THE AUSTRALIAN

Tech wave: we're missing the boat

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The recently released Harvard Atlas of Economic Complexity made for uncomfortable reading in Australia. We have an image of ourselves as a sophisticated, high-wage, high-skill economy, and no doubt we are in many areas.

But what these rankings show is that we sustain our developed-world lifestyle with an ominously hollowed-out developing-world industrial structure.

Essentially, the atlas measures the research intensity and diversity of a country's exports as a proxy for its innovation capability. And since Australia relies mostly on the export of unprocessed raw materials, we rank in this context not with the advanced economies to which we usually benchmark ourselves, but with developing countries such as Senegal and Pakistan.

Nor was there any obvious disadvantage in Australia's export mix while commodity prices were high, and the boost to our terms of trade masked the structural deterioration in our productivity performance. However, it is becoming apparent in the post-mining boom transition that our future prosperity will depend increasingly on identifying new sources of value in knowledge-based goods and services.

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As economist Alec Ross observed in his book on industries of the future, these will be defined less by their production outputs than by the technologies they embody. These include robotics and artificial intelligence, advanced life sciences, "codification of money", visualisation, big data

and cybersecurity, the internet of things, autonomous transport, nanomaterials and energy capture, storage and transmission.

Such technologies are not only transforming existing industries but creating new ones, as well as superseding the industry classifications that guide current policy discussion of productivity-enhancing "structural reform".

They require a renewed commitment by business, universities and government to science and innovation, but here again Australia faces at least three largely self-imposed constraints.

The first constraint is well known. Australia rates well for published research but not for its commercialisation in global markets and value chains. Or, despite some notable exemplars, for the measurable industry-university collaboration essential for bringing such commercialisation about.

According to the National Survey of Research Commercialisation, only $80m, or just over 2 per cent, of university research income is generated from "licences, options and assignments of intellectual property". However, it is important to bear in mind that another 13 per cent results from "consultancies, contracts, collaborations, direct sales".

The second constraint is the decline in government and business expenditure on research and development, from about 2.2 per cent of GDP six years ago to 1.79 per cent today. This compares unfavourably with an OECD average of 2.4 per cent, let alone with countries such as Switzerland, Korea and Japan, which commit well over 3 per cent of GDP.

The federal government's seeming abandonment of this space is particularly damaging, as the funding envelope for research and innovation continues to shrink. And the efforts of various states, including most recently NSW, to compensate through valuable, but more localised, initiatives cannot make up for national policy negligence.

As a result, more than 60 per cent of university research is funded internally, primarily from student fees and the proportion of time that academic staff allocate to research paid for by salaries. This is now doing the heavy lifting for Australia's research effort, but the interests and priorities of researchers are skewed both by research ranking metrics and the narrow focus of external funding.

The third constraint is consequently a mismatch between funded university research and the research needs of the industries of the future.

As may be seen from the diagram, this is not a question of the balance between basic and applied research but of the fields of research that are prioritised.

With the preponderance of external funding in health and medical research, university research-activity has become unduly concentrated in this area at the expense of others.

During the past 20 years, Australian medical research output has more than tripled from 10,356 Web of Science documents to 36,792. This is a faster rate of increase than the world average, with Australian universities now investing more than $4bn a year in this area.

Commendably, it has contributed to the growth of a flourishing health services sector that accounts for 7.6 per cent of our GDP.

The problem is that this investment has not been matched by a similar commitment to engineering and information technology research. This is the research that drives the new industries defined by their technologies, rather than production-oriented industry classifications.

Australian university research output in engineering has increased to only 13,789 documents during the same 20-year period, while being the dominant research priority by far for business. Australia's largest industry sectors — mining, construction, professional, scientific and technical services and manufacturing — account for more than 40 per cent of economic value added.

As elsewhere around the world, they are experiencing a process of digital transformation and disruption, which is also creating entirely new markets through entrepreneurial spin-outs and start-ups.

However, according to the latest IMD global survey, Australia's "digital competitiveness" ranking is slipping behind the rest of the world, particularly in business agility, digital skills and communications technology. Clearly the time has come for a rethink of industrial strategy, workforce and management skills and the role universities can play in building the industries of the future.

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