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Entrepreneurial Ecosystems: A Governance Perspective

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Abstract

Entrepreneurial ecosystems have grown in prominence given the vital need to transform economies around the creation of innovative products and services, thereby leading to wealth creation and international competitiveness. Such ecosystems involve a network of interactions of individuals and organizations from business, government and university. Despite the heightened popularity of entrepreneurial ecosystems, more attention is needed on the effective governance of its key stakeholders to ensure that anticipated outcomes are achieved. The current literature focuses mainly on business stakeholders rather than the wider variety of players from government and university who also play a critical role. It also inadequately addresses the governance process in managing these stakeholders to ensure appropriate performance. To address these issues, this study applies network governance theories to the entrepreneurship literature. In so doing, it offers pertinent governance implications to key stakeholders involved in entrepreneurial ecosystems including firms, universities and government agencies.

Keywords: Entrepreneurial Ecosystems; Governance; Entrepreneurship; Innovation; Networks; Ecosystem.

1. Introduction

Entrepreneurial ecosystems have captured the attention of nations in transforming their economies around the creation of innovative products and services, thereby leading to wealth creation and international competitiveness [1, 2]. They have soared in popularity in many countries, including OECD countries, for instance, the Netherlands, United States and Australia [3-5]. Entrepreneurial ecosystems are defined as "dynamic, institutionally embedded interaction between entrepreneurial attitudes, abilities and aspirations, by individuals which drives the allocation of resources through the creation and operation of new ventures" [6, p. 469]. There is growing understanding that entrepreneurship does not only benefit the creator firm, but occurs in networks involving knowledge spill-overs to other organizations [7, 8]. Given this pervasive reach, entrepreneurial ecosystems have encompassed key stakeholders including industry, government and university involved in various aspects from product development to the provision of staff to the investment of funding [9].

Given the substantial level of both public and private investment into entrepreneurial ecosystems, there is an increased need to ensure that they are effectively governed so that desirable entrepreneurial outcomes are in fact achieved [10-14]. The challenge facing the governance of these ecosystems is due to the diversity of actors involved in the innovation process, with their varied goals from education and research in universities to profit maximisation in business [15, 16]. More research is therefore needed to examine the effective governance involving diverse actors. Aarikka-Stenroos et al. [17, p. 377] argue “that a holistic understanding involving the examination of all involved actors' perspectives on networks for commercialisation is often missing, so researchers should investigate the perspectives of divergent network actors.” They call for more research on how diverse actors can be orchestrated. Additionally, Corsaro et al. [18] call for more research on the mechanisms to manage interactions among heterogeneous actors.

Given the need to examine effective governance strategies, the research question of this study is: How can entrepreneurial ecosystems be effectively governed, given the variety of actors involved? The study will make an important theoretical contribution to the entrepreneurship literature by linking governance processes to performance outcomes. This is in response to Manser et al. [19] who call for research on effective network governance research that links governance strategies to performance measures. Some studies do exist that either examine the relational rather than the network level or do not link governance strategies to performance or do not include key network actors such as government. For instance, Mitrega and Pfajfar [20] investigated process management at the relationship level but not the network level, excluded government players and did not link governance activities to performance. Others scholars have focused on exploring the relationship between governance and performance of firms [21] but have not moved beyond firms to incorporate other vital innovation actors such as government and university. Hara et al. [22] argue that previous literature has not looked at the impact of actors such as governments on governance and its impact on performance. They argue that such government actors can seriously impact of the effectiveness and legitimacy of network governance.

This study is important as a better understanding of the governance of entrepreneurial ecosystems is vital given the critical role that they play in the transformation of firms and national economies [23]. Many countries including those in North America, Europe, Asia-Pacific and the Middle East are ramping up in their efforts to reinvent themselves around leading innovative industries and capabilities [24-31]. As traditional manufacturing has shifted to low cost locations, there is a trend towards developing capabilities around advanced manufacturing of higher value products and services. For example, in Australia, with high labor costs, entrepreneurial ecosystems are important in the transformation from low-cost traditional manufacturing to high value add advanced manufacturing. Large multinational automotive manufacturers such as Holden, Ford and Mitsubishi have shifted their manufacturing out of Australia resulting in significant job loss. Consequently, this study is based on an entrepreneurial ecosystem, the AUS$1.5billion Tonsley precinct which involves actors from business, government and university that has been set up to address this issue. The Tonsley case will provide managerial implications for renewal programs as economies undergo transition from traditional manufacturing towards the development of advanced products and services. It will be of particular interest to marketers such as entrepreneurial ecosystem stakeholders, commercialisation officers, industry liaisons, university technology transfer managers, communication specialists, community engagement managers and product development managers. Furthermore, the study will advance theory development in the entrepreneurship literature by informing understanding of how entrepreneurial ecosystems can be effectively governed to achieve relevant performance outcomes of the diverse actors.

2. Theoretical Background

The governance of interactions among various organizations have been investigated from different approaches. It has been examined in various literature streams within industrial marketing, management, sociology, economics and public administration [32]. Consequently, several approaches have begun to emerge for network governance including managing in networks through relational approaches, role based and network orchestration approaches.

Some industrial marketing network researchers employ a focal firm perspective of managing dyadic relationships within networks rather than the governance of the entire entrepreneurial ecosystem. For instance, Ojasalo [33] applied key network management. This approach applies the key account management technique to the network management context. He defines a key network as a ‘set of actors mobilised by the focal company to realise an opportunity’ (p. 195) and discusses that the approach involves the (1) identification of the key network; (2) development of strategies for managing the key network actors; and (3) development and application of operational level methods to manage key network actors. However, key network management, like key account management, generally focuses on the focal firm perspective of managing dyadic relationships in stable business environments such as supply chain networks rather than the holistic perspective involving the governance of the entrepreneurial ecosystem [34]. Similarly, other industrial marketing researchers apply the network pictures approach which informs strategies in managing dyadic relationships within the network from a focal firm perspective, also in relatively stable business networks such as supply networks, rather than entrepreneurial ecosystems [35, 36]. Furthermore, even in other studies where scholars have focused on the entrepreneurial context, much of the emphasis has been on relating in business networks rather than managing the ecosystem [37].

Other researchers adopt a role-based perspective for governing entrepreneurial ecosystems. The importance of roles for managing has long been present in the fields of social science [38, 39], management [40-42] as well as network research [43-45]. More recently, Nyström et al. [46] confirmed seven roles previously identified by role theorists for orchestrating in the entrepreneurial context including the webber, instigator, gatekeeper, advocate, producer, planner and accessory provider [44, 47] and also contributed 10 additional roles namely coordinator, builder, messenger, facilitator, orchestrator, integrator, informant, tester, contributor and co-creator. However, most role theorists acknowledge that roles are context specific, difficult to generalise and few role studies have attempted to

link roles for network performance [44-46]. Therefore, further work is necessary to link entrepreneurial ecosystem governance processes to performance.

In addition to the relational and role based approaches, the third approach has focused on governance or orchestration activities at the network or ecosystem level. This will be the focus of this study. Some authors have examined orchestration activities in loosely coupled international online innovation communities and have focused on activities of knowledge mobilisation, innovation appropriability and network stability [48, 49]. However, those authors did not focus on entrepreneurial ecosystems that are more formalised in agreements involving government, university and business actors; but instead examined loosely coupled international innovation communities. Other studies have focused on the management of strategic networks by a hub, in the form of an organisation or group of organisations, able to exert coordination among network actors [50]. The important role of the hub has been examined by Partanen and Möller [51]. However, this role was investigated in a strategic network involving firms in the ICT industry and not an entrepreneurial ecosystem involving a range of actors including university and government partners. Hara et al. [22] argue that it is vital to examine the role of such diverse actors as they could seriously undermine governance efforts.

In this vein, drawing on studies involving public sector networks (i.e. networks lead by government agencies) from the public administration literature [52, 53], Järvensivu and Möller [32] suggest four main functions of network governance, namely framing, activating, mobilising, and synthesising. However, these areas are yet to be empirically tested in the context of entrepreneurial ecosystems and moreover, are yet to be examined for their impact on to entrepreneurial outcomes from the perspective of a range of actors including firms, government and university actors operating in such ecosystems.

2.1. Framing

Framing can be defined as ‘establishing and influencing the operating rules of the network and altering the perceptions of the network participants; setting goals is a part of this task’ [32, p. 658]. This can also include creating a ecosystem vision and identifying the key role of actors in fulfilling that vision [51]. Framing involves establishing an identity for the ecosystem and developing a working coordinating mechanism (for instance, committees) [53]. Framing cannot only be used in the formation phase of the ecosystem to guide activation and mobilisation but also when ecosystem effectiveness decreases; hence indicating an influence of ecosystem effectiveness on framing [52]. In this regard, an ecosystem can be reframed by the introduction of new ideas into the ecosystem or a shared vision, thereby developing new solutions or approaches to problem solving [54, 55].

2.2. Activating

Activating refers to ‘the process of identifying participants for and structuring the network’ [32, p. 658]. It is also referred to as configuring the ecosystem via selecting partners and determining relationships [51]. It is arguably the most important task in ecosystem governance as it involves tapping into the knowledge, skills, expertise, and resources of potential actors, which are essential in integrating the ecosystem [53]. Ecosystem managers have a key role in arranging and nurturing the ecosystem [55]. Similar to framing, activation is used both in the formation stages of the ecosystem as a precursor to mobilisation and also when ecosystem effectiveness is suboptimal, thereby reflecting the impact of ecosystem effectiveness on activation [52]. Hence, if the ecosystem is underperforming, de-activation can occur whereby some ecosystem actors can be removed or replaced [53].

2.3. Mobilising

In addition to framing and activating, ecosystem managers must induce ecosystem actors to make a commitment to the initiative [52]. Mobilising involves ‘building commitment among actors’ [32, p. 658]. Mobilisation has been recognised as a key governance activity [51, 56] and can be seen as a continuous process for achieving ecosystem effectiveness [53]. It involves inspiring, motivating and forging agreements and obtaining commitment of financial support, investment, resources and cooperation to achieving the ecosystem’s goals [52]. Purchase et al. [57] argue that successful innovation networks are likely to efficiently mobilise network resources. They criticise previous research which has predominantly ignored the network level and instead focused on the dyadic or intra-firm perspective in mobilisation or resources.

2.4. Synthesising

Synthesising relates to ‘organising and controlling; it involves creating conditions for productive interaction while preventing, minimising, and removing obstacles to cooperation’ [32, p. 658]. It includes promoting communication and information exchange among actors [52]. This resonates with the work of Manser et al. (2015) who recognise communication for coordination and encouraging solidarity as key network management activities. Similarly, it reflects the importance of fostering network stability [51, 56] and motivation of network actors to collaborate around network priorities [51]. Stabilisation can be used together with activation as the removal of a participant

involved in unproductive interaction may require conscious attempts to improve interaction and ecosystem actors perceptions of changes [52].

These network governance activities of framing, activating, mobilising and synthesising are yet to be empirically tested in the context of entrepreneurial ecosystems; and also their impact on effectiveness from the perspectives of diverse actors involved in such ecosystems. Manser et al. [19] call for more research along these lines in including network performance measures and linking orchestration activities to network performance. Therefore, this study will contribute to ecosystem governance theory by examining the impact of orchestration activities on performance and also investigating such performance from the perspectives of diverse actors including business, government and university actors. This contribution is vital as the perspectives of diverse actors, how these actors can be orchestrated within entrepreneurial ecosystems and the impact of such orchestration on performance are much needed in the literature [17, 18, 22].

2.5. Entrepreneurial ecosystem outcomes

Measuring entrepreneurial ecosystem outcomes is challenging given the variety of actors involved and their different objectives [58]. Nevertheless, for the sustainability of any entrepreneurial ecosystem, outcome metrics need to be relevant to participating organisations. However, existing metrics have been skewed towards the firm's perspective. For instance, Estrada et al. [59] measure product innovation performance in terms of the share of turnover attributed to products which were introduced by the company in a given period, that were not only new to the firm but new to the market. In general, firm based metrics include sales, productivity, skilled staff recruitment and new product and service development [60]. Hara et al. [22] argue that more emphasis is needed on other non-firm actors such as government as these players can have a vital influence on the effectiveness of orchestration efforts. Governments tend to emphasise job creation targets, investment and industry attraction, return on investment, skill capacity building and patents [61]. Patents have been a popular measure for national assessments of innovativeness and inter-country benchmarking due to convenience [62]. However, it has received considerable criticism as it fails to capture some innovations that are not patented due to the expense and also several forms of innovation such as service innovation that may not be patentable [8]. Corsaro et al. [18] call for more research on outcomes that go beyond patents. Baraldi et al. [63, p. 383] point out that in addition to patents, universities use licenses, spinoffs, relationships sponsored research (from contract R&D to materials testing, and from joint R&D to third-party sponsored projects), informal and pre-formal discussions with industry, shared personnel, education of industrial PhDs, provision of labs and facilities, and network creation and participation. Additionally, Levén et al. [64] suggest various metrics for measuring the productivity of entrepreneurial ecosystems such as new products, research publications, new jobs, new companies and new installations. Given the diverse players and interests involved in innovation, there has been growing calls both among practitioners (for instance the European Commission) and scholars for a multi-perspective, participatory approach for evaluating outcomes that take into account the variety of objectives of key actors [65]. Hence, this study will attempt to address such calls for a multi-perspective approach in assessing outcomes from entrepreneurial ecosystems.

3. Case Study of the Tonsley Entrepreneurial Ecosystem

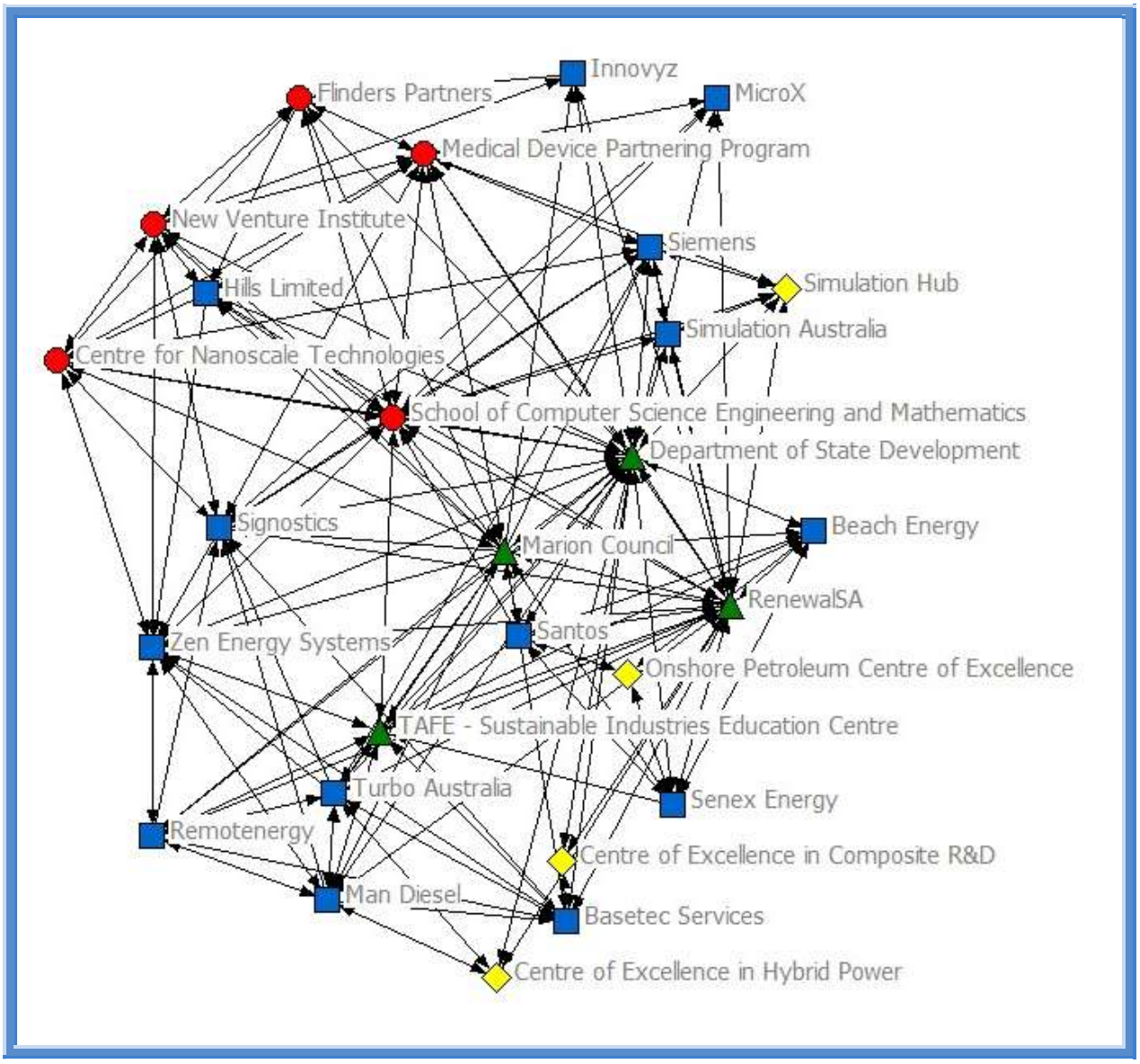
A case study of the Tonsley entrepreneurial ecosystem formed the basis of this study. The case study approach was deemed appropriate given the exploratory nature of the research. Furthermore, this approach is prevalent in network research due to the complexity and connected characteristic of networks [66]. In addition, the case study method is suitable in exploring governance processes under examination and also in capturing reality in a considerable level of detail [67].

The Tonsley entrepreneurial ecosystem is an AUS$1.5billion precinct which is located in a site which once housed automotive company, Mitsubishi's manufacturing centre in South Australia. Since Mitsubishi suspended manufacturing in Australia, it resulted in high job losses and as a result, the local, state and federal governments have attempted to invest in the site to renew the region and boost job creation. A network diagram of the Tonsley entrepreneurial ecosystem is illustrated in Fig 1.

Key government actors include State government agencies, such as RenewalSA which is responsible for the infrastructure and urban renewal at the site; the Department of State Development which is responsible for economic development and industry attraction; as well as local government, the City of Marion, with an interest in business development in the region. The State government has invested AUS$125 million in creating the Sustainable Industries Education Centre for the training college, TAFE which was opened in 2014. Additionally, Flinders University has invested AUS$120M in the construction of a new building at Tonsley which was opened in January 2015. It houses its School Computer Science, Engineering and Mathematics (CSEM) which is a significant feature of the network given the track record of the School in university business collaboration including its successful contract R&D program, the Medical Device Partnering Program [68]which provides R&D services to biomedical firms around the creation of new medical devices for instance joint replacement and spinal cord surgical

devices; and its leading industry placement program for its students spanning over 2 decades. Another university contract R&D nanotechnology group, the Centre for nanoscale technologies has also been co-located in the building which provides expertise to industry partners in solar cells and the development of energy efficient technologies. Another university occupant at the site, the New Venture Institute, provides business incubation, entrepreneurial support for start-up companies and industry consulting services [69]. Also at the site is the university's commercialisation office, Flinders Partners, which engages in the management of intellectual property and the commercialisation of university research. Several businesses have relocated to Tonsley including Siemens, Micro-X, Zen Energy, Signostics, Hills Industries, Simulation Australia, Madderns Patent Attorneys and Innovyz with more planned over the upcoming couple years. There are also a number of research and development (R&D) Centres of Excellence, co-funded by mining and oil companies such as Bastec Services, Man Diesel, Turbo Australia, Remotenergy, Santos, Beach Energy, Senex Systems. Additionally, a Simulation Systems hub has been created which is collaboration between multinational technology giant, Siemens, Simulation Australia and State government. Given the downturn of manufacturing in South Australia and nationally due to high labour costs and the high dollar, this redevelopment is seen as the State's response to the manufacturing crisis given the need to develop higher value, advanced products and services [70].

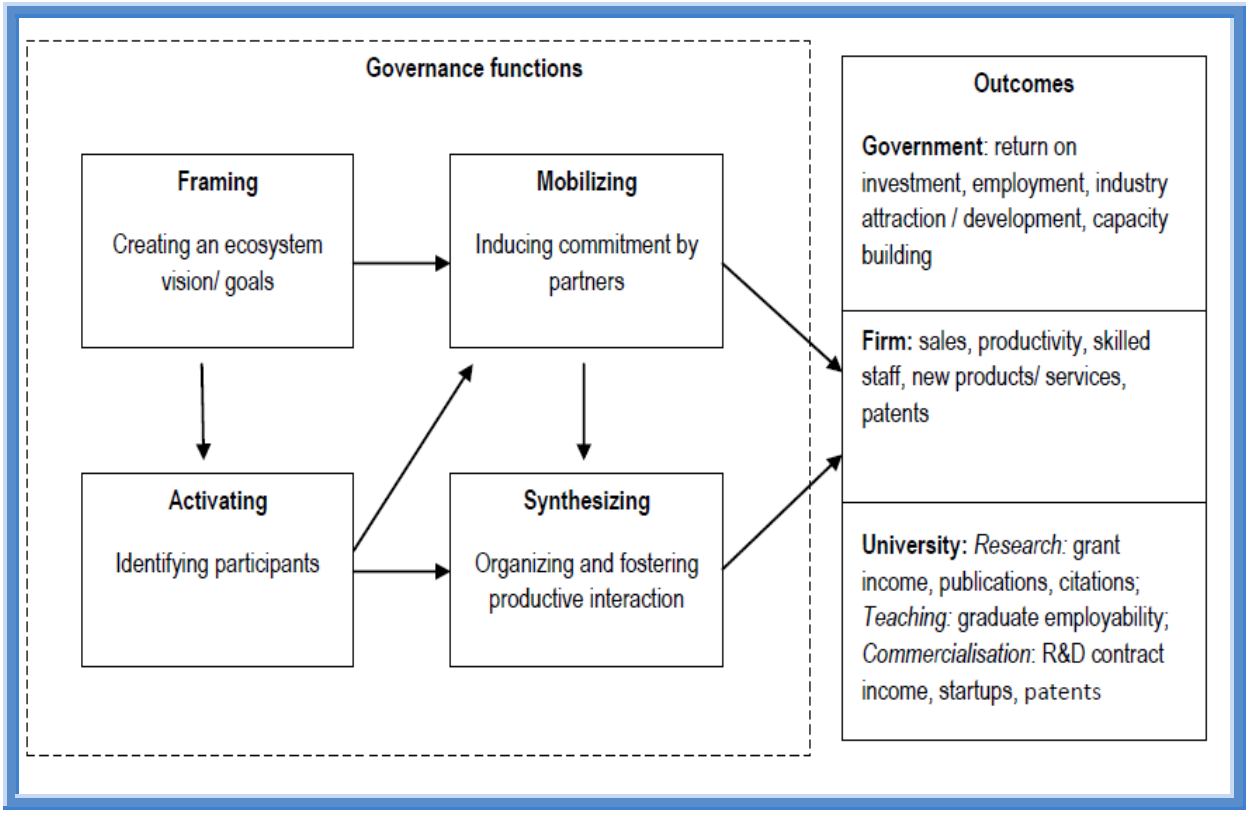
Fig 1: Network Diagram of the Tonsley Entrepreneurial Ecosystem



4. Findings

Fig 2 illustrates how the case study of Tonsley addresses key network management functions including framing, activating, mobilising, synthesising and performance monitoring of entrepreneurial ecosystem outcomes. These will be further discussed in this section.

Fig 2: Conceptual Framework for Governance of Entrepreneurial Ecosystems



4.1. Framing

Framing involves establishing a vision and identity for the ecosystem. Tonsley's vision is to be is "Australia's first innovation district bringing together leading-edge institutions and companies to connect with start-ups, business incubators and accelerators in a high-value industry, research, education and residential precinct" [70]. In terms of identity, four focus sectors have been established including health, medical devices and assistive technologies; cleantech and renewable energy; software and simulation; and mining and energy services. These sectors or specialisations align to the priorities for South Australia as identified in the State government's strategy, Manufacturing Works: A strategy for driving high-value manufacturing in South Australia [71].

First, the medical devices and assistive technologies sector has been recognised as a key focus area for several reasons. (1) People aged 65 plus will exceed one billion by 2030; (2) the incidence of chronic illness is likely to

burden the health system; and (3) poor diet and limited exercise will likely lead to increases in lifestyle diseases [70]. These trends will provide opportunities for the development of sophisticated medical devices and services; advancements in the aged care industry; improved delivery of healthcare; and innovations in mobile health and e-health. Tonsley will leverage on growing health capabilities in South Australia including a Health and Biomedical precinct which incorporates a new AUS$3billion Royal Adelaide Hospital; an AUS$2million South Australian Health and Medical Research Institute (housing 600 researchers) and an AUS$231million School of Medicine, Nursing and Dentistry at the University of Adelaide.

Second, the clean technology and renewable energy sector has been identified as another key focus area. This area pertains to renewable energy technologies; waste management; green building and energy-efficient construction materials; and water technologies. The development of innovations in these areas is well aligned to the State' direction in developing the renewable energy sector. South Australia uses 41% of its power from renewable energy and has targets of 50% by 2025; makes the largest solar electricity contribution in Australia with one is four households with rooftop solar panels; provides 35% of the nation's wind capacity with industry capital investment of AUS$3.23 billion in wind farms; and represents over 90% of the country's geothermal exploration investment [70]. Given that South Australia is the driest State in Australia, it also has a strength in the development of water efficient technologies, with this sector being a key export sector for the State and having potential for the continued development of such innovations to address global water scarcity issues.

Third, software and simulation have been emphasised as important focus areas for Tonsley. Innovations stemming from these areas will have synergies and provide services to other sectors such as defence. South Australia has a long established capability in defence with one quarter of all national expenditure on defence equipment acquisition and sustainment made in South Australia, which is also home to Australia's main defence research organisation, the Defence Science and Technology Organisation (DSTO) [72]. Global technology giant, CISCO has also named Adelaide, the capital of South Australia, as the first 'Lighthouse City' in Australia, one in only 10 internationally, that will pilot new urban solutions to improve the citizen experience [70].

Fourth, the mining and energy sector represents the final area of focus at Tonsley. This area pertains to the development of technologies, equipment, training and services to the mining and energy sector. It was selected as it is well aligned to South Australia's combination of natural assets and skills in this sector. The State has 80% of the country's uranium resources and 60% of its current uranium production. The State's Bight Basin is a significant offshore exploration site as it is the similar size to the Niger Delta but less explored, thereby providing significant future prospects. The State also possesses major deposits of gold, copper, iron oxide, and shale gas [70]. The development of downstream industries and value-add technologies, equipment and services pertaining to these resources are important to the State's economy in leveraging the benefits of the State's resources.

4.2. Activating

Activating includes the selection of key partners.

First, in terms of the health, medical devices and assistive technologies sector, several key partners have been selected. Tonsley will leverage on the close proximity to two major hospitals, Flinders Medical Centre and Flinders Private Hospital with which various collaborations ensue. Flinders University opened its Tonsley building in 2015 which includes the Medical Device Partnering Program (MDPP). The MDPP includes researchers involved in developing medical devices from those that significantly reduce the cost, risk and recovery time of spinal surgeries to joint replacements which represent an AUS$16billion joint replacement industry. Other current Tonsley health business partners include: Signostics that develop portable point-of-care devices for instance, handheld ultrasound devices and bladder scanners; Micro-X that develops ultra-lightweight medical x-ray products; and the Hills Innovation Centers that have developed a nurse-call medical device for arthritis patients.

Second, the Clean-tech and Renewable Energy sector includes several education and industry partners. Education partners include the Sustainable Industries Education Centre (SIEC) which trains over 6,000 students annually in sustainable construction as well as Flinders University's Centre for Nanoscale Science and Technology which is involved in developing energy efficient technologies such as low-energy desalination membranes and solar technologies. Other actors include ZEN Energy Systems which is a renewable energy provider and develops energy storage technologies; the Collaborative Research Centre for Low Carbon Living which undertakes research programs at Tonsley via an Adelaide Living Laboratory; and the start-up company, Latent Heat Storage that develops large scale thermal energy storage technology.

Third, the software and simulation stream develops information and communication technology innovations for the defence, health and energy sectors. Partners include Simulation Australia which is Australia's peak industry body and is made up of members such as BAE Systems, Kellogg Brown & Root, Saab Australia Pty Ltd, Boeing Defence Australia, the New South Wales Police Force Simulated Operations Unit, the Australian Defence Simulation and Training Centre, the Australian Institute of Medical Simulation and Innovation, Coal Services, and TraumaSim.

Flinders University's School of Computer Science, Engineering and Mathematics (CSEM) at Tonsley trains students in Information Technology and Software Engineering and engages in research collaborations in these fields. Signostics, a medical company, conducts software and hardware development at Tonsley. The System Simulation Hub is a partnership between multinational company Siemens, State Government and Simulation Australia, which will deliver training in system simulation to firms and universities.

Fourth, the mining and energy services sector includes several organisations. Siemens' Tonsley Service Centre focuses on turbomachinery (gas turbines, wind turbines, steam turbines and compressors). Radical Torque Solutions develops torque tools and bolting solutions for the energy industry. The Onshore Petroleum Centre of Excellence (OPCE) Training Facility is a fully simulated environment which provides training to operation and maintenance staff in the oil industry from organisations such as Beach Energy, Santos, and Senex Energy and their contractors. The AUS$32.2 million Drill Core Reference Library houses the State's full collection of drill cores from 120 years of exploration that benefits geoscience explorers.

4.3. Mobilising

Mobilisation has occurred in the Tonsley network through demonstrated commitment to the initiative via financial commitment, agreements and formalized cooperation towards achieving the network's goals

Several organizations have made financial commitments around Tonsley. The State Government has invested AUS$125 million in developing the Sustainable Industries Education Centre which was opened in 2014. Flinders University has also invested AUS$120M in a Tonsley building for its Computer Science, Engineering and Mathematics (CSEM) School which opened in January 2015. Mining company, Basetec Services invested AUS$9 million in forming a Centre of Excellence in composite pipeline technologies and the State government has co-invested $1.5 million to establish the Centre of Excellence in Composites Research and Development at Tonsley. Siemens, leading multinational German Fortune 500 company, has invested AUS$5million in its Tonsley service center which opened in July 2015. The AUS$32.2million drill core reference library also reflected another commitment.

Several agreements have been signed around Tonsley. The Memorandum of Understanding between the South Australian Government, Flinders University and Prospect SV in Silicon Valley, United States allows Australian cleantech innovators to access business networks, markets and sources of capital in the US, and encourages collaboration with US cleantech innovators. Additionally, MAN Diesel and Turbo Australia/Remotenergy have been engaged with the State Government to establish a Centre of Excellence in hybrid power development at Tonsley. Similarly, an Onshore Petroleum Centre of Excellence has been formed through investment by oil companies including Santos, Beach Energy and Senex Energy.

A number of businesses have also relocated their head offices to Tonsley including Zen Energy, Signostics, and Micro-X (from another State, Victoria) with more planned over the upcoming couple years.

4.4. Synthesising

Synthesising involves organising, communicating and creating conditions and removing barriers around productive interaction.

The Tonsley entrepreneurial ecosystem has a number of mechanisms in place towards organising and communicating capabilities of each partner to help establish collaborations. First a number of expos have been held by CSEM, the NVI, and the contract research groups, the Medical Device Partnering Program and NanoConnect, in order to showcase their capabilities and pave the way for future industry collaborations. Second, the State Government has planned several training and networking initiatives such as the Manufacturing Leaders Network and the High Performance Workplaces to assist participating organisations in boosting their innovation capability and partnerships [71].

Additionally, the State Government has initiated a Mining Industry Participation Office (MIPO) to assist mining in building local capability, identifying service and technology needs, determining existing and future capabilities, and aligning workforce development strategies. Furthermore, a PACE Manufacturing program will be established to foster industry awareness about supply requirements for the mining sector, standards, levels of compliance, benchmarking and overall development of capability. [71]

The Tonsley entrepreneurial ecosystem also has a number of processes aimed at removing barriers and creating conditions for productive interaction. In entrepreneurial ecosystems, the allocation of intellectual property or innovation appropriability can be a major barrier among partners if not managed effectively [56, 73]. Flinders Partners, the university's commercialization office, has been located at Tonsley. It provides expertise in developing intellectual property agreements around patents, licenses, contract R&D and confidentiality agreements. Another barrier in entrepreneurial ecosystems is the high failure rate of start-ups or entrepreneurial initiatives within

companies. To address this challenge, the New Venture Institute has been set up to support entrepreneurs as well as entrepreneurial initiatives within firms through mentorship programs, legal and technology consulting support. The NVI also runs the Entrepreneurs in Conversation Series which invites high-profile entrepreneurs to share their stories on how they overcame barriers along their entrepreneurial journeys. [69]

4.5 Entrepreneurial Ecosystem Outcomes

The State government has defined performance metrics for the Tonsley entrepreneurial ecosystem. Government metrics include employment targets (jobs from existing and startup firms, wage rate growing with productivity, improved capabilities), return on investment (gross state product, labor productivity, infrastructure of use to community), industry attraction and development (value of output, value of import substitution, value of exports, patent registrations), capacity building (strategic alliances across value chains and clusters). Business outcome metrics include sales, productivity, patents, and the development of new products and services (global niche market, interlinked product-service solutions, well-defined continuous and integrated innovation, reputation for high-quality innovative products and services) and employment of skilled staff (entrepreneurship, ambition, capability /appropriate skills/ command of critical knowledge domains, experience, continuous improvement, mutual responsibility and loyalty, low turnover). University outcome metrics as defined by government include a 'comprehensive, integrated approach to innovation and strategic alliances across value chains and clusters' [71].

However, delving deeper into university performance metrics, three key areas are generally rewarded including research (grant income for instance through Australian Research Council linkage grants and innovation vouchers, publications and citations), teaching (graduate employability through student industry projects and the course evaluation questionnaire which students complete at the end of their course); and commercialisation (R&D contract income, patents and start-ups).

5. Governance Implications

This study offers useful governance implications to a range of actors.

First, the study is valuable for firms involved in technology commercialisation or product development. It will help their managers build effective collaboration with R&D partners from universities or public research institutions. Additionally, success of an entrepreneurial ecosystem is important in attracting future participants, thereby increasing business partnership opportunities for participating firms. This would contribute to effective governance surrounding the ecosystem and in turn the identity, positioning and branding of the network; synergies for participating firms; and future attraction of additional firms and hence, prospective partners for participating firms.

Second, the study will be useful to government agencies. Specifically, it will be useful to government departments pertaining to entrepreneurship, industry, manufacturing, science, technology, economic development, education and skills development in facilitating goals focused on industry attraction and development, employment targets and up skilling, and the building of a high-value innovation economy. In particular, the study is valuable for government departments with responsibility for economic development and urban renewal. It will assist them in policy development around governance of entrepreneurial precincts, as they attempt to boost transformation from traditional manufacturing towards the development of high value-add industries, products and services. It offers a useful framework for managing entrepreneurial ecosystems that would be beneficial in the effective governance of such initiatives. This framework can be used for analyzing dynamics and evaluating performance as ecosystems evolve. Overall, it resonates with the global trend towards growing advanced manufacturing and consequently, the findings of this study can be integrated into government policies on how best to support entrepreneurship through effective governance.

Third, it offers implications for universities in their entrepreneurial efforts, industry engagement strategies, regional innovation and the development of their strategic positioning as the key contributors of entrepreneurial skills for the high-value technological economy. Additionally, it will be useful to their technology transfer offices, start-up incubators and industry consultancy arms in building successful collaborations with industry and government partners.

It also has insights for managing entrepreneurial ecosystems on a broader level such as cooperative research centers or university-industry collaboration in unpacking key issues in governing the ecosystem and articulating meaningful performance metrics.

6. Conclusion

This research makes an important theoretical contribution to ecosystem governance theory. First, unlike past studies that have predominantly investigated inter-organizational interaction at the relational level of coping or managing relationships within networks, this study builds on the work of strategic network researchers who investigate network management of strategic networks [32, 49, 51, 74]. Second, while previous research mainly examined

strategic networks involving mostly business actors, this study investigated an entrepreneurial ecosystem involving firms, government and university actors. Addressing this diversity is a direct response to calls for further research in examining the role of diverse actors as overlooked actors could undermine network governance efforts [17, 18, 22]. The study therefore, builds on previous work on orchestrating public sector networks that identified key functions of framing, activating, mobilising and synthesising [32, 53]; and extends such work by empirically testing it in the context of entrepreneurial ecosystems from the perspectives of firms, government and university actors. Third, the study extends previous work even further by linking governance efforts to network outcomes from the perspectives of diverse actors. This contribution is critical given calls for more research on effective network governance research that links orchestration strategy to performance measures [19].

Despite its contribution, the study has limitations and therefore it paves the way for future research. First, given that it is based on a single case study, future research can compare it to other entrepreneurial ecosystems. Nevertheless, this case study was deemed suitable as it included several industries including health, medical devices and assistive technologies; cleantech and renewable energy; software and simulation; and mining and energy: such diversity contributing to rigour in theory development. Second, the model should be tested quantitatively to continue to strengthen theory development. Third, as the entrepreneurial ecosystem matures, a longitudinal study can be undertaken to investigate the evolution of the network in various phases of development so that relevant management strategies can be applied in each phase in future entrepreneurial ecosystems.

Indeed, this study is instrumental laying the foundation for the effective governance of entrepreneurial ecosystems in the future.

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