THE EXPLORATION OF THE TRIPLE HELIX CONCEPT IN TERMS OF ENTREPRENEURIAL UNIVERSITIES AND CORPORATE INNOVATION

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Abstract

University-industry-innovation networks (UIINs) are made up of entrepreneurial higher education institutions, industry and government. Universities such as Scotland's Strathclyde University, which was the entrepreneurial university of 2013 in the UK, organise themselves as co-productive institutions by means of technology transfer offices (TTOs), innovation centres and a variation of offices for knowledge transfer and university-business-co-operation (UBC). Such a network is referred to as the triple helix approach/concept/model of co-operation between industry, universities and government, with the aim of building an enterprising state in which these partners co-innovate in order to solve global economic challenges. The global economy faces multiple challenges represented by indicators such as the World Health Organisation's (WHO's) spiralling health-care needs, unemployment, un-sustainable changes to the environment and rapidly emerging digital business models. Most universities promote academic engagement with industry for various reasons (e.g. to generate a third stream of income). The effective management of triple helix takes UBC to the next level in terms of a formal prominent mission for the university. This article broadly describes the triple helix concept and analyses several international cases. The three main objectives of this article are to: 1) explore triple helix and the related concepts such as UBC and TTO; 2) determine the leading stakeholders of the triple helix model; 3) conduct a content analysis of triple helix case studies (45) in four groups, namely (1) national innovation strategies, (2) entrepreneurial universities, (3) entrepreneurship education, and (4) new initiatives, frameworks and technologies.

Keywords: University-industry-innovation networks (UIINs), Entrepreneurial Higher Education Institutions, Co-productive Institutions, Technology Transfer Offices (TTOs), Innovation Centres, University-business-co-operation (UBC), Triple Helix Approach (concept), Third Stream of Income, National Innovation Strategies, Entrepreneurial Universities, Entrepreneurship Education

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1 Introduction

In recent years, the university-industry-interaction concept has become more prominent because of the corporate benefits of collaborative innovation as well as the establishment (or enforcement) of the entrepreneurial university. Universities have a rich intellectual property (IP) base to push or to be pulled by industry. It would be foolishness to cover it up or keep it secret by means of various copyrights and protection laws – especially if all parties can benefit from it. The engagement of universities with industry (and other stakeholders) has multiple benefits in terms of teaching, learning, research and income generation. Several South African universities have embarked on some of these benefits in terms of offering short learning programmes (SLPs) by employed academic staff in order to generate additional income.

The so-called "triple helix" concept originated at Stanford University (Triple Helix Association, under the leadership of Professor Henry Etzkowitz) (Proceedings of papers, 2013) and provides a body of knowledge to assist universities with a better mode of co-ordination between industry and government, to develop innovative markets, to build more innovation-friendly financial institutions and to make universities interactive entrepreneurial partners in national innovation systems. Stephen Mclaughlin (NUIM) elaborates on a case study, namely "Identifying the challenges in developing a triple-helix open innovation approach to research" (Proceedings of papers, 2013) about establishing a trusting and balanced relationship, in which all stakeholders in the innovation process see a return on their investment. The particular case focused on the Innovation Value Institute (IVI), a research organisation that was formed through a direct alliance between industry, academia and government.

2 Problem statement

The problem is a lack of conceptual synthesis owing to the paucity of literature to date and the absence of a holistic framework covering the range of concepts

required to promote academic entrepreneurship. The reason for this problem is the complexity, unfamiliarity and confusion of the triple helix dynamics in practice. Another related problem is the untapped potential of higher education institutes (HEIs) in terms of their inherent value relating to intellectual property, knowledge and research that are not exploited or utilised to their full potential. This asset should be made available through university-business-cooperation (UBC) to the benefit of all stakeholders, including universities in need of a third stream of income. This practice could make a significant contribution to the multiple global economic challenges in need of solutions for economic growth. A holistic enterprising and innovative state could make a huge contribution. The research problem therefore relates to the international need for effective university-industry-government interaction (triple helix) as well as the need to understand and implement the triple helix approach effectively.

3 Objectives

The three research objectives of the study were as follows:

- to explore triple helix and the related concepts such as UBC and TTO
- to determine the leading stakeholders of the triple helix model
- to conduct a content analysis of triple helix case studies in four groups, namely (1) national innovation strategies, (2) entrepreneurial universities, (3) entrepre-neurship education, and (4) new initiatives, frameworks and technologies

4 Research method

A basic literature review of theory, concepts and principles of triple helix was used as a vantage point. This was followed by a case study review, a content analysis and a summative synthesis of the results (findings). Content analysis is a qualitative technique used to summarise and scrutinise the presence and meaning of and relationships between principles (or descriptive phrases) in order to make inferences about the content communicated. This integration of multiple practical case studies with different focuses resulted in a comprehensive cumulative account of the phenomenon. This review made it possible to add value to existing knowledge and to promote a new informative understanding of the phenomenon. The main inclusion criteria for the review were as follows:

- general reported literature on the triple helix concept
- information relating to the triple helix concept published by the UIIN Science-to-Business Marketing Research Centre (http://www.uiin.org/participantsarea/index)
- forty-five (45) selected cases presented and published at the University-Industry Interaction Conference, Amsterdam, the Netherlands, in May 2013

A mono-method in terms of qualitative exploratory research was therefore used in the literature study of published cases. The sample of 45 case studies was based on a non-probability sampling strategy in terms of purposive samples with a variety of extreme cases, which were typical case and heterogeneous purposive.

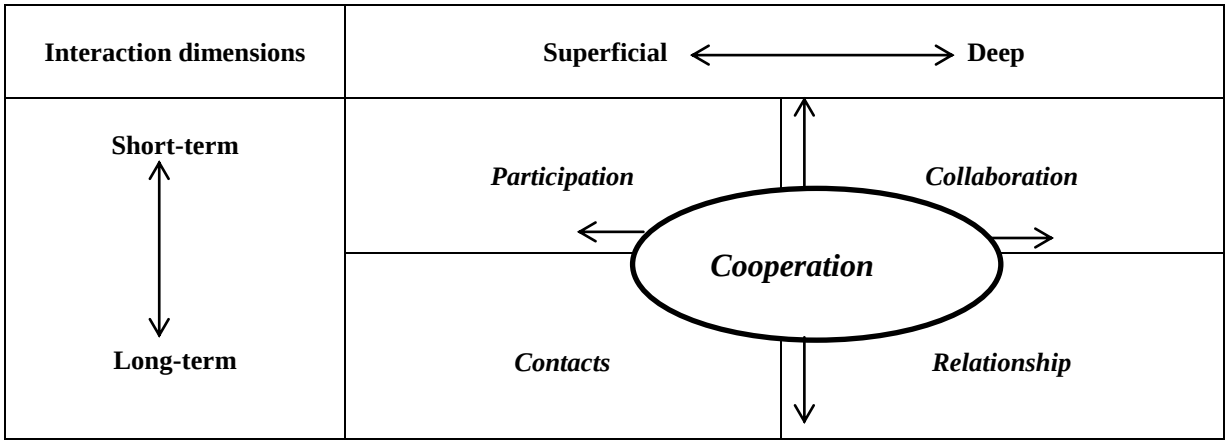
5 Literature review

The paucity of literature on the topic could justify mention of the comprehensive study (the largest at that point in time) on the topic by Davey, Baaken, Muros and Meerman (Proceedings of papers, 2013) on the general status of UBC in Europe. The research was conducted among most registered European HEIs (over 3 000) in 33 countries and among 6 280 academic participants. The survey identified multiple good practice UBC cases as benchmark examples in a European context covering the breadth of the European Union (EU), the economic community and members of the European Economic Area (EEA). The cases demonstrate the progress to date and are relevant for knowledge transfer professionals (academics) and those who seek innovation through UBC.

A UBC network is referred to as the triple helix approach/concept/model of co-operation between industry, universities and government, aimed at building an enterprising state in which these partners co-innovate to solve global economic challenges for mutual and societal benefit. Such benefits could include the increase of funding for universities, help businesses to become and remain competitive, economic development, meet the demands of the labour market and provide knowledge and skills (Davey et al., 2011:5).

Although many business relationships commence on an informal basis, it is vital to take things to a next level in terms of formal interactions. These interactions can be arranged and formulated by different means. Baraldi and Forsberg (Proceedings of papers, 2013) crafted such interactions. Their report contributed to a *typology* of university-industry interactions in terms of four main types, namely "participation", "co-operation", "collaboration" and "relationships". They added a fifth "potential interaction" type, namely "contacts". This typology is based on the following dimensions: depth, type of exchange, involved resources, intensity and duration. The five interactions can, for example, be analysed by means of two dimensions (in this case *depth* and *duration)* as depicted in figure 1 below.

Figure 1. Formal interaction dimensions



The enormous possibilities imbedded in the wide variety of ongoing formal interactions, projects and partnerships are formally recognised as UBC success stories. The UIIN recognises the top contributions (www.award.uiin.org) such as the following 2012 finalists: New York Solutions Fair (written by Peter Pritchard, Centre for Economic Growth); Win-Win Public-Private-Partnership ARCA (written by Umberto La Commare, ARCA); The 4M Framework (written by Mike Alvarez Cohen, Office of Technology Licensing at UC Berkeley); Roadmap for Employment (written by Irene Sheridan, CIT Extended Campus); 3D Chemical Imaging (written by James Whitby, Empa, Swiss Federal Laboratories for Materials Science and Technology); Student Digital Centre (written by Anthony Francis, Flinders Partners); Stimulating Partnerships (written by Siobhán Jordan, Interface); ICT in Healthcase Observatory (IHO) (written by Luca Gastaldi & Mariano Corso, Politecnico di Milano); Open Collaboration (written by Masayoshi Esashi & MiwakoWaga, Tohoku University); and Knowledge Circulation (written by Peter van der Sijde, VU Amsterdam) (http://magazine.uiin.org/index/issues#2013_issue1).

The degree of business innovation can be improved by specific focused and funded support of research in terms of partnership programmes/university projects. This increase in applied research and innovation will grow, and universities will become more important to small business innovation success. Bert van den Berg (Natural Sciences and Engineering Research Council) and Michael Lam (Natural Sciences and Engineering Research Council) reported on increasing the impact of universities and colleges on business innovation success (Proceedings of papers, May 2013). The report provides evidence of how powerful UBC can be in terms of small business innovation success. Federal investment in Canadian university and college research is at €2 billion per annum and second to this is federal funding of business R&D tax credits at €3 billion. Canada has more than 50 universities and 150 colleges with approximately 900 campuses that together are in a position to offer innovation support to businesses in virtually all centres across Canada's vast geography. The Natural Sciences and Engineering Research Council (NSERC) is the leading Canadian funding agency supporting university and college research in the natural sciences and engineering. It invests approximately one-third of its budget (or about €275 million) in support of research between post-secondary institutions and businesses through a suite of partnership programmes. The strategy is based on input gathered from business and academics across Canada and has actions in the following four themes: (1) enabling and sustaining new partnerships; (2) streamlining programme access; (3) people and skills for business innovation, and (4) focusing on national priorities. Hence the number of colleges active in applied research and innovation has grown substantially and colleges are increasingly important to small business innovation success.

The Triple Helix Association (THA) (www.triplehelixassociation.org) promotes the concept as the new wave of the future in terms an academic revolution and the following principles and concepts:

- The active interaction of institutional spheres must be driven.
- Most universities will engage in this third academic mission.
- Stanford University and MIT (Massachusetts Institute of Technology) are the benchmark for triple helix consultation (as incubators such as Silicon Valley).
- Consulting professors are better teachers in terms of POPs (professors of practice) and more industry PhDs are needed.
- The EIT (European Institute of Innovation and Technology) supports the KTC (knowledge innovation community) concept.

To conclude the literature overview, the following leading secondary research sources are recommended for more UBC reports and related information: (www.analytics.uiin.org), the Lahti

University for Applied Sciences, the University of Adelaide (http://ecic.adelaide.edu.au/), Saxion University of Applied Sciences (http://www.saxion.edu) and TTT (Technology Transfer Tactics) (http://www.technologytransfertactics.com.

The next section presents the content analysis of cases summarised in four categories namely (A) national innovation strategies, (B) the entrepreneurial university, (C) entrepreneurship education, and (D) new initiatives, frameworks and technologies.

6 Triple helix dynamics in practice (content analysis of 45 cases)

The following case studies (sources) were selected from the Proceedings of papers presented at the University-Industry Interaction Conference, May 2013, Royal Tropical Institute, Amsterdam, the Netherlands. In reviewing the literature, certain themes emerged and the cases were grouped according to these themes (A, B, C and D) as identified by the authors in table 2 below.

Table 2.A. National innovation strategies

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(1) Axel Faix (University of Applied Science Dortmund), Christoph Koeller (Goergen & Koeller GmbH) and Dr Ute Gerhards (German National Research Centre for Space and Aeronautics) report on the success factors of science commercialisation. Main theme: Technology transfer is the core task of research institutions and HEIs. The success of science commercialisation and technology transfer depends on two main factors, namely (1) marketability – a demand for the innovation; and (2) the properties of the research organisation itself and the capability of the institute to create innovations. This report is about enabling innovation funded by the German Ministry of Research and Education. One of the main results of the study is a utilisation strategy in terms of the way in which a research institute is commercialising its skills.	Many universities have tremendous value (often hidden) to offer. The im-portance of sharing their science in terms of tech-nology, through comercia-lisation, is a win-win prio-rity.
(2) Erik Knol (Qeam BV) reports on the creation of innovation and education hubs in the Nether-lands. Main theme: The formation of industry-specific innova-tion and education hubs in the Netherlands is important. Technological innovation is a complex, non-linear pro-cess with the involvement of various types of stakeholders such as companies, research organisations, uni-versities, intermediary organisations and end-users. Engineers and technicians play a critical role in transforming science- and technology-based conceptual ideas into working prototypes and production-ready products. Shortages of these technical specialists are reaching high levels in the Netherlands. These hubs are referred to as Centres of Expertise ("Centra voor Innovatief Vakmanschap" (vocational level). Their role is to conduct applied research and development, stimulate innovation and networking, train engineers and technicians and enhance the influx of youngsters to science and technology education programmes. Each hub focuses on one of the key industries in the Dutch economy. A few are already active in water technology and automotives. Many more of these hubs will be established in the field of life sciences and health.	Innovation and education hubs are a strategic prio-rity. These hubs will in-crease for key industries in the Dutch economy in the near future, even though technological inno-vation is a complex, non-linear process and in-volves various types of stake-holders.
(3) Awie Vlok (Stellenbosch University, South Africa) reports on a strategic framework for integrative multidisciplinary research, innovation and mar-keting. Main theme: The focus is on a review by a leading South African multidisciplinary R&D institution with a public innovation mandate and its business deve-lopment practices of the past 20 years. Silo behaviour is one of the challenges experienced by universities and similar organisations involved with knowledge gene-ration and its commercial or societal application. A related challenge is the ability to link individual and organisational capacity across the research and in-novation value chain in support of business objectives. The report provides a strategic framework in support of scientific research and marketing objectives across the innovation value chain.	Some South African uni-versities lack a business vision and a corporate in-novation mandate. This leads to weak coordina-tion and utilisation of in-dividual academic exper-tise for its business vision.

Table 2.A. National innovation strategies (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(4) Awie Vlok (Stellenbosch University, South Africa) reports on a strategic framework for integrative multidisciplinary research, innovation and mar-keting. Main theme: The focus is on a review by a leading South African multidisciplinary R&D institution with a public innovation mandate and its business deve-lopment practices of the past 20 years. Silo behaviour is one of the challenges experienced by universities and similar organisations involved with knowledge gene-ration and its commercial or societal application. A related challenge is the ability to link individual and organisational capacity across the research and in-novation value chain in support of business objectives. The report provides a strategic framework in support of scientific research and marketing objectives across the innovation value chain.	Some South African uni-versities lack a business vision and a corporate in-novation mandate. This leads to weak coordina-tion and utilisation of in-dividual academic exper-tise for its business vision.
(5) Marina Ranga, Juha Perälampi and Juha Kansikas report on university brainpower un-chained – a comparative analysis of university-business co-operation in the USA and Finland. Main theme: The report provides a comparative analysis of university-business co-operation (UBC) in the USA and Finland, drawing on the experience of three US universities (MIT, the University of Utah and the University of Colorado at Boulder) and four Finnish universities (Aalto University, the University of Jyväskylä, the University of Turku and Lappeenranta University of Technology). The analysis is conducted along the following three major axes of the UBC process: (1) institutional context (UBC origins, stake-holders and financial resources); (2) process (drivers, barriers, motivations and objectives); and (3) results (benefits and the impact on stakeholders). The report makes the following primary recommendations for strengthening UBC: • Consolidate a university-wide innovation and entre-preneurship ecosystem and build capacity. • Adopt UBC as a strategic institutional policy aimed at strengthening both education and academic re-search. • Acknowledge both education and research as de-velopment paths for UBC. • Diversify funding sources and adjust fund-raising strategies accordingly. • Hire people with business experience, especially in the offices working at the university interface with business, and provide specialised training courses for technology transfer managers. • Increase the participation of business representa-tives in university governance and in teaching and entrepreneurship education, curriculum develop-ment and so forth. • Ensure management of conflicts of interest.	A comparative analysis is necessary to find bench-marks to adapt and/or im-prove the UBC vision and mission.
(6) Maurits van Rooijen (London School for Business and Finance) reports on the incidental to the strategic Main theme: Many HEIs are actually fairly proficient in incidental innovation collaboration projects. This report focuses on this with the added dimension of a strategy to ensure a formal and strong facilitating platform.	Incidental UBC can be the catalyst to formally plan-ned strategic projects.

Table 2.A. National innovation strategies (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(7) Maria Theresa Norn, Michael Mark, Niels Matti Søndergård (from the Think Tank DEA) and Rasmus Lund Jensen (DAMVAD A/S) report on measuring the economic effects of companies collaborating with a research-intensive university. Main theme: An econometric analysis supplemented by a set of case studies provided evidence of a significant and positive relationship between companies entering into R&D collaboration with the University of Copen-hagen. Each company (average company size of 350 employees) in collaboration with the university is associated with increasing productivity corresponding to a net gain of €7 000 per employee. The net gain improves the bottom line of each collaborating company by €2.43 million. With 625 unique companies in the analysis, this adds up to a total economic impact of €1.5 bn.	University output in terms of graduates has an in-direct influence on the economy and its direct influence (economic im-pact) by means of UBC is a powerful measure to use.
(7) Damir Isovic (Mälardalen University, School of Innovation, Design and Engineering), Christine Gustafsson (Mälardalen University, School of Health, Care and Social Welfare) and Fredrik Wallin (Mälardalen University, School of Busi-ness Society and Engineering) report on the co-productive university–education and research in co-production with the wider community. Main theme: Mälardalen University has a strong profile of co-production with society, trade, industry and the public sector, with many years of experience in developing working methods in that setting. The report illustrates how Mälardalen University has continuously been elaborating on the co-production concept at diffe-rent levels. The researchers conclude that co-pro-duction should be flexibly executed, with respect to different co-producing partner organisations and they highlight key success factors for long-term partnerships, such as mutual understanding, trust and confidence, internal strategy and organisation and innovative ways of providing graduate education for the benefit of all.	It is a positive approach for service institutions to refer to co-production with external stakeholders. The concept may relate to servitisation in terms of productisation of services as a co-productive univer-sity.
(8) Antti Paasio, Pasi Malinen and Petteri Sinervo (all from the University of Turku) report on a comparative study of university innovation sys-tems in five European universities. Main theme: Supporting and developing the links between the worlds of science and industry and pro-fesssional technology transfer organisations by means of TTOs are important. An increasing number of researchers claim that technological development cannot be viewed as an isolated phenomenon, but it should be studied as a part of a larger system, that is, "innovation system" dynamics. The innovation system is a key component in the concept of the entrepreneurial university. The report provides valuable insight into technology transfer activities and the innovation system in five universities in different European countries (University of Gothenburg, Katholieke Universiteit Leuven, University of Oxford, University of Konstanz and University of Turku).	Universities transfer knowledge and technology, but the TTOs of the effective universities operate in a larger and dynamic inno-vation system.
(9) Nuno Oliveira, Carlos Vieira and António Jorge (ISG Business School) report on sustainability as the ultimate challenge for business schools. Main theme: The report provides perspectives on economic stability and innovation in countries like Portugal. It was concluded that the more independent the business school is, the better, faster and more intelligently it can respond to the new challenges and provide the market with innovative and tailor-made solutions for training students and developing applied research that can be promptly used.	Freedom to do business makes business schools more responsive to mar-ket needs.

Table 2.A. National innovation strategies (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(10) Paul Hannon (National Centre for Entrepre-neurship in Education, UK) and Clive Winters (Coventry University Enterprises Ltd) report on piloting new knowledge partnerships in terms of the European university enterprise network. Main theme: The growth of entrepreneurship in higher education is essential for Europe's economic recovery and stability. The European University Enterprise Net-work (EUEN) is one of three pilot projects for the development of knowledge partnerships approved by the European Commission. This report focuses on shaping the leadership in education institutions and building the capability to deliver entrepreneurship.	Academic leadership should become more en-trepreneurial.
(11) Ardalan H. Talab (TU Delft), Cees P. van Beers (TU Delft and Victor E. Scholten (TU Delft) report on transnational academic knowledge sharing aimed at increasing entrepreneurial opportuni-ties. Main theme: Previous research focused on the knowledge transfer from the parent university to ensure the success of SMEs. However, new practices among TTOs and academic entrepreneurs have emerged where they source knowledge and expertise, not only from the parent university, but also from other uni-versities located elsewhere. At a conceptual level, transnational alliances provide SMEs with a more diverse set of knowledge content compared with intra-national (i.e. domestic) knowledge sharing.	TTOs may not merely reside on the main cam-pus or at parent univer-sity.

Table 2.B. Entrepreneurial universities

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(1) Paul Coyle (University of Wales) reports on fostering an entrepreneurial culture in universities in order to support university-industry interaction Main theme: The study reports on the model set of entrepreneurial attributes that have been applied to all staff in a university and a range of development activities used to start the development of a holistic organisational entrepreneurial culture. The study refers to other studies that provided a definition of entre-preneurial leadership and report on the associated attributes in use at the University of Wales, Newport.	Values precede action and an UBC culture is the point of departure.
(2) *Kornelia van der Beek (University Koblenz-Landau) and Sandra Speer (University Koblenz-Landau) report on the evaluation of entre-preneurial universities: a special focus on the context factors.* Main theme: With the increasing commitment of universities to becoming entrepreneurial universities, the evaluation of this concept is increasing. This report cites an example of linking different existing evaluation approaches and indicators. The University Entre-preneurial Scorecard or the "Entrepreneurial univer-sities: a guiding framework" can be used for bench-marking (www.entrepreneurialuniverstities.eu). Another instrument of special relevance is the F-DUP, which has been developed at the University Koblenz-Landau and is widely used in Germany. It evaluates entrepreneurship education as well as start-up coaching. The entre-preneurship office at the University Koblenz-Landau (Gründungbüro) has also developed an "Index of entrepreneurial climate".	The concepts relating to an index of entrepre-neurial climate and entre-preneurial scorecards in-dicate the increasing com-mitment of universities to becoming more entrepre-neurial.

Table 2.B. Entrepreneurial universities (continued

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(3) Henriette Schoen (Florida Business Incubation Association), Ivan Garibay (UCF Complex Adap-tive Systems Lab) and Thomas O'Neal (Florida Economic Gardening Institute) report on academic entre preneurship and entrepreneurial university initiatives to foster entrepreneurship. Main theme: The University of Central Florida (UCF) has adopted an active role in the local entrepreneurial environment in order to induce venture creation. UCF is a partner in the local economic development agenda in a number of ways. Besides undergraduate and graduate tracks in entrepreneurship, they have added the UCF Centre for Leadership and the UCF Centre for Innovation and Entrepreneurship on campus. The report focuses on the details of the creation of the UCF's entrepreneurial ecosystem and the entrepreneurship support entities (ESEs). The efforts of developing the ESEs at the UCF have led to a dynamic and vibrant entrepreneurial support system in the greater Orlando area that contributes to a highly productive overall entrepreneurial ecosystem.	Several initiatives are needed to foster UBC such as entrepreneurship support entities (ESEs) as part of a broad entrepre-neurial support system.
(4) Bettina Dencker Hansen (Aarhus University), Flemming K. Fink (Aarhus University) and Rikke Wetterstrøm (Aarhus University) report on the facilitation of knowledge collaborations between researchers and SMEs. Main theme: The project "Genvejtil Ny Viden" (GTNV) is a three-year project launched in 2011 and funded by the Central Denmark Region (CDR) and the EU Regional Fund. The overall aim of the project is to further innovation and development in SMEs through know-ledge collaboration between SMEs and re-searchers from both Danish and foreign universities. The term "knowledge collaboration" is used to emphasise that the collaboration is a two-way process that is different from the traditional research projects. GTNV suggests a way to stimulate knowledge based innovation through direct knowledge collaboration between researchers. One of the prerequisites for success is that the process is demand driven and tailor made, and that collaboration between the partners is well facilitated.	Knowledge sharing (a two-way process of know-ledge and collaboration) can be the point of depar-ture leading to general collaboration between SMEs and re-searchers.
(5) Tiina Saarinen (Business Arena Oy) reports on overcoming bottlenecks in innovation creation and research commercialisation. Main theme: Having a dedicated TTO at the university is not enough. Some researchers and teachers are not even aware of technology transfer services and do not always recognise the advantages of becoming involved. The challenge was to bring business insight into the science community and change the innovation culture. This report focuses on the positive results after four years of successful UBC. The number of disclosed ideas and innovations has more than tripled.	A TTO should remain a dynamic open system (e.g. bring business and industry into the science and academic society) and should not become isolated.
(6) *Herbert Gillig, Andrea R. Hofer and Klaus Sailer (Munich University of Applied Sciences and Strascheg Centre for Entrepreneurship) report on development path and influencing factors in pro-moting entrepreneurship at the Munich Univer-sity of Applied Sciences.* Main theme: The report focuses on the leading role of the Strascheg Centre for Entrepreneurship as a not-for-profit business organisation at the Munich University of Applied Sciences. The report reviews the development path of entrepreneurship support at the Munich University of Applied Sciences for the period 2002 to 2012 in four main areas: institutional anchoring and embeddedness, internal organisational set-up and external collaboration, financial resources and human resources.	It is realistic to be patient with the development path of entrepreneurship and entrepreneurship support at universities.

Table 2.B. Entrepreneurial universities (continued

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(7) *Olaf Gaus (Otto-von-Guericke University) and Matthias G. Raith (Otto-von-Guericke University) report on business of science: the business model of the entrepreneurial university.* This report focuses on the logic of value creation in the university through its general university business model as a research and teaching institution.	The important principle of science as a business should be applied.
(8) Simon Denny, Wray Irwin, Bill Toyer, Chris Durkin and Chris Moore (all from the University of Northampton) report on developing a socially entrepreneurial university. Main theme: Higher education in the UK is facing unprecedented change and the report focuses on the genesis of the strategy, its key components and the elements that are needed to change a university into a socially entrepreneurial university to become part of a socially innovative region.	The university institution has a social responsibility in terms of entrepreneur-ship.
(9) Claudia Bremer (Studium digitale, Zentrale eLearning-Einrichtung der Goethe-Universität Frankfurt/Main), Matthias G. Raith (Otto-von-Gue-ricke-Universität Magdeburg, Interaktionszen-trum Entrepreneurship, Lehrstuhlfür Entrepre-neurship), Bodo Vogt (Otto-von-Guericke-Univer-sität Magdeburg) and Johannes Wildt (Tech-nische Universität Dortmund, Hochschuldidakti-sches Zentrum) report on Uni-prise (universi- *ties as enterprises), identifying the value poten-tial of universities for entrepreneurial ventures.* Main theme: The paper presents perspectives of a joint research project of the Universities of Dortmund, Frankfurt and Magdeburg, known as Uni-prise (universities as enterprises), funded by the German BMBF (2011–2014). The project deals with the specific identification of the value-creating potential of uni-versities.	Although most universities have entrepreneurial po-tential, it should be speci-fically identified.
(10) Patricia Mannix-McNamara (Research Centre for Education and Professional Practice, University of Limerick), Tommy Foy (Human Resources, University of Limerick) and Pat Rockett (Employee Relations and Equality, Universi-ty of Limerick)(2012) report on promoting an en- trepreneurial disposition through strategic plan-ning and quality of work climate insights from the University of Limerick in Ireland. Main theme: The focus of this report is on the enhancement of the University of Limerick as an entrepreneurial university. A survey was conducted to examine perceptions of organisational climate, quality of work life and quality of work relation-ships/collaboration among its 1 150 employees. The level of job satisfaction was above the national HEI norms.	Entrepreneurial universi-ties need to promote, plan and create a favourable internal working environ-ment. This may lead to higher job satisfaction.
(11) Juan Ignacio Igartua (Mondragon University), Leire Markuerkiaga (Mondragon University) and Nekane Errasti (Mondragon University) report on success factors for managing an entrepreneurial university – a review and an integrative frame-work. Main theme: The entrepreneurial university is a societal change agent and a relevant instrument in the facilitation of the contemporary knowledge-based economy. Owing to the strategic relevance of this co-productive univer- sity, research on the topic has increased considerably in recent years. However, there is no conceptual synthe-ses of the literature to date, involving the absence of a holistic framework covering the range of factors required to promote academic entrepreneurship activities in the corporate entrepreneurial university paradigm.	An entrepreneurial univer-sity should identify and manage the success fac-tors required to promote academic entrepreneur-ship activities.

Table 2.B. Entrepreneurial universities (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(12) Johann Bronstein Bejarano (Leuphana Univer-sity of Lüneburg) reports on entrepreneurial uni-versity archetypes: a metasynthesis of case stu-dies. Main theme: Entrepreneurial university is a broad concept that embodies distinct university types that have evolved from traditional HEIs. Most research on entrepreneurial universities is case based, each displaying unique configurations, depending on the context and scope of the study. The aim of this study is to synthesise existing research and generate a tax-onomy of entrepreneurial universities by finding emergent archetypes. The underlying assumption of this research is that there is no single model or best type of entrepreneurial university. Notwithstanding this, the researcher expects to see entrepreneurial universities converge into a few distinct archetypes that display similar organisational attributes. Twenty-six case studies on entrepreneurial universities constituted the primary data source. This study contributes to a more compre-hensible understanding of the structures, processes and strategies that shape emergent higher education institutions. After preliminary analysis, the researcher tentatively classified relevant attributes into five higher-level dimensions, namely structures, processes, re-sources, strategies and environment.	Although no single model or best type of entrepre-neurial university exists, entrepreneurial universi-ties are expected to con-verge into a few distinct archetypes that display si-milar organisational attri-butes in terms of struc-tures, processes, resour-ces, strategies and envi-ronment.
*(13) E. Keravnou-Papailiou and C. Chrysostomou (*Cyprus University of Technology) *report on fos-tering innovation and entrepreneurship through joint initiatives with industry.* Main theme: The Cyprus University of Technology has set nine strategic goals for 2020. One of these is the linkage with the productive fabric of the country. Various steps have since been taken towards the achievement of this strategic goal focusing on fostering innovation and entrepreneurship through joint initiatives with industry and the business world. The paper focuses on these initiatives in the broader context of the university's mission.	The principle of net-working with industry is the logical catalyst to many new co-operative initiatives.
(14) Dina William and Alexey Kluev report on the entrepreneurial university: evidence of the changing role of universities in modern Russia. Main theme: Over the past 20 years, Russia has experienced an overhaul of its social, political and economic system. The social and economic changes have had the most significant impact on science and technology systems. Increasing pre-sure has been placed on universities to embed themselves effectively in the triple helix system of innovation to contribute to regional and national economic development by fostering knowledge transfer between academia and industry. The report explores the effect the most recent public innovation policies have had on the position of leading Russian research universities.	The changing role of uni-versities towards the triple helix in Russia is signi-ficant.
*(15) Damir Isovic, Christine Gustafsson and Fredrik Wallin (*Mälardalen University) *report on the co-productive university: education and research in co-production with the wider community.* Main theme: Mälardalen University has a long history of a successful co-operation and co-production with the industry and public sector in Sweden. This has resulted in its becoming one of the leading higher education institutes in Sweden for excellent co-production with different societal actors, both internationally and nationally. Through its co-production activities, the university has become convinced of its value and the wide range of opportunities it can afford all parties involved.	The co-productive university as a win-win concept.

Table 2.B. Entrepreneurial universities (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(16) Enrico Baraldi and Petter B. Forsberg report on crafting university-industry interactions: a typology and empirical illustrations from Uppsala University, Sweden. Main theme: The report focuses on four issues: (1) the types of university-industry interactions, (2) the way this university crafts such interactions, (3) the perceptions and assessments made of these interactions by the various actors involved, and (4) the differences in such perceptions and assess-ments.	There are many ways in which universities can craft industry interactions.
(17) E. Keravnou-Papailiou (Cyprus University of Technology, Department of Electrical and Computer Engineering and Computer Science) and C. Chrysostomou (Cyprus Uni-versity of Technology Research and Inter-national Relations Service) report on foster-ing innovation and entrepreneurship through joint initiatives with industry. Main theme: the Cyprus University of Technology (CUT) is an urban university in Limassol, whose aim is to be an integral component of the local com-munity. The report highlights the work of a new, urban, technological university aimed at engaging innovatively and entrepreneurially with industry, business and other local stakeholders, in order to generate revenue from external sources to push its growth and at the same time have a significant social impact by contributing to growth in the region.	The principle of networking with industry is the logical catalyst to many new co-ope-rative initiatives.
*(18) Jussi Halttunen and Heikki Malinen (*JAMK University of Applied Sciences) *report on the entrepreneurial university of applied scien-ces.* Main theme: the JAMK University of Applied Sciences (Finland) is strongly focused on the forestry sector (papermaking, wood products, forestry and machinery industries) and has deve-loped a new "JAMK generator" concept. It combines tools for innovation and entrepreneurship assis-tance. The primary functions of this generator are education on entrepreneurship (study programmes), ideas or innovations (help to evaluate the com-mercial potential of ideas), the business incubator (helps students to develop their own businesses during their studies), and as a part of their studies, the service factory (combining the ideas of staff and students for creating new service innovations). The goal is to expand entrepreneurial education and integrate it into all fields of study. The JAMK University of Applied Sciences is also part of a larger innovation system, namely the Jyväskylä Business and Innovation Factory (BIF).	The nature of the entre-preneurial university may de-mand a special "generator concept" as practised by uni-versities in the applied scien-ces and ideally also part of a larger national innovation sys-tem.
(19) Victoria Galan Muros (Science-to-Business Marketing Research Centre) reports on the influence of experience in the degree of UBC. Main theme: The rising importance of the colla-boration between the triple helix participants is clear, but the level of co-operation between academics is currently diverse. The UBC survey among 4 321 academics from 33 European countries indicated that prior experience in business significantly in-creases the academic's chances of having a higher level of co-operation in all types of UBC. An academic's experience in UBC significantly and positively affects the extent of all types of UBC. However, academics' experience in an HEI signi-ficantly and positively influences only three types of UBC, and in some instances, the influence on co-operation is negative.	The level of co-operation be-tween academics can be extre-mely diverse – the UBC of aca-demics in Europe indicates that prior experience in busi-ness significantly increases UBC.

Table 2.B. Entrepreneurial universities (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(20) Olaf Gaus and Matthias G. Raith (Otto-von-Guericke University, Germany) report on the business of science and the business model of the entrepreneurial university. Main theme: The notion of the entrepreneurial university suggests a view of a research institution as a business. The paper indicates that the core motivation should be a deeper economic under-standing of the process of value creation and distribution. By disassembling a business model into separate modules, the researchers were able to illustrate the different forms of value creation in the university and identify for whom these values are created. A further consideration is technology transfer as the "third mission" of the university. Technology transfer via the sale of research output inevitably also implies a capitalisation of knowledge.	The business of science pla-ces the focus on the university as a business with a deeper understanding of value crea-tion (beyond teaching and learning) and technology trans-fer (or research output) as a third mission.
(21) Peter Franz (Department of Urban Econo-mics, Halle Institute for Economic Research Halle/Saale, Germany) reports on going beyond tuition and grants by exploiting new revenue sources for HE: the Saxony Anhalt case. Main theme: The report shows that in recent years the legislation for HEIs in Saxony-Anhalt has allowed more freedom for universities to develop strategies for generating revenue, but its unfavour-able starting position in benefiting from the income potential is a major challenge. The relative patenting weakness also reduces the number of occasions on which universities in Saxony-Anhalt might start a business of their own or might hold shares in a private company. The university law also limits this new mission (continuing education) by stating that it does not belong to the primary tasks of universities. In the case of a centralised solution, the marketing of continuing education in Saxony-Anhalt could be practised under the umbrella brand "Erxleben College", also hiring qualified expert teachers (e.g. from non-university institutions) and building the reputation of the university on the basis of its top-quality offerings in continuing education and voca-tional learning.	HEIs have different streams of income and should be allowed more freedom to develop stra-tegies for generating revenue. The traditions and laws will continue to be a challenge in finding the balance between the university's different mis-sions.

Table 2.C. Entrepreneurship education

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(1) Liisa Kairisto-Mertanen and Olli Mertanen (both Turku University of Applied Sciences) report on innovation pedagogy: producing qualifications needed by higher education students. Main theme: According to the European Parliament and Commission's definition, the term "entre-preneurship" refers to an individual's ability to turn ideas into action. The innovation pedagogy deve-loped at Turku University of Applied Sciences (TUAS) is defined as a learning approach, which defines in a new way how knowledge is assimilated, produced and used in a manner that can create innovations. The focus of this report is to provide the rationale for the new concept of innovation pe-dagogy.	Universities should teach the correct entrepreneurship curri-cula and understand the con-cept of innovation pedagogy.
(2) Jozsef Rooz (Centre for Adult Education, Budapest Business School) reports on learning by doing: a possibility for develop-ment of entrepreneurship. Main theme: The report focuses on the challenges of the labour market and provides perspectives on the changes of the EU's employment needs up to 2020 as well as the achievements of the learning by doing movement in the EU. It concludes with a description of the Finnish Partus Rocket Model.	The challenges in the labour market demand effective learning by doing as entrepre-neurs (e.g. by means of a rocket model).

Table 2.C. Entrepreneurship education (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(3) *Sven H. De Cleyn (Karel de Grote University College and Interdiscplinary Institute for Broadband Technology and the University of Antwerp), Jan Trommelmans, Jef De Wach-ter, Lucien De Roy and Walter Daems (all Karel de Grote University College) report on the company: e ntrepreneurship for engineers.* Main theme: The report focuses on the weakness of Belgian engineering education with its long tradition based on mathematical rigour and a thorough knowledge of science and technology – turning engineering students into businesspeople. The alternatives of becoming self-employed or an entre-preneur seem to have been excluded from the curriculum. The report refers to "The Company" - a set of educational activities that engineering stu-dents at the Karel de Grote University College can choose in order to become acquainted with entrepreneurship and management. Its most impor-tant characteristics are the "look and feel" of a real start-up, and learning-by-doing and theoretical lectures have been limited to the minimum.	Engineering students may become business employees, but becoming self-employed or an entrepreneur should not be disregarded in the curri-culum.
(4) BRIAN CLEMENTS (GRADUATE ENTERPRISE, UNIVERSITY OF WOLVERHAMPTON) AND CHRIS-TOPHER BIRCH (ENTERPRISE, UNIVERSITY OF GREEN-WICH) REPORT ON WORKING FOR A DEGREE: A NEW ENTREPRENEURIAL STRUCTURE FOR 21ST-CENTURY BUSINESS SCHOOLS Main theme: Current pedagogical provision lacks the agility to respond to the rapid evolution of business models and to meet the learning needs of young entrepreneurs. Graduate employability is often considered to be an adjunct to be applied retrospectively or at least in the final stages of a degree programme. The authors propose an inno-vative structure of university-directed businesses and professional practices that will employ students at all levels and share responsibility for their assessment in all stages of their higher education. It is likely that the best graduates will be afforded the opportunity to develop their careers further in this academic-commercial structure after graduation.	Graduate employability is a social responsibility and new programmes (pedagogical structures) are needed to overcome the lacking agility to respond to the real learning needs of young entrepre-neurs. This case emphasises a new pedagogical structure to prepare students for both employability and an entre-preneurial career in business creation.
(5) *Juha Ruuska and Piotr Krawczyk report on the team academy as a learning living lab: a European phenomenon of entrepreneurship education and development.* Main theme: Tiimiakatemia (Team Academy in Finnish), established at the Jyväskylä University of Applied Sciences (Finland) has received numerous awards for innovative learning methods and entre-preneurship development. In the year 2000, the Finnish Ministry of Education nominated the Jyväskylä Team Academy as a Centre of Excel-lence in Education. In 2008, the Finnish Minister of Trade and Industry, Mauri Pekkarinen, declared the Team Academy a Centre of Excellence in Entre-preneurship. In 2009, 37% of the students were self-employed as entrepreneurs within six months after graduation, and 47% of the students two years after graduation (OPALA 2013). The Team Academy learning concept is used in several colleges and universities around the world, including France, Germany, the Netherlands, Hungary, the United Kingdom, Spain, Brasil and Argentina. Here students learn in teams through their legally independent co-operatives, which they establish at the beginning of their studies. "Teampreneurs" have weekly training sessions (instead of classes) with their coach, who is responsible for team learning. The annual turnover of the 11 team companies in 2012 was 2,05 million euros.	The complexity of entrepre-neurship education demands teaching and learning innova-tion such as a team academy concept in terms of a "learning living lab" for "teampreneurs".

Table 2.C. Entrepreneurship education (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(6) *PETER VAN HOORN (VU UNIVERSITY AMSTER-DAM) REPORTS ON ENTREPRENEURSHIP AND INNO-VATION IN SCIENCE EDUCATION.* Main theme: The relationship between entrepre-neurship, innovation and valorisation in the context of operationalisation is highlighted. In 2007, a novel bachelor's programme, namely Science, Business and Innovation (SBI), was started at VU University Amsterdam by different faculties such as the Economic Sciences, Business Administration and the Social Sciences. The SBI programme was highly successful with 250 bachelor's students and 25 master's students registered in 2012. The case describes a coherent, interdisciplinary education programme that serves academic requirements and at the same time provides practical knowledge and skills.	The relationship between en-trepreneurship, innovation and valorisation is successfully taught by a bachelor's pro-gramme, namely Science, Business and Innovation (SBI).
(7) KyoungockRoh (KAIST) and Tahir Hameed (Sol Bridge International School of Business) report on effective entrepreneurial education internal linkages between programmes and technology incubator firms at KAIST. Main theme: Entrepreneurship education has successfully penetrated national innovation systems of developed countries where universities also take the lead in this field. This case focuses on university-industry linkages inside a university. KAIST (Korea Advanced Institute of Science and Technology) in South Korea is an example of a university in transition. Not only is the number of student-spin-off firms from labs increasing at the KAIST technology incubator, but the member firms are also engaged in entrepreneurial education programmes launched by the KAIST Office of University-Industry Cooperation (OUIC).	Effective entrepreneurship education should successfully penetrate the national innova-tion systems as a win-win strategy in developing coun-tries where universities take the lead.

Table 2.D. New initiatives, frameworks and technologies

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(1) *Maria Trulsson, Karl Maack and Thomas Hednerall University of Göteborg, Sahlgrens-ka Academy, Innovation and Entrepreneur-ship) report on technology push and demand pull perspectives on life sciences start-up and early growth companies in an academic cluster.* Main theme: The "technology-push" concept of inno-vation has been the prevailing perspective in several industry sectors. However, several industry sectors have shifted towards a customer focus as the starting point for innovation. This report focuses on three companies from the biomedical innovation cluster in Gothenburg; a medtech company (Carmel Pharma), a pharmaceutical company (DuoCort) and a medical information/service company (Internet-medicin). It shows that in each of the start-ups, there was a mix of approaches and frequent shifts from a "demand/market/needs perspective" to a "technology push perspective" during early growth and development.	Both a customer focus (a pull or demand from the market) as the starting point for inno-vation and the so-called "tech-nology push" concepts are important.
(2) Romulo Pinheiro (Centre for Advanced Studies in Regional Innovation Strategies and University of Oslo), and Roger Normann and Hans Chr Garmann Johnsen (both Centre for Advanced Studies in Regional Innovation Strategies and University of Agder) report on knowledge structures and patterns of exter-nal engagement. Main theme: The report focuses on technology transfer offices (TTOs) and across disciplinary and/ or professional domains. The study was based on a survey covering a total of 20 departments at the University of Agder in Southern Norway. Substantial variations across units and knowledge types were detected.	Different patterns of external engagement through effective managed TTOs across disci-plinary domains are important.

Table 2.D. New initiatives, frameworks and technologies (continued)

Triple helix researchers (and/or institution) and main theme	Core finding and/or principle
(3) Frederic Andres (National Institute of Informatics), Epaminondas Kapetanios (Uni-versity of Westminster) and Kenneth Brown (MaSante) report on enhancing enter-prise innovation by applying social project management. MAIN THEME: THE PAPER FOCUSES ON THE IMPACT OF SOCIAL PROJECT MANAGEMENT ON ENTERPRISE INNOVATION. IT INTRODUCES THE COMMUNIGRAM PLATFORM (ARCHI-TECTURE, FEATURES AND ASSESSMENT METRICS). THIS INNOVATION CREATIVITY PLATFORM ENABLES SHARING OF KNOWLEDGE ASSETS AND SOCIAL PROJECT MANAGEMENT.	The modern concepts of social project management, enterprise innovation and cre-ative innovation platforms (e.g. by means of a "commu-ninigram") should be consi-dered/utilised.
(4) Ciara Fitzgerald (University College Dublin), Conor O'Kane (University of Otago) and Will Geoghegan (Syracuse University) report on the legitimacy of university technology trans-fer offices: an international perspective Main theme: The increasing normalisation of aca-demic entrepreneurship and the entrepreneurial university has resulted in much attention being focused on the legitimacy and productivity of the commercial activities of universities. PMO (project management office) is a well-known term but less attention has been paid to the legitimacy of the university TTO as an entity in itself. This report focuses on seven barriers relating to university faculty (power of suppliers; business model; per-ceptions; social controls) and management (rhetoric; consistency of support; institutional pressure) and five facilitators (competence; transparency; institu-tional gains; management buy-in; governance and policy) which TTO personnel proactively leverage to improve their legitimacy.	TTOs are recognised as key intermediaries in the comer-cialisation process and be used as a method to bridge practical and cultural barriers between universities and in-dustry. TTOs seem to pro-actively leverage their legiti-macy.
(5) *Kaj Morel and Lisanne Bouten (Saxion University of Applied Sciences, Academy of Marketing and International Management) report on going beyond category perfor-mance: creating brand equity by managing corporate identity.* Main theme: This case describes the development of the identity management dashboard (IMD) for Zorggroep Sint Maarten (ZSM). During the in-company development and implementation of the IMD, stakeholders explored together, learned together, made mistakes together and celebrated successes together. Through the co-creation of the IMD and its specific measures of brand behaviour, brand attitude and brand processes, employees and researchers alike have gained a deeper under-standing of what their organisation and work are about. Greater involvement per se is positive for many reasons. Building a strong brand through identity marketing takes time and careful and systematic construction. This systematic approach of translating brand pillars into brand behaviours, brand attitudes and brand processes helps organisations to build their brand in a stepwise manner.	This case shows the im-portance of UBC for deve-loping the IMD (identity ma-nagement dashboard) as an in-company technological de-velopment providing the mar-ket with a solid and sys-tematic method to measure its brand performance. This tech-nology can also be used to promote the university's iden-tity towards "co-production" and being a leader for UBC.
(6) Carl-Johan Rosenbröijer (Arcada University of Applied Sciences, Finland) reports on creating innovative mobile applications: a student-driven approach. Main theme: This case describes a project of en-gaging students by mobilising them in developing two mobile applications that were finally tested in their real-life context. The results of the project were as follows: (1) the valuable experiences for both students and teachers. The students clearly indi-cated that working with real state-of-the-art appli-cations together with business partners was both challenging and rewarding; (2) The type of project should be appropriate in respect of digital services. Most innovations have been made by younger people in the digital industry. It would seem that the attitude to risk, new innovative thinking and entrepreneurial attitude is something that younger people might be more suited to; and (3) The real-life context is the ultimate test of a mobile application.	This is another example of UBC where students are en-gaged in popular and esta-blished industries such as the development of two mobile applications that were finally tested in the real-life context.

7 Conclusions

The objectives of the research were achieved in terms of the exploration of triple helix and related concepts (UBC, TTOs, ESE, POPs, KTC, etc.) and who the leading stakeholders (authors, researchers, higher education institutions and practitioners) of triple helix are. The third objective was to conduct a content analysis of triple helix case studies in four categories, namely (A) national innovation strategies, (B) entrepreneurial universities, (C) entrepreneurship education, and (D) new initiatives, frameworks and technologies.

On the basis of the overall report, the following core conclusions can be drawn:

(1) The research problem was addressed in terms of a conceptual synthesis of terms and concepts. In addition, the report should contribute towards a holistic framework covering the range of concepts required to promote academic entrepreneurship. The triple helix concept was explored and the results indicate a huge variety of approaches, methodologies and outcomes. There are many ways in which universities can craft industry interactions. The research is wide and should generate further studies relating to the rich untapped potential of HEIs in terms of their inherent value in respect of intellectual property, knowledge and research capacity.

(2) The core principle of science as a business is crucial. The content analysis of 45 cases indicated the importance of co-production and the commercialisation of science as a win-win priority. Innovation and education hubs are a strategic priority and these hubs will increase for key industries in the Dutch economy. A comparative analysis is necessary to find benchmarks to adapt and/or improve the UBC vision and mission. Incidental UBC could be the catalyst for formally planned strategic projects.

(3) The business of science will place the focus on the university as a business with a deeper understanding of value creation (beyond teaching and learning) and technology transfer (or research output) as a third mission.

(4) University output in terms of graduates has an indirect influence on the economy and its direct influence (economic impact) by means of UBC is a powerful measure.

(5) Freedom to do business makes business schools more responsive to market needs. Universities transfer knowledge and technology, but the TTOs of the effective universities operate in a larger and dynamic innovation system. TTOs do not have to be situated on the main campus or at the parent university. A TTO should remain a dynamic open system (e.g. bring business and industry into the science and academic society) and should not become isolated. TTOs across disciplinary domains are significant. TTOs are recognised as crucial intermediaries in the commercialisation process and can function as bridging practical and cultural barriers between universities and industry. TTOs seem to proactively leverage their legitimacy.

(6) The concepts relating to an "index of entrepreneurial climate" and entrepreneurial scorecards indicate the increasing commitment of universities to becoming more entrepreneurial. Several initiatives are needed to foster UBC such as entrepreneurship support entities (ESEs) as part of a broad entrepreneurial support system.

(7) UBC of academics in Europe indicates that prior experience in business significantly increases UBC. Although no single model or best type of entrepreneurial university exists, the expectation is tha t entrepreneurial uni-versities will converge into a few distinct archetypes. Universities must teach the correct entrepreneurship curricula and understand the concept of innovation pedagogy. The challenges in the labour market demand effective learning by doing as entrepreneurs. Graduate employability is a social responsibility and new programmes (pedagogical structures) are needed to overcome the ability that is lacking to respond to the real learning needs of young entrepreneurs.

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