and career success during the pandemic, particularly among women

carers of school-aged children (Andrew *et al.*, 2020; Guy & Arthur, 2020; Hermann & Neale-McFall, 2020; Beech *et al.*, 2021; Deryugina *et al.*, 2021; Donoso & Valderrama, 2021; Johnson *et al.*, 2021; Kasymova *et al.*, 2021; Matulevicius *et al.*, 2021; Minello *et al.*, 2021; Urio *et al.*, 2021; Walters *et al.*, 2021; Staniscuaski *et al.*, 2021; Bowyer *et al.*, 2022; Cohen Miller & Izekenova, 2022; Watson *et al.*, 2022). This impact entailed suddenly increased carer-responsibilities when schools and childcare centres closed and supporting grandparents became unavailable due to their need to shelter given their higher risk of severe morbidity from COVID-19 infection; along with abruptly increased teaching workloads produced by the demand for fully online instruction in those universities which had not hitherto offered this systematically. A small 2021 survey and interview-based study of 121 women academics with school-age children in the UK found that most reported being 'overwhelmed' by the massive increase in both their teaching workload and child-care time during the lockdowns (Kasymova *et al.*, 2021).

Research on the impact of school closures in the UK has found that it was mothers of school-aged children who bore the primary burden of supervising learning at home and increased childcare time (Hupkau & Petrongolo, 2020). Other studies have shown that women's research outputs globally in 2020 were lower than men's and lower than previous women's levels (Amano-Patiño *et al.*, 2020; Gabster *et al.*, 2020). Auto-ethnographic scholarship by Australian women academics who are mothers of school-age children and from diverse cultural, racial and disciplinary backgrounds, has indicated severe disruptions to research activity, professional self-esteem, and career progression, but also with adaptive and resilient psychological responses (Bowyer *et al.*, 2022). However, because time to publication following research activity can vary drastically between disciplines and publishers (from three months to as much as three or four years), with promotions and grant success following downstream from outputs, the true impacts of the pandemic on women's research capacity and opportunity may not be discernible for many years to come.

The COVID-19 impacts appear to have markedly exacerbated existing long-term unequal research opportunity and outputs between men and women in academia (King & Frederickson, 2021), and a growing body of scientific and scholarly policy analysis has called for universities and government to address the impact on women's academic career opportunities following the pandemic (Ross, 2020; Fulweiler *et al.*, 2021; Langin, 2021; McMillen, 2021; Staniscuaski *et al.*, 2021). Women academics in Australia are more likely than men to be employed at Level B (Lecturer), while men are more likely than women to be employed at Levels C-E, representing Senior Lecturer, Associate Professor and Professor levels (ARC, 2018), so the disproportionate reduction of Level B staff during the pandemic likely also contributed to a gendered impact.

The Australia Institute's Centre for Future Work reported in 2021 that a 24.8 per cent reduction in total tertiary education jobs had occurred among women, compared to a 16.1 per cent reduction among men (Littleton & Stanford, 2021). This was undoubtedly not the intention of university management executives or research policy advisors which have, in many cases, sought to increase research opportunities for women academics in recent years (National Health and Medical Research Council, 2021). However, like the broader question of research capacity in general, gender equity was likely to have been a subordinate consideration in executive cost-cutting decisions in Australian universities in 2020-2021. Among Australian university academics, women constitute a varying proportion of staff according to ARC disciplinary field, with higher numbers of women than men in Education, in Studies in Human Society, in Psychology and Cognitive Sciences, in Law and Legal Studies, in Language, Communication and Culture, and in the Medical and Health Sciences (ARC, 2018). The disproportionate impacts on women academics with school-aged children are therefore likely to be reflected in research capacity in the humanities and social sciences (HASS) and medical/health fields more than in the STEM, or economics and commerce fields where men are still in the majority.

Research degree candidates were another significant casualty of the pandemic on which there is also a growing corpus of international research (Kariotis, 2020; Börgeson *et al.*, 2021; Plakhotnik *et al.*, 2021; Pyhältö *et al.*, 2022; Tienoven *et al.*, 2022; Covington & Jordan, 2022). The Australian Bureau of Statistics reported that, in 2018, as much as 56 per cent of human resources devoted to research and development in Australia were research degree candidates, while academic staff constituted 30 per cent and other supporting R&D staff 14 per cent (Australian Bureau of Statistics, 2020). Postgraduate by research candidates may be researchers in training, but they are still researchers, so impacts of the COVID-19 pandemic on their capacity to conduct research must also be considered in relation to the research-training and development pipeline. Because only around 36 per cent of PhD candidates in Australia receive scholarships, casual teaching and research assistant roles are a common form of income support for most (Bentley & Meek, 2018; Le, 2021), which meant that the dismissal of casual academics in Australian universities during the pandemic created immediate financial hardship for many PhD candidates. Before the pandemic around one third of research degree candidates were international enrolments (Bentley & Meek, 2018), meaning that the border closures also had similar negative impacts on these researchers as they did on international undergraduate students who found themselves locked either in or out of Australia. Those locked

in Australia were cut off from family, unable to undertake paid work, and unable to access JobKeeper support. A group of PhD researchers at the University of Sydney surveyed 1020 of their peers in April 2020, finding that 75 per cent of respondents reported financial hardship due to loss of part-time work, 5 per cent considered themselves homeless or on the brink of becoming so, while 45 per cent reported their intention to abandon their studies unless more support in the form of extensions of candidature and scholarships was provided by the institution (Johnson *et al.*, 2020). Nonetheless, most universities preferred to deal with extension requests on a case-by-case basis, with only a few, such as the University of Melbourne and Monash University, rapidly offering automatic extensions to all candidates (Le 2021), while some other universities later followed suit.

Impacts were felt at the master's level too, since specialist MA programs, which typically have low enrolment numbers due to their specialist nature, were abolished by some universities in the belief that they were unprofitable according to a purely economic rationalist view of research degree provision. In many Australian and international universities, research candidates during the COVID-19 lockdowns found themselves cut-off from support services, such as hot-desk areas on campus and social activities with peers, as well as unable to meet the conditions of their candidature, such as conference participation and access to libraries and other fieldwork needed for their projects, resulting in higher demand for extensions on thesis submissions, and reports of high anxiety, depression and social isolation found in surveys of research degree candidates (Wang & DeLaquil, 2020). Disruptions to postgraduate candidatures have been a global issue during the pandemic and Australia is not exceptional in this regard. However, the disruption to research degree candidature, alongside the loss of Level A and B academic positions leads to a decline at both of the early stages of the research training and career pipeline in numerous fields of Australian university research. In combination with the contraction (or in the University of Western Australia case, wholesale abolition) of research groups particularly in the HASS sector, the damage to research capacity is therefore not likely to be repaired without deliberate university management and government policy interventions.

Discussion

It seems likely that the pre-pandemic levels of subsidisation of Australian university research provided by high international student enrolments will not be seen again, at least for the next few years. Some analysts predict that Chinese students, who constitute the largest cohort of international students in Australia prior to the pandemic, will not ever return to Australian universities in their previous numbers due to the reduced demand for international education with the expansion of Chinese universities and their growing capacity to compete with international providers (Bebbington, 2020; Wells Advisory, 2021). International education works on a three-year 'pipeline model', unlike other industries disrupted by the pandemic, such as tourism (Wells Advisory, 2021, pp. 2, 5-6). Research training too clearly has a pipeline structure, meaning that the impacts on HDR candidates are likely to have long-term effects on knowledge expertise and research capacity at the ECR and established researcher levels.

The 2021 Wells Advisory report commissioned by TEQSA on COVID-19 impacts on Australian higher education stated that the research-intensive universities face a 'core challenge' of needing 'to address long-held assumptions about the necessity to cross-subsidise research from teaching activities' and instead ensure economic sustainability through other means (Wells Advisory, 2021, p. 22). For the entire sector, it recommended as 'critical' that institutional planning entail 'greater diversity and risk tolerance in future revenue and expenditure scenarios' (Wells Advisory, 2021, p. 33). Even before the pandemic, both in Australia and internationally, some higher education researchers and sector leaders have referred to the need for increased profiling and prioritisation to meet the funding challenge of ongoing higher education massification (Jongbloed & Vossensteyn, 2015).

Since the pandemic, some have suggested the need for most universities to reduce their range of disciplines and become more specialised to ensure sustainability (Bebbington, 2020; Wells Advisory, 2021). However, reduction of disciplines carries the negative risk of reducing course offerings available to students, of particular concern for students in regional universities (Wells Advisory, 2021, p. 40). Such is the situation now in Western Australia that students must travel at least 2000km to study the key disciplines involved in mediating and documenting corporate and government impacts on Indigenous Australians (Anthropological Society of Western Australia, 2021). Rio Tinto's June 2020 destruction of an ancient and sacred Aboriginal site at Juukan Gorge in the Pilbara region is a stark reminder of the need for ongoing work in this area (Business and Human Rights Resource Centre, 2020).

Prior to the pandemic, education represented Australia's third largest export industry (Bentley & Meek, 2018), so the loss of international student income was particularly consequential for the higher education sector. Given that some of the loss of research capacity and performance in Australian universities resulted from the lack of federal JobKeeper support for the higher education sector to compensate for this loss of income during the COVID-19 pandemic, it might be expected that its regeneration post-pandemic would be funded by federal investment. Indeed, A$1 billion in support funding was provided by the federal

government to universities in 2020-2021 to mitigate the negative effects of the pandemic on research specifically (Wells Advisory, 2021). But this funding was accompanied by federal announcements of increased pressure on universities to prioritise research relating to six newly designated National Manufacturing Priorities, which referred to several areas of downstream manufacturing in industry partnership: space, medical products, resource technology and critical materials processing, food and beverage, and defence. The shift was announced in the form both of changes to ARC funding schemes aimed at aligning them with the then government's research commercialisation agenda, proposing to convert 70 per cent of ARC funding available for Linkage projects aligned to the National Manufacturing Priorities (ARC, 2021) though, for now, it appears this change has been suspended. Changes were also announced to Research Block funding allocations to tertiary institutions aimed at incentivising industry-funded internships and partnerships in postgraduate training (DESE, 2022a), which now also look to be suspended by the new ALP federal government.

Nonetheless, the post-election environment appears even more to fit the category of a VUCA (volatile, uncertain, complex and ambiguous) context as defined in higher education management leadership research (Bolden *et al.*, 2015). The 2022 world is one of rising inflation, global disruptions to the flow of goods and services produced both by ongoing COVID-19 impacts and by the Russian war of aggression against Ukraine, ongoing stressors on the public health system, and ongoing impacts of climate-change related natural disasters such as Australia suffered both in the 2020 bushfires and in the 2022 and 2023 flood disasters – both events of unprecedented scale and destructiveness. In such a context, Australian universities would clearly be unwise to rely on substantial ongoing state financial support to fund the renewal of their damaged research capacity and performance given the immense competing demand for federal resources from other major sectors. Nonetheless, in our increasingly knowledge-based economy, research capacity underpins the growth and sustainability of every other industry and sector.

Conclusion

Given the ongoing constraints on federal funding for higher education in the current context of global inflation and ongoing negative impacts on the economy, the detriment to research discussed here will need to be addressed judiciously by tertiary institutions through targeted new recruitment aimed at increasing research capacity and performance in accordance with each institution's unique profile and strategic specialisation. Australian universities are likely to face continuing long-term financial pressures, along with increased pressure to maintain quality standards and rebuild competitiveness for international student markets. The rebuilding of research capacity will therefore need to be strategically focused on recruiting research-performative early-career academics, mindful of gender equity, in key areas where external grant or industry income is both likely and where higher ERA ratings and international rankings are possible due to existing relative critical mass. Investing in vibrant local research cultures through seminar series, collaboration and networking events, research fellowship programs and research infrastructure investment, would begin to address the loss of capacity, while also providing an encouraging support structure for HDR candidates, with downstream improvements in HDR candidate wellbeing and completions (Spronken-Smith *et al.*, 2018; Hanover Research, 2014). Academic staff recruitment to renew research capacity will also need to be compatible with undergraduate teaching needs which continue to provide the largest portion of university income. This will require a renewal of integrated scholarly identities and research-led teaching that works against the grain of the recent historical pattern of separation of teaching and research roles in Australian universities. As Andrew Norton remarked, it is the separation of teaching and research in federal funding policy of the past thirty years which has resulted in common misalignments of these respective academic roles (Norton, 2022b). If programs have seen a steady decline in undergraduate enrolments dating from before the pandemic, alongside high research performance and research degree enrolments (such as was the case for Anthropology and Sociology at UWA), these fields might still be considered for investment in research capacity rebuilding and pedagogic renewal. This would require acceptance of the view that not every function within every group in the university needs to return an immediate short-term profit, and with a view to the long game of improving ERA ratings and international rankings in those fields and building capacity for success in external federal and industry funding. Such a strategy may also be compatible with growing postgraduate program quality and completions, including micro-credential qualifications that would respond to 21st century curriculum challenges identified by education researchers in relation to the increased need for professional continuing education in knowledge-based societies (Trilling & Fadel, 2009; Jongbloed & Vossensteyn, 2015). Moreover, if these investments were to include upgraded, fully online and asynchronous forms of graduate training, they would be resilient to further disruptions of the kind caused by the COVID-19 pandemic, which may not be the last of such events. Robust systems require duplication, as higher education policy scholars have long observed, though duplication is often avoided in the new public management styles of administration that have prevailed in university executives globally since the 1980s (Clarke 1983; Hood, 1991).

The pressure to diversify funding sources has a been a feature of higher education systems in most countries, including Australia since the late 1970s, as a result of their continual and ongoing massification, placing strain on the capacity of the state in most countries to fund the growing demand for university degrees (Jongbloed & Vossensteyn, 2015). Higher Education policy scholars have long recognised the importance of multiple income sources for institutions as systems become increasingly massified and unpredictable developments become more common, avoiding 'putting all of one's eggs in one basket' and 'planning for the unplanned' (Clarke 1983, pp. 270-2). Fragility indeed resulted from the overreliance on international student income to subsidise research and made Australian universities uniquely vulnerable to the research capacity losses with the COVID-19 pandemic international border closure and the federal government refusal to compensate tertiary institutions for their consequent deficits. Even after the change of federal government and the record $20 billion higher education funding for 2022-23 announced in July 2022 (DESE, 2022b), Australian universities will need to think strategically about remedying the loss of research capacity to restore resilience. Developing research cultures and strengths will require continued financial planning that includes multiple income sources beyond either student fees, direct federal funding or national competitive grants. Industry funded research and research-training partnerships suggest an important pathway to sustainable growth of the knowledge economy but are unconventional for many disciplines or unfamiliar to many academic researchers. Universities clearly needed to significantly increase their number of industry funded research programs and research degree enrolments to thrive in the policy environment introduced by the federal government in 2021-2022 (DESE, 2022a). They will still need to do so following the change of government, given the VUCA contexts of our time. However, any gains won by universities through such funding and the corresponding federal support it may attract risk being unsustainable or inequitable if institutions are not equally focussed on nourishing vibrant research cultures and postgraduate support systems, building critical mass in high-performing areas of integrated teaching and research scholarship, maintaining discipline and skill-specific research training for postgraduates in those areas most impacted by the disproportionate gender impacts of COVID-19, and repairing lost research capacity among ECRs and parenting women academics through targeted support schemes for these groups.

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