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Developing the Entrepreneurial University: Architecture and Institutional Theory[1]

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Abstract

Given the diverse environmental contexts of universities worldwide there is a need for a theoretical orientation that addresses the entrepreneurial university in a range of settings. Applying the institutional perspective this research explores how universities are strongly influenced by, as well as active influencers in, their surrounding environment. To do this, we examine case narratives of two universities in each of the following countries: Norway, Sweden, Finland, the UK, and the U.S. Analysis focuses on five entrepreneurial dimensions as defined by Nelles and Vorley (2010a): *Structures, Systems, Leadership, Strategies, and Culture* while examining the impact of regional and national context at regulative, normative, and cognitive levels of analysis. We address two research questions: *How do universities interact with their institutional context in developing entrepreneurially and what actors and forces are most important in motivating institutional change in developing a university's entrepreneurial architecture?*

Keywords

Academic Entrepreneurship, Entrepreneurial University, Institutional Theory, Technology Transfer

1. INTRODUCTION

The term entrepreneurial university can be traced to a highly cited book *'Academic Capitalism: Politics, policies, and the entrepreneurial university'* (Slaughter and Leslie, 1997) that examines the changes of academic labour between 1970 and 1995 while focusing on the importance of market forces in securing university external finance. In a study of the transformation of five European universities, Clark (1998:3-4) uses the term "entrepreneurial university" to define a characteristic of social systems; that is of entire universities and their internal departments, research centres, faculties and schools. In our conceptualization, universities tend to be entrepreneurial in two main ways. First, *academic entrepreneurship* focuses on the commercialisation of knowledge and research findings (Klofsten and Jones-Evans, 2000; Roessner et al., 2013). In this way universities are seen as knowledge hubs (Youtie and Shapira, 2008) with the associated challenges and opportunities of technology transfer (Mowery et al., 2002; Owen-Smith and Powell, 2003).

A second path toward being an entrepreneurial university is through *entrepreneurial education* (Gibb and Hannon,

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2006) encompassing the university's teaching mission and the building of entrepreneurial competencies in students and faculty (Altmann and Ebersberger, 2013). Despite an increasing number of publications on university entrepreneurship scant attention has been given to the role of context in the emergence and development of entrepreneurial universities (Wright et al., 2008; Morris et al., 2013; Hoskinson and Kuratko, 2014; Fayolle and Redford, 2014; McKelvey and Holmen, 2009; Fetters et al., 2010; Curi et al., 2012; Howells et al., 2012). In an extensive literature review, Rothaermel et al. (2007) concludes that research on university entrepreneurship lacks a complexity in models and richness that is needed to better understand interdependent processes across different actors, agents, and institutions.

Given diverse political and market contexts of universities worldwide, there is a clear need for a theoretical lens that addresses this multilevel phenomena in a diverse range of environmental settings. We believe such theory should emphasise that universities are both creatures of their institutional environments as well as active players in these processes (Scott, 2014). Thus the entrepreneurial university is seen to be a result of complex processes by which institutional forces both shape, and are shaped by, organizational and individual actions. A main contribution of this approach is to offer a greater appreciation for the history and unique nature of the entrepreneurial university's development and operation, in relation to its institutional context, interrelationships, and interdependences. To add richness to this orientation, we reference Nelles and Vorley (2010a) who elaborate a university's "entrepreneurial architecture" in terms of five key dimensions:

1. *Structures*: Includes technology transfer offices, incubators, technology parks and business portal
2. *Systems*: Focuses on networks of communication and the configuration of linkages between structures and administration
3. *Leadership*: Emphasizes the qualification and orientation of key influencers including administrators, board of directors, department heads, and "star scientists"
4. *Strategies*: Refers to institutional goals elaborated in institutional planning documents, incentive structures, and policy
5. *Culture*: Refers to institutional, departmental and individual attitudes, and norms

We discuss these five architecture dimensions at regulative, normative, and cognitive levels of analysis as we present examples from ten case narratives. Case analysis is focused on answering two main research questions:

1. *How do universities interact with their institutional context in developing entrepreneurially?*
2. *What actors and forces are most important in motivating institutional change in developing a university's entrepreneurial architecture?*

1.1 Institutional Theory

Scott (2014) cites four components of institutional theory that are important in our analysis of the development of entrepreneurial architecture dimensions in the ten case narratives. First, emphasis needs to be on the importance of the environment in which the university is embedded (Scott and Christensen, 1995: 310). Institutional theorists recognize the value of "attending to the larger drama, rather than to the individual player" (Scott, 2014: 262). To our thinking, this orientation encourages an emphasis on the importance of institutions which surround, "penetrate" and are "penetrated by" the entrepreneurial university an orientation that is supported by Zahra (2007); Welter (2010); and Vorley and Nelles (2008; 2009).

Second, our research recognizes how innovative actions make use of pre-existing activities and existing contexts. As Scott (2014: 263) states, institutionalists stress the continuing impact of the old on the new and the existing on the becoming. All the case narratives highlight the importance of particular events occurring over time as they provide timelines of important changes related to the 'entrepreneurial turn' of the university. In accordance with institutional theory, we also emphasize how things happen in addition to what happened as we attempt to uncover the sources of agency in the entrepreneurial university.

Third, we emphasize the important role that ideas and symbolic elements play in the functioning of organizations—in addition to material resources, technological drivers, and exchange/power processes --- in the shaping of organisations. As Scott states (2014: 263) throughout much of the 20th century, organisations have been treated as if they were "culture-free" systems driven by instrumental objectives and governed by "natural" economic laws. Accordingly, it is important to appreciate that universities are multifaceted and culturally complex and are best understood as organisations with multiple levels of control and loosely coupled activity where different components are likely to have a cultural identity that motivates normative and cognitive behaviour (Wright et al., 2008).

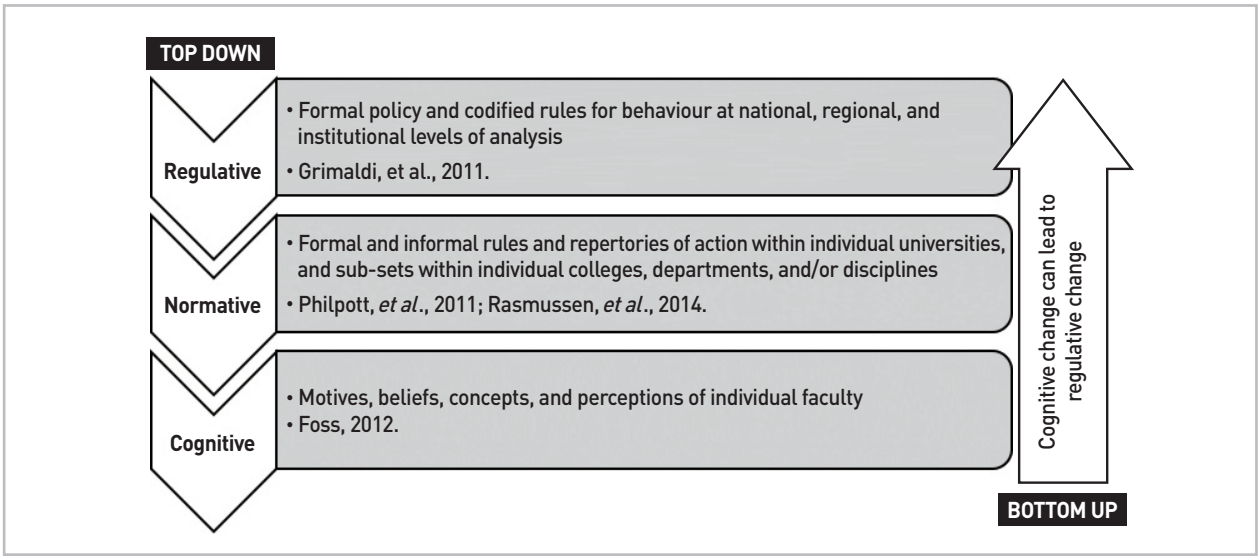

Fig. 1. Levels of influence at three levels of analysis impacting university's entrepreneurial architecture change efforts

Source: Foss and Gibson (2015), p. 251.

Fourth, our analysis supports the interdependence of the architecture dimensions operating at multiple levels to affect the outcomes of interest. In many of the cases we see the interplay of "top-down and bottom-up" processes as they affect the formation and sustainability of the entrepreneurial university. Organisations operate within fields that shape, constrain, and empower them, but they are also influenced by the interests and activities of their own participants. When placed in the context of an 'organizational field', there are forces at work between organisations and agencies that interact at the regional, national, and international levels and together may foster and sustain or impede an entrepreneurial university.

Accordingly, we view the university as constrained within a wider context or environment including different institutions comprising organizational fields of activity. The term 'organisational field' is defined as, "those organisations that, in aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organisations that produce similar services or products" (DiMaggio and Powell, 1983: 148). This concept fulfils the vital role of connecting the entrepreneurial university to its wider macrostructures—sectorial, societal, and transnational. As DiMaggio (1986: 337) asserts, "the organisation field has emerged as a critical unit bridging the organisational and the societal levels in the study of social community and change." It is an interesting exercise, perhaps, to consider how the concept of 'organization field' relates to characterizations of innovation ecosystems (Oh et al., 2016). For the purposes of this paper, the organisational field of concern is defined by those organizations, agencies, programs and relationships that are important to the development of the entrepreneurial university, leading to our first research question, *How do universities interact with their institutional context in developing entrepreneurially?*

1.2 Level of Analysis

Our dual level framework, at the university and institutional levels, necessitates working across different units of analysis to accommodate Welter's (2010: 174) argument "that contexts are intertwined and cut across levels of analysis—contextualizing theory thus needs to a apply a multi-context perspective." Scott (2014: 59) suggests that institutional change can be best understood at regulative, normative, and cognitive levels that together with associated activities and resources, provide stability and meaning to social life, Figure 1. Also well suited to our purposes, Storper (2013: 8, 9) considers institutions as being made up of rules, laws, and formal policies as well as the organization of key groups or communities from elite networks to civic associations and neighbourhood groups. In this regard, we are interested in how national and regional institutions interact to shape policies and attitudes and actions toward the entrepreneurial turn within and external to the university as

well as how the university impacts its regional context. Accordingly, we assess institutional change at three levels of analysis:

1) The *Regulative Pillar* concerns mandated specifications including laws, governance, and monitoring systems. This pillar, derived from economics, represents a rational actor model of behaviour including rules, sanctions, and conformity. How do or to what degree do national or regional rules and regulations encourage or discourage entrepreneurship?
2) The *Normative Pillar* incorporates values, expectations, and standards, including roles, repertoires of action, conventions, and standards. As university cultures and their surrounding contexts may encourage or discourage entrepreneurship, this pillar is important in understanding motivation for, or resistance to, behavioural and institutional change toward the entrepreneurial turn.
3) The *Cognitive Pillar* encompasses predispositions and symbolic value as models for individual behaviour regarding the individual acceptance of entrepreneurship, or not, within universities and their contexts. Are certain actors (e.g., faculty, staff, students) within the university more inclined to support the entrepreneurial turn?

Scott's Institutional Pillars Model incorporates feedback and interactive loops of top-down influences (for example, changes in the broad national and regional policy environment) as well as bottom-up contributions from individual actors. Our analysis of the case narratives draws upon this model to discuss the pressures and influences to which organisations and institutions are subjected and the means through which these entities accommodate change, or not, in terms of the entrepreneurial turn leading us to our second research question: *What actors and forces are important in motivating institutional change in developing a university's entrepreneurial architecture?*

1.3 Case-based narrative approach

Bruton et al. (2010: 432-433) state that institutional research needs to ensure that the setting examined includes multiple locations otherwise it is difficult to be sure that institutional impact is merely representing an idiosyncratic result of a given sample. According to Uyarra (2010) there have been few in-depth attempts to collect and compare such empirical material on the institutional diversity of universities both within and across different national and regional contexts. Furthermore, as noted by Wright et al. (2013) much of the research on academic entrepreneurship has focused on universities that are "outliers of excellence" in terms of being atypical in their own countries and worldwide. In short, such research would benefit from enhanced awareness of less well-known and celebrated universities as well as from countries other than the

Table 1. Select comparative statistics on universities and regions discussed

University (Year Est.)	Total Students	Under-graduate Students	Graduate Students	Faculty	Staff	Research Budget (£M)	Region Population
Cambridge (1209)	18,812	11,878	6,934	3,175	6,648	332	200,000
Lund (1666)	48,000	36,000	12,000	5,200	2,300	649	700,000
Chalmers (1829)	10,107	6,415	3,692	2,012	826	205	1,000,000
NYU (1831)	38,391	19,401	18,990	6,564	2,424	96	8,336,697
UT Austin (1883)	52,000	38,463	12,682	3,081	------	412	1,000,000
UiT(1972)	11,759	7,885	3,874	1,448	1,164	159	70,000
KUL(1992)	20,668	16,658	4,010	807	2,146	3	8,416,535
KyUAS (1996)	4,200	4,000	200	174	157	4	180,738
UiS (2005)	10,148	6,940	3,208	632	419	37	460,000
Aalto (2010)	16,143	10,101	9,235	2,747	2,246	266	1,092,404

United States and the United Kingdom.

In order to control for a host of extraneous variables all the cases discussed in the present research involve universities that have embraced the entrepreneurial turn at different speeds and forms and where entrepreneurship programs and activities are either working relatively well or are being challenged in interesting ways. The cases include two universities embedded in different regional contexts within Sweden (Chalmers and Lund Universities), Finland (Aalto University and Kymenlaakso University - KyUAS), Norway (The Artic University of Norway - UiT) and Stavanger University - UiS), the United Kingdom (Cambridge University and Kingston University - KUL), and the United States (New York University - NYU) and The University of Texas at Austin – UT-Austin).

Despite the 'developed region' profile, the cases still provide considerable diversity to compare and contrast on such characteristics as size of faculty, students enrolled, research budgets, historically renowned and newly formed, and being located in large established cities or small, developing regions, Table 1. Importantly, the entrepreneurial architecture dimensions are seen to be capable of being applied to diverse universities and contexts. As noted by Nelles and Vorley (2010a: 173) "...since institutional dynamism is central to entrepreneurial architecture, the framework can be applied to a wide variety of universities and can accommodate very different initial and policy contexts. As a result, entrepreneurial architecture is equally relevant to universities irrespective of the nature and stock of research within the institution, the characteristics of the regional economy, the power of and political status of the university, or the legacies of different institutional priorities regarding teaching and research agendas."

Each case was written by participant-observers with an orientation that was clearly influenced by their individual histories and positions. However, as Golden-Biddle and Locke (1993) suggest a narrative style appeals to the reader through authenticity and plausibility. The case authors also conducted interviews and consulted archival material to help produce an unbiased portrayal of their universities entrepreneurial turn. In an effort to enhance cross-case comparability, the authors were also asked to consider the Nelles and Vorley (2010a) entrepreneurial architecture framework as it applied, or not, to their case narratives. We concede that different authors writing about the same university might well emphasize a different narrative; however, external expert observers were considered less likely to provide rich narratives important to our research objectives. Following Brannick and Coghlan (2007), insider research provides important knowledge that traditional descriptive approaches may not uncover and are particularly relevant to an emphasis on contextualisation.

2. ENTREPRENEURIAL ARCHITECTURE DIMENSIONS

The narrative case study methodology allowed us to explore the interrelationships within the university and between the university and its surrounding context providing data across actors and institutions involved in a university's entrepreneurial turn. In agreement with institutional theory and the orientation of Nelles and Vorley (2010a; 2010b) each of the five entrepreneurial dimensions is seen as being interconnected with the other dimensions, both within the university and with external actors, well representing the multi-dimensional nature of the academy. Guided by the two main research questions the following analyses presents selected examples of how different institutions, at regulative, normative, and cognitive levels of analysis shape, constrain, and empower the university as well as how they are also influenced by the interests and activities of university participants.

2.1 Culture

Nelles and Vorley (2010a) identify the architecture dimension of culture at the university level in terms of institutional, departmental, and individual attitudes and norms. We define culture more broadly as "an object of orientation existing outside the individual" (DiMaggio and Powell, 1991: 17). In our analyses we consider regional and national culture as a key component of university context. Welter (2010) classifies dimensions of context as business (industry, markets), social (networks), spatial (geographic environments), and institutional (culture, society, and political and economic systems). The culture dimension is presented as the first of the five architectural dimensions in our analyses because we consider that it is indeed the most important determinant of the speed and success of a university's entrepreneurial turn and as all the architecture dimension are considered to be highly interrelated the cultural dimension is seen to have a significant impact on leadership, systems, strategies, and structures.

In short, all the case narratives demonstrate the importance of the "culture/context" dimension impacting regulative, normative, and cognitive levels of influence on the entrepreneur-

ial university. At Kingston University (KUL) extra-curricular programs offered students a wide variety of entrepreneurial opportunities; however, it was also noted that while being highly valued program its diffusion was limited since the university's culture did not integrate enterprise education into its wider thinking. In response to this challenge, in 2010, the Head of Enterprise Education emphasized the need for class modules focused on entrepreneurship across all disciplines. In support of this effort, KUL gave university-wide 'Enterprising Business Awards' to recognize outstanding academic enterprise and knowledge transfer.

The context of New York City was extremely important to NYUs' development as an entrepreneurial university. The University's founding vision embraced and drew inspiration from the city's international and entrepreneurial vitality. For example, the financial crises of 2008 motivated the city's mayor and NYU's president to work together on a common vision that focused on entrepreneurship and innovation to diversify the city's economic base beyond Wall Street including the formation of The NYC Economic Development Corporation as a public-private partnership that launched several business incubators and accelerators.

The Kymenlaakso University of Applied Sciences in Finland had experience with engaging in student projects linked to the regional business community, but apart from company visits this kind of activity was not really supported by faculty norms and values as there was a lack of clarity regarding of charging income for student projects and establishing appropriate compensation for a faculty owned company. As the promotion of entrepreneurial activity gained importance within the larger academic culture many faculty and administrators responded by including traditional business subjects (marketing, accounting, finance, business planning) into the curricula of non-business programs. In short, the norms of the University's business department were that there was no need to add or change instruction in an 'entrepreneurial curricula', or in methods of teaching, as it was thought that, by definition, the business department already taught these subjects.

During the late 1980s and through the 1990s, Austin, Texas' fast growing technology and entrepreneurial environment was considered an important catalyst for the entrepreneurial turn of the University of Texas at Austin. Two main cultural assets of "Austin's DNA" were seen to set the region apart as a "talent magnet" and as a nationally recognized leader in creativity and innovation. One was the promotion and acceptance of the "Keep Austin Weird" culture that the authors suggest was sustained by Austin's music and creative environment. The second defining asset was seen to be the cooperative "can do" attitude that key academic, business, and government influencers exhibited when coming together at important moments to implement regional action strategies assisting civic, social, and technology entrepreneurship.

Due to the university's lack of business school traditions or a culture of venture financing and investment capital, Norway's Artic University of the North (UiT) faced difficult challenges in motivating the entrepreneurial turn despite the region's growing research-based companies and biotechnology and satellite industries. However, the efforts of the Business Creativity and Entrepreneurship (BCE) Program working with select UiT faculty began to motivate normative and cognitive change among faculty and students toward the importance of university-based S&T commercialization. These efforts receive additional interest and credibility with the declining strength of the nation's energy-based economy which strengthened UiT's and the region's cultural support of the entrepreneurial turn.

2.2 Leadership

Nelles and Vorley (2010a) emphasize the qualifications and orientation of key influencers including university administrators, boards of directors, department heads, and "star scientists" as important to the development of an entrepreneurial architecture. Through the case narratives, there was a recognition of the important roles key actors have, both inside as well as outside the university, as opinion leaders. Formal and informal leadership is clearly exercised both inside and outside the academy in the governance processes through which the university determines its direction and contributions to the entrepreneurial turn (Phillips, 2008).

The Cambridge Phenomenon, launched in the 1960s, was motivated by an informal and influential "group of 25" local academic, business, and government influencers who represented important agencies of an innovation eco-system. These influencers took personal responsibility to motivate change within their organizations to support regional innovation activities. However, leadership also came from the regulative level with the 1969 Mott Committee Report that was a response to a 1964 national government initiative that urged UK universities to expand their contract with industry. The objective was to increase return of the country's investment in basic research and higher education. Two key normative dimensions were also seen to have helped shape the effective-

ness of Cambridge's entrepreneurial culture that underpins the success of the Cambridge Phenomenon. They were:

1. The enabling norm of 'benign neglect' that permitted faculty to pursue interests external to their university roles, including exploiting their research findings, as long as they continued to pursue high quality research, publications, and teaching.
2. Regularly scheduled college dinners that faculty were expected to attend and that facilitated cross disciplinary communication, connectivity, and relationship building.

NYU's emergence as a entrepreneurial university was championed by the university's president working alongside the governor of New York State and the mayor of New York City. Governor Cuomo launched START-UP NY tax free zones to attract and grow new businesses across the state and to accelerate entrepreneurship and job creation. Mayor Bloomberg emphasized the importance of the entrepreneurial economy in all five of NYC's boroughs. Similarly, in Texas key influencers from the University of Texas at Austin working with state, city, and regional business influences were critical to Austin's winning major national R&D consortia that catalysed the city's transformation from a university and state government town to an emerging R&D centre. An early and important catalyst for the entrepreneurial turn of UT-Austin was the appointment of a successful California entrepreneur, Dr. George Kozmetsky, as Dean of the university's College of Business in 1966. Dean Kozmetsky founded The IC2 (Innovation, Creativity, and Capital) Institute, at UT-Austin in 1977 and was an early and important mentor to Michael Dell of DELL Technologies, Jim Truchard of National Instruments, and John Mackey of Whole Foods. Kozmetsky founded the Austin Technology Incubator and the Texas Capital Network in 1989 and the Austin Software Council in 1993. All these activities were seen to be important catalysts for Austin's transformation to an entrepreneurial hot spot. Nelles and Vorley (2010a) include "star scientists" as being important leaders in the entrepreneurial turn. The Austin case also emphasizes the importance of the university significantly increasing the number of endowed professorships in science and technology as being key to attracting high quality faculty who were key to winning major competitive research grants and to attracting top students key to building world-class centres of research and education excellence.

Torkel Wallmark spent fourteen years at RCA Laboratories in Princeton, New Jersey where he became inspired by the emerging microelectronics revolution and the associated opportunities for academic entrepreneurship. In 1964 he was appointed professor at Chalmers University and in this capacity was a key supporter of university-based innovation and entrepreneurship. As a result, Chalmers was an early leader as an innovation centre that provided advice and education to professors and students interested in starting technology-based ventures. Continuing this effort, Wallmark's successor, Soren Sjolander co-founded important entrepreneurial support structures including the first Swedish VC firm in 1994; the school of entrepreneurship in 1997; the university's seed investor fund in 1998; and launching an incubator in 1999. At Lund University there was an attitude that cooperation with surrounding society was not necessarily important; however, this orientation began to change when Per Eriksson took over as Vice-Chancellor in 2009. Before taking his university position, Eriksson was General Director of Vinnova, the Swedish Governmental Agency for Innovation Systems. Reflecting the values of his previous job, as Vice-Chancellor, Eriksson emphasized that Lund University should support innovation in areas important to society and that social scientists should also be involved in societal development.

The Kymenlaakso case describes, at a very personal level, the significant resistance, at normative and cognitive levels of analysis, to change attempts toward the entrepreneurial turn. While new university-wide regulations and functions were imposed at a regulative level --- including implementing coordinating teams for common studies in leadership, entrepreneurship, and methodological studies --- the case emphasized the slow pace of integration across departments with respect to curriculum development and noted that this was to be expected given the retention of staff in key roles of authority and influence. However, with time university reorganization did motivate important university change that legitimized and strengthened cross-disciplinary collaboration among faculty and staff from "different corners of the university" to work on initiatives and projects concerning entrepreneurial activities and new models of learning environments concerning entrepreneurship and innovation.

While the above examples emphasize the importance of "top down" leadership initiatives, the important role "bottom up" initiatives was also highlighted in the cases. For example, Finnish higher education encourages students to become members of entrepreneurial associations when enrolling in a university. The Aalto University Entrepreneurship Society is a key actor in the university's entrepreneurial ecosystem where both top-down strategies and student-driven push come to-

gether in the development of the university's Presidential Circle, Centre for Entrepreneurship, and Ventures Program. Aalto University students manage StartupSauna, the largest national seed accelerator program, and Northern Europe's largest start-up event, Slush. The Kymenlaakso case highlights entrepreneurial leadership at the team level by pushing power and responsibility downwards in the organization. Mid-level leadership by a small number of committed entrepreneurship lecturers and department managers sustained the effort, along with leadership from the students, supporting the Patteri Entrepreneurship Society. Select professors and students at Stavanger University (UiS) are moving the university toward a more entrepreneurial path through The Centre for Entrepreneurship and The Centre for Innovation Research. Working with The Centre for Entrepreneurship, UiS students launched a venture capital competition and related events across the campus. The student organisation START has played an important role in fostering entrepreneurship at the university by working with industry representatives to launch new entrepreneurship courses at the master's level.

2.3 Systems

The "systems" component emphasizes networks and linkages that apply within the university and between the university and the external environment and is, in many ways, the connective tissue of the entrepreneurial architecture. However, since such activities often require reaching outside the university though networks and building relationships there can be tension for faculty as to where to focus their time and effort. On the one hand, as noted in the case narratives, effective entrepreneurial networks are inhabited by participants at multiple levels of influence, they span different institutions and interests that can be initiated by academic, business, or government actors at different levels of influence. On the other hand, such linkages are challenged when the norms and vertical rigidities of academic disciplines do not support horizontal linkages across university departments and colleges or with the surrounding environment of government and business actors. Such trans-institutional relationships require considerable effort to build and maintain and this effort can conflict with the mandate to focus time and resources on academic verticals. Research on university industry interactions emphasize that it takes a strong commitment from the university at regulative and normative levels to enable effective engagement with industry and to enhance the dialogue between industry and researchers (Ranga et al., 2008; Bruneel et al., 2010).

Several of the case narratives revealed how public-private collaboration was catalysed through regulative action. For example, a 1992 Swedish national law mandated the universities cooperate with surrounding institutions concerning entrepreneurship and technology. This regulation motivated the development of the "Lund University Innovation System" and The 'West Focus Consortium' a national collaboration to leverage the unique strengths of seven universities. The consortium created WestFocus, a business portal, to foster collaboration across the partner institutions for knowledge and business creation and development, promotion of university talent, and entrepreneurship. KLU's Entrepreneurship Centre was initially conceptualized as a means of supporting regional SMEs; however, once WestFocus began operating this remit was quickly expanded to include developing new enterprises and in particular encouraging students to value their own ideas and to develop them as enterprises.

While the case narratives indicated that university-industry linkages and resulting relationships can either be formal or informal, a study of such collaborations and its effect on innovation found that informal links were more important than formal ones in terms of innovative outcomes (Howells et al., 2012). In support of this finding, Chalmers University (which ranks number three in the world of the 2013 Leiden Ranking regarding university–industry collaboration) emphasized that regional and university entrepreneurship activities were developed without much organised or regulative effort by the university. Such informal faculty networks with industry were facilitated, in the 1970s, by 'The Innovation Centre' and 'Chalmers Industrial Technologies' (CIT) that conducted commercial R&D. Over the years faculty-industry interaction increased by appointing supportive faculty, by facilitating incubator seed investors, and by launching a school of entrepreneurship. Chalmers third evolution of an entrepreneurial architecture was launched in 2005 and represents a heightened integration of research and innovation into a network model where research groups get institutional support in dealing proactively with innovation in their research strategies and where students are expected to have hands-on learning throughout their education.

The Tromsø case emphasized that a strong Artic-based research base was a prerequisite for building regional, national, and international networks and entrepreneurial programs. Formal and informal networks were formed around select academic disciplines linked to regional industry needs. For example, The Business Creation and Entrepreneurship (BCE)

program fostered student initiatives that have been important in creating an entrepreneurial culture across the university and within the region. BCE students, of which about fifty percent are foreign, have launched ventures involving university research with the participation of local public-private sectors. Within Tromsø's regional population of 70,000 individual actors become known across the academic, business, and government sectors as they work on the common vision to strengthen the Far North as a knowledge city and to establish platforms for economic growth and societal and environmental sustainability.

Stavanger public-private committees and workshops established the ARNE Project with the Stavanger Chamber of Commerce that created a sense of common direction within the region which led to the formation of the Greater Stavanger Economic Development Organization. However, the Stavanger case also illustrates that while close and coordinated public-private collaboration can "get things done" there can also be perceptions of making it difficult to "think outside of the box" and where one group has too much influence. For example, due to the dominant success of the energy industry and its motivation to launch the University of Stavanger to educate needed talent and by providing excellent job and career opportunities for graduates it has been a challenge for UiS to diversify its curriculum, to attract students to entrepreneurship, and to build needed momentum in developing an entrepreneurial culture that encourages risk taking.

The Kymenlaakso University (KU) case provided an example of how faculty members, energized by new leadership, contributed to the entrepreneurial turn by reinventing their roles in collaborative settings and networks focused on innovation. A resulting change in normative values inspired faculty to value outside partnerships as contributing to the universities educational mission. This strategy was strengthened by 'The Learning and Competence Creating Ecosystem' (LCCE) model that featured a corporate liaison on the university's campus. The corporate liaison's entrepreneurial drive brought company representatives into university courses and interdisciplinary learning and resulted in improved contracting of university-industry activities. These activities catalysed a "reinvented identity" in KU from a disciplinary focus to a learning model that featured networked collaboration among institutional hierarchies of education and innovation.

2.4 Strategies

The "strategies" component concerns institutional goals elaborated through such components as planning documents, incentive structures, and policy (Nelles and Vorley 2010a). Research has considered different university strategies for encouraging academic entrepreneurship and technology transfer (Henrekson and Rosenberg, 2001; Markman et al., 2004; Powers and Mc Dougall, 2005; Nelles and Vorley 2010b; Resende et al., 2017). The present research highlights examples of strategy toward the entrepreneurial turn at the level of national, regional, and university policy.

While the Cambridge narrative emphasized the importance of regional public-private influencers at normative and cognitive levels of influence, it was also emphasized that national policy was also important. The Cambridge Cad-Centre which was launched in the 1960s was a national government initiative for increased competitiveness of British industry. In an important strategic decision, the management of the Centre was assigned to a private company, rather than a research council, so an industry perspective drove the selection of staff and the research agenda. This public/private initiative attracted talent to the Centre and to Cambridge which generated the first wave of regionally-based high tech companies in the 1970s and it also helped attract business and entrepreneurial services to the region. A second important result of this strategic decision, at the normative and cognitive levels of faculty and staff, was to reinforce the linkage between the academic research community and emerging technology businesses by encouraging scientists to do interesting work involving start-ups. An additional regulative change at Cambridge University involved the management of intellectual property. Historically the University allowed individual academics to use their research findings as they wanted; however, with the founding of the Wolfson Industrial Liaison Office (WILO) in 1970 a strategy was institutionalized to help faculty with commercial applications, licensing, and spin-outs.

The regulative level was also an important catalyst for KUL in pursuing a strategy that responded to national government initiatives for attracting student applicants located in London's extremely competitive higher education (HE) environment. KUL strengthened and promoted its entrepreneurial programs and activities to attract and retain students and to develop "an entrepreneurial person" to address a wide range of skills, knowledge, attitudes, and capabilities. The Higher Education Funding Council for England (HEFCE) announced the Higher Education Innovation Fund (HEIF) in 2001 "to support and develop a broad range of knowledge-based interactions between universities and colleges and the wider world, which would result in economic and social benefit to the UK."

Finland's national government directive to merge the Helsinki School of Economics, Helsinki University of Technology and the University of Art and Design was to focus on creating a major innovation hub for the Helsinki region while connecting public, private and educational initiatives. Following this national initiative, the vision and strategy of Aalto University was to be the "world's leading innovation university contributing to societal and economic development through world class research, interdisciplinary collaboration and pioneering education".

Due to large scale regionally-based paper industry operations, Kymenlaakso, Finland was economically strong for the latter half of the 20th century. Average salaries were high and public sector spending and growth was steady as both income and corporate tax payments were secure. However, the region's prosperity changed drastically with the closing of several large paper factories from 2000 to 2010 and Kymenlaakso dropped from second place in GDP per capita to 11th among 19 regions in Finland. No other Finish region suffered such a drastic economic downturn in such a short time. Motivated by this dramatic economic shift, Kymenlaakso University of Applied Sciences implemented regulative change that initiated a transformation of faculty (norms and values), from educating skilled labour for industry and the public sector to providing talent for an innovation-generating system supporting entrepreneurs across a variety of disciplines and professions.

Chalmers and Lund Universities operate under Sweden's regulative policy and normative value of a "professor's privilege regime" which encourages innovation and entrepreneurship at the level of the individual professor. The 1994 Swedish government transformation of Chalmers to a "private" foundation-based institution gave the university the freedom to operate and to form new structures and mechanisms for innovation and entrepreneurship. However, this regulative change met with resistance and is still a work in progress. A main challenge concerns how to institutionalize the entrepreneurial turn at normative and cognitive levels of faculty and staff. On the one hand, Lund University's culture stresses the importance of excellence in teaching and research while the subject of entrepreneurship has been largely defined as "outreach." On the other hand, Lund was the first Swedish university to establish a Professor of Entrepreneurship and the first to initiate a science park. For both Chalmers and Lund Universities, engagement in entrepreneurship was supported at the regulative level by Sweden's Higher Education Act of 1997 that stated, "in addition to producing scientific knowledge and raising the level of advanced knowledge among students," the university should also "collaborate and cooperate with the surrounding society and inform about its actions." Both these case narratives highlight that when strong normative values, expectations and standards are infused into organization participants, it can take considerable time and effort for the entrepreneurial turn to occur even with a concerted top-down regulative initiative.

University of Tromso's (UiT) strategy was to become academically excellent in areas that were especially relevant for the arctic environment. Such a focus has proved to be extremely beneficial for the university and for the region as it has facilitated the development of research and teaching competence that fills important gaps in the national university structure and which also facilitates regional development. UiT rectors have continually followed the path of contributing to the value and strength of the northern region rather than trying to mimic the strategy of other more established Norwegian universities. Since the founding of The University of Stavanger (UiS) in 2005, the strategic push has been to graduate qualified employees for the country's oil, energy, and related industries. As a result, building entrepreneurial programs and activities and recruiting student talent for entrepreneurial programs has been a challenge. UiS has yet to develop a competence base to become a recognized regional leader in innovation and entrepreneurship; despite the region opening Norway's first knowledge park in 1993 followed by launching the regions first technology transfer office in 2002.

2.5 Structures

In terms of physical structures, one of the most compelling examples of successful science and technology parks is in the UK where each of several parks is associated with a Cambridge College. The vision for this development came from a "Group of 25" academics, businessmen, and government officials who visited Silicon Valley and Stanford Research Park in the 1960s. The government sponsored Mott Committee Report provided the strategy for the Cambridge Science Park Model which was launched in 1973 with Trinity Science Park. (Another example of the diffusion of the science park model suggests that in 1981 a Finnish chemistry professor, Sture Forsén, read an article about the Cambridge Science Park and lobbied for the establishment Finland's Ideon Science Park that was established in 1983.) Eight Cambridge College affiliated research and technology parks have followed Trinty including St. John's Innovation Centre in 1987; Granta Park in 1997; and Peterhouse Park in 1988, the home of ARM a world leader in semiconductor research for mobile devices. A second wave of Cam-

bridge-based science park development followed the UK government's identifying Cambridge as the preferred location for national competiveness investments in biotechnology. Supporting programs and activities include the Laboratory of Molecular Biology, the Sanger Institute and the Genome Campus, the European Bioinformatics Institute, and the Babraham Research Campus. It is important to emphasize that all these initiatives benefitted from Cambridge University's long and distinguished academic and research history including Nobel Prize winning research.

Chalmers (est. 1829) is also an early leader in entrepreneurship, programs and activities that have evolved and changed over 40 years from primarily internal academic structures (departments and innovation centres) into the mid 90ies period of focusing on incubators and seed financing, and establishing a school of entrepreneurship linking students and technology transfer activities. A significant boost to these entrepreneurial activities came in 2007 when the Swedish Government named Chalmers as one of five key GoINN actor projects supported by an eight-year budget. GoINN focused on early stage innovation processes and the building of intellectual assets around ongoing research by engaging advisors and commercial actors to process innovations around specific disclosures and to build intellectual assets.

Historically, Lund University had been resistant to participating in regional engagement outside of the faculties of medicine and engineering. But beginning in the 1980s the University started to see itself as an important actor in society as it was emphasized that collaboration with business and society needed to be developed. The change in attitude was influenced by the establishment of Ideon Science Park in 1983 dedicated to the exploitation of university knowledge. In 1994 the Lund University Limited Company (LUAB) was established to support university innovations and to ensure that knowledge was commercialized. In 2003, Lund University Innovation (LUI) was formed to further encourage staff members to commercially exploit their knowledge as it was determined that university research and resulting ventures should generate funds to strengthen education and research.

NYU, in cooperation with other regional universities, city business leaders, and city and state government officials launched and sustained a range of entrepreneurial structures, activities and support services. In many instances these were motivated by university leaders in other instances they were motivated by city and state government leaders and included the Berkley Center for Entrepreneurship and Innovation at the Stern School of Business, the NYU Poly Tech Incubator, and NYU's office of industrial liaison (OIL). As NYU implemented university-wide policies to increase its commercialization footprint, an important challenge was networking and coordinating across all the relevant entities. In response to this challenge the University founded The Mark and Debra Leslie Entrepreneurs Lab in 2013 to facilitate university and city-wide collaboration and coordination of a range of entrepreneurial structures and initiatives.

UT-Austin launched The Austin Technology Incubator (ATI) in 1989 only after receiving assurances of financial and other support from the City of Austin, the Greater Austin Chamber of Commerce, and county government. In addition, ATI was able to build a regional 'know how network' of IP lawyers and business professionals who agreed to donate time to mentor the incubator's entrepreneurs and a Texas Capital Network was formed to provide financial support for ATI's resident and graduated companies. In short, an entrepreneur support system was constructed to assist ATI's entrepreneurs launch and scale their companies. UT-Austin's Office of Technology Licensing (OTL) was launched in 1991 and was staffed with lawyers who largely focused their efforts on "protecting" UT-Austin IP. In 2003 the office was renamed the Office of Technology Commercialization (OTC) with an emphasis on technology marketing and licensing. Since 2011 OTC has organized a university-wide Commercialization Series and an Inventor of the Year award to celebrate outstanding faculty who exemplify the link between excellent research, technology transfer, and commercialization. During 2010-2017 an "entrepreneurial fever" spread across UT-Austin as different colleges launched their own entrepreneurial courses, competitions, and business incubation activities. However, as in the NYU case, an important ongoing challenge of establishing such a broad range of entrepreneurial support activities across the university and within a dynamic city environment is establishing effective collaboration and coordination to maximize associated benefits to the academy, entrepreneurs, and the surrounding region.

3. CONCLUSION

In our analysis of the significance of the five architecture dimensions on the entrepreneurial turn of each of ten universities, we considered the number of faculty and students and size of research budgets and whether the university was a rel-

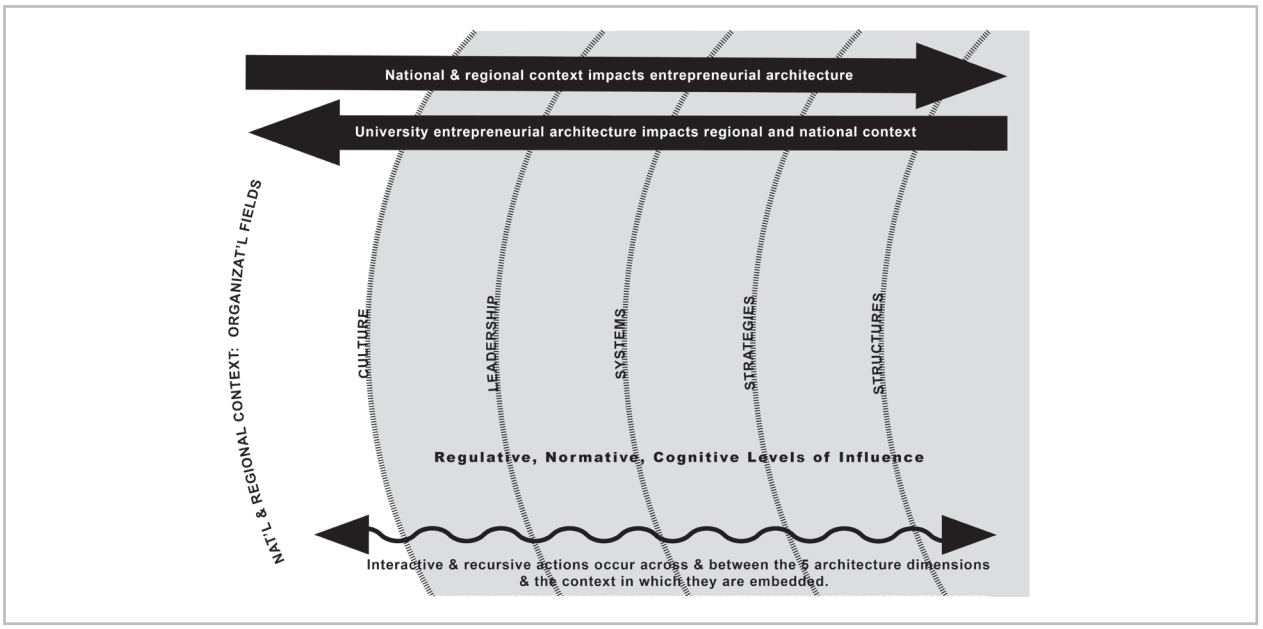

Fig. 2. Interactive and recursive actions occur across the five architecture dimensions and the three pillars of influence as well as the context in which they are embedded.

Source: Foss and Gibson (2015), p. 271.

atively new institution or located in a large city or rural area. While no meaningful patterns emerged it was clear that an analysis each architecture dimension helped us understand the entrepreneurial turn at each university in terms of *How universities interact with their institutional context in developing entrepreneurially and what actors and forces are most important in motivating institutional change in developing a university's entrepreneurial architecture?*

One main conclusion that is supported by all ten case narratives is the importance and impact of the regional and national context in which the university was embedded concerning the launch, development, and sustainability of programs and activities supporting the entrepreneurial turn. In this regard, we are in strong agreement with Nelles and Vorley (2010b) concerning the importance of regional and national context on how and at what speed a university employs a entrepreneurial architecture. As institutionalists stress the continuing impact of the old on the new, all the case narratives provided examples where new entrepreneurial strategies and programs entered into existing contexts to which they had to adjust and which supported or inhibited the entrepreneurial turn. A second major conclusion is that all the case narratives had examples of where institutional change was initiated "top down" and "bottom-up" by formal and informal leaders and actions. In some cases change was catalysed by national policy while other cases emphasized the importance of regional influencers. However, even in the cases which emphasized university autonomy a national law or environmental jolt was an important motivator for university change toward the entrepreneurial turn.

From our cross-case analyses, the general picture emerges that there are different ways to accomplish an entrepreneurial mission and that each architecture dimension may be employed in different ways and strengths. However, in all cases, there is general agreement that the dimensions were relevant to the entrepreneurial turn of the academy and regional actors. While context is seen to be an overarching determinant, we suggest the importance of recognizing a hierarchy of influence across the five architecture dimensions where culture is seen to be a dominant force that strongly influences the regulative pillar as well as the norms and cognitive orientations of leaders (influences) who are critical to the implementation of successful and sustainable entrepreneurial systems, strategies, and structures. However, it is well recognized that there were important recursive and interactive loops across all the architecture dimensions, Figure 2. Accordingly we suggest that building "structure" first --- without considering and involving university and regional leaders, systems, and strategies --- is not the most effective or efficient way to motivate the entre-

preneurial turn. Our proposition is that the development and operation of such structures benefits by being aware of the influence of existing attitudes towards entrepreneurship at key levels or sectors within the university as well as the region in which the structure is embedded. Worldwide, there are countless examples of top down government planned and funded structures (e.g., science parks, incubators, research canters) built as a visible and important commitment to a creative and innovative economy that, in the end, do not contribute to entrepreneurship in a meaningful and sustainable manner or to the creation of wealth, jobs, and new technology sectors.

At the national level there is also a challenge of how best to structure policy to fund innovative research and entrepreneurial capacity building that recognizes and rewards established excellence as well as newer institutions or academic areas that do not have well recognized research traditions. On the one hand, newer universities have an important role to play in catalysing an entrepreneurial culture and activity of a region. On the other hand, older research universities often benefit from established research excellence and a more distinguished track record of publications and winning competitive financial awards. Additionally, the financial impact of knowledge transfer from universities is seen to vary with regional context. Even within one university, there are important professional and cultural differences across and within colleges and research units in addition to levels of authority among faculty and administrators and students who pursue the entrepreneurial turn. In conclusion, we suggest that policy makers at national and regional levels would benefit from recognizing that there is no "one best way" or "set of best practices" to legislate an entrepreneurial economy and that policy directed at "the university" is often interpreted and employed differently across and within university colleges and departments. Different universities have different orientations to the entrepreneurial architecture dimensions that reflects the context in which they are embedded. Developing entrepreneurially is a complex endeavour crossing levels of influence and control while being strongly influenced by broader institutional and organizational environments.

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