# Running out of STE(A)M

## A critical perspective on the political rhetoric of innovation.

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*Abstract*— **The frequent use of the acronym STEM (Science, Technology, Engineering, Maths) within the rhetoric of the National Innovation and Science Agenda should immediately sound alarm bells for the field of architecture. While some, now and then, include the A (Art), there is a bias toward these four core disciplines and a perception that they provide a means towards "innovation", and with it "progress" and "growth" through new technology. In Australia the socially facing practice of architecture has found itself navigating the territories of service and construction economies through technologies of shelter, in doing so it is complicit in serving mainly the wealthy, and assisting in the political control of resources. As we enter a post-resource era is the architectural profession making the same mistake by adopting the rhetoric of another capitalist profit driven economic paradigm? In this paper, I wish to assess the political rhetoric behind the innovation economy critically to highlight the assumptions contained within. In response, I will offer alternative approaches based on social use-value and a focus away from consumption and labour as means of value exchange. Through considering peer to peer production, and associated cultures of making, hacking and re-use, as alternative frameworks for political economy, the question is proposed whether architecture should seek to create its own agenda for innovation, rather than adopt the dominant economic model? The paper aims to address the assumptions that surround the rhetoric of innovation in Australian political discourse, question the motivations of this focus, and assess its benefit for architecture.**

***Keywords— Political Economy, Capitalism, Peer to Peer, Architectural Commons.***

## I. INTRODUCTION

As anyone living in Australia during May to June of 2016 would recall, Malcolm Turnbull and his Liberal Party's election platform was about "jobs and growth". An important precursor to this trajectory of campaign message was the National Innovation and Science Agenda report (referred to as NISAR from here on) released in December 2015. This document introduced the "ideas boom", promoting the use of innovation, as economic stimulus, through increased participation in science and technology, viewed as critical towards achieving their mantra. This discussion paper does not seek to question the importance of innovation; instead, it aims to highlight and critically assess the assumptions, existing within the rhetoric of the "ideas boom", that should cause concern with society and the architectural profession. It will start by looking at the political motivations of innovation, address four identified assumptions and assess the impact of these on the architectural profession. I will conclude by considering some alternative ways that architects could operate within the current political-economic system, and help redefine a new one.

## II. WHAT ARE THE POLITICAL MOTIVATIONS AROUND INNOVATION?

Between 2003 and 2014 the world price of Australia's mining exports tripled due to the manufacturing demand of China. The RBA estimates that, by 2013, it had raised real per capita household disposable income by 13%, increased real wages by 6% and lowered the unemployment rate [1]. As resource demand and availability reduces, other sources of wealth generation are required. The service sector has taken over from mining as the dominant employer causing a shift in the government's approach. NISAR demonstrates that it has turned its attention towards science and technology, and specifically innovation, as a way of generating a new "ideas boom".

This shift from material to immaterial resource extraction represents a change in Australia's political economy. Commentators such as Michel Bauwens view this as an evolution of capitalism that commodifies information through ownership and appropriates economic surplus from knowledge [2]. Bauwens argues this translates the resource manipulation paradigm, where controlled scarcity manages market demand, onto the realm of information. For Bauwens this leads to a form of social Taylorism where technological innovation appropriates knowledge, via systems of capital, and resells as a commodity.

Bauwens cites McKenzie Wark as responsible for identifying this new political relationship, and the resulting vectorisation of information [3]. Where employers previously controlled the means of production, and employees provided labour, Wark points to a new condition where a political class control the means of storing and distributing information, while workers provide knowledge.

Therefore, innovation is attractive to political power as it produces new sources of information and knowledge which

can be owned and exploited for capital gain. As a result, access to information and capital is controllable and the potential for capitalism's unequal distribution of wealth remains.

## III. Assumptions around the ideas boom

### *A. Innovation to produce growth is good.*

In the opening sentences, the NISAR refers to innovation and science as a way of seizing the next "wave of prosperity". In Australia, these waves have involved commodifying wool, wheat, meat, iron, coal and nickel, but all periods of economic boom lead to slump and possible economic recession. For the political establishment this is a necessary evil of growth and wealth the capitalist system provides, but for society, and in particular those tied to the construction industry, this can be devastating.

A capitalist economy requires constant growth in business to create investment confidence, maintain prospects and avoid bankruptcy. This system is successful in producing enormous wealth, but in doing so has helped to damage the biosphere and generate inequality. Some are questioning the reliance on this growth model as they feel it will begin to fail when biosphere resources start to deplete, and excessive consumption means outputs become less than inputs [4].

A possible response has come in the form of the de-growth movement which cites the steady state economics of Herman Daly [5]. Degrowth speculates on the reduction of production and consumption, and shift away from material accumulation as modus operandi, to enhance the ecological condition and equity of the planet [6]. The movement exposes the illusion of economic growth as means to serve human needs, arguing that it has become inequitable and ultimately uneconomic.

### *B. A bias towards STEM is good.*

Globally there is a trend towards the promotion of STEM (Science, Technology, Engineering and Maths) in schools, considered critical toward the conditions of innovation. While it is certainly important to increase participation in school, STEM is biassed towards achieving greater efficiency and productivity within a paradigm of economic growth. The fields within STEM provide means of innovation for innovation's sake but do not focus on the critical reflection or interrogation that art based disciplines can provide.

The omission of A within STEM is indicative of two political biases, one that art and culture do not generate profit within the economy [7], and the other is that its proponents are more interested in exposure than the generation of capital [8]. The 2016 Australian Council funding cuts illustrate this, with some seeing it as a threat to imagination and balance in the ongoing drive for innovation [9]. The future of such a STEM-based scenario would tend towards efficiency and functionality but potentially miss a connection back to social life and culture.

### *C. Innovation creates jobs.*

Innovation will inevitably bring automation. To achieve efficiency and productivity businesses will employ automation to reduce costs, and if given the choice will decrease employees to avoid labour costs. Automation is desirable within growth economies as it improves efficiency and productivity, providing a path of least resistance towards profit. A report by CSIRO and the Australian Computer Society, published in February 2016, found that 44% of Australian jobs were under threat [10]. This phenomenon is not new, machines replaced human dexterity in factories during the industrial revolution and now software is starting to automate cognitive tasks. Of course, innovation in new types of employment will emerge, this paper does not wish to speculate on the outcome of this trend, but instead, highlights the potentially mutually exclusive relationship between innovation in science and technology, and the government's aim of increased jobs.

The ideas boom also assumes that entrepreneurs create jobs. While they do create some, Tim Mazzarol argues that only successfully scaled up businesses create numerous stable jobs [11]. The Office of the Chief Economist found that for every 100 existing jobs in Australia, startups will, on average, add only 5 jobs within the following three years [12]. Through promoting high-risk investment and greater entrepreneurial activity, the NISAR is more likely to produce multiple small businesses, rather than the large tech companies that would be required to provide a significant number of jobs.

### *D. Tech start-up culture is good*

The United States have shown how technological innovation and start-up culture can generate wealth, and how important entrepreneurs are in achieving this, but many are critical of this approach. Silicon Valley, the epicentre of tech entrepreneurial activity, thrives on the success and failure of start-ups, and the development of ideas it generates. However, in the process associated business cultures and products have been shown to be elitist [13], racist [14] and sexist [15], suggesting this may not be a good precedent to base an economy.

The reality of entrepreneurial endeavour is that failure is extremely common, on average in Australia 95% of start-ups will fail. Those that are successful have been shown to be set up by those with access to initial wealth or investment funding [16]. The risk of failure, as the NISAR highlights, is what stops entrepreneurs and investors proceeding with ideas, the ideas boom economic policy aims to protect investors through tax breaks but what about entrepreneurs? Start-ups must have freedom to fail, but to do so requires a financial safety net, if one does not exist then it disadvantages lower socio-economic groups.

There are academics such as Kazys Vernalis who are critical of the infiltration of start-up culture into schools. His criticism

lies in the projected value onto children and teenagers that ideas and entrepreneurship will bring fame and wealth [17]. This promotion of entrepreneurial culture through high school and university incubators creates pressure to succeed and conform to an elite of future capitalists while missing the chance to foster a more general enjoyment of personal exploration and critical investigation.

This tension exists in the emerging global maker movement that has given rise to a culture of peer to peer production, external to work, via community space and access to digital fabrication technology. Commercial operations like Make Media and Tech Shop link grassroots innovation to the next big tech idea, thus drawing it into a cycle of property management and capital generation, whereas Fab Labs and maker / hacker spaces focus on making as a socially aligned activity which can lead to innovative and potentially economically beneficial outcomes. Start-up culture thus can be seen to erode the division between everyday life and capitalism's accumulation of wealth, and reduces the potential for young people to think about the world in alternative ways.

## IV. What are the impacts and alternatives for the architectural profession?

This discussion paper does not argue for a disengagement with innovation in architecture, but rather it questions the reasons for and outcomes of it. I have shown that the relationship existing between creative practice and capital accumulation means that information produced is commodified by those who control the means of production, distribution and market access. For Architects some see this relationship resulting in capital absorbing creativity, spatial intelligence and skills serving only corporations and investors rather than the public [18]. The following will suggest some alternative approaches to this relationship and the formation of a new value system away from the dominant mode of consumption.

### *A. Architecture beyond buildings.*

The architecture profession in Australia carefully navigates the territories of creative and construction economies, monetising knowledge and products relating to technologies of shelter. Innovation is necessary to improve the processes, outcomes and performance of the built environment. However, some are critical of architects' treatment of buildings as commodifiable objects within an economy that seeks to maximise profits and growth [19]. The energy spent on innovation towards the built environment becomes misappropriated when economic forces favour quantity over quality.

Architects should redirect their innovative energy towards removing architecture's reliance on profit-driven investment by realigning focus from tradable object to an ecological view of buildings. This provides a necessary shift for architecture to be able to gain value through the processes and relations that come before and after a built outcome [18]. Architecture, as a result, can become more about engagement with the life cycle of buildings, their users, the consequences of construction and their relationship with the world.

An example that points towards this approach is Breathe Architecture's Commons housing project in Melbourne, Australia. Rather than designing an apartment block for a profit-driven developer to construct and then sell, manipulating supply and demand to maximise income, it emerged through creating a community of building owner stakeholders. The practice worked with a developer who shared their ethical viewpoint and based decisions on building lifecycle and community impact. The project sought design quality and affordability by removing marketing teams, real estate agents and display suites, and shifting expectations of property from individual unit to collective whole.

### *B. Distributed Markets / Smart Contracts*

Another way for architecture to circumnavigate markets controlled by those with access to capital is to construct alternative economic networks. The profession participates in a system that is seen to manipulate scarcity and desire to produce capital gain [18], consequently it is heavily influenced by the boom to slump nature of capitalist economic waves as referred to earlier. An over-reliance on investors tied to the property market mean that in any financial downturn the construction industry, and architects in general, are heavily impacted. The profession needs an alternative where access to capital, mutual trade and contractual agreements can be set up without the need of mediating power-brokers.

Innovations within network technology, such as the block chain, crowd funding and cooperative web platforms, provide an opportunity to avoid commercial middlemen who control access to funding and markets. Architectural practices such as FOAM in the US are exploring the Decentralised Autonomous Organisations (DAO) model, facilitated through an online platform called Ethereum. The DAO constructs a set of relationships that align the incentives of contractors, i.e. service providers, with the incentives of community organisations, rather than investors. FOAM's aim is to provide project autonomy to stakeholders through crowd equity, peer to peer transactions and smart contracts collected and recorded in the distributed and transparent ledger of the blockchain.

### *C. Peer to Peer Architectural Commons*

Architects and practices are forced to protect their work and ideas in an economy that relies on property law and resource ownership. They must learn to share and construct mutually beneficial repositories of information to avoid the absorption of creativity by the mechanisms of capital gain; the creation of an architectural commons would achieve this.

The concept of the commons is far from new but has re-emerged recently as an alternative approach to the management of resources facilitated by networked information technology and increasing computer processing power

[20][21][22]. A shift of ownership from individuals to collectives, or even its complete removal altogether, predicts the rise of distributed mutual shareholdings that could reduce reliance on decentralised markets or centralised states. Peer to peer collaboration and production, where sharing is the dominant mode of operation, have been shown to thrive on social benefit rather than wealth, and can allocate resources based on need rather than under economic or managerial influence [20].

Eric Von Hippel believes this can lead to a democratisation of innovation, realigning the beneficiaries from investors to users [23]. Taking this democratisation one step further Carlo Ratti et al. point towards a profession of architecture that is open to a democratisation of its expertise. Their future professional is a "choral architect" who concentrates on designing open source frameworks for permissive and sharing based design and production, rather than architectural objects [24].

Architecture and design commons already exist in projects such as Wiki house [25], Open Source Ecology [26], and Open Structures [27]. Significantly these are not owned as property and consequently not politically controlled, but rely on a critical mass of participants to make them successful. However, sharing does not mean an abolishment of income; capital exchange still exists, but markets form through peer to peer networks and value is not based on a product, labour or time, but instead on participation and collective benefit. The creation of peer to peer networks and associated commons has the potential to shift economic flow from decentralised patterns of capital control to distributed trading networks of architects, producers and customers.

## V. Conclusion

This paper has set out to problematise the rhetoric around innovation by questioning assumptions the Australian government have made in their National Innovation and Science Agenda. In doing so, it has highlighted that innovation provides a vehicle towards a form of capitalism that seeks to commodify access to information. This paper demonstrates that emerging opinion no longer recognises growth as a sustainable aspect of western economies and that some feel a move towards more steady state systems would suit a context of finite and diminishing ecological resources. The over emphasis on Science, Technology, Engineering and Maths in education, at the expense of art, is shown to focus too much on technological advancement, and innovation for innovation sake, rather than fostering more critical and creative attitudes in the next generation. The very basic argument that innovation and entrepreneurs create jobs is fragile due to the increase in automation and association of small workforces with start-up cultures. Evidence of social, racial and gender discrimination and inequality by a new entrepreneurial class in the United State's has challenged the social, cultural and political benefits this culture could bring.

This paper has sought to highlight how architecture participates in, and in some cases helps maintain, an unequal and hierarchical capitalist economy. While experiencing prosperity during an economic boom, architecture is at the mercy of downturns which profoundly impact the profession due to an over-reliance on buildings as a tradable product. This treatment of buildings as commodity within a system that promotes private ownership and property law has led to an unhealthy protection of information within architectural practices. To begin to address these problems, I have suggested that an alternative approach could be to shift away from the focus of designing buildings as products, to instead concentrate on systems, processes and relations in and around the built environment, which provide added value to society. A way of this focus providing fiscal sustainability is through constructing communities and tradable markets to allow a flow of capital based on common use and participatory value rather than profit. A creation of a peer to peer architectural commons and utilisation of encrypted distributed communication could help achieve this and benefit the evolution of the profession. Doing so could welcome in forces of democratisation and provide a foundation of open knowledge for enhanced processes, outcomes and performance in the built environment.

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