If living labs are the answer – what’s the question? A review of the literature

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Abstract
The world’s economy is becoming increasingly knowledge intensive. This will drive further technological, societal and organisational change. A knowledge intensive economy gives the producers of knowledge – universities – a potentially key role in shaping our future. However, this paper shows that neither Australian industry, nor universities are good at collaborating for innovation. Change is needed but change is hard, resource intensive and never ending. This paper demonstrates why change is so difficult and suggests steps for success. It demonstrates why effective leadership is central to the change process and suggests further applied research to understand the practical obstacles that are preventing universities from developing partnerships for innovation. It defines a principle for evidence-based innovation that is fit for the Anthropocene and proposes the sustainable development goals as a measure to understand the impact of university research in order to help move society in the direction society is seeking. It also pries into the Pandora’s box of the role of Universities in partnering for innovation in the Anthropocene and proposes further research on the role of ‘leading by doing’ on potential partnerships for innovation.

1. Introduction
The world’s economy is continuing to transition from an age of the “white heat of technology” [1] to a knowledge intensive economy. The pace and rate of change is accelerating [2]. In a knowledge based economy knowledge of how to develop and use it is the key to success. The future should therefore be bright for universities (as knowledge creators and sharers) as well as businesses (knowledge users and sharers). It should be brighter still for those entrepreneurial universities and businesses that work together to combine their skills to innovate in a knowledge intensive economy [3].

However, Australian Universities do not compare well with their OECD counterparts in their ability to collaborate with industry for innovation [4] despite the fact that Australian research outputs are world class [5]. The potential of commercialisation of university knowledge is not being realised [6] and further it is unclear the level of uptake of research by university sector itself to aid commercialisation.

Australian industry too is generally weak at collaborating for innovation. It underperforms OECD competitors on collaboration with its customers, suppliers and universities both internationally and domestically [5] even though innovation was seen, by industry, to be the driver of business success. Industry is also poor at reaching out to other organisations to develop strategic advice relating to the future [7]. However, Australian industry does fund public research in universities at a level that is greater than the OECD average [5].

In addition to the changes that are happening as the knowledge based economy intensifies so too does humanity’s impact on the natural environment. Society understands the scale of the impacts due to high quality research outputs from universities,
industry and elsewhere. If there is to be a close relationship between business and publicly funded universities the innovation it produces needs to be based on evidence of its efficacy in the Anthropocene; if it is not it will be undermining the ability of society to deliver the sustainable development goals endorsed by the UN general assembly in 2015 [8].

1.1. Background

The world’s economy is transitioning away from being industry based towards becoming a knowledge economy where knowledge is the predominant factor in driving economic growth. A knowledge economy is only truly possible in a networked world where knowledge can be shared with ease due to the network effect [9, 10].

1.2. Economic impacts

Developed economies are becoming increasingly knowledge intensive [11]. This is a process that has been recognised since the mid-20th century and possibly since the dawn of the Anthropocene in the 1750s [12]. The increasing reliance on, and importance of knowledge and information in product and service development has been widespread and accelerating with over 50% of GDP of major economies being knowledge-based [13]. This may be as high as 70% in some developed economies. However, the ability of economists to track the stocks and flow of knowledge through an economy is still developing [13].

The ‘knowledge economy’ is a widely used term to signify the intensification of knowledge use in the modern economy [13, 14, 15]). Using the term does not mean that previous economies (ie agricultural or industrial economy) were knowledge free – they were not. Those economies used the available knowledge effectively and were driven by technological innovation [12]. However, the key change was with the adoption of technology horizontally across the economy rather than vertically within trades. For example, the steam engine, and thereby access to power on demand, transformed many industries – from agriculture to textiles to public transport. It was this adoption of ‘horizontal’ technology (or general purpose technologies [16]) in the 1750s that started the transformation towards a knowledge-based economy; a trend Drucker noted in 1959 when he coined the phrase ‘knowledge workers’ [12].

The pace if the development has increased markedly in the late 20th and early 21st century with the widespread adoption of the internet [17] and the exponential growth in devices linked to the web (with Intel predicting 20 billion devices connected by 2020 [18]). Some argue that proof of its development came with the rise, from the 1960s in the service economy where people with specific knowledge and skills did work for those who did not have it [19]. But the knowledge economy should not be merely defined by its initial association with the service economy. Rather it can be identified by its investments in research and development, education and training and new managerial work structures [13].

1.3. Societal impacts

And while our economy is transforming so to is our society and environment. The knowledge economy is leading to the development of two types of jobs: those jobs where people tell computers what to do and those jobs where computers tell people what to do [20]. The knowledge economy has been blamed for real wage stagnation in the low to middle income groups, stalling service sector productivity growth and increased inequality within society.

In order to maximise the benefits that the new knowledge and information will bring it is essential to adopt new work practices [21, 16]. Investments in technology enable complementary organisational investments which help to improve productivity [11] and these are often associated with workforce changes enabled by the adoption of the technology [22]. The flattening of hierarchies, development of team work where everyone has a voice, and the general empowerment of the workforce can only happen with easy access to knowledge and information are evidence of this new economic era, as well as a clear break with the past industrial based economy [23]. However, the gains from the adoption of new technology are not the same in each organisation – the limiting factor is the ability of the management to create a new environment that will maximise the benefit of the technology [24]. Similarly simply adopting a technological fix without associated process changes can have the opposite effect [16].

1.4. Environmental impacts

The world’s environment is also being impacted which Hardin (1968) described as the “tragedy of the (un)managed commons” [25]. Today there are few if any unmanaged commons left and yet humanity’s impact on our natural systems is significant and far reaching, even though positive for human well-being and economic growth [26]. The result is that the current geological epoch is referred to as the Anthropocene in view of the impact of humanity [27] – which are so significant as to be geological in scale.

1.5. Emergent ‘mega’ trends [43] and institutional responses

At the same time as these global changes to the economy, society and environment it is anticipated that economic activity will move from the north to the south and the west to the east [18]. This puts Australia – historically suffering from the “tyranny of
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