**The role of University Innovation Activities in Developing Agglomeration Economies**

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**Abstract**

Agglomeration economies are barely a result of natural advantage; the economic actors need to act to trigger them. The university is a prominent actor in the economy and has intellectual capital that can be a centre of agglomeration economies. A functioning collaboration model is needed to lead fruitful integration of business and university activities. Intensifying the Triple Helix Model is beneficial for enabling businesses to have open innovation processes.

Data were collected from a population that comprises universities and their innovation activities. The sample size of 180 provided qualitative and quantitative data. A mixed method approach was used to collect data from university-based innovation centres and incubators, to determine whether their current collaboration model results in agglomeration economies.

This study shows that research on its own is insufficient to make universities centric agglomeration economies. In the core of agglomeration economies there is a functioning collaboration model; the Triple Helix Model seems to be a better fit to explain university involvement in innovation, and the Open Innovation Model is seen as being more appropriate to explain the open innovation process of businesses.

Key words: Entrepreneurship, agglomeration, triple helix, innovation

1. **INTRODUCTION**

According to Wolman (2014), agglomeration economies result from businesses locating in geographic proximity to each other – resulting in external economies of scale. The cost savings that result from lower input costs and increased productivity, are external benefits to businesses that come about as a result of this proximity (Wolman, 2014). Explaining the reasons for agglomeration, Ellison, Glaeser and Kerr (2010) state that agglomeration can also appear empirically, even if there are no gains from locational proximity. The above researchers also mention that natural advantages such as the presence of natural inputs, differ spatially, and businesses may choose locations to gain access to those inputs. However, agglomeration economies do not necessarily mean an innovative environment where every firm benefits (Kolehmainen, 2003). Certain structural features of agglomeration and collaborative and/or competitive relationships of companies do not guarantee that the companies will search, adopt, mediate and create innovations effectively (Kolehmainen, 2003). The positive synergy between different actors in an agglomeration, and mutual learning orientation, results in positive externalities. Thus, businesses in agglomeration economies benefit from the following:

* *Proximity to Customers and Suppliers: Goods*

Agglomeration economies create an environment that reduces the costs of obtaining inputs or shipping/moving goods to downstream customers (Couture, 2015). Businesses normally agglomerate to a location closer to the source of raw material or resources needed to produce goods and services. When inputs are far away from the eventual market, businesses will trade off the distance between customers and suppliers based on the costs of moving raw inputs and finished goods. Agglomeration consists of businesses that use similar resources, and results in falling costs of moving goods and transmitting information (Glaeser, 2010a).

* *Labour Market Pooling: People*

The second benefit of agglomeration economies is to take advantage of economies of scale associated with a large labour pool (Glaeser, 2010a; Carlino and Kerr, 2014; Maietta, 2015; Rigby and Brown, 2015). Agglomeration economies result in labour market pooling – but it does not necessarily result in increased productivity. It, however, reduces the trouble that businesses have to go to in order to find employees, as it suggests that agglomeration occurs because workers can move across businesses and industries (Glaeser, 2010a). Labour movements across businesses and industries, however, can occur only if the industries use the same type of workers (Glaeser, 2010a).

* *Intellectual or Technology Spillovers: Ideas*

Workers and businesses learn skills quickly from each other in a cluster (Ellison et al., 2010). This is based on the belief that the metrics of information flows (for patents, research and development), reflect only the highest level of information flows, rather than worker-level spin-offs. Agglomeration economies enable specialisation because businesses in these economies are aware of the external benefits they create (Kolehmainen, 2003). The university holds stock of knowledge/information that is critical for innovation. Some businesses use Innovation Centres in universities to reap external benefit from university research findings.

* *Natural Advantages*

Agglomeration of businesses may also result from natural advantages. Some regions simply possess better natural environments for certain industries, and agglomeration can follow from these natural cost advantages (Glaeser, 2010a). For example, businesses agglomerate to areas with exogenously cheap electricity, which can be due to hydroelectric power (Kolehmainen, 2003).

Carlino and Kerr (2014) state that knowledge spin-offs positively affect agglomeration economies at a local level. Some knowledge can apply to a specific local level, because of the knowledge required, and areas develop at a different pace; to engage some areas, a specific knowledge might be required. Explaining the patterns of agglomeration and innovation, Carlino and Kerr (2014) state that innovation activities are spatially concentrated. They assert that innovation is concentrated, and appears to be more localised than other economic forces linked to agglomeration. Innovative activities often take place inside a cluster. However, Carlino and Kerr (2014) explain that clusters do not only lead to productivity growth – they tend to stimulate the formation of new business, leading to ongoing growth in entrepreneurial activities. Clustering promotes input sharing and collaboration of different kinds.

Institutions like universities and other institutions of learning and research have the required characteristics – such as knowledge, an enabling environment, supporting staff, a culture of innovation, research capabilities and support creativity – for innovation (Carlino and Kerr, 2014; Couture, 2015; Phan et al., 2005; van Dijk et al., 2013). Agglomeration for innovation can form around an Innovation Centre (for the utilisation of University Knowledge and Academic Research and Development), as a firm seeks to benefit from spin-offs from the university. Universities are key role-players in creating new knowledge and local universities are important for the innovative activities of local businesses (Carlino and Kerr, 2014).

## **INNOVATION THROUGH UNIVERSITY ACTIVITIES**

The link between university and industry is important for stimulating knowledge development that can lead to commercial innovation (Yusuf, 2008). To achieve effective knowledge exchange in the economy, different kinds of intermediaries have to work together. Yusuf (2008:2) states that “active and many faceted intermediations for knowledge sharing and commercialization is essential when the knowledge is tacit or uncodified”. Tacit and uncodified knowledge is the kind of knowledge that is difficult to transfer to another person by means of writing it down or verbalising it (Yusuf, 2008). Universities transfer knowledge and aid the process of innovation in a comprehensible way to the public.

Innovation is the application of fresh ideas that enables a business to compete better in the future – which include any new or significantly improved goods or services and operational processes or managerial processes (Davenport, 2013). According to Lyon (2013), innovation is accomplished through more effective products, services, technologies, processes or ideas that are readily available to markets, industry, governments and society. It is argued that innovation is based on a belief that increasing individual creativity, and identifying and removing barriers to individual creativity, can increase the ability of organisations to respond to changes in the environment (Csikszentmihalyi and Sawyer, 2014). Therefore, innovation helps organisations to deal with changes better. According to Csikszentmihalyi and Sawyer (2014), innovation is a trait of an entire organisation, not of individuals only, because it is the full organisation that must invest in the development, manufacturing and marketing of new products and processes. Therefore, there should be systems to create and manage research and development in order to foster innovation.

Kuratko et al. (2014) support the contention that continuous innovation regarding products, processes, and administrative routines and structures, is needed to compete effectively in the global markets of the 21st century. Innovation goes hand-in-hand with entrepreneurship. Businesses that exhibit corporate entrepreneurship are typically viewed as dynamic and flexible entities prepared to take advantage of new business opportunities when they arise. Ideas come from people, and innovation is a capability of the group. Kuratko et al. (2014) assert that innovation is derived from the deviation from prior routines, strategies, business models, and operating environments that are typical modes of operation, and by giving individuals the liberty to pursue actions and initiatives, regardless of the rules. Innovation is also fundamental for generating economic development.

As a process, innovation incorporates management activities and decision-making at individual and organisational levels (Ferreira et al., 2015). Innovation is determined by the skills with which businesses perform their daily tasks, confront risks, and invest time and money in organisations. There are different drivers of innovation, and it can occur as a result of a focused effort by a range of different agents, by chance, or as a result of a major system failure (West and Bogers, 2014). In general, sources of innovations are different changes in the industry structure, market structure, local and global demographics, human perception, mood and meaning, and also the amount of available knowledge (Drucker, 2014). However, Research and Development remains the most critical source of innovation.

Universities can attract the interest of industry in their innovation activities. Bramwell and Wolfe (2008) state that knowledge transfers between the university and other economic actors are highly localised, which makes geographical proximity important for the process of knowledge transfer. It is believed that proximity to the source of research is important for business success, because the knowledge generated in the research laboratory is transferred to businesses for commercialising and the innovation process. Therefore, universities contribute to the development and expansion of local industries through the provision of skilled graduates who become key players in local industries and knowledge spin-offs. While the presence of a leading research university in a community is a critical asset for regional economic development, its precise contribution is a function of the way in which it interacts and responds to the needs and interests of local industries. Agglomeration and entrepreneurship development, according to Msulwa, Black, Turok and Dunne (2012), lead to business efficiencies and regional development.

Agglomeration and firm efficiency in South Africa, according to Krugell and Rankin (2012), has resulted in firm clusters where there are efficiency gains from outsourcing, labour pooling and knowledge spin-offs. Knowledge spin-off is a very important source of agglomeration in the knowledge economy. Agglomeration economies are not only determined by human capital, access to markets and exports (which are significant determinants of output growth), but also by businesses’ responses to the needs of the knowledge economy.

The section explained innovation and argued that innovation is not only an internal process, but involves various stakeholders. It also asserts that innovation and university research are important for business success. Knowledge spin-off is good for economic development, which is why universities play such an important role in the development of agglomeration economies.

## **3 AGGLOMERATION ECONOMIES THROUGH LINKING THE UNIVERSITY WITH INDUSTRY**

Agglomeration economies are defined as the benefits that come when businesses and people locate close to one another in cities and industries. Wolman (2014) shows that businesses form clusters around universities to benefit from higher education outputs – which include teaching and learning, research and development, and business solution programmes. Entrepreneurial universities result in firm clusters and spin-offs. In this section, the role of universities will be explored to determine how they bring businesses and business people together in search of knowledge. According to Glaeser (2010b), the measure of agglomeration economies is price, wages and quantity. Businesses will associate with institutions that they perceive to be beneficial. All agglomeration can be understood as consequences of reducing cost, and the nature of agglomeration will depend on what cost is being reduced (Glaeser, 2010b). Therefore, there is a need to understand the benefits from university activities that have the potential to reduce business costs. Glaeser (2010b) highlights knowledge spin-off as another source of agglomeration. Having knowledgeable neighbours may enable businesses to fast-track their innovation and save costs.

Rosenthal and Strange (2001) identified colleges, universities, and professional schools as a determinant of agglomeration economies. There are various externalities that come from university links with industry and government. Belderbos, Van Roy, Leten and Thijs (2014) state that university and industry linkages have led to an increase in the innovative performance of businesses. Research findings suggest that businesses will locate their research and development projects in regions with strong academic health (Belderbos et al., 2014). Strong academic health affects business projects, industry agglomeration, the technological strength of the region, R&D tax incentives, and innovation (Belderbos et al., 2014; Glaeser 2010b). Businesses therefore agglomerate closer to academic institutions to fasten and improve their research, to benefit from knowledge spin-offs, and to normally interact with university innovation activities through Innovation Centres, research hubs and incubators.

## **4 INCUBATION, INNOVATION CENTRES AND RESEARCH HUBS**

Research recommends the collaboration of small business entrepreneurs and higher education institutions for exploration and to achieve entrepreneurship development (Fayomi and Fields, 2016). University Innovation Centres and Incubators are platforms that encourage collaboration between businesses and universities. Jansen et al. (2015) assert that universities all over the world are becoming more entrepreneurial – to stay competitive, generate new sources of income through licensing or contract research, and to follow policy guidelines from governments. Jansen et al. (2015) concur that the most powerful resource universities have, is to stimulate entrepreneurship in their students.

Universities drive students and entrepreneurs into entrepreneurship through activities such as Innovation Centres/hubs, incubators and research centres (Voisey et al., 2013). Entrepreneurial encouragement activities offered and applied at MIT and other universities show that innovation activities are important for business development. A longitudinal study conducted over 10 years of university incubation in Wales, reflects that incubation helps businesses to improve their income and helps to create jobs in areas of economic underperformance (Voisey et al., 2013). University Innovation Centres are critical in the creation of the knowledge economy. According to Deiaco et al. (2012), universities are providers of both public and private goods of education and research, and also play a historical role in applied problem solving. Scholars concur that universities act as channels for the development of societal impacts, and for facilitating integration into the wider social and innovation system (Deiaco et al., 2012). Powell and Snellman (2004) found that the breakthrough discoveries in university laboratories and centres led to the founding of start-ups in these universities. University Innovation Centres therefore create start-ups – thereby increasing the number of businesses associated with the university. University Innovation Centres consist of a wide and dynamic range of activities that enable the formation of technology entrepreneurship (McAdam et al., 2005). The functions of Innovation Centres are: to generate ideas, create new knowledge, develop spin out and spin in companies, technology licensing, to secure intellectual property, technology appraisal, venture capital and funding, and developing business plans and business growth. University technology transfer leads to the formation of technology-based businesses (THE, 2015).

Comunian and Faggian (2014) assert that universities are key role-players in the creation of knowledge and creative economies, by emphasising that universities transfer knowledge and recognise creative sectors to be of importance for economic growth and development. Innovation is complementary to the development of the creative economy. Denning (2014) supports the view that innovation is complementary, by mentioning that the fastest growing segments of the economy are increasingly dominated by businesses with a single-minded focus on innovation. The result is that the business environment is now known as ‘the creative economy’ – an operating arena with the unique requirement that successful entrepreneurs realise that they need to be innovative to stay relevant (Denning, 2014). Many scholars acknowledge that small business innovations (new products and processes), as a driver for entrepreneurship, economic development and growth, which is they are supported by interest groups like government and business support agencies (Deligianni et al., 2014; Mazzucato, 2013; van Dijk et al., 2013; Colombo and Piva, 2012). According to Deligianni et al. (2014), small businesses make a significant contribution to the wellbeing of the economy of a region. Studies show that different combinations of technology, market and ‘international knowledge’, drive differences in the way businesses grow. Thus growth depends upon different types of knowledge businesses acquired (Deligianni et al., 2014). This means that small businesses will address area-specific requirements, and their growth will bring development.

Through research centres, Innovation Centres and research parks, the entrepreneurial university still can fulfil its primary mission simultaneously – teaching, research, and entrepreneurship (Guerrero and Urbano, 2012). Thus, the entrepreneurial university can innovate, recognise, and create opportunities, work in teams, take risks, and respond to challenges (Guerrero and Urbano, 2012). Universities provide adequate environments for their students, academics, entrepreneurs and staff to explore and exploit entrepreneurial activities – ranging across new products, processes or markets. Entrepreneurs have to be innovative, and the university holds a stock of knowledge, and therefore to accelerate innovation a university has to play its part as an entrepreneur and facilitator for innovation. Universities get involved in facilitations for innovation through entrepreneurial and business-support programmes. For the last two decades, innovation accelerated due to increased competition, new technology and changing customer needs (Drew, 1995). Starr (1992) also argues that innovation strategies are aimed at expanding market share, revenue and operation, so that businesses can enjoy the greatest competitive leverage. These changing market behaviours need to be studied and researched so that the economy can stay updated.

All in all, the activities of Innovation Centres create agglomeration economies, because they have benefits to offer the public and businesses. Firms/businesses, government, entrepreneurs and communities are working closely with academic institutions to benefit from their research, infrastructure, knowledge, and also to do business with the university. These benefits create agglomeration economies (academic agglomeration), within which there is sharing of important information, development of technology entrepreneurs and innovation – which is important for entrepreneurial success. Both start-ups and already established businesses can benefit from university innovation activities. As a facilitator of innovation, universities will acquire and study in the environment and provide businesses with reliable information to include in their processes. Universities are important for technology transfer, generation of knowledge, and economic development.

The next section reveals how universities started involving industry in their activities, and that resulted in resource sharing and patent citations.

## **5 LEADERS IN RESEARCH, ENTREPRENEURSHIP AND INNOVATION**

This section reveals that university collaboration is important, because it can impact university ranking according to resources from industry, patent citation, research and industry collaboration. Collaboration, as stated earlier, is important for a university’s image and projects’ funding. According to Times Higher Education (THE), approximately 80% of the budget of the world’s most innovative institutions is devoted to research (THE, 2015b). This shows the importance of research for educational institutions like universities. There is also pressure on researchers to make sure that when they have done work in partnership with industry, they continue until it is published (THE, 2015; THE, 2015b). Universities therefore open Innovation Centres to engage students, industry and government in applied research. The aim of such initiatives is to convert ideas into practical solutions that can have a direct impact on people’s lives (Colombo and Piva, 2012). Duke University in the US receives many resources from industry, including funding, because they are ranked among the top five world universities; businesses have confidence in their research and innovation. Incubators have become a tool to initiate collaborations with industry and to promote entrepreneurship and innovation (Alon and Godinho, 2016). University incubators initiate collaboration because they are university spaces where businesses contact other businesses and funders (Government and NGO) (Etzkowitz, 2008).

Top ranking universities have Innovation Centres to support innovation and encourage entrepreneurship (THE, 2015b). Leydesdorff (2013) states that a university plays a much more enhanced role in technology entrepreneurship and the government encourages this academic transition as an economic development strategy that also reflects changes in the relationship between knowledge producers and users. Universities such as MIT and Stanford have become a model for other universities to emulate when they pursue entrepreneurship and innovation development. Universities have “extended their activities deeper into the technology transfer process, identifying and filling gaps in the technology push process, establishing incubators to assist the formation of businesses from campus research and venture capital arms to fill gaps in the availability of seed funding” (Etzkowitz et al., 2000: 319).

Block et al. (2013) explored what turned knowledge into innovative products and showed that a high rate of entrepreneurship increases the chances that knowledge will become new-to-the-market innovations and entrepreneurial in the process of the commercialisation of knowledge. The study asserts that “university research and regional innovative activities are positively related, and there is evidence that university research impacts business research and development both directly and indirectly” (Block et al., 2013:697). The universities are important because they manage knowledge, which leads to spin-off attributes that are regional agglomerations of knowledge activities (entrepreneurship capital) that become the breeding ground for growth (Block et al., 2013). Universities need to be entrepreneurial leaders in their countries and help their staff to be innovative risk takers, without harming their careers or programmes in the process – to take learning and research findings from the classroom to the market (Yamagata-Lynch et al., 2015). Universities discover and create opportunities for their stakeholders to engage in innovative activities (Yamagata-Lynch et al., 2015). Clifford (2012) concurs that universities discover and create opportunities through embracing creativity as part of learning, using effective strategies. Strategies such as (Fayomi and Ziska, 2016; Cropley, 2015; Yamagata-Lynch et al., 2015; Cropley, 2016):

participating in or creating programmes to develop creative skills, using a creativity model,trying the Incubation Model, deepening expectations, knowing the standards, gathering resources, allowing room for mistakes, allowing space for creativity, encouraging curiosity, observing a working model of creativity, considering the work of current experts in the field, exploring different cultures, using a collaborative creative thinking model to solve problems, designing multidisciplinary lessons when possible, tapping into multiple intelligences, and teaching creative skills explicitly

Research universities create entrepreneurship ecosystems that allow for the interaction of an entrepreneurial community of stakeholders with their environment (Maritz et al., 2015). A university-based entrepreneurship ecosystem represents the interest of entrepreneurship researchers and educators – with many academic institutions looking for guidance on how to frame, design, launch and sustain their efforts in the area of entrepreneurship (Maritz et al., 2015). Since universities are ranked, it is the top-ranking universities that organisations want to be associated with the most. Universities that publish high-quality papers in scientific and accredited journals ensure that they will receive citations in the future (Ale Ebrahim, 2015). University Collaboration with stakeholders allows researchers to increase the research impact and citations for their publications (Ale Ebrahim, 2015). Research productivity, research impact and research excellence are important for overall university performance, which impacts on ranking and attracts industry partnerships (Ale Ebrahim, 2015; THE, 2015b).

An academic institution’s innovation activities are involved in creating and disseminating knowledge through their position in the collaboration network (Ronda-Pupo and Guerras-Martín, 2016). The role these institutions play in the academic community is not only through scientific output or citations, but also through the collaborations they forge with other institutions. Universities operate within an ecosystem, where innovation and entrepreneurship are key. The US is adopting the Fraunhofer Model to the US market following its success in creating innovation ecosystems and supporting technology transfer in Germany (Edmorrison, 2014). Reid et al. (2010) show that the Fraunhofer Model is simply to get industry and university working together on cutting-edge research through Innovation Centres. The model shows the advancement of applied research in German research organisations: about 67 institutes spread across the country, each focusing on different fields of applied science (Edmorrison, 2014; Reid et al. 2010). The use of the Fraunhofer Model led to the employment of approximately 24,000 people, with an annual research budget of about €2.1 billion (Edmorrison, 2014; Reid et al. 2010). Some basic funding for the Fraunhofer Society is provided by the state, but over 70% of the funding is earned through contract work, either for government-sponsored projects or from industry (Edmorrison, 2014; Reid et al., 2010).

Figure 1 shows that universities have to build trust through their activities to attract industry and other collaborations for innovation. *Fraunhofer-Purdue* is a collaborative model that shows that activities such as teaching and learning, entrepreneurship and technology transfer of the research organisation are at the root of centres – as they are selling services. In that way, Innovation Centre Activities will have the following benefits: generation of new knowledge, knowledge transfer, new research, support, and innovation. For the above benefits to be diffused, organisations such as government, businesses/firms, entrepreneurs and the community need to be involved in creating agglomeration economies. The collaboration map in Figure 1 shows that university activities such as teaching and learning, entrepreneurship, and technology transfer, make collaboration work. Innovation Centre activities benefit from the generation of new knowledge, knowledge transfers, new research, support and innovation, because these outcomes are what universities publish. The *Fraunhofer-Purdue* Model also shows that agglomeration economies and innovation are results of the collaboration of government, businesses/firms, entrepreneurs and the community. Incubators are part of a technology transfer strategy. University activities have to involve industry and government to make technology transfer work. University research also impacts on business research and development, which is why industry finds collaboration with a university beneficial.

**Figure 1:Innovation Centres creates agglomeration economies.** Adapted from Edmorrison (2014)

Agglomeration benefits can increase entrepreneurial success and result in numerous innovation activities. There are many entrepreneurial universities in the world that are in the same proximity as businesses. As a result, many universities benefit their entrepreneurial activities, because they improve or create links between universities and businesses. Universities are important for business success in the knowledge economy. Agglomeration economies that businesses enjoy from universities, are as a result of the changing role of universities.

Businesses are associated with universities to reap from their pool of knowledge, research, technology transfer and connections with other business. Entrepreneurial universities specifically create a pool of businesses that are clients of the university due to their collaboration – which creates agglomeration economies.

**6 RESEARCH METHODOLOGY**

The mixed method used, uses qualitative and quantitative data to analyse the role of universities in South Africa. The sample includes participants from the top five research universities in South Africa, government institutions such as the Department of Trade and Industry (DTI), the Small Enterprise Development Agency (Seda), the Department of Small Business Development, and non-university Innovation Centres. Interviewees who were available for interview during the data collection period were selected to participate and questionnaires were distributed using simple random sampling. A total of 159 questionnaires were coded into SPSS 24 for quantitative data analysis. The qualitative data were collected through interviews with 21 agents working in innovation centres and incubators associated with universities.

## **7 MODEL TO DRIVE ENTREPRENEURSHIP AND AGGLOMERATION ECONOMIES**

Primary data were collected from the top five research universities in South Africa to assess the role of university entrepreneurial activities in developing agglomeration economies. The top five research universities in South Africa have strategies to engage industry and government at different levels, and there is Triple Helix collaboration by these universities. The Department of Science and Technology, together with Nipmo, are spearheading university involvement in innovation and technology transfer. However, the current strategies used to engage stakeholders have been criticised for not resulting in the innovation levels expected from the top five research universities. Therefore, this section explores why universities have to intensify their models to trigger industry interest in innovation activities, so that they can be more beneficial to an entrepreneur’s associates.

Interviewees argued that current university models for engaging stakeholders are working, but are not as effective as they should be in driving up South African innovation levels. The current models are bringing incremental changes in innovation levels, but South African universities need to cement these changes to be as innovative as leading entrepreneurial universities. The Triple Helix and Innovation Models teach about innovation boundaries. The current model has not been used for a long time in South African universities. The universities should collaborate with industry and government, and their activities such as innovation incubators and centres should autonomously use the Triple Helix Model. As suggested by the Triple Helix, this study also suggests that the university should take a leading role in facilitating and initiating innovation.

Interviewees from Innovation Centres argued that if universities do not start relationships with industry and government, they could not expect government and industry to start these collaborations. The participants believed that universities are best suited to host the collaboration of the Triple Helix actors through their activities. Engagement with stakeholders must recognise there are no boundaries. Innovation Centres must collaborate with international, as well as local organisations. Interviewees engaged in innovation activities at universities agreed that this would give South African universities a significant in innovation levels and would enable them to compete at a different level where innovation is the centre of their competitive advantage. The idea is to cement the changes in innovation levels at universities, and increase the benefits that these institutions have to offer. Interviewees stated that a country cannot grow the economy without investing in research and development – and for South Africa to grow, innovation has to be at the centre. Universities are starting initiatives to facilitate innovation, and these must be funded.

The government needs partnership, particularly with academics and universities, to succeed. Research on its own is insufficient. Research needs to be commercialised, and there should be greater collaboration among universities, industry and government. The government is establishing technology hubs throughout the country to hasten the growth of ideas by collaborating with universities. The Triple Helix and Innovation Models both support the idea of no boundaries, so that businesses and government can have input into the functioning of the university at different levels. Both models have the following benefits (Alessandrini et al., 2013; Coan, 2016; Etzkowitz, 2008; Ferreira et al., 2015; Georghiou et al., 2014):

* Innovation is displayed as an open process (allows for interactions at different levels);
* Support of the collaboration of university, industry and government, as well as communities;
* Research is an important element of innovation (a key player in research, knowledge production and development in the university);
* Knowledge spill-over attracts business (businesses are attracted to relationships that will help them minimise cost and maximise benefits);
* Stakeholder roles have some degree of homogeneity (they are all entrepreneurial); and
* There is collaboration among government, industry and universities to promote economic development (collaboration is important for development).

Agglomeration economies are those activities that result in forces that bring together different actors in the same space to explore available activities. An interviewee stated that:

“*University models currently have many benefits to its associates. We, however, have to better sell our services to attract stakeholders’ interest.*”

Agglomeration economies originate from university academic benefits, comparative advantage and economies of scale. There is still a lot that however needs to be done to find a model that works for South Africa. However, many universities have been implementing the Triple Helix Model to find resourceful partnerships. The interviewees stated that the core input to business innovation is knowledge, and many institutions will associate themselves with a university once they realise the importance of knowledge.

Interaction through inter-university activities brings a step change to innovation levels in the country, according to interviewees. If all universities participate, it means that there will be 26 institutions working together to make South Africa more innovative. A positive sign is that the top five research universities already have a model that all participants acknowledge is facilitating easy interaction among the Triple Helix actors.

To study the purposefulness of universities in South Africa, the study evaluated how university-based innovation activities (such as incubators and innovation hubs) interact with other stakeholders. Agglomeration is centred on fruitful collaboration that was evident in this study, because 78% of participants agreed they have activities where collaboration with different stakeholders is sought. The interviews suggested that collaboration levels between university activities and businesses is not yet at a desirable stage.

**Figure 2: The Innovation Centre has a model that allows for easy interaction with stakeholders (business, government and communities)**

This study revealed that there are significant similarities between the Triple Helix and the Open Innovation Models. The university has to implement the Triple Helix Model and businesses must apply the Open Innovation Model. Like the Triple Helix Model, the Open Innovation Model shows that businesses’ innovation is based on their interaction with different stakeholders. Businesses can interact with a university according to their model to acquire know-how that will grow innovation. Many participants agreed that innovation is an open process, which means that it is subjected to many views/inputs from other actors. Interviewees stated that Innovation Centres are spaces where businesses get significant inputs directly and indirectly from other businesses, centre staff, and also government. This shows that collaboration is important for the success and innovation of individual businesses. Every firm has a production process, and participants said that interactions with others improved the process of businesses – big or small.

In the core of agglomeration economies, the literature signify that there is a functioning collaboration model. The Triple Helix Model seems to be a better fit to explain university involvement in innovation, and the Open Innovation Model is seen as being more appropriate for explaining the open innovation process of businesses. The participants believed that partnerships and collaborations are important for the university, which is why this study suggests the use of the Triple Helix Model to South African universities – to promote collaboration and agglomeration economies. Strategic models do not work the same in all environments; for example, some institutions in the US and Germany adapted the Fraunhofer Model. The adopted model is more suitable where there are industry leaders seeking to establish collaboration agreements with universities (proactive industry). All universities operate within an ecosystem, where innovation and entrepreneurship are key, as do South African research universities. The literature states that the US is adapting the Fraunhofer Model to US markets, followed its success in creating innovation ecosystems and supporting technology transfer in Germany (Edmorrison, 2014). Reid et al. (2010) show that the Fraunhofer Model is simply to get industry and the university working together on cutting-edge research through Innovation Centres. The model illustrates the advancement of applied research in German research organisations (Edmorrison, 2014; Reid et al., 2010).

South African universities operate on a different platform where business success is minimal, and universities are organised institutions that can organise and host collaboration, according to interviewees. Since the Triple Helix Model suggests that universities take the lead in the facilitation of innovation, it should be adapted to the South African environment. The Triple Helix Model is better for South African institutions, because it also allows a resourceful actor like the government to participate in the facilitation of innovation.



**Figure: 3 Adapted Triple Helix for Open Innovation Model**

Government and business involvement in university activities can improve the quality of human capital, and, most importantly, new knowledge can be created – resulting from these interactions. A collaborative relationship through university activities enables a firm’s Open Innovation Model, as it allows many stakeholders to interact with and participate in business support activities offered by the university. There are direct and indirect inputs to innovation demonstrated by the model – such as location, infrastructure and university relationships.

Association with universities is based on benefits that businesses drive from being close to university activities. When several businesses realise the benefits of having open innovation through universities, they will associate with the university.

### **8 SOUTH AFRICA UNIVERSITY AGGLOMERATION ECONOMIES**

The main aim of these universities’ activities, according to the findings of this study, is to increase entrepreneurial success in the country (this study finds that South Africa is faced with low business success, which means fewer employers in a country that has high levels of unemployment) and agglomeration economies (positive externalities that businesses and society will enjoy by having incubators, ranging from low business risk and cost to economic development). This study found that university innovation activities are aimed at achieving the above; however, due to many challenges that businesses face when trying to work with other stakeholders, there have been limited spillover benefits. For a University Innovation Centre to offer greater benefits beyond actual incubation, more resources and collaboration are required.

University innovation activities include a good relationship with the regulatory body and this helps to implement innovation, allow for an easy interaction with stakeholders (business, government and communities), provide access to critical resources needed to support innovation, provide services that are reaching clients, commercialises its research findings, protects intellectual property, has spin-offs for companies/businesses, and also creates jobs. University innovation activities can be beneficial to businesses, and not only with cost saving, and this can result in more businesses associating and collaborating with university activities. Innovation is a process that universities enforce, and they encourage the culture of innovation and partnership through collaborative work. Innovation Centres do not only benefit students, universities and academics, but also uplift livelihoods in communities, with a few universities operating centres located externally – such as the UP Mamelodi Business Clinic and the UCT MTN Solution Space. There is an agreement that the centres of the top five research universities contribute to economic development and the agenda of the nation, which is stipulated in the National Development Plan (NDP). Innovation Centre activities and incubators are all used by universities to reach out to their clients or fulfil their service to the public. Therefore, agglomeration economies and entrepreneurship are focused on minimising cost and maximising benefits.

**Conclusion**

The study strongly suggests that the universities’ activities intensify by using the Triple Helix Model – as it is very beneficial for enabling businesses to have open innovation processes, because collaboration is at the heart of agglomeration economies. The findings reveal that this is important for innovation. It was found that Triple Helix collaboration should include collaborating with resourceful actors and other similar organisations, to share successes, in order to realise agglomeration economies. The model the universities employ should consider aspects like collaboration, location, the institution, infrastructure, the needs of the economy, and economic impact. The universities have a role to play in the development of entrepreneurs and agglomeration economies from their innovation activities.

The natural advantages that the universities currently have are failing to create agglomeration economies. Therefore the study suggests greater collaboration efforts from universities – to the extent that they will attract more entrepreneurs and businesses. The starting point is to make the university collaboration model functional. Universities are a prominent actor of the economy, and have the intellectual resources that businesses need in order to survive.

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