Constructing an Entrepreneurial Architecture: An Emergent Framework for Studying the Contemporary University Beyond the Entrepreneurial Turn

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Abstract Universities are engines of the knowledge-based economy, both as sites of knowledge production and exploitation. Over the past two decades a "Third Mission" for universities has been articulated, alongside teaching and research; and this third mission is understood as commercial engagement. While growing literatures on the entrepreneurial university and university entrepreneurship have emerged, they are broadly conceptualized and overly fragmented. In this article we advance the concept of entrepreneurial architecture as an analytical framework to understand the organizational dynamics of the contemporary university and fuse two dominant discourses on the entrepreneurial evolution of higher education. We offer a pragmatic approach for institutions to respond to the challenges of the Third Mission.

Key words third mission · entrepreneurial architecture · higher education policy

It is well documented and understood that universities are in an era of transition (Etzkowitz et al. 2000). No longer are universities simply teaching and research institutions; they are now increasingly expected and even sometimes required to engage formally with the

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economy and society. Shifting policy imperatives towards externally-oriented engagement have served as a catalyst for institutional change that is redefining or perhaps has already redefined the traditional role of universities. In addition to the core missions of teaching and research, the newly emphasized and frequently commercially-oriented activities are now framed as what is called a new Third Mission[1] (see Etzkowitz 1997; Laredo 2007; Mollas-Gallart et al. 2002). In broadest terms this mission is defined as everything that is not traditional teaching and research (Jongbloed et al. 2008) while elsewhere this term has been more narrowly conceived in terms of knowledge and technology transfer (Hackett and Dilts 2004). In both instances the commercial engagement of universities has become a cornerstone of national and regional innovation policies. In light of evolving political and social situations as well as institutional contexts, we must seek to understand through academic debate the dynamics of these newly emphasized economic and social roles.

The existing literature on the evolving roles of higher education institutions addresses normative questions of policy and the contemporary university by considering this entrepreneurial agenda and institutional adaptation in different contexts (Goldstein 2008; Powers 2003). This literature is divided in its focus on micro studies of university entrepreneurship and macro studies of the entrepreneurial university, but both foci consider different aspects of the same central question. Namely, how do universities address and adapt to the challenges of the entrepreneurial turn in higher education policy, which exerts pressure to increase social and economic engagement outside of the academy? While there are some notable exceptions (i.e., Debackere and Veugelers 2005; Jacob et al. 2003), few contributions have attempted to establish a theoretical approach to conceptualize how universities can respond effectively to entrepreneurial imperatives. Consequently, there is a need to present a more theoretically grounded framework to inform policy design, to understand the broader implications of increasing socio-economic engagement, and to structure institutional responses.

To address this gap in the literature and to explain the dynamics and determinants of the entrepreneurial university, we introduce in this article the concept of "entrepreneurial architecture," adapted from the literature on corporate entrepreneurship (Burns 2005), as a lens through which this expanded mission of universities can be better understood. The metaphor of "entrepreneurial architecture" refers to the collection of internal factors that interact to shape entrepreneurial agendas within universities. In this framework these diverse, internal factors are classified in five categories: structures, strategies, systems, leadership, and culture. The core argument of the entrepreneurial architecture approach is that successful implementation of the Third Mission requires development and coordination across all five categories and the integration (rather than separation) of the entrepreneurial mission into teaching and research activities. As a theoretical and analytical approach, entrepreneurial architecture provides a framework capable of bridging differences expressed in the existing literature so as to establish a more comprehensive and nuanced understanding of the Third Mission in contemporary universities. Thus, the concept of entrepreneurial architecture offers a comprehensive, unifying but non-deterministic

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[1] The term 'Third Mission' is predominantly used in an Anglo-European context to refer to the socio-economic role of universities. In the U.S. the third mission of the university, after teaching and research, is regarded to be service provision (MacLabhrainn 2004) while the fourth mission, stemming from the Bayh-Dole's, emphasises realising maximum socio-economic benefit from government-funded research (Henderson and Smith 2002). While the missions do not map directly, the Anglo-European interpretation of the Third Mission can be seen to include those activities classified under the third and fourth mission in US universities. The remainder of this discussion is framed in a U.K. context, and the term Third Mission used to identify their socio-economic role.

approach that embraces the diversity of higher education institutions as they address the expanded mission of entrepreneurial activity.

We present our explanation in two parts. While the concept of entrepreneurial architecture is the principal contribution of this article, in the first section we situate this concept by outlining the burgeoning literature on the contemporary university and the concept of entrepreneurship. We begin by identifying the apparent disjuncture between the entrepreneurial university and university entrepreneurship, characterized by abstract models or caricatures of the contemporary university on the one hand and a series of institutional case studies and best practice on the other. This section concludes by exploring two notable exceptions to this pattern, which assume a broader perspective in their interpretation of the entrepreneurial agenda and how it has affected the contemporary university. In the second part we focus more explicitly on entrepreneurial architecture and the rationale for the concept as a response to the gap in the existing literature. We outline a theoretical framework and detail how this approach can be of use to university administrators and policy makers. While based on empirical research, the focus of this article is primarily theoretical. Our purpose is to develop the concept of entrepreneurial architecture both as a conceptual framework and as a pragmatic approach to understand the evolving dynamics of the Third Mission. We conclude by identifying the merit of entrepreneurial architecture as a unified framework for analyzing the dynamics of the entrepreneurial turn in contemporary universities. Moreover entrepreneurial architecture provides institutions and policy makers alike with an adaptive, non-prescriptive approach to develop and appraise the Third Mission.

Before Entrepreneurial Architecture

The literature to which we seek to contribute has grown exponentially over the past quarter of a century. We earlier made reference to the literatures on the "entrepreneurial university" and "university entrepreneurship" in order to differentiate crudely between distinct but not disparate aspects of the same literature. Much of the scholarship on the entrepreneurial university identifies models of the university and its transformation while the literature on university entrepreneurship focuses on institutional practice and performance. We now provide an overview of this literature as background for understanding the concept of entrepreneurial architecture and identify the limited work that has sought to bridge the divide in the literature to which entrepreneurial architecture seeks to contribute.

Inspecting the Conceptual Foundations

The "entrepreneurial turn" in universities has deeply seated roots. Clark Kerr's (1963) reference to the "multiversity" during the 1960s seminally demonstrated how universities had evolved to meet the changing demands of society, both economically and culturally. Kerr regarded the institutional change towards embracing an increasingly entrepreneurial role as "an imperative rather than a reasoned choice" (1963, p.37); and, while public policy is driving the entrepreneurial turn, it is being implemented at the institutional level. The existing literature is characterized by its diversity in the study of this new imperative to increase socio-economic engagement, Our aim, however, is not to provide a comprehensive review of that body of literature, but rather to establish an overview of the variety of perspectives on the institutional effects of the promotion of the Third Mission within universities.

The concept of the "entrepreneurial university" was first introduced by Etzkowitz (1983) and Clark (1983), and their work is widely recognised as pioneering in the description of the

changing form of the contemporary university. Indeed, so significant is the entrepreneurial transition that Webster and Etzkowitz (1991) identified the dawn of the entrepreneurial university as marking a second academic revolution, which introduced the market into the heart of the university, a trend that Etzkowitz et al. (2000), considered, as had Kerr (1963), to be the unavoidable model for the university of the future. The comparison of the introduction of a third mission of socio-economic engagement to the first academic revolution that transformed universities from purely instructional to educational and research performing institutions highlights the significance of this era of university evolution. For Etzkowitz et al. (2000) the entrepreneurial university marked a new ideological contract between universities and the state and society that is observable worldwide although Etzkowitz (2002) admitted that the concept of the entrepreneurial university is based on a convenient rather than a representative sample of universities.

There are several other conceptualizations of the growing role of the market and entrepreneurship in contemporary universities. Slaughter and Leslie (1997) referred to "Academic Capitalism" to describe the market and market-like behaviour of universities; but in their studies of British, United States, Australian, and Canadian universities they recognized that not all disciplines or indeed universities were, or in fact could be, market-oriented and so did not benefit equally from this capitalist turn. There is some disagreement in the literature as to whether or not the Third Mission adversely affects teaching and research (Leys 2000) although elsewhere the Third Mission is perceived as facilitating the institutional development of other components of university missions (Vorley and Nelles 2008a). Extending the emphasis given to market and market-like behaviour, Aronowitz's (2000) model of the "Corporate University" identified profit as a motivating factor, whereby teaching and research that do not yield any commercial value are viewed with indifference. This bears some similarity to Academic Capitalism although the Corporate University model is founded on fundraising and private partnerships (Walton 2005). Like the other models presented here, Marginson and Considine's (2000) "Enterprise University" recognised the commercial engagement of universities in a mixed public and private context; and they contended that the Enterprise University defines a "new orthodoxy that favours business values and income generation" (Marginson and Considine 2000, p. 370). Central to the Enterprise University is a new tier of commercial management, which Marginson and Considine (2000) argued is characterised by a stronger executive (non-academic) culture of control.

These models identify the increasingly important (socio)economic roles played by universities. However, while each model makes claims about the form of the university, they provide only generalized accounts developed from the aggregated histories of the institutions studied. Thus, while compelling in many respects, these models have been described as generic abstractions (Tuunainen 2005) or caricatured descriptions of contemporary universities (Seerano-Velarde 2007); and the degree to which they can be universally applied has been questioned. While the above studies have been criticized as empirically undeveloped (Tuunainen 2005) and ill-defined (Armbruster 2008), the other aspect of the literature, which we have identified as university entrepreneurship, has focused on empirical studies. We now present a broad overview of this burgeoning field.

In their taxonomy of the literature on university entrepreneurship and the evolution of the entrepreneurial university, Rothaermel et al. (2007) intentionally defined university entrepreneurship broadly to include any entrepreneurial activities in which a university could be involved. They identified 173 articles published between 1981 and 2005 and categorized them into four related research streams: (a) entrepreneurial research university; (b) productivity of technology transfer offices; (c) new firm creation; and (d) environmental

context including networks of innovation. These streams, or themes, are presented in Fig. 1 as a system of innovation.

In contrast to the models outlined above, much of the literature on university entre- preneurship assumes an institutional focus in understanding how the organization and performance of universities has addressed and adapted to the challenges of the entrepreneurial turn. Rothaermel et al. (2007) identified many studies that addressed the impact of organizational design on university entrepreneurship. These studies focused on incentive systems, university status, location, culture, administrators, research focus, technology transfer experience, and the role of the university in the regional economy. With regard to Third Mission performance, other studies have sought to identify and measure the impact of formal knowledge transfer programs, cooperative research agreements with industry, research support, licensing, marketing activities, quality of commercialization (licences, patents), involvement in joint research ventures, and the existence of incubators and science parks (see Mollas-Gallart et al. 2002; PACEC 2009; Siegel et al. 2003). Collectively this literature provides a comprehensive portrait of the entrepreneurial aspects of contemporary universities and aptly illustrates the system of entrepreneurial innovation described by Rothaermel et al. (2007).

In this transitional era of university evolution, scholarly efforts have focused on documenting models of the entrepreneurial university and university entrepreneurship conceptualizing the entrepreneurial turn. While the existing literature on the entrepreneurial
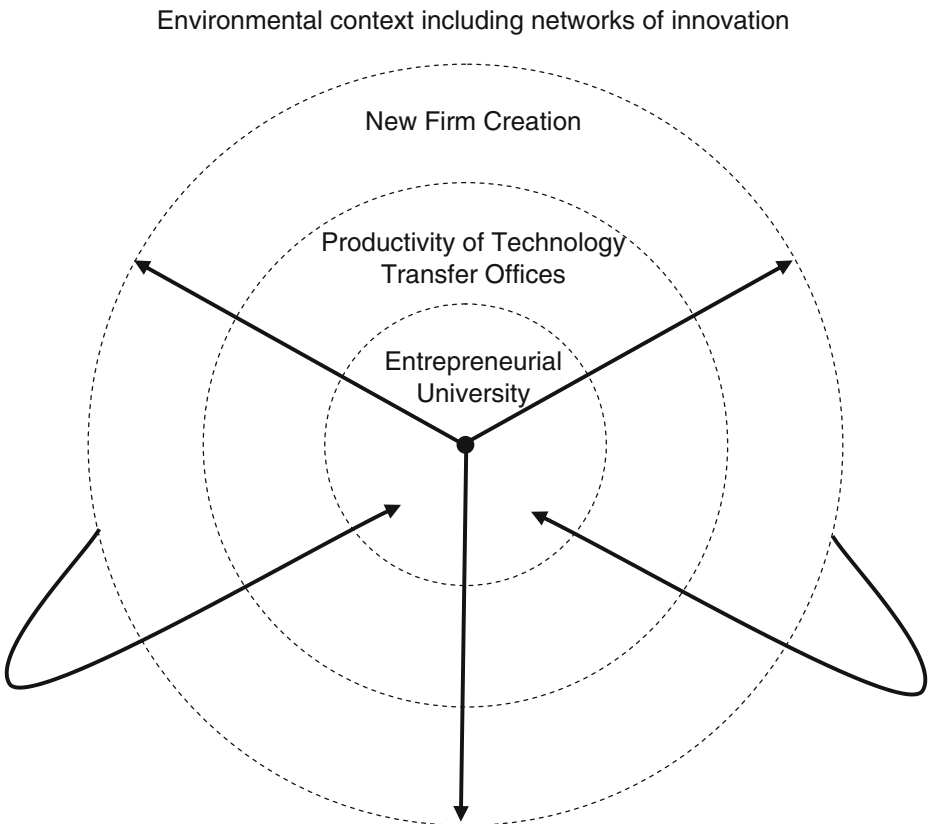
Fig. 1 Conceptual framework of university entrepreneurship. (Rothaermel et al. 2007: 17)

university has been critiqued as fuzzy and deterministic and the literature on university entrepreneurship critiqued on account of its micro analytical focus, the literature outlined in this section does provide a cursory and partial understanding of the contemporary university and its entrepreneurial transformation. However, it does not offer a theoretical grounding of the entrepreneurial transformation occurring within universities. This gap in the literature, summarized below, is one which the concept of entrepreneurial architecture attempts to fill. This stage in the evolution of the literature is understandable when considering the assertion of Aldrich and Baker (1997) that it is in a chaotic pre-paradigmatic phase (Armbruster 2008; Guenther and Wagner 2008) or that of Rothaermel et al. (2007) some ten years later, who stated that the literature is still largely atheoretical. It is this challenge that in part provides the rationale for the article.

Challenging the Structural Integrity of the Entrepreneurial University

As is generally the case in new and emergent fields, formative discussion occurs; and we argue that current debates on the entrepreneurial university and university entrepreneurship lack a substantive theoretical foundation documenting the transformation of universities and focusing on practice (Clark 2001). While the second part of this article advances entrepreneurial architecture as the conceptual and theoretical bridge to reconcile this seemingly fragmented literature, there are two noteworthy contributions that offer a broader perspective on the entrepreneurial turn and merit discussion. Jacob et al. (2003) survey of the entrepreneurial transformation in Swedish Universities and Debackere and Veugelers' (2005) investigation of the factors that affect industry science links stand out in that that they explore a range of factors that affect success in adopting and adapting to the Third Mission. Both studies identified organizational inertia and inflexibility as barriers to the implementation of Third Mission activities, even in contexts of significant university autonomy and generous public support. This observation justifies an examination of the dynamics at play *within* universities as they approach the Third Mission. What is also significant is that both articles' critiqued structural approaches to understanding these dynamics, attempted to engage with a broader range of variables than appears in the literature reviewed in the previous section, and represented an effort to construct a more holistic approach to understanding the evolution of the entrepreneurial university. Outlining these contributions provides the basis for introducing the concept of entrepreneurial architecture as a means of theorizing the entrepreneurial turn by consolidating and extending underlying principles of entrepreneurial evolution.

In their case study of Chalmers University of Technology, Jacob et al. (2003) argued that the success of science-based entrepreneurship policies aimed at universities were dependent on the effectiveness of institutional implementation of policy priorities more than the design of the policies themselves. Indeed at the institutional level Jacob et al. (2003) identified resistance of and barriers to the entrepreneurial turn at Chalmers University. These factors included a lack of academic awareness and interest, an unclear commercialization infrastructure, a deficiency of entrepreneurial champions and leadership, and the absence of an entrepreneurial culture within the university. These observations highlight the utility of theorizing the institutional adaptation and appropriation of the Third Mission. While Jacob et al. (2003) advocated a more holistic approach, what they mean by that is not clearly defined. They recognised the significance of a coordinated Third Mission infrastructure and strategy to overcome organizational inertia; however, institutional culture and leadership are treated only residually in their work. Arguably the residual importance of

institutional culture undermines the ability of Jacob et al. (2003) to present the holistic approach they claim after identifying culture and leadership as barriers to realising the entrepreneurial turn.

The other comprehensive account of the evolution of the entrepreneurial university is Debackere and Veugelers' (2005) framework, which they employed to analyze the effectiveness of university-based technology transfer systems. In this account an effective technology transfer system is facilitated by a central support office and assumes a decentralized approach whereby engagement in Third Mission activities is led by departments, research groups, and individuals with institutional incentives to stimulate participation in entrepreneurial activities. Through their analysis of industry science links at Katholieke Universiteit Leuven, the Netherlands, Debackere and Veugelers (2005) developed a methodological framework consisting of structures, processes, and contexts. In one sense the article is seminal, marking a turning point in the conceptualization of the contemporary university by highlighting the complex interplay of institutional dynamics that shape responses to the imperatives of the Third Mission coupled with an empirical case.

The sample of European research universities and the case of Katholieke Universiteit Leuven highlights the dynamism of linkages between universities and industry. However the discussion of the methodological framework is somewhat fuzzy in defining the nature of structure, process, and context; and the connections among them remain underdeveloped. Given the narrow focus on technology transfer in terms of industry science links and technology transfer offices as the primary facilitating structure, their analysis overlooked the wide variety of third stream activities mediated through other structures. Moreover, the focus on technology transfer offices obscures the importance of context and other processes that contribute to university entrepreneurship. This restricted focus limits the generalizability of the concept to the Third Mission as more broadly conceived. Indeed, although we do not refute the basis of the framework proposed by Debackere and Veugelers (2005), we argue that it is necessary to deconstruct and extend it further, which we address through the concept of entrepreneurial architecture.

In summary, the existing literature on the entrepreneurial evolution of the contemporary university consists largely of either empirical studies or organizational models. The contributions of Jacob et al. (2003) and Debackere and Veugelers (2005), however, have begun to move beyond the entrepreneurial university/university entrepreneurship binary described above. Bridging this polarized literature demands a more nuanced approach that is less contextual and contingent. We now introduce the concept of entrepreneurial architecture to extend these seminal contributions by advancing a flexible and pragmatic approach and theoretical framework to understand how universities can and have addressed and adapted to the challenges of the entrepreneurial turn inherently a part of the Third Mission.

Presenting the Concept of Entrepreneurial Architecture

As previously explained, the exponential growth of research on the contemporary university has seen the literature about the entrepreneurial turn coalesce into two dominant approaches. However, this literature can still be characterized as "pre-paradigmatic" and lacking consensus on how the entrepreneurial pressures of public policy play out within the institutions of the academy (Aldrich and Baker 1997). What follows is a focused account that serves as a unified basis for a theoretical discussion about the organization and performance of the Third Mission.

Foundations of Entrepreneurial Architecture

The term "entrepreneurial architecture" was coined by Burns (2005) as an organizational framework for understanding entrepreneurship in a corporate context. The term can be defined generally as the institutional, communication, coordination, and cultural factors internal to an organization oriented towards innovation. The principal value of the architectural metaphor is that it emphasizes the elements of institutional design that enable the effective functioning of an internal structure. In this context, architecture establishes routines and norms that influence individuals to behave as conceptualized by the designers. Thus, an entrepreneurial architecture provides the structures and conduits through which knowledge and innovation can profitably flow to other actors and the market (Kay 1993). Although the term was introduced in the corporate literature, the framework it offers is useful for exploring organizational entrepreneurship in the context of institutions of higher education. In both instances the framework addressed the challenges of encouraging and leveraging entrepreneurship within innovative organizations. It fits with the goal of contemporary universities, which are attempting to encourage entrepreneurship and enterprise in order to realize the potential and the value of the research base. Both firms and universities are under pressure to respond quickly to change and the opportunity to build competitive advantage and secure investment, and both need a functional architecture (structures and processes) in order to manage these goals effectively.

In this article we develop the conceptual foundations of entrepreneurial architecture articulated by Burns (2005) in an academic context, with our conceptualization based upon two projects—one examining English universities and the other examining European universities (Vorley and Nelles 2008b, November). While distinct projects, both are focused on the entrepreneurial turn that has increasingly demanded universities to assume a greater socio-economic role. With comparable research designs, both combine surveys and semi-structured interviews with senior university academic and administrative staff members who have responsibility for managing and/or directing third stream activities. The first study of 33 English universities was a regionally representative sample of universities initially focused on the Third Mission and specifically on the role of technology transfer offices. However, our research demonstrated that, while technology transfer offices have often represented the structural foundation of the Third Mission within universities, they are neither the only nor the most important internal determinant of Third Mission performance. The Third Mission, facilitated by public policy, has almost come to be normalized in universities in the United Kingdom; however, the experience in European universities is more varied. The second ongoing study[2] examines 15 universities in two European countries (France and Germany) and began with a broader perspective on the entrepreneurial function of universities by examining the organization of non-teaching, non-research based activities. The results again demonstrated the scope of the Third Mission to extend beyond technology transfer offices into other areas of the university, again highlighting the need to understand the development and consolidation of the Third Mission as more than just structural change.

Building an Entrepreneurial Architecture

Entrepreneurial architecture consists of five institutional elements: structures, strategies, systems, leadership, and culture. Presenting the framework as architecture serves to

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[2] This research project, entitled *Entrepreneurial Architectures: Reconceptualising Higher Education's New Mission in Europe*, was funded through a British Academy Small Research Grant, and it is scheduled to be completed in June 2010.

emphasize the interdependence of the variables, and we argue that the successful implementation of the Third Mission demands a synthesis of all five factors. Doing so can appropriately inform management practices and public policy.

These five elements are mutually supportive, and the absence of one aspect may contribute to weakness in the evolution and implementation of the Third Mission. Alternatively the prioritization or over-development of one aspect of the entrepreneurial architecture at the expense of the others may create an imbalance that could undermine the effectiveness of third stream activities or the Third Mission entirely. A coherent entrepreneurial architecture is imperative if universities are to realise their third stream goals since the architecture defines the entrepreneurial capacity of the institution.

The adoption of entrepreneurial architecture to the academic context is an innovation in this literature on university entrepreneurship; in essence it is merely a tool to structure and re-conceptualize the wide variety of variables that other scholars have proposed as critical to the success of the Third Mission.

The Five Elements of Entrepreneurial Architecture

Many of the variables assessed in recent articles on technology transfer and entrepreneurial universities can be classified under one or more of the five elements of entrepreneurial architecture—structures, strategies, systems, leadership, and culture (see Table I). Building on the existing literature the innovative and novel contribution of entrepreneurial

Table I Elements of Entrepreneurial Architecture: Defined and Identified

Entrepreneurial element	Defined as:	Referenced in existing literature by:
Structures	entrepreneurial infrastructure including TTOs, incubators, tech parks, business portals, etc.	Del Campo et al. (1999); Collins and Wakoh (2000); Friedman and Silberman (2003); Owen-Smith and Powell (2003); Powers and McDougall (2005); Siegel et al. (2003, 2004)
Systems	networks of communication and the configuration of linkages between structures and departments, admin, etc.	Bercovitz et al. (2001); Etzkowitz and Klofsten (2005); Powers and McDougall (2005); Siegel et al. (2003, 2004); Wright et al. (2004)
Strategies	institutional goals elaborated in planning documents; includes internally determined formal incentive structures	Del Campo et al. (1999); Henrekson and Rosenberg (2001); Jensen et al. (2003); Markman et al. (2004); Owen-Smith and Powell (2003); Powers and McDougall (2005); Schmiemann and Durvy (2003); Siegel et al. (2003, 2004); Thursby and Kemp (2002); Thursby and Thursby (2004); Wright et al. (2004)
Leadership	qualification and orientation of key leaders (administration, board of directors, department heads, star 'scientists') towards the Third Mission	Clark 2001; Siegel et al. (2004)
Culture	institutional, departmental and individual attitudes and norms towards the third stream	Clark 2001; Jacob et al. (2003); Kenney and Goe (2004); Kruecken 2003; Siegel et al. (2003, 2004)

architecture as it is presented here is in its holistic approach towards understanding these five categorical elements and their inter-relationship. The central tenant of this approach is that *all five* elements and their interaction with one another are equally salient to the entrepreneurial success of high education institutions. Consequently, no one element is more important than the others. This section discusses these five elements in turn beginning with those most frequently associated with entrepreneurial success in the literature on university entrepreneurship and the entrepreneurial university.

Structures

Structures in an entrepreneurial architecture are the formal offices or departments involved in knowledge exchange. The most common such structure or unit is the technology transfer office. However, there are other entrepreneurial structures such as technology parks, incubators, industrial liaison offices, departments of continuing education and professional development, and collaboratively administered programs. The effects of the design, experience, and strategies of knowledge exchange structures and the search for best practices are discussed in the literature on the entrepreneurial university (see Collins and Wakoh 2000; Del Campo et al. 1999; Friedman and Silberman 2003). As the most visible element of the Third Mission, the focus on structures is not surprising. In the context of the Third Mission many accounts of the contemporary university have overemphasized the significance of structures. For example, Feldman et al. (2002) explained how technology transfer offices have been created as a response to the new mission of contemporary universities and have since come to embody the Third Mission both in practice and in the literature. This emphasis can in part be understood since establishing structures to focus and channel entrepreneurial activity is an obvious first step towards enabling socio-economic engagement. It is a visible signal of entrepreneurial intention. However, these structures can be weakly supported and viewed as an end rather than as the beginning of entrepreneurial development. Recent scholarship recognises that the effectiveness of structures is at least partially conditioned by other internal factors such as leadership and culture (Debackere and Veugelers 2005; Jacob et al. 2003; Siegel et al. 2003, 2004). The entrepreneurial architecture framework challenges the assumption that the Third Mission needs to be conceived as the outcome of structural changes. Rather, it emphasizes the importance of structures embedded in coordinated systems guided by visionary leaders as agents of a coherent entrepreneurial strategy and within an environment that supports and sustains innovation. In other words, it stresses an approach to institutional change that is explicitly conscious of the potential to steer organizational development more effectively through an understanding of the dynamics beyond the most obvious structural manipulations. Entrepreneurial structures are important interfaces among researchers, administrators, and the market. Entrepreneurial *capacity*, however, is a product of individual innovation encouraged through the positive interplay among all the elements of institutional architecture.

Systems

While structures are clearly important to the enterprise of knowledge exchange, their effectiveness in terms of entrepreneurial architecture is partly determined by their capacity to engage with and relate to other structures and other elements of the entrepreneurial architecture (Bercovitz et al. 2001; Etzkowitz and Klofsten 2005; Siegel et al. 2003, 2004). Systems are made up of these networks of communication and coordination but also describe norms of interaction between researchers and entrepreneurial structures as well as the relationships among teaching, research, and entrepreneurial activities. These systems

determine how information is transmitted between and among those persons involved in knowledge exchange. As a result, internal systems are critical measures of how embedded Third Mission structures are in the institutional environment. For instance, the degree to which third stream structures, such as technology transfer offices, operate as departments as opposed to isolated and administratively separated organizations is as much a function of their institutional design as their integration into systems of coordination. Bercovitz et al. (2001) argued that decentralized configurations of technology transfer operations are more effective than centralized configurations. However, while the organizational configuration of structures as elements of entrepreneurial architecture is a factor, the conceptual framework emphasises the *embeddedness* and dense networks of those engaged in the Third Mission, irrespective of structural form.

Leadership

Structures and systems are established by institutional leadership at different levels, from that of individual research groups to department and faculties to the university itself. Leadership relates both to the key personnel who shape and alter structures and processes and to the strategic vision that guides organizational evolution. The concept of leadership can also be extended to encompass strategic goals within individual units of the organization, which is sometimes conceptualized as a "strengthened steering core" (Clark 2001). Although leaders are most effective when positioned in key coordinating offices (eg. vice president for research), they do not necessarily have to be located in the central administration of the university and may include faculty and research staff.

Important leaders of Third Mission agendas can be found within departmental leadership and within the faculty, with star scientists leading new forms of third stream engagement (Zucker and Darby 2001). The Third Mission requires internal coordination that is heavily dependent on the initiative and agency of strong individuals such as star faculty members who provide examples to others and can lobby administrators for support or governing boards or departments that are intent on encouraging the Third Mission. These are the *architects*. To a certain degree this involves establishing a coherent institutional strategy but also relies on the ability of leaders to drive and guide the development of the Third Mission. Therefore, leadership for entrepreneurial architecture is both a function of the entrepreneurial orientation and capacity of leaders within various branches of the university.

Strategies

An entrepreneurial strategy is most frequently outlined in corporate plans, often consisting of a list of Third Mission objectives although may also include prescriptions as to how these goals should be achieved. Mechanisms such as internally determined incentives for faculty members and departments engaged in the third stream are a part of the entrepreneurial strategy of the institution (Henrekson and Rosenberg 2001; Markman et al. 2004; Powers and McDougall 2005). The reciprocity of the elements of entrepreneurial architecture is evident in the way that leadership informs the development of Third Mission strategies, where the outcomes will be closely tied to the effectiveness of leaders' visions and their capacity to achieve goals by changing or establishing systems and structures. Strategies must be both sensitive and specific to institutional contexts and conditions. It is therefore critical that those persons implementing these strategies understand, adapt, and respond to specific institutional contexts rather than simply copying the approaches of other institutions.

Culture

Finally, organizational culture is a critical determinant of third stream activities (Clark 2001; Jacob et al. 2003; Siegel et al. 2003). It informs institutional design and strategic orientation and determines collective attitudes towards the Third Mission. Culture also reflects the attitudes of individuals within the organization, the value they place on innovation, and their propensity for entrepreneurial engagement. Evolving attitudes and shifting norms affect organizational strategies and shape the goals of university leadership, again highlighting the reciprocity between elements of the entrepreneurial architecture. Conversely, dominant cultures evident within disciplines and institutions may counteract strategic and structural attempts to institute or encourage the third stream. While established cultures can be difficult to alter or overcome, if their effects on entrepreneurial capacity remain unacknowledged, these can act as a barrier to advancing the Third Mission. An increasing number of studies now highlight the importance of a strong entrepreneurial culture within universities (Bramwell and Wolfe 2008; O'Shea et al. 2007), but very little research explores the sources or the evolution of desirable cultures in academic institutions. What kinds of administrative interventions are most effective in encouraging entrepreneurial behaviour? Do incentive systems stimulate *cultural* change, or simply opportunism? How can entrepreneurial norms be culturally embedded? Does entrepreneurial culture vary between institutional types or between fields of research, and if so why? Considering these questions will be important to increasing our understanding of the role of institutional cultures and in determining how these cultures interact with other architectural elements in supporting the entrepreneurial agenda. In the future development of the entrepreneurial architecture framework these gaps in the literature will need to be addressed.

An Integrated Approach

Taken together these five elements—structures, systems, leadership, strategy, and culture—constitute the entrepreneurial architecture. Successful implementation of the Third Mission depends on the degree to which the entrepreneurial architecture is embedded and consolidated within contemporary universities. Elsewhere, we have contended that adopting this framework can help sort out which institutional changes in support of wider engagement are complementary or detrimental to the core mission of teaching and research (Vorley and Nelles 2008a). A determination of institutional effectiveness for the Third Mission needs to take into account broadly-defined and relatively objective measures of success—such as patents, licenses, research and consulting income, and it should also measure the embeddedness and effect of third stream activities on teaching and research. These latter measures are largely institutionally specific and reflective of the goals of university leadership in these areas, and they reinforce a central argument of entrepreneurial architecture: that it provides a conceptual framework to understand and approach university entrepreneurship which is sensitive to institutional context. This institutional specificity complicates theoretical development, but an analysis of the broad relationships among variables is possible.

Our preliminary empirical findings suggest that, not surprisingly, leadership and strategies tend to evolve together at the level of university structures. For instance, the intention to establish technology parks or industrial liaison offices is elaborated in steering documents, with the initiative of key individuals. However, the effectiveness of these structures is often highly influenced by factors that are only rarely discussed in the

development or assessment of official strategies, at least early on in the process of entrepreneurial intensification, such as systems. It stands to reason that the more effectively the structures can relate to one another and the more closely they relate to the institution's goals, the more effective they are. These relationships, however, are often slow to evolve. Furthermore, it is important to remember that successful engagement beyond the university might not be mediated, or measurable, through formal structures. Strategies tend to be more geared towards the structural dimension of the architecture and less attuned to individual or departmental behaviour, which is an element of cultural attitudes. This observation highlights another emerging dimension of entrepreneurial architecture, namely, how architectural dimensions interact at and across different scales within the university (i.e. institutional, departmental and individual).

Conclusion: Entrepreneurial by Design

The growing literature on the entrepreneurial university and university entrepreneurship as a whole is both extensive and rich in its contribution to our understanding of contemporary universities. Current debates are now addressing how universities have begun to adapt to the challenges of the entrepreneurial emphasis emerging in higher education policy. However, we argue it is missing an approach that unites the diversity of internal determinants of third stream success in contemporary universities within a single framework. Higher education policy and funding schemes are placing increasingly complex demands on universities to deliver a growing return on public investment in all missions of the institution. Consequently, administrators and policy-makers alike are interested in the question of how institutions can best respond to conflicting and ambiguous goals and exploit new opportunities (Pilbeam 2008). Maximizing the socio-economic contribution of universities demands an understanding of the factors that underpin institutional productivity *irrespective of context.* In other words, effective Third Mission policy and institutional design relies on establishing which internal, and therefore mutable, factors affect the effectiveness of socio-economic engagement regardless of institutional strength or environmental context. The principal strength of entrepreneurial architecture is that it is comprehensive and flexible and provides a practical and theoretical framework that can inform both institutional strategies and public policy.

Entrepreneurial architecture goes beyond Chandler's (1962) seminal thesis that structure follows strategy, incorporating a wider variety of interdependent elements such as leadership, culture, and systems of coordination. In exploring these variables and the relationships among them, the framework provides a basis to analyze, understand, and manage the Third Mission. Moreover 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 conditions 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 and political status of the university, or the legacies of different institutional priorities regarding teaching and research agendas.

As a pragmatic approach this model provides a framework for policy makers but not a set of rigid prescriptions. While the Third Mission has evolved in an ad-hoc fashion, with universities relying on the collective knowledge and experiences of peer institutions (Sampat and Nelson 1999), this kind of emulation or mimetic practices may culminate in standardization and impede the development of the Third Mission. In framing the collective

knowledge and experience of contemporary universities, entrepreneurial architecture emphasizes the need for universities to consolidate and embed the elements flexibly and with sensitivity to organizational context and strengths. The success of the Third Mission is dependent on recognizing the capabilities of universities and viewing them as central to developing the Third Mission rather than prescribing a standardized approach. A challenge shared by administrators and policy-makers alike is to maintain institutional autonomy while still encouraging creativity and innovative approaches to promoting the Third Mission such that universities in any context can profit from increased engagement. Entrepreneurial architecture offers just such a framework to assess and develop flexible entrepreneurial responses.

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