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The Entrepreneurial University and the Triple Helix as a Development Paradigm¹

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Introduction

The creation of an entrepreneurial university involves a cultural transformation of academia to play a more active role in society at several levels. Most fundamentally, it involves faculty viewing their research and teaching activities in a new light, seeing how they can contribute to economic and social development as well as to education of students and advancement of knowledge. Moreover, the university itself becomes an active leader and innovator in its region, taking the lead in organizing cooperative innovation projects with other local actors. Such a university, infused with entrepreneurial attitudes and capable of taking initiatives at all levels, among faculty, students and administrators, is properly characterized as an entrepreneurial university.

An entrepreneurial university is the generative principle in the development of a triple helix of university-industry-government. It takes a pro-active stance in putting knowledge to use and in broadening the input into the creation of academic knowledge. The university plays a key role in the reconstruction of relationships among government and industry, transforming the traditional dual bases of science and technology policy into a triadic interaction. . The enhanced role of the university in knowledge-based economic development can especially be seen at the regional level where it is active in several ways: providing “the knowledge space,” the resources for incubation of technology-based firms; “the consensus space,” providing leadership in creating collaborations with government and industry; and “the innovation space,” creation of new organizational formats.

¹ See www.triplehelix6.com for information on the international conference series on university -industry-government relations

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The entrepreneurial university is an emergent phenomenon that is a result of the working out of an “inner logic” of academic development that previously expanded the academic enterprise from a focus on teaching to research. Paradoxically, the ability to generate new ideas is rooted in the original purpose of the university, the conservation and dissemination of knowledge. Some of these changes are internal developments within the academy such as the development of the research group that has firm-like qualities. Thus, the Research University shares homologous qualities with a start-up firm even before it directly engages in entrepreneurial activities. This paper focuses on how the university has expanded its core functions from teaching and research to economic and social development, thereby taking a key role in the dynamics of innovation, as part of a triple helix of university-industry-government relations.

Innovation in Innovation

A triple helix regime typically begins as university, industry and government enter into a reciprocal relationship with each other in which each attempts to enhance the performance of the other. Most such initiatives take place at the regional level where gaps in industrial clusters, problems in technology transfer and lack of governmental capacity have hindered development. As a result government may agree to simplify regulatory processes for firm formation; universities may undertake to train more students in an area relevant to the local economy; firms may negotiate new supplier relationships with each other as an incipient cluster.

At this initial level of the triple helix, the three strands typically begin to interact in order to improve the local economy by enhancing the performance of existing industry.

The triple helix changes its spin as production of new knowledge and technology becomes more important. Enhancement of the performance of the university and other knowledge producing institutions becomes the key issue as part of a strategy to renew an older economy or create new economic activity on the basis of intellectual capital in one form or another, ranging from formal R&D in government, university and industrial laboratories to tacit knowledge emanating from existing industries.

Innovation is thus transformed from a relatively simple set of linear and reverse linear processes within industry, extending from research to the market and vice versa, to a non-linear process. Beyond the development of new products, innovation is the creation of new configurations among the institutional spheres. University- Industry-Government interactions are increasingly the basis of economic and social development strategy in both advanced industrial and developing societies. The transition to a “Triple Helix”, characterized by inter-dependence among relatively autonomous institutional spheres, takes place from divergent starting points of “statist” and “laissez-faire” regimes (Etzkowitz, 2005).

In some countries, there is a movement away from an assumption that there is single starting point of research and an end point of the economy: an autonomous linear model based on laissez-faire assumptions in which innovation takes its own course. In other countries in transition from a central planning to a market economy, a role for government was temporarily lost. It is increasingly recognized that government plays an important, if sometimes hidden, role in innovation in market economies and that government programs have an important role to play, not only from the national level – top down—but also from the local level—bottom-up, in a movement from a “hands off” linear to an “assisted linear” model of innovation.

The triple helix is an analytical and normative concept derived from the changing role of government in different societies in relation to academia and industry. Interaction among university-industry-government, as relatively independent, yet inter-dependent, institutional spheres is the key to improving the conditions for innovation in a knowledge-based society. A triple helix coordinated entirely by the state only provides a limited source of ideas and initiatives. Under these circumstances government may take initiatives without consulting others; indeed it may subsume the other institutional spheres and direct their activities. Although large projects may be accomplished it is not

the most productive form of triple helix relationships since ideas are coming only one source, the central government.

Conversely, if the state is absent from the innovation picture: coordination, regulation and funding necessary to encourage improvements may be insufficient. There is no single answer to finding an appropriate balance between intervention and non-intervention. However, the previous history of the role of the state in society will set some bounds and also determine whether it is most useful for the state to intervene directly or indirectly, acting through other institutional spheres. In statist societies direct intervention is expected while, under laissez-faire conditions, only indirect approaches may be possible

The triple helix model

The triple helix model comprises three basic elements (1) a more prominent role for the university in innovation, on a par with industry and government in a knowledge –based society; (2) a movement toward collaborative relationships among the three major institutional spheres in which innovation policy is increasingly an outcome of interaction rather than a prescription from government; (3) in addition to fulfilling their traditional functions, each institutional sphere also “takes the role of the other” operating on a y axis of their new role as well as an x axis of their traditional function. Institutions taking non-traditional roles are viewed as a major potential source of innovation in innovation.

Initially, industry operates in the Triple Helix as the locus of production; government as the source of contractual relations that guarantee stable interactions and exchange; the university as a source of new knowledge and technology, the generative principle of knowledge-based economies. The increased importance of knowledge and the role of the university in incubation of technology-based firms has given it a more prominent place in the institutional firmament. The entrepreneurial university takes a pro-active stance in putting knowledge to use and in broadening the input into the creation of academic knowledge. Thus it operates according to an interactive rather than a linear model of innovation. As firms raise their technological level, they move closer to an academic model, engaging in higher levels of training and in sharing of knowledge. Government

acts as a public entrepreneur and venture capitalist in addition to its traditional regulatory role in setting the rules of the game.

Universities, heretofore primarily seen as a source of human resources and knowledge, are now looked to for technology as well. Many universities have developed the internal organizational capabilities to formally transfer technologies rather than relying solely on informal ties. Universities are also extending their teaching capabilities from educating individuals to shaping organizations in entrepreneurial education and incubation programs. Rather than only serving as a source of new ideas for existing firms universities are combining their research and teaching capabilities in new formats to become a source of new firm formation, especially in advanced areas of science and technology.

Enterprises are constructed out of elements from all the relevant institutional spheres, not merely from industry itself. Universities increasingly become the source of regional economic development and academic institutions are re-oriented or founded for this purpose. New organizational mechanisms, such as incubators, science parks, and networks among them become a source of economic activity, community formation, and international exchange. New modes of interdisciplinary knowledge production, involving Triple Helix partners, inspire research collaboration and firm-formation projects.

The interaction between linear and reverse linear dynamics results in the emergence of an interactive model of innovation. Globalization becomes decentralized and takes place through regional networks among universities as well as through multi-national corporations and international organizations. As universities develop links, they can combine discrete pieces of intellectual property and jointly exploit them. These new configurations become the basis of a continuous process of firm-formation, diversification, and collaborations among competitors.

In current international competitive circumstances, innovation is too important to be left to the individual firm, or even a group of firms, the individual researcher or even a cross-

national collaboration of researchers. Innovation has expanded from an internal process within and even among firms to an activity that involves institutions not traditionally thought of as having a direct role in innovation such as universities.

Expansion of University Missions

Teaching	Research	Entrepreneurial
Preservation and dissemination of knowledge	1 st Academic Revolution	2 nd Academic Revolution
New missions generate conflict of interest controversies →	Two Missions: teaching and research	Third Mission: economic and social development; old missions continued

Academic Revolutions: The Transformation of the University

The university, originating as a medieval institution for the conservation and transmission of knowledge (Rashdall, 1896), has twice been radically transformed. The discovery of new knowledge became an academic goal during the late nineteenth century---the so-called 'academic revolution' (Jencks and Riesman, 1968). The translation of knowledge into economic activity has recently emerged as a recognized university function, alongside research and teaching---the second academic revolution.

In recent decades a broad range of universities, both private and public, have established one or more of the following mechanisms for academic-industrial relations: offices to manage patenting and licensing of technology, interdisciplinary research centers with industrial participation, research parks and incubator facilities. In addition, many schools have established procedures to manage potential conflicts of interest and commitment as faculty members play dual roles on both sides of the academic and industrial divides.

The first academic revolution created the necessary conditions for the second: a research tradition and an organizational model for research teams. The sufficient conditions for the second revolution have appeared as traditional academic entrepreneurialism, attracting research funds from external sources has been insufficient to support the academic research enterprise. On the one hand, the competition for research funds has intensified as more academic institutions attempt to become research universities. On the other, academic fields such as molecular biology produced technological and commercial possibilities even as technologies such as computers became academic fields and disciplines, as well.

Moreover, as companies sought external sources of R&D in response to increased international competition, universities became more salient to industry as R&D providers. Even though industry provides a relatively small proportion of academic research funds, it is significant because it represents an area of growth and its presence is now the prerequisite for attracting many kinds of government funds, offered in support of technological innovation and local economic development.

What is new in the present situation is that many academic scientists no longer believe in the necessity of an isolated 'ivory tower' to the working out of the logic of scientific discovery. Heretofore, in the hiatus between scientific discovery and application, industry was expected to have its scientists and engineers pursue applied research and product development. The model of separate spheres and technology transfer across strongly defined boundaries is still commonplace. However, academic scientists are often eager and willing to marry the two activities, nominally carrying out one in their academic laboratory and the other in a firm to which they maintain a close relationship.

Thus, technology transfer is a two-way flow from university to industry and vice versa, with different degrees and forms of academic involvement: (1) the product originates in the university but its development is undertaken by an existing firm; (2) the commercial product originates outside of the university, with academic knowledge utilized to improve the product, or (3) the university is the source of the commercial

product and the academic inventor becomes directly involved in its commercialisation through establishment of a new company.

Transition to the Entrepreneurial University

The emergence of the university as an entrepreneur is part of a broader academic evolution from an individualistic to an organizational focus. This shift is most obvious in research, especially in the sciences where the basic unit is becoming a research group consisting of a professor, assisted by graduate students, post doctoral fellows and technicians. Interaction and collaboration takes place laterally as well as vertically, with some supervisory and mentoring responsibilities devolved to post-doctoral fellows and senior technicians. This academic “quasi-firm” contrasts to professor-student dyads, still commonplace in humanistic disciplines.

There is a similar transformation in the mission of economic and social development. There the transition is from being merely a facilitator for transferring technology to individual firms to being a force for fostering regional economic and social development. Instead of a focus on an individual patent or transfer of a particular technology, there is an enhanced concern with the university playing a broader role in its region. Sometimes, as in Portugal, where regional political entities are weak, the university plays a role of “regional innovation organizer,” (RIO) bringing together local businesses and municipalities to jointly develop an innovation strategy.

The shift from an individual to broader focus is more difficult to discern in education since it typically takes place in non-traditional academic contexts, such as incubator facilities and entrepreneurship programs. Nevertheless, just as the university trains individual students and sends them out into the world, it is now doing the same for start-up firms and other organizations.

The appearance of economic development phenomenon within the teaching mission of the university occurs in parallel to its appearance within the research mission. Research inevitably produces new knowledge that is potentially commercializable, given

appropriate circumstances. Similarly, teaching also leads to the discovery of new knowledge. This process can even be seen in the attempt to retrieve lost knowledge. For example, in the Renaissance project to revive Graeco/Roman learning, new interpretations of old texts inevitably occurred, influenced by changed circumstances and interests.

Tensions between Academic Missions

When the first academic revolution took place in the late 19th and early 20th century, there were objections that research activities were improperly taking professors away from their traditional roles as teachers. A similar controversy is occurring as economic development is added to research and teaching as a legitimate function of the university. Teaching will not disappear from the university: it is too costly to do without and counterproductive to other academic objectives. Students are not only potential junior researchers, but also future alumni who make philanthropic donations and provide political support for their alma maters.

Those few research universities in the 19th century that tried to do without undergraduates soon thought better of it and brought back their undergraduate colleges. In the early 21st century, even as universities become much more explicit agents of economic development, as part of their nation's and region's industrial and science policies, they will also retain their traditional functions of research and teaching. It is this 'capitalization of knowledge' that is the heart of a new mission for the university, linking universities to users of knowledge more tightly and establishing the university as an economic actor in its own right.

As each new mission is incorporated within the university, it restructures how the previous one is carried out. Thus, as research becomes an academic mission; research methods are taught to students, thus making it part of the educational mission. Conversely, as students perform research tasks as part of their education, new knowledge is generated. Thus research becomes incorporated in the teaching mission and teaching in the research mission. A similar dynamic occurs as economic development is introduced

and is realized both through the research and teaching missions. Rather than being seen as separate functions, each mission becomes interrelated with the other, although not without controversy and persisting tension. Nevertheless, the extension of each mission through the other is one reason why the university as a flexible organizational format has an advantage over other more specialized organizational formats such as the research institute or the firm.

Varieties of Entrepreneurial Universities

The transformation from the teaching and research to the entrepreneurial university takes place in distinctive ways depending upon previous academic traditions and circumstances (Rothblatt and Wittrock, 1993). In Brazil, the entrepreneurial university model is introduced through the teaching mission in the form of extension of entrepreneurial training throughout the university. Academic entrepreneurship also takes place through innovation in incubation, extending it from high tech to other endeavors that can be enhanced by higher levels of organizational knowledge and training, and by embedding incubation in the laboratory, as well as through the development of research as a highly organized activity.

In the US the academic entrepreneurial transition primarily occurs as an extension of the research mission of the university that itself had its origins as an entrepreneurial activity in the 19th century, when support for research was largely lacking with the notable exception of agriculture. A substrate for firm formation exists in US universities in that professors are already running quasi-firms in the university through their research group activities. There is an almost a natural progression in the US from quasi-firm to firm as commercial opportunities for advanced research open up in new fields and as venture funds become available from private and public sources. In other countries, and in many US universities, entrepreneurial activities may be introduced through explicit initiatives as well as through the transfer of an entrepreneurial academic culture.

There is more than one base on which to build an entrepreneurial university. Research funding based on academic entrepreneurship is only one foundation. An entrepreneurial university can also be based on the teaching role of the university, by introducing entrepreneurial training into the curriculum. In this model, which has been explicitly developed in Sweden and Brazil, students are expected to play the entrepreneurial role in taking research out of the university and making it into firms, playing the role of technical entrepreneurs.

The progression is non-linear since entrepreneurship can also be generated from the teaching mission of the university, even in the absence of an entrepreneurial research tradition. Whereas, In the US academic entrepreneurship has largely proceeded from the research mission of the university; in Europe and Brazil it has typically arisen from the academic teaching mission. By taking account of different academic traditions and developing formats appropriate to local circumstance, rather than assuming a common model, it has proven possible to create entrepreneurial universities on strikingly different academic bases.

Forward and Reverse Linearity

The entrepreneurial academic model is part of a triple helix that includes extra-academic as well as transformed academic elements. As the entrepreneurial university develops out of the ivory tower format, it retains its classical features even as if becomes part of a broader context for knowledge based innovation. An entrepreneurial university affiliated with a cluster is the new ideal for knowledge-based economic development. To realize this goal requires two transformations, one in the university and the other in the firm.

Both involve the creation of organizational mechanisms to interface with other organizations within and across institutional spheres. For example, the technology transfer office as a an internal search mechanism within the university to identify the subset of technology arising form the research stream that can be marketed outside the university, to existing firms. Lacking a market the office may determine that there is a

potential market that could be addressed by founding a new firm. The establishment of an Incubator facility is the next step in a forward linear model

A reverse linear model is based on identifying technological needs in industry or government, utilizing the resources of the university to provide solutions. In this model, a service organization is created to identify and meet those needs. This model is based on organizing the human capital resident within the university. It provides a means of capitalizing this human capital in order to provide funds for developing academic capacities. It provides a professional capacity to seek external work and organizes groups of academics to provide the solutions thus translating consulting activity from an informal individual activity into an organized group activity.

In contrast to a technology transfer unit, one of the founders of an academic consulting unit described how, “we work the other way around looking for problems that can be solved with human capital ... One of the early jobs we had was a contract to develop the website of a large supermarket chain.” The earnings from these contracts provided the means to support academic development of the computer science department at the University of Recife, Brazil..

The change in scope and scale of consultation provides a mechanism, for academic capital formation. Moreover, the consulting organization is an arm of the academic unit or department and thus returns profits to that unit. The alternative is for the organized consulting firm to exist outside of the university as an independent business, supporting academics only on an individual basis by hiring them for specific projects or paying them retainers for exclusive availability to the firm. The internalization of project management and translational research capabilities as an overlay on traditional academic research groups often takes place through the development or renovation of research centers.

The Rise of Centers

The trend toward center formation originated in the experience of scientists and engineers working on joint projects during World War II who wished to continue the

interdisciplinary collaboration they had found so exciting in wartime research and apply it to new goals. Centers provide a flexible format to fill epistemological and organizational voids in academic structures. They combine some of the lateral features of a strategic alliance among companies with the hierarchical characteristics of a traditional European professorship. A strategic alliance is a temporary coalition of organizations for a specific project; a center is a succession of strategic alliances for a longer term goal.

Centers are typically based on the research mission of the university although they increasingly include responsibility for outreach and public understanding of science . Although individual investigator grants remain a sacred tenet of U.S. academic science a shift in gears is underway in which funding arrives in larger packages with additional expectations based on economic, health and social criteria. As a flexible format for conducting research, centers provide a means to accommodate new goals while retaining old ones. Similarly, external economic development initiatives seek to connect to the academic process through the center format..

In an academic system based on departments and disciplines, centers foster interdisciplinarity by coordinating researchers within and across intellectual and administrative boundaries. Centers allow the separate and distinct knowledge of individuals located in different departments to be brought together in a common framework. They encourage cross-disciplinary collaboration and make available expensive equipment that one research group could not afford. Centers can also bring together university researchers with those from industrial and governmental laboratories. They allow the issues of non-academic organizations to be addressed in an academic format by scientists from each sector. In principle, centers are temporary bodies that may close if funds run out, whereas departments are part of the general university budget.

Combinations of intellectual and practical impetuses drive the formation of centers. One is the intensified competition in fast-moving disciplinary fields. Despite strong motivations for individual research, collaboration is often the better strategy. As one scientist put it, “You can no longer be autonomous in your research because if you want

to keep up and know what is going on you have to be collaborative and the center structure facilitates and permits that." This situation leads several faculty to join in a concentrated research focus at a center attached to a department. There is also the realization that a practical or theoretical problem can best be attacked by a group of investigators drawn from several disciplines.

Centers also provide a neutral ground for company researchers to collaborate. The work done at the university is open, but the follow-up at the company laboratory can be proprietary. Centers enable companies to access the intellectual life in a university in "real time," eliminating the lag between research discovery and publication. A center director noted that, "... if someone is very interested in rapid processing, then they will work with this faculty member because that is the main topic of his students research. So they share an office and they work very close together so that person gets to know all the facets and you are constantly in touch with your company....It would be a means to incorporate new technologies much sooner and much faster." Companies involved in this center wish to gain a competitive advantage by cutting the usual time it takes to learn about new research.

The growth of centers is making the university more complex, with faculty performing multiple roles in departments, centers, and other organizations. Center directors increasingly resemble a corporate chief executive officer (CEO), administering the center and serving as a liaison to academe, industry, government, and the public. The center format is extensively utilized by state and local governments in less research intensive regions as a means to develop concentrations of research relevant to their present and future economies.

The Enhancement of Clusters

A cluster classically referred to a network of low tech firms, in the shoe or clothing industries in Italy connected by family and friendship ties. A cluster may recognize an existing groups of firms in a sector that interact with each other to create products that individual firms each contribute a share. In its weak sense, a cluster is simply a new label

for a local sector that may not have much interaction among firms. However, once the cluster concept is introduced, it may provide the basis for discussion among firms as in the “gypsum cluster” in Recife. This may lead to the formulation of joint projects resulting in the development of a true cluster, even one with a knowledge component (Callegati, Grandi and Napier. 2005).

Prototypical clusters, such as the Italian industrial districts, have found that many of their production activities have been outsourced, in recent years. The benefits of proximity have been outweighed by lower labour costs abroad and the enhanced ability to coordinate utilizing IT rather than face-to-face interactions. Thus, industrial clusters have had to incorporate more knowledge-intensive modes in order to survive. Although, the cluster concept focuses on firms and their relationships, it can be expanded to include knowledge producing institutions such as universities and research institutes. Thus, the cluster becomes part of a triple helix, with university relations introduced to upgrade technology.

Students as Knowledge Transfer Agents

Students often play a key role in university-industry relations as an aspect of their training, especially through internships in firms. The University of Aveiro, a campus oriented to science and engineering, was founded in 1973 to help revive a declining northern region of Portugal. Most area firms in ceramics and wood pulp are small, having fewer than fifty employees. The owner is typically the manager of the firm; the production processes are low to mid-tech. Some workers have specialized technical skills but these firms seldom employ a graduate engineer and, of course, have no R&D department.

Although the emerging research capacities of the University of Aveiro are not immediately relevant to such firms a basis has been found for linkage through the university's educational activities. Student internships that have been arranged by individual faculty members and departments, especially management science and

production engineering, has become a significant method of technology transfer. Initially begun as informal arrangements between individual teachers and companies, internships are increasingly officially encouraged by the university. The director of a new liaison office, the Forum, arranges meetings between a group of firms in an industrial sector and teachers whose disciplines might be relevant.

Whether initiated from below by a faculty member or from above by a liaison office seeking partners for the university; the actual work of transferring knowledge and connecting company problems to university capabilities is carried out by an undergraduate student. Coursework in management and engineering departments provides internship students with knowledge useful to firms such as production scheduling and procurement logistics. Introducing a software package to meet a firm's needs and training employees in its use has been found to be the most useful first step that can be taken in upgrading the capabilities of these companies.

Interaction with a professor often presents status problems at such firms; the entrepreneur might feel the necessity to defer to the academic. Ideas from a student can be accepted or rejected without feeling that anything is at stake. The company's relationship with the teacher takes place through the student's continuing contact with their academic mentor. A two-way flow of knowledge arises; suggestions often come from the professor, transmitted through the student, to fine-tune a project. The firm's successes and failures are reported back to the teacher; often entering into lectures as examples to enliven course material, thus providing local relevance as well.

Academic expertise useful to firms is not only high tech or knowledge at the research frontier. It can be an application of existing knowledge to meet the needs of a company. Such expertise could come from a consulting firm or an independent extension center. Funneling it through the educational process is a low cost, low key method that allows schools, with or without research capacities, to develop relations to industry as an extension of their educational mission.

The University's Regional Role

The triple helix thesis at the regional level is based upon a model of knowledge, consensus and innovation “spaces” and the transition process from one space to another. Phase 1 is the creation of “knowledge spaces” or concentrations of related R&D activities in a local area that have been identified as a precursor to knowledge-based regional economic development (Casas, 2000) Thus, New England’s comparative advantage was a higher concentration of universities and colleges than other parts of the US. In Mexico, the decentralization of Research Institutes created new opportunities for knowledge-based economic development.

Phase 2 is the creation of a “consensus space” a venue that brings together persons from different organizational backgrounds and perspectives, to generate new strategies. The concept is derived from the activities of the New England Council, representing academic, business and political leaders during the 1930’s depression. Based on several instances of firm formation from research at MIT in the 1920’s, MIT President Karl Compton convinced this organization, to discard long-held ideas and focus on creating new firms from scientific research as a development strategy (Etzkowitz, 2002). Joint Venture Silicon Valley (JVSV), through its open regional “brainstorming sessions,” played a similar creative role in Silicon Valley during the recession of the early 1990’sⁱ The New York Academy of Science attempted this role in the New York metropolitan region during the mid 1999’s, drawing together representatives from different institutional spheres for a series of discussions. Another instances is the Swedish “regional growth agreements,” arrived at after broad-based discussions among various actors.

Phase 3 is the creation of an “innovation space” a new organizational mechanism that attempts to realize the goals articulated in the consensus space to fill gaps in the regional innovation environment. The new mechanism is typically a “hybrid organization,” synthesizing elements from different institutional spheres. Thus, just after the Second

World War, a coalition of New England academic institutions and financial interests invented the venture capital firm, drawing upon academic and business resources.

A summary of the phases of regional knowledge-based economic development can be found in the table below.

Stage of development	Characteristics
Creation of a <i>knowledge space</i>	Focus on “regional innovation environments” where different actors work to improve local conditions for innovation by concentrating related R&D activities and other relevant operations
Creation of a <i>consensus space</i>	Ideas and strategies are generated in a “triple helix” of multiple reciprocal relationships among institutional sectors (academic, public, private)
Creation of an <i>innovation space</i>	Attempts at realizing the goals articulated in the previous phase; establishing and/or attracting public and private venture capital (combination of capital, technical knowledge and business knowledge) is central

Redressing Regional Imbalances

The concentration of national research resources at a few universities is no longer acceptable to other regions now that the role of academic research in creating new firms and jobs has been widely recognized (Greyson, 2002). In the U.S major research universities were primarily located on the east and west coasts, with a few mid-western exceptions. In Sweden the Stockholm region was the major concentration, with additional foci in Gothenburg and Lund. The research council system of distributing funds primarily to the existing concentrations of research has been supplemented by two additional levels of research funding which have introduced regional criteria as one of the basis for distribution of funds. Research policy has been integrated with regional policy, whether directly as in Sweden or indirectly as in the US.

At the regional level, in many countries, there may not be a governmental actor available to take the lead since there are no or only very weak regional governments. In Portugal, for example, there is not a strong tradition of regional government. In this situation the University of Aveiro took the lead in bringing together companies and municipalities, playing the role of Innovation organizer. In Silicon Valley during the recession in the early 90's a company played the role of regional innovation organizer (RIO), bringing together area municipal governments, the universities and companies to meet for brainstorming session to create new initiatives.

The Entrepreneurial University and Development

Regions have the possibility of making rapid progress by basing their development strategies on the construction of niche knowledge sources, supported by the local political economy. Political and social arrangements based upon principles of equity and transparency lay the groundwork for rapid development in a stable environment. “Leapfrogging”, to skip some stages of development, is thus possible as well as “catch-up” strategies of attracting foreign direct investment (FDI) and inward technology transfer.

The enhanced importance of science and technology to economic development is well recognized North/South; East/West. What is relatively new is the broad acceptance of a corollary principle that it is important to have the capacity to generate science-based innovation locally rather than relying on turn-key technology transfer. This principle has significant implications for institutional arrangements, especially in developing countries where industry has traditionally had limited R&D capacity. Nevertheless, firms in advanced industrial countries have also found it useful to broaden the scope of their access to new ideas.

The university has twice expanded its mission, from its original task of preservation and dissemination of knowledge, to research and production of new knowledge and more recently to putting knowledge to use in various ways. Thus, at each point of transition and the assumption of a new task has involved organizational and ideational change in

the concept of the university Nevertheless, despite incorporating new and seemingly contradictory roles and functions, the university still maintains a common identity.

Why has the university “hung together” rather than splintered? The answer is that each of these new roles have fed back into and enhanced the carrying out of a previous function. This explains why the university has held together as a common institution despite taking on various tasks that are seemingly at odds with each other. Centripetal forces have outweighed centrifugal ones. The methodology of institutional transformation is a key element of the triple helix framework. This process of transformation occurs at two levels, the invention of new organizational arrangements and of ideas to justify them. Either may precede the other but neither one is likely to be too far ahead of the other.

In addition to performing useful functions that can be justified in their own right, it has also been possible to legitimate the new tasks as contributing to the carrying out of the old. Indeed, the basis for each transition of the university is at least to some extent emanates from its previous mission. Each of these new missions begins to be developed out of the previous one. The new mission continues to exist in tension with the old; nevertheless it is found that each mission informs the other and that it is both more fruitful and cost-effective to unite multiple functions in a single organization rather than to conduct them separately.

The closeness or distance between academic types is strongly related to how the previous missions were carried out. Thus, research may be part of the teaching process and entrepreneurship part of research. Conversely, entrepreneurship may be incorporated within teaching as a subject matter. It is possible therefore to build an entrepreneurial university on the base of either the teaching or research mission. Since the basic format of the university is a reproductive process that takes place through its teaching mission, tying the generation of economic activity to the academic format can create a self sustaining dynamic of economic and social development. In the entrepreneurial academic model the university educates and graduates organizations as well as individuals.

In addition to cultivating and encouraging entrepreneurial attitudes, specialized organizational units such as technology transfer offices and incubator facilities are established to assist potential faculty and student entrepreneurs in transforming their technology and business concepts into firms. The University itself becomes an entrepreneur as it develops the capabilities to assist new firm formation, including financing these firms and retaining part ownership as a reward for its efforts. In the long term, the entrepreneurial university gains the ability to self-finance some of its activities rather than being wholly dependent upon other institutional spheres.

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