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Invigorating innovation and entrepreneurship: Insights from selected South African and Scandinavian universities

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Background: University innovation and entrepreneurship have evolved discretely and struggled with legitimacy, which marginalised them and vitiated their optimal societal impact. However, three recent developments have compelled universities to become innovative and entrepreneurial: workplace demands for creative and innovative graduates, chronic university underfunding and graduate unemployment. Therefore, this study sought to understand how universities in different geographic contexts fostered innovation and entrepreneurship.

Aim: The study aimed to: (1) better understand how innovation and entrepreneurship were fostered in each geographic location, (2) glean lessons for developing a new innovation and entrepreneurship model, (3) develop an integrated innovation and entrepreneurship model.

Methods: The study used semi-structured interviews conducted with 15 innovation and entrepreneurship senior managers drawn from five Scandinavian universities and three South African universities.

Results: Structurally and strategically, the innovation and entrepreneurship units are located outside the core faculty activities: (1) there are no direct linkages between faculty and these units' activities. (2) Creativity and innovation are not explicitly taught in faculties. (3) Research agendas of faculties and these units are not mutually inclusive.

Conclusion: Faculty, innovation and entrepreneurship activities are not structurally and strategically linked.

Keywords: Innovation; creativity; entrepreneurship; higher education; commercialisation.

Introduction

Universities are important wellsprings of knowledge, part of which contributes towards building and sustaining innovative practices that often lead to entrepreneurial opportunities. However, this university knowledge strength does not always translate into high conversion rates of research output turned into intellectual property (IP) commercialisation, the first stage of a business cycle. There are a number of factors that could be contributing to this challenge, some of which are deeply historical. The Humboldtian model of universities, sustained over centuries, entrenched the production of research without the proviso that it contributes to any practical end such as in innovative outputs or increased entrepreneurial activity. This traditional Humboldtian university model was also erroneously used to defend an academic model that framed undergraduate studies in terms of known, canonical scientific knowledge. This academic model fostered academic practices with a strong mimetic epistemology that mostly marginalised the development of critical and creative thought in undergraduate curriculum (Csikszentmihalyi 2009:23–27; Pitso 2015:4–5) as well as students' entrepreneurial mindsets (Benamar 2016:1–2; Pitso & Lebusa 2015:42). Csikszentmihalyi (2009:23–24) argued that most doctoral students often failed to complete their advanced studies because they were unable to contribute original ideas to a selected body of knowledge, which is a key requirement in doctoral level studies. Csikszentmihalyi (2009:24) blamed this problem on students' earlier formal learning orientation that taught them how to answer questions rather than how to pose them. According to Csikszentmihalyi (2009:25), a similar pattern of scarcity of originality appears in industry, the business world and civil society, mainly because the kind of graduates they recruited lacked such skills of creativity and innovation. These creativity and innovation skills are often not central in the formal undergraduate learning at most universities.

Yet, contrary to popular belief, the modern university is the result of an academic vision where students are expected to learn via conducting their own empirical research and becoming creative.

When Wilhelm von Humboldt proposed a new university model in 1809, although some scholars claim earlier conceptions (Ash 2006:245–247), he advocated for a research-intensive model that included students' research projects. Students and professors, under this new academic vision, were expected to meet on a weekly basis in seminars to discuss progress that was being made in each student's research project. Von Humboldt was vehemently opposed to the curriculum model for academic practices. Humboldt's criticism of the curriculum model was that it resembled, in form and substance, the ancient religious model of education that entrenched didactic learning, hence his new academic vision that focused on students' research as the effective means of learning. The original religious educational model compelled students to summarise, repeat, recite and imitate the canon, and thus had a strong epistemology of mimesis. In the Humboldtian university, dull lectures that transmitted existing knowledge in a curriculum format would cease to exist. Unpredictable seminars where students and their professors explored new frontiers of knowledge would become ubiquitous. The most important aspect of these seminars would be their collaborative nature between students and professors. This approach to learning would foster a learning culture of self-renewal and outcomes would be epiphanic, that is, they would not be decided in advance or be certain so that these efforts were open to wherever research might lead. Organised this way, academic practices would ensure that both students and professors contributed to science and scholarship.

The highly structured, authoritarian and dogma-inclined curriculum model was proposed for German schools rather than their universities. Conditions of academic practices that foster students' research and drive high-impact research are more likely to foster innovation and entrepreneurship under certain specifications. Firstly, the fostering of students' research has to be accompanied by the strong and explicit development of students' critical and creative thought in teaching and learning. Students' developed critical thought capacitates them to make sound judgements of ideas and to assist in decision-making processes and thus plays a meaningful role in students' research projects, evaluation of unique ideas and their conversion into tangible results. Every research initiative, often a basis for the generation of unique and original ideas, is based on a problem space that delineates the discursive context of the area under focus (Scott 2004:4–5). Each discursive context outlines systems of meaning in each existing discourse and how those meanings got adapted to a particular context, thus warranting rational analysis and assessment to determine their salience under new historical or contextual conditions. These deconstructions and assessments of specific meaning systems are intended to identify research gaps for further probing and their relevance under different conditions. Critical thought, as key in critical analysis and assessment of ideas and systems of meaning (Paul & Elder 2004:3–4), is thus central to research and for attempts to push knowledge boundaries in respective disciplines or new cross-disciplinary areas.

Critical engagement with meaning systems of a selected discursive context is intended to situate a research project within other intellectual work and requires huge critical thinking skills. Students' research, as with all other research, has to be premised on a firm grasp of logic, reason and rationality, hence the need to explicitly develop students' critical thought. Critical thought also plays a major role during the ideation stage of an entrepreneurial cycle, as well as during prototype design and testing for efficacy (Figure 1). It is thus not clear why critical thought has historically been marginalised in teaching and learning in both undergraduate and postgraduate studies.

Creative thought, on the contrary, draws from sound reasoning and judgement (critical thought) but pays attention to imaginative and intellectual inventiveness as key constructs in the generation of novel ideas that can lead to tangible results. Within the framework of innovation, critical and creative thought assists students and even academics to simultaneously produce and assess, as well as generate and judge, ideas for originality and novelty. Those ideas that have been judged to be promising then get prototyped and empirically tested for subsequent commercialisation. In this way, critical thought assists students in doing critical assessments of ideas and questions as creativity gives rise to new ideas and poses new, imaginative questions. Secondly, it is important that these research initiatives are steered towards a clear university IP strategy. This university IP strategy ought to incentivise high-impact research as well as research conducted collaboratively with students and with industry in highly specialised areas with a clear practical end.

The IP strategy has to also provide a framework for increasing the rate and quality of research and development (R&D) that will lead to diversified and high-patent IP portfolios for the university. Strong partnerships with industry and other pertinent societal organs are vital for a substantial increase in R&D and innovative practices that could lead to successful commercialisation. In the next section, I provide a conceptual framework that I used, to better understand how innovation and entrepreneurship in universities are conceptualised. The framework also focuses on the general epistemological crisis that innovation and entrepreneurship pose through adding to the plethora of meanings and roles of universities in the digital age. The conceptual framework also played a role in shaping the collection and analysis of data related to innovation and entrepreneurship within universities.

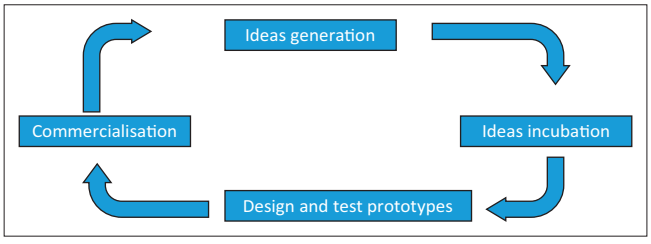


FIGURE 1: The entrepreneurship cycle.

Conceptual framework

The core functions of any university relate to research and teaching. Research has always been conducted to advance scholarship of discovery (SoD), integration, application and teaching (Boyer 1990:15–36).

Traditionally, research has been conducted unhindered for its own sake, that is, with no clear outcomes so that it has always been about wherever it might lead. This is the research conducted to advance the SoD, whose main aim is to search for new frontiers of knowledge that could contribute to new information and new models. The SoD is noted by internally and externally funded research projects that mostly pursue research for its own sake and 'blue-sky' research. Its contribution to innovation and entrepreneurship relates to its new knowledge and models, serving as a baseline for creativity and innovation because these new knowledge and models open up new possibilities that never were accessible to humanity before. Creativity and innovation are the major sources of entrepreneurial activities. These new possibilities, as manifest by new knowledge discoveries, I argue, serve to initiate the generation of novel and original ideas that can be converted to tangible results if greater effort is made. More effort can be put towards connecting research outputs of basic research to innovation and entrepreneurship.

A credible and dedicated Scoping Review Protocol could be developed for the sole purpose of synthesising the outputs of basic research in ways that feed into fostering creativity and innovation and eventually entrepreneurship. A Scoping Review Protocol is a knowledge synthesis mechanism that explores a research question that is aimed at mapping out key concepts, types of evidence and gaps in research related to a defined area or field through systematic search, selection and synthesis of existing knowledge (Heather 2016:5). Studies dedicated to Scoping Review Protocols that summarise and disseminate findings of basic research and even make recommendations for future research that could assist ideation, innovation and eventually entrepreneurship may need to be fostered and sustained. This is one of the critical means of steering university basic research outputs towards innovation and IP commercialisation. Access to basic research outputs in digestible form, as made possible through relevant scoping review studies, is essential in the generation of top-notch unique ideas that could lead to innovation and feed into the entire value chain of entrepreneurship (see Figure 1).

The myth that basic research cannot be steered towards innovation and IP commercialisation needs to be eliminated and new models that connect basic research to innovation and IP commercialisation need to be developed. Scoping review studies could help bring a firmer connection between basic research and its contribution to innovation and IP commercialisation.

Another scholarship that needs particular attention in relation to innovation and entrepreneurship is the scholarship of integration (SoI). The SoI is noted for:

- synthesis of knowledge from different sources
- providing overview of findings from different research sources
- pulling together findings from different disciplines and pointing out their areas of convergence
- identifying research trends and compelling new ways of seeing knowledge, as well as developing insights that have direct bearing on original research.

Scholarship of integration is thus synthetic, interpretive, integrative and interdisciplinary. It is facilitated through scoping basic research findings, reviewing literature and conducting meta-analyses of existing knowledge, and as such falls neatly into the scoping studies. It provides a practical framework for developing scoping models that connect basic research with innovation and entrepreneurship in terms of fostering quality generation of unique ideas in the ideas-generation stage of the entrepreneurship cycle as outlined in Figure 1.

The scholarship of teaching and learning (SoTL) has a strong focus on researching curriculum, as well as teaching and learning. It plays a pivotal role in helping universities to search for innovative practices in curriculum, as well as in teaching and learning. Scholarship of teaching and learning ought to be central to finding new ways of enacting curriculum and shifting teaching to learning in the digital age. It also ought to situate learning and knowing as internal constituencies that set universities on a constant search for its higher design. When universities make moderate use of a hybrid of face-to-face and online learning in their offerings in which the explicit development of critical and creative thought remains on the periphery of teaching and learning, SoTL may be struggling to serve its mandate in the digital age. It may also be that the warning to the SoTL community by Boshier and Huang (2008) that learning cannot remain in the basement in the digital age has not been sufficiently heeded. Scholarship of teaching and learning has to turn faculty into a learning space for both professors and students and we are back to Humboldt's model of an academic practice. The Humboldtian model of an academic practice ensures that both professors and students contribute to science and scholarship. Science and scholarship have always been understood as key in driving collective learning, as well as in building a community of researchers and thinkers. Conceptualised this way, SoTL positions itself within the framework that sees universities as engaged in epistemologies of a crisis. This crisis emanates from the ofttimes heated debates about the role of academic practices in knowledge-based societies and increasing reliance on digitisation and automation with implications for the nature and form of knowledge that must be produced and shared. Within this perspective, our professional development workshops, consultancies, as well as research endeavours in curriculum, teaching and learning could greatly benefit from the use of digital approaches and digital methods of inquiry.

They could also build new models of disseminating research findings and knowledge transfers (blogs, Open Education resources, immersive learning, exploitation of data visualisation, metadata generation and digital publishing). In this sense, SoTL opens itself up for contributing to university patent activities and IP commercialisation, as artefacts produced through SoTL can be converted to innovation and entrepreneurship activities such that they can be packaged in a sellable way. Such innovation and entrepreneurship-inspired SoTL practices fit into the entrepreneurship cycle as outlined in Figure 1.

However, some scholars, such as Readings (1996:7–8), caution against the allure of the techno-bureaucracy in universities as it can turn universities into corporations that chase profit margins. Readings (1996:8) cautions that universities' focus on profit margins often comes at the expense of developing a community of critical and creative thinkers whose responsibility is to provide ideal models of a society. In more recent times, Hayes (2017:9–11) argues that the techno-bureaucracy in universities has become so entrenched that academic practices have been reduced to factory-like production sites that produce McDonalised students with fixed graduate attributes and research outputs have been directed towards making money, hence the crisis. There is, however, an embedded romantic nostalgia in their argument that seeks to return universities into academic practices that drive mimetic curriculum, didactic teaching and the production of knowledge without a particular purpose. In an era where universities are no longer exclusive sites of knowledge production, knowledge has become accessible through Information and Communications Technology (ICT), global online learning is the reality and the production of knowledge for a purpose is ubiquitous, then their rational justifications of the traditional university model lack soundness. Added to that, my suggestions of greater synergies between academic practices and innovation, as well as entrepreneurship are not guided by profit motives or the techno-bureaucratic capture of universities. They are rather directed towards university practices that seriously consider the developmental nature of South African and other developing societies. Furthermore, the pulling together of academic practices and innovative as well as entrepreneurial activities is directed towards achieving key goals of social justice, such as better redistribution of collectively produced wealth, elimination of inequality and poverty. This latter position resonates globally because economic neoliberalism generates inequality and poverty wherever it makes its presence felt, including in developed countries; hence, I posit that all forms of scholarship and curriculum enactment ought to be directed towards the entrepreneurial cycle as outlined in Figure 1.

In Figure 1, all activities of entrepreneurship begin with the generation of unique ideas (ideas generation) that result from critical assessment, analysis and imagination. Promising ideas get incubated and refined through a series of seminars: those ideas that survive the rigour of seminars then get prototyped and tested through mainly iterative processes until they are ready for commercialisation.

My view is that this positioning of universities could generate a new, empowering narrative as new efficiencies are developed. A crisis gets resolved when a new narrative emerges. Graduates trained in critical and creative thought in a community of critical and creative thinkers are unlikely to be captured by narrow interests and tend to drive broader agendas.

The traditional, liberal graduate was noted for individualism and general disconnect with the realities of mundane worlds (Ash 2006:249). This kind of a graduate can barely drive broader social justice agendas, hence my rejection of the call to return universities to the traditional, liberal model of a university. Academic practices should also not be reduced to delivering corporate efficiency through producing the so-called employable graduates and generating research that drives industry innovation. Broader conceptions of innovation and entrepreneurship are vital. Such practices should include new ways of engaging communities, civil society, state and industry, the outcomes of which should contribute to the birth of a socially just society. The next section describes diagrammatically the conceptual framework for this study.

Diagrammatic representation of the conceptual framework

In Figure 2, the two main circles represent two distinct activities of universities: those that form the inner core of the university, such as scholarship and curriculum, and those that serve a supporting role, such as innovation and entrepreneurship activities, summed up as enterprise support.

In this study, these main university activities are used as a framework for analysing and understanding the degree to which these major university activities remain discrete and loosely connected. When maintained as mostly discrete and loosely connected, that is, having a weak to moderate relationship between scholarship and curriculum on the one hand and innovation and entrepreneurship on the other hand, then entrepreneurship in such a university is marginalised. However, when explicit efforts and university strategies, including incentive mechanisms, gently nudge or aggressively push the two circles close together, then a university is likely to exhibit an entrepreneurial behaviour. Entrepreneurial university behaviour is thus strongly correlated when academic practices (scholarship and curriculum) are closely connected to enterprise activities. I have attempted, earlier, to describe how these close connections between academic practices and enterprise activities could be achieved so that a convergence of the activities of both circles can be attained to give rise to the third circle in the diagram, that is, the entrepreneurial behaviour circle. In this way, a strong merger of faculty activities and innovation, as well as entrepreneurship units

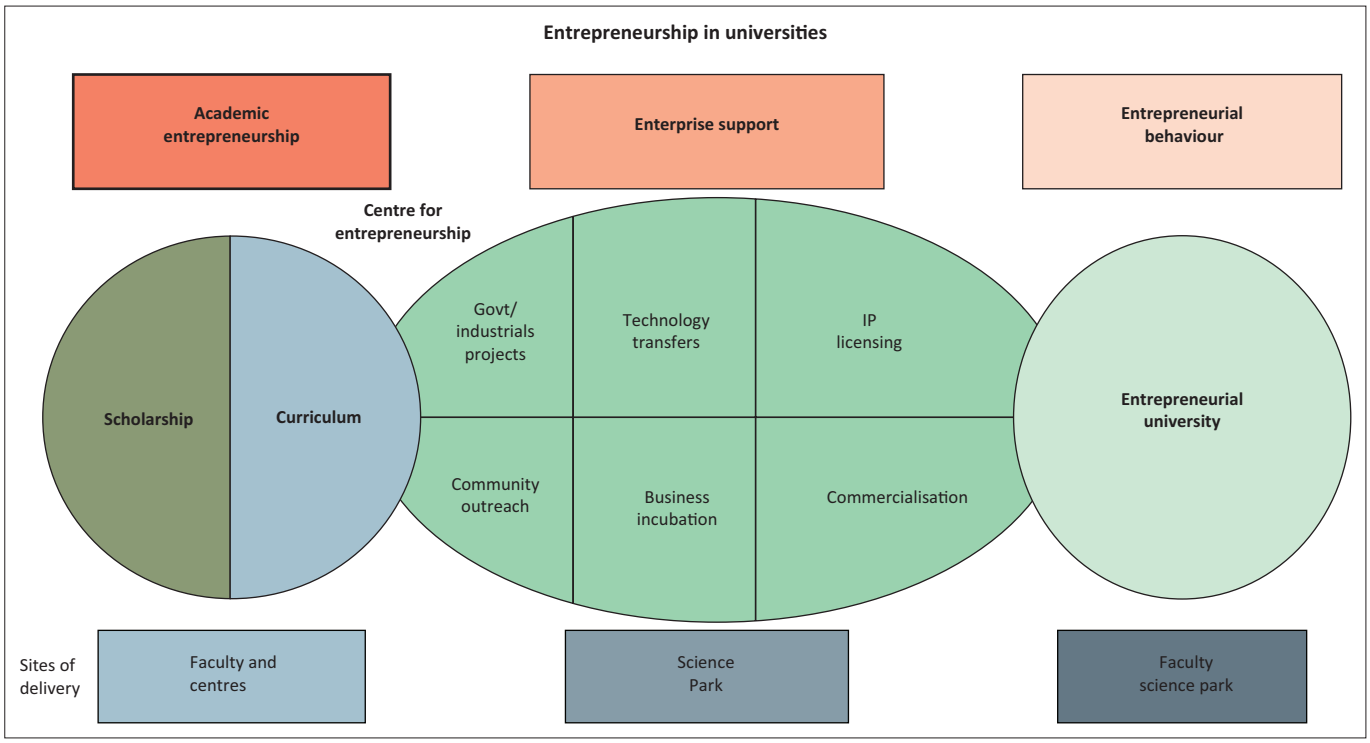


FIGURE 2: A fragmented Model for Entrepreneurship in Universities.

in their various guises should be fostered. This is the level at which innovation and entrepreneurship within universities could be invigorated. This framework was used to better understand and analyse the extent to which innovation and entrepreneurship in selected universities are mapped out. In the next section, I describe the framework of the methods of data collection, its analysis, limitations and practical implications for the worth of this study.

Research methodology, sampling and methods

Research design

This study used a qualitative research design. This design was chosen because studies that link innovation and entrepreneurship activities to faculty activities, as well as their social impact within higher education are scant. Furthermore, models that describe the entire value chain of activities from faculties, innovation hubs and entrepreneurship centres as also being linked to their social impact have not been attempted in any meaningful way. Creswell (2003:14, 18) explains that a qualitative research design is often employed when the study's research problem is generally 'immature' and there is a general lack of theory of the topic under investigation. This study thus attempted to use the views and perspectives of senior managers of university innovation and entrepreneurship units in two different geographic contexts for better understanding the relationship between faculty activities and those of innovation and entrepreneurship. The main purpose of eliciting these managers' views and perspectives was to abstract the theory of a process that would describe the linkages and interrelationships that ought to exist between faculties and university innovation units, as well as between university innovation and entrepreneurship units. This approach used multiple stages of data collection to develop and refine the interrelationships between these universities' entities through constant juxtaposition and contrasting of data as it emerged in different times of their collection.

Purposive selection of universities and cognate units

To select research participants within the public-funded, research-intensive Scandinavian universities, the snowball sampling technique, also called exponential non-discriminatory snowball sampling, was used.

Exponential non-discriminatory snowball sampling involves the researcher linking up with the first potential research participant who then provides the researcher with multiple referrals which are then explored for relevance to the study. The selected new research participants then provide new multiple referrals until a manageable sampling frame is created (Etikan et al. 2016:3–4). In this study and within the context of the Scandinavian universities, the researcher linked up with a known colleague within the academic network, who, in turn, introduced the researcher to the Deputy Vice Chancellor (DVC): Innovation and Collaborations at his university. The DVC suggested names of senior managers of innovation hubs and entrepreneurship centres known to her across Scandinavia. Additional names were added by the new research participants that were suggested by the DVC until a total of 10 research participants drawn from five Scandinavian universities was achieved. The more than 3 months' stay in Scandinavia allowed for securing appointments with these often-busy research participants.

Within the South African context, the purposive selection of research participants was done through the research study conducted by Clarivate Analytics on the most innovative universities in South Africa (see Table 1). Five senior managers of the innovation units and business schools of the top three innovative universities in South Africa were selected for the study, making the total number of research participants for this study 15.

Operational measures of key concepts

While this was a qualitative study, it was still important to clarify meanings of key concepts so as to aid the data collection process in terms of knowing which pieces of data were required to address which aspects of the study. The operational meanings of the following key concepts in the study served the purpose of delineating the meaning systems that were signified in each concept and made them measurable for clarity and for possible future research:

- Creative thought, in this study, was understood as, firstly, increased generation of promising ideas that an individual can manage in a given timeframe. This factor refers to *fluency* in idea generation and plays a major role during the ideation process of an innovation process. The fewer the generated ideas are, the more difficult it is for the next stages of creative thought. Secondly, creative thought deals with the determination of the number of different categories that an individual produced during the first stage of fluency. In other words, of the generated ideas during the fluency stage, how many different categories of ideas were generated. This factor is called *flexibility* in ideas generation and depends on the fluency stage and feeds the next stage of creative thought.
- In the third stage of the creative thought, generated categories of ideas are tested for statistical and practical rarity. This means that a determination is made whether these categories of ideas are novel, unique and original but also implementable. The most promising original ideas are taken into the next stage of the innovation process, that is, the stage of ideas incubation. In this stage, the promising ideas are elaborated on through research and rigorous evaluation before being converted into prototypes. Paul Torrance has developed a standardised test to measure these factors of creative thought called the Torrance's Tests of Creative Thinking (TTCT) .
- Critical thought refers to rational thinking processes that guide the mind towards logical steps and open-mindedness that widen our scope and range of perspectives. It also exposes us to credible data that support our claims and reduce our biases as we eschew blind beliefs so we could make sound judgements. Richard Paul and Linda Elder of the Critical Thinking Foundation have developed a number of techniques to assist people to improve their critical thought ranging from unreflective thinker through to a highly reflective thinker. Sound judgements and rigorous evaluations of ideas are vital during the ideation stage of the innovation process and this skill serves to support the ideas generation and incubation phases.
- Entrepreneurship refers to all thinking efforts, activities and practices invested in creating new markets and challenging existing ones with new or improved business models, products or services. It is a huge mindset enterprise that compels individuals to think and act proactively, creatively and innovatively in creating markets and becoming more independent. It is a forceful habit of mind that constantly searches for higher designs of existing things and better ways of creating and sustaining human conveniences. Such human conveniences include making more people economically active and making people access things that improve their lives in a more affordable, accessible and convenient way.
- Innovation, in this study, refers to activities, actions, practices and units designed to assist people to convert their promising ideas into tangible results whether in the form of new or improved products, services or models. These models could include business models that introduce existing products and services to non-consuming contexts or pay attention to overshot customers, that is, those customers that access products or services in the most expensive or difficult way. It often includes stages of ideation, prototyping, testing and refining new or improved products, services or business models. Products include educational technologies that may appear invisible but significantly develop new ways of thinking and doing things. It may also include introducing existing or improved educational models in new contexts.

TABLE 1: Patent family to publication output comparison, and patent rating for top five innovative South African universities.

University	Web of Science documents	Total patent documents	Patent families	Patent family: publication	Patent family rating
University 1	6783	527	99	14.6	5.3
University 2	17 235	530	236	13.7	2.2
University 3	19 530	521	223	11.4	2.3
University 4	25 919	554	285	11.0	1.9
University 5	17 415	266	98	5.6	2.7

Source: Adapted from Dudhia, Z., 2017, *A focus on the top 5 innovative universities in South Africa*, Clarivate Analytics, Johannesburg

Data collection and analysis

Semi-structured, qualitative interviews were used in this study to elicit the views and perspectives of purposively selected senior managers of innovation and entrepreneurship units drawn from five Scandinavian and three South African universities. The structured part of the interview schedule was based on the four master themes developed by Corbin and Strauss (1990:7–8), which also served to analyse the collected data.

- The questions focused on the *conditions* under which each innovation and entrepreneurship university unit functioned and whether such conditions fostered or hindered the development of innovation and entrepreneurship within each university. The questions particularly paid attention to national and institutional policies, and how they guided each unit's operations and strategies. Two sets of data emerged as drawn from two distinctly different contextual situations (Scandinavia

and South Africa), which, in turn, were juxtaposed and contrasted for variation and commonalities.

- Questions also paid attention to *interactions* that each innovation or entrepreneurship university unit forged with cognate university units, such as faculties, as well as national or regional entities with similar mandates. The interrelationships between faculties and these innovation and entrepreneurship university units came in for sharper focus in terms of their degree of alignment and synergies as understood within the value chain framework. The questions also focused on the possible areas of conflict or disagreements and attempts on resolving them. While the external partnerships were explored under the open-ended questions of the interviews schedule, the data were reserved for future research.
- The degree to which the activities of each innovation or entrepreneurship university unit were aligned with broader goals of the university was investigated. Questions particularly focused on the alignment of each unit's *strategic framework* and the strategic goals of the university, as well as the strategic alignment between the innovation and entrepreneurship units.
- The last sets of questions focused on the intended outcomes of each innovation or entrepreneurship unit and how these outcomes *impacted* other university units and society. For instance, questions sought answers on how outputs of the innovation unit affected those of the entrepreneurship unit.

Open-ended questions of the interviews schedule sought to gain more insights into the functioning of the units in terms of resource allocations, staff and access to seed-funding, the role of the university holding company, patents, licensing, out-licensing and IP commercialisation. It was expected that new themes might emerge from these data.

The analytic coding technique as undergirded by the grounded theory of Corbin and Strauss (1990:1–19) was adopted. This technique identifies four master themes – conditions, interactions, strategy and tactics, as well as consequences – as key in analysing qualitative data. Under the *conditions* theme, data were placed into categories of circumstances of operations, situations that prevailed over time as shaped by both internal and external factors, as well as institutional culture and its effects on the unit's operations. The *interaction* theme focused on the interrelationship between faculties and innovation units, as well as between innovation units and entrepreneurship centres. Data analysis paid attention to the strength of the alignment of activities amongst these university units. The *strategy/tactics* theme looked into a unit's goals and intended outcomes and their degree of alignment with institutional and national goals – also understood as social impact. The *consequences* theme focused on a unit's outcomes and impact on society however minimal. Open-ended data were analysed in terms of whether such data led to contours of a new theme.

Ethical consideration

The actual names of the research fieldwork and research participants are kept anonymous to protect them against any perceived or real threats to their image and branding, even when those threats are not immediately obvious or available in this study. Extra effort is made in reporting on this study not to create cues that could point to a particular institution or research participants.

Findings, conclusions, recommended model and future direction of research

Findings

The results of the study are as follows:

- In Scandinavian universities, funding and resources for innovation units are provided by the national government, whereas such funding and resources for entrepreneurship units come from the universities and numerous other funding agencies spread across Scandinavia. In the South African context, innovation and entrepreneurship units tend to receive funding and resources only from the universities and the private sector.
- In Scandinavia, there is a national innovation strategy that is driven at national government level and fully funds innovation units within universities.
- The university faculties which form the steering core of university activities and offer mainly research and teaching are structurally and strategically located at the plinth of university functioning, with innovation and entrepreneurship units given the status of supporting units in both geographic contexts.
- Critical thinking and creativity as crucial elements of innovation were not, at the time of the interviews, explicitly taught in faculties and no scoping reviews of existing research were conducted within universities in both contexts.
- Innovation and entrepreneurship units of each of these universities in both contexts evolved discretely and independently of each other.
- In sampled Scandinavian universities, holding companies are a permanent feature of the university and are located in innovation units and serve to invest in new business ventures.
- Patents and IP rights in Scandinavian universities are nationally legislated as belonging to innovators, with universities benefitting very little from the outcomes of innovation hubs. In the South African context, such rights remain arbitrarily adjudicated by individual universities with the propensity towards university ownership of such rights.

Conclusion

Based on the results of the study, the following can be reasonably inferred:

- The activities of faculties, as well as those of innovation and entrepreneurship units are not structurally and

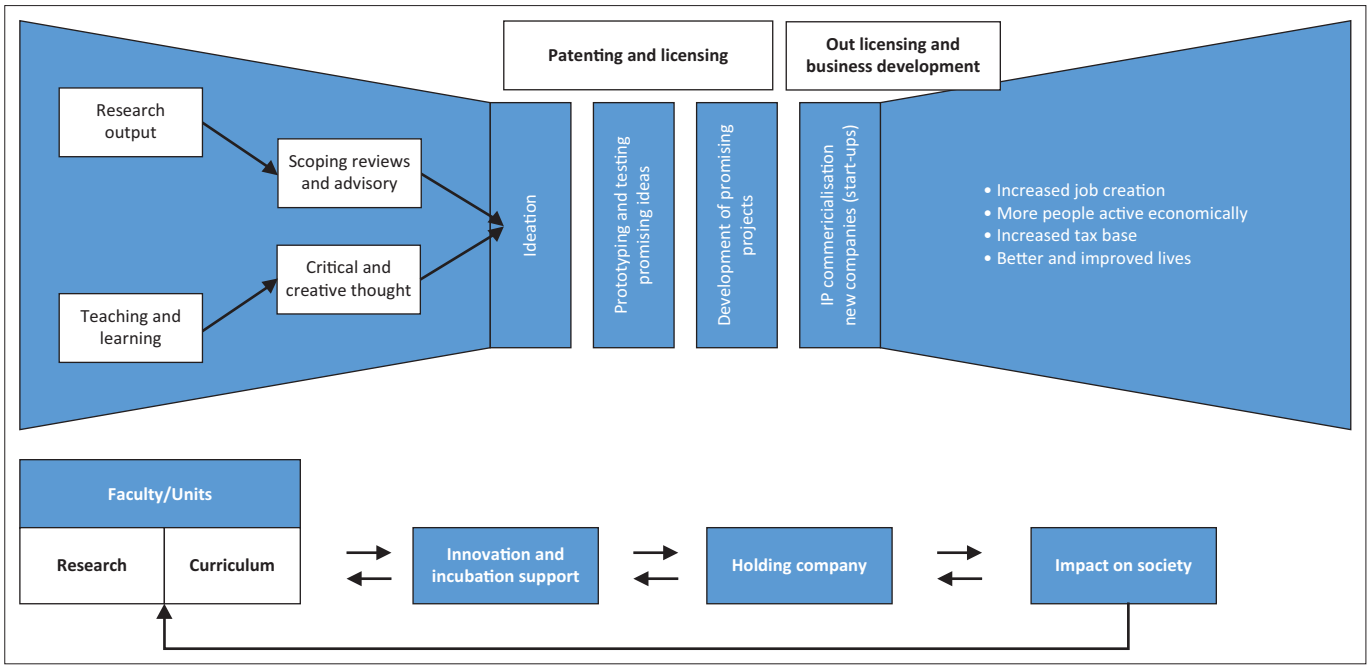
strategically linked in both contexts; therefore, the synergic relations amongst these university entities are generally weak in both contexts.
- Innovation and entrepreneurship units remain mostly on the periphery of core university activities as shown by their locations either in hubs, centres or business schools.
- Resource allocations still favour faculties which receive a huge chunk of university resources.
- The interrelationship and collaboration between faculties, innovation units and entrepreneurship units are generally weak and often difficult.
- Faculty support of innovation and entrepreneurship is generally weak as demonstrated by the lack of explicit training of students on critical thinking and creativity, as well as the lack of influence of the innovation and entrepreneurship units on the research agenda of the university.
- The optimal impact of these university activities on society can be enhanced by forging stronger synergies and linkages between faculties and innovation units, as well as between innovation units and entrepreneurship units.

Recommended ecosystem model for fostering innovative entrepreneurship

The buildings blocks of this model (Figure 3) are the conversion of research output into knowledge that can be applied to generate original ideas in the ideation stage, as well as for the development of students' critical and creative thought that could assist with stronger ideas generation. Scoping review studies could assist in converting basic research into useable knowledge that may fit into the ideation stage of innovation. Curriculum may be modified to accommodate explicit training of students on critical and creative thought as defined in this study. One of the findings of this study shows that researchers' ideas have a higher technical complexity as compared to those of students. This means that it takes longer, in terms of market readiness, to convert the ideas of researchers into promising commercial projects from which new companies could spin out, hence the need for scoping reviews to mitigate this problem.

The scoping reviews and developed students' critical and creative thought could substantially increase the conversion rate of research output into IP commercialisation. The key advantage of this integrated model is that while cross-pollination, as a result of stronger synergistic ties, between faculties and innovation hubs thrives, the discrete character of faculties does not substantially change. The model is thus unlikely to generate strong resistance as scoping reviews mitigate the technical complexities of basic research and allow for unhindered production of basic research. The model also suggests the modification of curricular activity to accommodate the development of students' critical and creative thought and does not fundamentally challenge its status quo. The model also gently nudges research and curricular activities towards the developmental agenda of the country. With such high inequality and poverty (the current South African Gini coefficient is estimated to be 0.69 by the World Bank), faculties can hardly afford not to create some space in their research and curriculum for attending to these societal challenges.

The model also shows that while promising ideas are being converted into tangible results (prototyping, testing and IP commercialisation), other parallel activities of protecting these ideas (e.g. patenting, licensing and outlicensing) should also take place. In most of the selected Scandinavian



IP, intellectual property.

FIGURE 3: The Integrated Model for Invigorating Innovation and Entrepreneurship.

universities, these activities are outsourced, while South African universities tend to insource them.

Limitations of the study

This study is based on 5 of 11 public-funded, research-intensive universities in Scandinavia and three of five top innovative universities in South Africa. Its focus was on senior managers' views and perspectives and other methods of data generation were not used, thus compromising the corroboration and triangulation across rich sources of data, although triangulation was performed on the interviews data. The results of this study, while providing insights and leading to a model, are limited to sampled universities and cannot be generalised across all the universities that formed the population of this study.

Future direction of research

The following areas are worthy of further investigation:

- the testing and refinement of the model presented in this study
- the factors that marginalise critical thinking and creativity within faculties
- the factors that make it difficult for innovation and entrepreneurship units to influence the reserch agenda of faculties and universities
- the patents and IP rights in the South African context.

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Competing interests

The author declares that he has no financial or personal relationships that may have inappropriately influenced him in writing this article.

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