Abstract
The premise of triple helix circulation is that movement of people around the spheres enhances creativity, ideas and skills. Universities, traditional providers of human resources and knowledge, are now critical socio-economic development actors. Removing the blockages to circulation and enhancing interaction and cooperation among development actors and agencies is the development challenge of the 21st century. Sustainable knowledge-based development is the objective of all societies in an interdependent era characterised by resource constriction and efflorescence of science and technology.

Keywords: Triple Helix, Circulation, innovation, development

Introduction
Knowledge-based development revolves around relatively independent yet interacting institutional spheres. Beyond increasing gross domestic product, the ability to move within and among the institutional spheres is a significant indicator of socio-economic development. While separating the spheres, to an extent, facilitates the emergence of new initiatives, a degree of functional integration, bringing together diverse actors, encourages idea creation and the accumulation of relevant resources for implementation. Triple helix interactions may be likened to the flow of “blood” through the “arteries” that dynamizes various levels of the circulatory systems. In different innovation systems, reducing the blockages to interaction enhances the movement within and across institutional spheres, clearing the path to sustainable development. The transition to an open civil society, as in 1980s Brazil with the fall of the military regime, allows for multiple sources of initiative, creativity and enterprise. A vibrant civil society also serves as an intrinsic regulatory mechanism, a check and balance, that militates against free flowing triple helices suffering “hardening of arteries” and devolving into static complexes.
In a knowledge-based society, the bar is raised from the development goal of industrialization, focusing solely on manufacturing of tangibles objects, to an economy based on the capitalization of knowledge. This transition to a post-industrial mode of production has led to rethinking the development process. Socio-economic development is no longer limited to a series of stages that every society will inevitably pass through, nor inherently precluded by not following a traditional strategy primarily focused on heavy industry. The multi-faceted context of socio-economic development requires the interaction of different actors and institutions. The unitary notion of development in which, central government reserved initiative to itself; industry carried out technology transfer and local application and the university limited itself to training human resources is superseded. In the triple helix development model, government devolves decision making to collaborations with regional and local authorities and other actors. Industry engages in endogenous innovation as well as transfer. Universities play an innovative role in society, active in translational research, entrepreneurial training and community development, as well as, traditional tasks. These nascent transformations have fundamentally changed the development landscape, making triple helix actors the central development partners.

Triple helix interaction represents the heart of knowledge-based development with circulation among and within the spheres acting as the arteries that stimulates ideas and policies across from one point to another. As development is transmogrified, there are invariable changes relationships from single and double helixes to triple helix of university-industry-government joint projects. This makes it possible to stimulate knowledge-based strategy and speed the rate of socio-economic development by enhancing the free flow of people, ideas and innovations, the core elements of a triple helix circulatory system. Understanding these dynamic relationship and interplay is the first step to creating the necessary and sufficient conditions for innovation and sustainable development.

**Triple Helix Transition: Blending Normative and Empirical Designs**

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 and government as relatively independent, yet inter-
dependent, institutional spheres is the key to improving the conditions for innovation and sustainable development in a knowledge-based society. A triple helix coordinated entirely by the government only allows for 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 government 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 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 “takes the role of the other” in some regards. This may take the form of a university taking government’s role of initiating development projects or industry’s role of firm formation. Universities, traditional providers of human resources and knowledge, are now critical socio-economic development actors. The institutional spheres still perform their traditional functions but increasingly assume the task of advancing innovation and development.

Many universities have expanded their organizational capabilities to engage in knowledge transfer and development as in Brazil where a technology transfer society with about 70 university members has grown up in the past few years. In addition, universities are also extending their teaching capabilities from educating individuals to shaping organizations. Again, Brazilian incubator practitioners realized that the
incubator was essentially a means to train a group of individuals to operate as an organization. The incubator model was extended from an earlier emphasis on forming high-tech firms to creating low–tech firms as well as cooperatives that make it possible for excluded populations to collectively enter the labour market as service providers contracting with public and private sector organizations for cleaning and other tasks (Etzkowitz, Mello and Almeida, 2005).

In some circles, there is a debate over whether the triple helix model plays a different role in developed and developing country contexts. In the former, it is posited as an empirical model, conceptualizing an existing regime where the elements are in place and their relations open to enhancement. However, in developing countries, the triple helix is said to be a normative model that countries aspire to by putting the basic elements in place. Certainly, there are clear differences between the two regimes. The extent of the gap is an indicator of the level development. In all developing countries, the essential triple helix elements exist. The missing component is often the lack of a coherent strategy to integrate the fundamentals ingredients necessary for socio-economic development. This is the purpose of integrating triple helix circulation into core of development theory, policy and practice.

**The Triple Helix Development Model**

The Triple Helix is based on the premise that the university plays an enhanced role in development in concert with government and industry, the two traditional leading institutional spheres. Higher education institutions are virtually everywhere and their flexible nature opens them to fill a variety of roles, well beyond traditional missions. Traditional missions of teaching and research embed a knowledge transfer capability in any society. In the training of human capital for all sectors of society, the university, through its alumni, provides the basis for enhanced interaction. The prominent role of the university in the triple helix has made this model especially relevant to developing countries where universities are present and industry is either making strides, relatively weak or largely lacking.

In most developing countries, universities have largely focused on teaching, as a result of their role in colonial or neo-colonial technology transfer regimes, where attention was directed at importing technology rather than encouraging endogenous
innovation even when research capacities were developed. The form and content of education and curricula most often mirror the prevailing concept of development underwritten mostly by donor agencies. In Africa, majority of the countries inherited a colonial educational system that was oriented to the developmental needs at the time. The goal of the educational system was to turn out clerks to monitor and record in basic accounting terms the purchase of traditional agricultural export commodities, missionaries to engage in proselytizing activities, and officers for the colonial civil service (Dzisah, 2006).

This does not mean that changes were not being initiated. New institutions were founded, some built on research institutes specialized in local agricultural opportunities, others were oriented towards the needs of the prevailing context and yet others sought to expand upon their original foundations (Etzkowitz and Dzisah, 2007b). For instance, in both Brazil and Ethiopia, new universities were built on research institutes to give them enhanced knowledge transfer capabilities. These new universities enable Institute researchers take on teaching responsibilities, with students contributing to research as their assistants. By their nature, research institutes on their own are very isolated. Unless a university supports them, with a flow of competent personnel, a research Institute on its own, will not function. This results in an overdependence on foreign sources of knowledge and training for survival and renewal.

Critics have argued that the university systems in most developing countries are academically oriented and industries are either non-existent or too weak and governments too bureaucratic to play respective roles envisaged by the triple helix model. However, the problem as noted by Konde (2004) does not lie with the model, but the fact in many countries these triple helix entities seem to be weak because their elements tend to work in isolation. Realising that knowledge holds the key to a fast-tracked development and reconstruction, post genocide Rwanda harness triple helix actors through its emphasis on the role of universities in economic reconstruction. In 1997, Rwanda converted the premises of a military academy into a base for a new technical university, the Kigali Institute of Science, Technology and Management (KIST). The institute in 2001 received the Ashden Award for Sustainable Energy for developing an energy-efficient oven that uses 25 percent of the fuel required by
traditional ovens. KIST subsequently established the Centre for Innovation and Technology Transfer (CITT) to develop solutions for rural areas, including renewable energy technologies, which are being installed in prisons and schools (Juma, 2005).

The development of Internet in Zambia (Konde, 2004) and the signs of reconstruction and development in Rwanda demonstrated that when triple helix actors and partners work together they represent a significant force for change in developing countries as well. In a triple helix development context, each institutional sphere maintains its core identity as it interacts intensively with the others. While the triple helix institutions at their nodes are active and recursively selective based on their own specific functions and institutional constraints, the network system of university-industry-government relations helps development actors translate policies into actions. As such, a triple helix development model is not necessarily reified into a neo-corporatist arrangement; its internal dynamics encourages the appreciation of difference (Etzkowitz and Leydesdorff, 1997).

A triple helix development model is based on the following trends:

i. The transition from an industrial society to a knowledge-based society in which knowledge producing institutions, like universities, potentially play a greater role in innovation and development

ii. The supercession of large scale physical technologies that mandate bureaucratic forms of organization to increasingly flexible smaller scale high technologies that can be utilized by smaller scale organizations

iii. The emergence of polyvalent knowledge, in such areas as biotechnology, computer science and nanotechnology, that is at one and the same time theoretical and practical; capitalizable and publishable

iv. The rise of new university formats that incorporate a classic ivory tower focus on discipline development with a culture of entrepreneurship, innovation and technology transfer.

A triple helix development model contrasts with others that place greater emphasis on state-led, market-led and community-led development (Kothari and Minogue, 2002). While this is laudable, it omits a critical agent of knowledge-based development—a university that is capable of undertaking socio-economic development initiatives in
cooperation with teaching and research. The triple helix development model focuses on creating intermediary mechanisms that play a broader role than in developed environments. They not only fill the gaps between industry and university and between discovery and application but in some instances they substitute for weak or missing actors. Moreover, in the triple helix development mode there is strong emphasis on interactions, linkages and collaborations.

This new way of development thinking, revolving around the crucial knowledge actors, strengthens diversity and represents a radical departure from the conventional development models that have separated the three institutional spheres, most often placing universities in a peripheral role in development strategies and policies. Thus, the triple helix refocuses the development field.

**Circulation: the Key to Development**

Enhancing circulation among university-industry-government is a basic premise of development. Conversely, blocked circulation is an indicator of social ‘hardening of the arteries’ and the failure of Civil Society to emerge. We argue that in addition to decentralization and devolution of the decision-making, underdevelopment can be overcome by enhancing circulation of persons, ideas and innovations. In the developing world, the circulation among triple helix actors occurs as an overlay on the oversight functions of various boards and advisory councils. The special importance of circulation in terms of persons derives from the reality of constant lack of qualified personnel.

The triple helix circulation concept is utilised in Brazil to minimise this problem through the 2004 Innovation Law. The law encourages the public and private sectors to share staff, funding and facilities such as laboratories. Until now, such collaboration was not officially permitted. Public sector researchers had to ask permission to work on privately funded projects, even when this did not interfere with their university positions. In addition, they could not accept pay for such projects (Veneu, 2004). Just as the Bayh-Dole Act legitimized university technology transfer in the US and provided a model, the Brazilian Innovation Law, legitimized the conjoint firm-research group, providing a model for developing countries to maximise
use of scarce resources and institutionalising and incorporating university-industry circulation in the same unit.

A good circulation regime is highly dependent upon the institutional efficacy of its members. We posit that that there is a close linkage between circulation and institutional change. The more a certain institutional arena is transformed, the greater the turnover of personnel within the command positions of that institution (Hanley, Yershova and Anderson, 1995). In spite of this, there is also a strong indication that the extent of institutional change does not have strong predictive value for circulation or reproduction, but the process of institutional change varies systematically across socio-economic sectors (DiMaggio and Powell, 1991).

Lateral mobility, including the introduction of expertise from one institutional sphere to another, stimulates hybridization, invention and innovation. In an examination of the evolution of meritocratic practices within business and political elites in several developed countries, Brezis and Crouzet, (2002) concluded that broader circulation increases diversity and is conducive to economic development Although they focused on traditional vertical circulation, following Pareto ([1968] 1991), the phenomenon of “pantouflage” a lateral movement from the civil service to the business world in France and from the military to arms industries in the US was also noted. C. Wright Mills (1956) had earlier characterised this latter phenomenon as deleterious, giving individuals from one sphere inappropriate influence in another (Mills, 1956). There is a positive element, in our view, to such lateral movements as part of triple helix circulation in terms of the infusion of new ideas, institutional perspectives and innovative experiences from one sphere to another.

**Elements of Triple Helix Circulation**

Naturally, triple helix circulation needs to be adapted to different cultural and national context. The *first* step is bringing relevant actors together in a neutral environment to have a free and frank discussion of strengths and weaknesses of the triple helix actors and partners and blockages. The *second* step may be in the form of a commissioned study to more precisely identify opportunities, limitations and barriers to overcome. The *third* step is to formulate an action plan that may adapt organizational models or
invent new ones that are particularly relevant to local circumstances. This is why a university-industry-government coalition in 1930s New England invented the venture capital firm to address regional strengths and opportunities: high presence of commercializable academic research but low availability of seed capital and business expertise relevant to new firm formation (Etzkowitz, 2002).

Triple Helix circulation is an alternative model of development based upon the notion of society as a series of interpenetrating rather than separate institutional spheres. A circulation strategy enhances the opportunities for rapid socio-economic development in the transition towards a knowledge-based society. The critical elements of triple helix circulation are persons, ideas and innovations (Pi^2) together with such sub-elements as dual-life, alternation, innovation networks etc.

![Figure 1: Elements of the Triple Helix Circulatory System](image)

**Circulation of People:** reflects a sort of a revolving door that allows for the introduction of viable ideas from one sphere to another through the flow of people. This sparks collaborative projects and promotes cross-institutional understanding. Circulation of persons may involve the “unidirectional” or “permanent” movement from one sphere to another within the university-industry interface. This movement is exemplified by the flow of high-tech-firm entrepreneurs who were university professors to industry. For instance, Amar G. Bose moved from MIT to his acoustical firm, while retaining a tie as adjunct professor. Reversely from industry to university, the archetypal figure is the co-inventor of the transistor, Shockley, who entered Stanford University as a faculty member from industry in 1963.
In addition, there are those who prefer a “double life” by holding simultaneous significant positions in two spheres such as a half time position in industry and a professorship. Provost Terman invited Carl Djerassi, Research Director of Syntex pharmaceutical firm to be a chemistry professor at Stanford as part of the strategy of building steeples of excellence in focused fields with significant intellectual and commercial potential, in this instance steroid chemistry. Djerassi brought the firms R&D operation with him to Palo Alto from Mexico City and continued as Research Director as part of his arrangement with Stanford (Etzkowitz and Blum, 1995).

Circulation of persons also takes the form of an “alternation” or spending of significant successive periods of time in more than one sphere. The Stanford Professor William Perry, after a significant business career and half-time professorship, served as Secretary of Defense and then returned to the university on a full-time basis. This circulation format typifies the initiative by Newcastle University in appointing ‘Professors of Practice’ who hold a half-time appointment in the university and half-time position in their firm (Etzkowitz and Dzisah, 2007a) and Research Associates of Practice, half-time in an academic research position in the Business School and half-time in a practice position the University’s Technology Transfer Office.

**Circulation of Ideas:** is reflective of collaboration and premised on information communication through networks at various levels of research, knowledge production, dissemination and utilisation activities. It may also extend into physical and virtual communities. This innovation network aids the communication and dissemination of government policies and funding resources, cutting-edge research results from universities and their implications for new technologies and industries; collaboration needs from industry and the support of innovative regions. Oresund, a cross-border region linked by a bridge between Copenhagen and Malmo, Sweden is both an information communication network between Denmark and Sweden and an innovative region (Törnqvist, 2002). Also, the Triple Helix Group of Newcastle University organizes a venue with partners in London to disseminate its work to government and industry, as well as, provide a meeting point for innovation researchers and practitioners.
**Circulation of Innovations:** is the instantiation and dissemination of various results to potential users and innovators to put into practice on a much larger scale to assist in knowledge-based development. The production, dissemination and use include forward and reverse linear elements, creating and interacting environment—a ‘seamless web’ among the triple helix actors. In this regard, ‘reciprocity’ among actors and ‘equality of contribution’ to innovation is a crucial factor in enhancing itself in a reflexive manner. As such, if there is a negative imbalance in contributions from among triple helix actors, a gap might appear in translating ideas into innovations. Conversely, a positive imbalance might stimulate other actors to increase their efforts thereby enhancing their institutional sphere. For instance, a crisis in the telecommunication system in Zambia led to the introduction of the Internet. In 1990, the director of the computer centre at the University of Zambia (UNZA), faced with shortage of human of capital, connected a few personal computers to exchange emails within his institution and with Rhodes University in South Africa, and then with the rest of the world (Konde, 2004).

**Rethinking Development**

Until recently, development implied state-planned modernization, neoliberalism and economic globalization or alternative populism (Kothari and Minogue, 2002). As a variant of modernization, exogenous development was premised on the importation of technologies, foreign direct investment and the extraction of natural resources. However, a paradox of resource–based development occurs in which local elites are enriched, while the general population may even grow poorer as is the case in the Niger Delta region since the creation of the oil industry. An economic sphere was created, disconnected from Nigeria, even as it was integrated with interests abroad. The classic solution is revolution or democratization, as in Mexico, Brazil, Iran and Venezuela, nationalizing the industry and utilizing the profits for development. Even if control of natural resources is attained, the ultimate reality is that they will eventually be used up.
### Development Thinking | Historical context
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Progress, evolutionism | 19th century
Classical development | 1890-1930s
Modernization | Post-war boom
Dependency | Decolonization
Neoliberalism | 1980s>
Human development | 1980s>
Innovation Systems | 1990s
Triple Helix | 2000s

**Figure 2: Development Theories (Adapted from Pieterse, 2001:9).**

A triple helix strategy may result in the creation of a self-generating dynamic of development based on intellectual resources that are in principle always renewable and expandable. In the early 20th century, an agricultural experiment station founded in the precursor to Israel, in a Palestine segment of the Ottoman Empire, determined that the carrying capacity of the land could support a much greater population based on export of agricultural products to Europe (Florence, 2007). A similar model of science-based agricultural development was adopted in California prior to the development of Silicon Valley based on innovation in electronics technology. Indeed, the model of scientific agriculture may have provided the template for the subsequent model of scientific industry. Certainly, a process of translating research into new products was common to both science-based agricultural and industrial development.

The objective is to create an endogenous source of development that mobilizes local resources and capabilities, drawing from abroad without allowing external forces or interests to dominate the relationship. In other parts of the world, like India, where the idea of science-based economic development was taken up in the early post-independence era, new universities, the India Institute of Technologies (IITs) were established to provide undergraduate training in technical fields. The sponsors and supporters of these new technical institutes both home and abroad, in the early formative years were guided by the parameters of modernization theory and thus expected these “junior MITs” to provide the engineering expertise and leadership
considered essential for economic and political modernization (Leslie and Kargon, 2006).

In the short term, the IITs accelerated India’s ‘brain drain.’ Need for skilled technical workers abroad was eventually accumulated into a “Diaspora” of intellectual capital that could be drawn upon as a development resource by countries of origin, either attracting some people back or utilizing the networks of those who remained to assist the development of science based industry. However, the fragmentation of production and R&D, especially in information and communication technology sectors, has led to unprecedented opportunities for the formerly peripheral economies through the ingenuity and entrepreneurship activities of technically skilled immigrants (Saxenian, 2006). In a knowledge society, second and even third mover advantages are possible as there are a variety of opportunities to adapt technology to local circumstances, and then generate innovations that can be marketed more broadly. The trajectory of the Nokia Company exemplifies this process. As knowledge becomes the basis of new technologies and industries, the traditional bases of industry in land, labour and capital are re-structured into a new format. In India and other developing countries, mobile phone technology is utilised in a wide range of traditional industries from fishing to marriage brokering.

The historical trajectory and the context of development and underdevelopment suggest that that there are multiple paths to knowledge-based innovation, rather than a single rigid sequence based on US precedent. The North American model of university technology transfer interactions originated in a legal discourse of how to deal with the ownership issues of research and quality control of products deriving from academic research (Bliss, 2007). Ownership of advanced research is less salient in an environment where the expansion of such research is at a relatively early stage. Creating mechanisms to promote economic development will be at the forefront of attention, explaining why the incubator model and its reconceptualization from a focus on creating high-tech firms in the US has been expanded in Brazil to a broader framework to train groups to form low and mid-tech firms, arts organizations such as dance troupes, cooperatives as well as design incubators to improve the products of existing firms.
The emergence of a triple helix changes the rules of game. By inserting the dualities of government-industry, university-industry, industry-government relationships within triadic university-industry-government interactions, opening relationships to innovation and new levels of cooperation and competition. Thus, new innovation platforms are expeditiously created to promote knowledge-based development. We believe that strengthening universities and other knowledge producing and disseminating organizations should help in realizing the objective of a knowledge-based development. Instead of playing peripheral roles in development, they should be regarded as the core actors of development.

**The second academic revolution in development**

From the mid-nineteenth century a first and second academic revolution has been ongoing in sequence and parallel. The introduction of research and economic and social development as academic missions, infuse the traditional academic mission with new purpose. Developing countries have the opportunity to leapfrog the traditional phases of modernization and industrialization, which are now disappearing in their countries of origin, by expanding the capacity and capabilities of their academic institutions and creating triple helices of university-industry-government interactions to promote development.

However, the taken-for-granted development presumption that mass primary and secondary education should precede the extensive development of tertiary educational capabilities is debatable. Major proponents of this development model, like the World Bank, are aware of the contribution of universities to economic growth, but insist that basic education should be the priority for public spending on education in those countries that have yet to achieve near-universal enrolment at the primary and lower-secondary levels (World Bank, 1995). In recent times, the recognition of the role of universities as a source element for development has led to a refocusing of higher education policies and strategies (see World Bank, 2002). In this regard, the World Bank financed the establishment of the African Virtual University (AVU) in 1997 to provide quality higher education in science and engineering. The AVU offers courses but does not yet have full degree programs.
In some developing countries, efforts to refocus undergraduate and graduate education on development are emerging as an academic reform strategy. A radical project in Costa Rica’s Earth University involves both students and faculty in farming tasks so that they may inductively relate problems encountered in the field to coursework and provide a common framework for discussion (Juma, 2005).

In Costa Rica’s Earth University, the EARTH model is dedicated to sustainable development through the formation of positive values, environmental and social consciousness, an entrepreneurial spirit and a commitment to community service. The programme’s most divergent element to that of a standard university curriculum is based on experiential education. The programme includes community outreach, a unique student entrepreneurship programme in which students form real businesses, an internship programme and work experience (Zaglul and Sherrard, 2005:36).

In Ghana, the University for Development Studies (UDS) is the first Ghanaian university to focus its efforts on topics that will help address issues of rural poverty and community development, including fieldwork projects as well as classroom training in its curriculum (Juma, 2005).

The University for Development Studies (UDS) was the first university in Ghana that adopted social and economic development in addition to teaching and research from the onset. Its Faculty of Integrated Development Studies is tasked with producing graduates that are well grounded in the realities of its surrounding poor communities. Also, the Faculty of Medicine incorporates the medical needs of the poor into the course content and is responsive to community medical needs. Its curriculum seeks to integrate theoretical concepts with extensive field practice in rural communities and districts within the university’s environs. In spite of this, the contested nature of development comes to the fore when both students and faculty challenged these ‘relevant context’ and the corresponding course content. However, the UDS has reaffirmed its core mandate of giving renewed vigour to the idea of ‘development university.’ In the pursuit of this ideals, the UDS utilizes a third-trimester approach, in which students take regular course work in two trimesters and then devote a third trimester to field practice, placements and community service. Faculty are expected to participate in these activities that both enhance teaching and address real-life development challenges of poor rural Ghanaians (Manuh, Gariba and Budu, 2007:54).

In the Friburgo Campus of State University of Rio de Janeiro, rather than developing undergraduate programmes focusing on existing industries, the university has developed a graduate research programme based on information technology (IT) that could be utilized to raise the level of a variety of local industries as well as create a
new IT industry. The undergraduate programmes were projected to follow as a second step in the development of this university’s full and extensive curriculum. Thus, academic development leapfrogs the current stage of industrial development in order to seed new technologies and firms and upgrade existing ones.

It is clear that by simultaneously drawing in expertise from other institutional spheres and infusing these spheres with new ideas and projects, universities are taking their traditional education and training mission of human capital development a step further by taking on board the task of socio-economic development. In fact, a continuous flow of science to the economy does not need to be achieved slowly through traditional stages of development models. This can occur more rapidly through the expansion and re-orientations of universities from the periphery to the centre of development. This requires that we take the Schumpeterian endogenous development model further by looking to institutional sources outside of the economy, in particular the university, as a source element for recombination and innovation.

**Conclusion: The Cooperative advantage of nations**

A democratic civil society in which professional associations, entrepreneur clubs and NGOs play supporting roles in the development of science, technology and innovation is the base of a vibrant triple helix. Universities and other knowledge producing and dissemination institutions have a leading role to play in sustainable development of the 21st century. The university’s role in creating an industrial sphere, supported by government actions institutionalizes innovation as a fundamental societal value. As a result, development is no longer only an industrial, economic or state-led process. A transition is underway from a two-actor political economy of industry and government to a multi-actor framework.

The enhanced role of knowledge producing institutions requires a re-think of development from a new starting point. A triple helix development model is at hand as the opportunities for achieving economic growth and social development are expanded by the emergence of knowledge as an increasingly important factor of production and impetus to social change. But the traditional questions of development remain to be addressed: Why have various regions of the world developed at a
different rate? What is the appropriate relationship among institutional spheres in the
development process? Are developing and least developed countries in the process of
overcoming past obstacles to economic growth? Is development only an issue of the
ordering of industry? What is the appropriate role of government and universities?
How can inequities in development be overcome? How can developing and least
developed countries cooperate and collaborate with each other to effectively advance
the sciences and technologies that have special relevance for development? (Mello
and Etzkowitz, In Press).

Nevertheless, the common long-term goal is a knowledge-based society with
opportunities and jobs resting on the application of knowledge to enhance economic
performance. Government and international agencies can promote the growth of
entrepreneurial universities with a broad inter-disciplinary scope and mission, and
support the birth of an entrepreneurial scientist who integrates knowledge and
innovation. Indeed, the weakness of the relation between development activities and
knowledge production is one of the sources of the persistence and consequences of
underdevelopment.

We have set forth a triple helix development model based upon enhancing circulation
among the institutional spheres. This triple Helix development strategy differs from
traditional development models in propounding the university as a leading
development actor, removing the blockages to circulation and enhancing interaction
and cooperation among development actors and agencies. As equal interacting
spheres develop, the pace of innovation is quickened. The classic functional
differentiation of institutions is superseded by hybridization of functions. We moving
toward a common global triple helix innovation and development environment in
which both developed and developing countries have much to learn from each other
as knowledge opportunities multiply. We are all developing!
References


