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Network-based innovation systems: A capital base for the Monterrey city-region, Mexico

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ABSTRACT

This paper advances notions of interactive learning as one of the key drivers of the knowledge based-development perspective. The paper explores the strategic role and close relationship between social and institutional learning as critical processes in order to generate knowledge and innovation in an urban context—i.e., knowledge city. The research reported in this paper makes an account of: (*i*) considering a capitals system perspective for knowledge flows to add value for the development of knowledge cities and communities; (*ii*) learning interactive processes among actors that leverage institutional capacity within regional innovation systems, and; (*iii*) adopting a knowledge-based development framework for investigating the capital basis of the City of Monterrey, Mexico. This research sheds light on how knowledge-intensive elements—such as higher education institutions, research centers, firms and other local actors—are contributing community building in a knowledge-based urban context—i.e., knowledge city.

1. Introduction

It has been advanced that a knowledge-based economy has become an attribute of leading urban centers (i.e., knowledge cities, or in short KCs) and has transformed them into important creators of value for nations, communities and regions (Carrillo, 2004; World Bank Institute [WBI], 2008; Yigitcanlar, 2009). Indeed, the new millennium has seen how knowledge content of goods and services are on the rise: we are increasingly buying and selling more and more knowledge. Such changes have given birth to new development paradigms, for example, the knowledge-based development paradigm or in short KBD—it is also referred as knowledge-based urban development (KBUD) further focusing on urban development dynamics (see Yigitcanlar 2010; Yigitcanlar & Lonnqvist, 2013; Yigitcanlar, O'Connor, & Westerman, 2008). This paradigm is the combination of a number of trends and development approaches: such as sustainable development and knowledge management. In addition to changes under the KBD flag, the emergence of complementary paradigms such as relational society (Allen, Deragon, Orem, & Smith, 2008; Castells & Cardoso, 2006; Donati, 2010; Mendoza & Vernis, 2008) is seemingly accelerating their impact and influence on a global scale. Unfortunately relational society only explains part of the complex and radical transformation of global cultures taking place in our cities, regions and nations.

Within these contexts, this paper focuses on notions of *interactive learning* as a key driver for KBD. It explores the strategic role and close relationship between social learning, knowledge and innovation in city-regional contexts for which social capital models indicate that *proximity matters*. The paper aims to characterize existing knowledge-based structures within regional innovation system (RIS) models through the lens of a KBD framework. This, in order to identify if learning competences and knowledge-based scaffolding are actually being built in the RIS. In such aim, this paper is set out to explore what we currently know about an emerging RIS in Monterrey, a city at the heart of the Mexico-Texas, US borderland region. Hence, the paper would invite a glimpse on how key individuals and organizations in Monterrey are building their intangible assets, their experience and their knowledge-based relationships their institutions and their future.

This paper first introduces the role of knowledge in city building, so as to give a context for the meaning-creation processes that define value-based taxonomies such as the KC concept. This is followed by a literature review on RIS and notions of *interactive learning* for innovation, as some identified models advance. The paper also attempts to bring further understanding on how intangible infrastructures contribute to the creation of new knowledge-based urban community paradigms. Then, the paper introduces the KC case for Monterrey, and the kind of RIS developing in the

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city-region. The closing section aims to highlight a culture shift observed in the way people share their knowledge in a wider, more social sphere, thus creating new forms of social learning and interaction.

2. Knowledge city: learning, knowledge and innovation

In urban settings specially, the 1990s challenged our societies to become accurate information managers. As data flows escalated and multiplied, individuals, organizations and societies were compelled to make sense of information (and ideally, knowledge) in real time despite of geographical distance (Castells, 2000). Information flows also changed our concept of development. A frantic rush for golden strategies to process knowledge and enable learning accelerated most organizations, and not few societies. In such context, the notion of learning regions started to emerge as a framework for understanding development in a multi-dimensional, highly networked setting beyond city limits (Florida, 1995), along with other conceptual tools such as a system of innovation approach (Cooke, Gomez-Uranga, & Etxebarria, 1997; Edquist & Johnson, 1997; Lundvall, 1992), clusters **(Porter, 1995), intellectual capital systems (Stewart, 1997), global networks (WBI, 2002), capacity building strategies (United Nations Development Programme [UNDP], 1997), capacity development (WBI, 2009), and other related concepts.

However, such rich blend of theory and practice is directed to knowledge-based typologies such as digital city, learning city, KC, a learning city driven by knowledge production (Work Foundation, 2005); or the Ideopolis, a city of Ideas and inclusive communities. The nature of knowledge, as an intangible asset, a flow and a process, imposed a new millennial epistemological shift from matter-centered to relation-centered knowledge (Carrillo, 2002). Hence, for the purposes of this paper, value-based systems and capital dimensions are the key elements of a KC definition. A KC is a city "purposefully designed to nurture knowledge" (Edvinsson, 2002, in Dvir & Pasher, 2004, p.17). It is "a region that bases its ability to create wealth on its capacity to generate and leverage its knowledge capabilities through knowledge-based extended networks formed by enterprises and people" (Chatzkel, 2004, p.62). In another terms, a KC is one "in which its citizenship undertakes a deliberate, systematic attempt to identify and develop its capital system, with a balanced and sustainable approach" (Carrillo, 2004, p.34).

Amongst KBD approaches, a strategic framework will be advanced for the identification, valuation and systematic development of the city's traditional and knowledge capital in an integrated way (García, Carrillo, Rivera, Leal, & García, 2009), which in turn will support a RIS analysis. The advanced knowledge-based framework is basically a taxonomy of urban capital that deliberately and systematically maps out all city resources—both traditional and knowledge-based required to leverage the balanced and sustainable development of contemporary urban communities. Such taxonomy is based on an assessment of a city's urban capitals system (CS) (Carrillo, 1997; Carrillo, 2002). The CS taxonomy has been the foundational basis of applications such as the *Most Admired Knowledge City Awards* (MAKCi), which greatly reflects how knowledge-intensive research work now depends on an extended community network to gain the necessary perspectives and paths to learn and make sense of emerging KBD initiatives.

The underlying rationale for this taxonomy is to satisfy the formal requirements of a value-production system, i.e., that it be complete, consistent and homogeneous. This taxonomy builds upon other efforts to identify and value collective individual capital in urban, national or regional levels. Known as CS, this taxonomy identifies the basic capital elements of productive systems and "meta-capitals": those other forms of capital not productive themselves but significantly leveraging the system's overall capacity. In the particular case of the RIS for Monterrey, the CS methodology will be applied in first instance to build up the analysis of the capitals system within the city. This would eventually create a complete and consistent set of indicators, within a coherent and practical framework. The key capital category dimensions used in the present exercise are:

1. Identity capital
2. Intelligence capital
3. Financial capital
4. Relational capital
5. Human individual capital
6. Human collective capital
7. Instrumental-material capital
8. Instrumental-knowledge capital.

The first four capital dimensions are considered "meta-capitals" as they facilitate the action of the "agent" (human) capitals and the instrumental capitals. The CS is the base criteria for the eight MAKCi Awards category dimensions that shape the consultation exercise. They constitute a generic taxonomy of urban capitals, deliberately and systematically mapped upon all the resources both traditional and knowledge-based. The CS assumes that the eight capital dimensions are required to leverage the balanced and sustainable development of contemporary urban communities. The CS framework is immersed within context, where the value-based background, history and capabilities of a city play a major role. It mirrors the city's historical antecedents and pre-existing knowledge, as well as present knowledge repositories and capital, which in turn will enhance the city's future potential for development.

2.1. Interactive learning for innovation

Cities are but one type of adaptive social forms of organization, an ever-challenging task in our post-modern world (Giddens, 2002). In them, social capital characterizations on emerging social structures are clearly sensitive to their corresponding ecosystems. They express their full complexity, through actors who are intelligent, expert, complex adaptive systems as well. Actors in cities are accompanied by organizational and institutional structures and rules that are continuously reconsidered and adjusted to match the multifaceted and ever-changing environment. Clearly, "innovative capability and the spread of innovation are a property of a social system that depends on its learning capability" (Wenger, 2009, p. 2). This notion of learning was introduced by Etienne Wenger in 1998, following a long tradition of learning as a social process of development. With Jean Lave, Wenger pioneered research work on the communities of practice (CoPs) concept. They advanced that people in CoPs could develop the capacity to create and share knowledge. This could become a social ecosystem of (social) learning "which includes the ability to find meaning in activities and to engage competently with other people involved" (Wenger, 2009, p. 4). Wenger sees such engagement as social learning accountability. It is perhaps the central challenge for 21st century organizations in all sectors that are concerned with systemic learning and innovative capability (Wenger, 2009; Wolfe, 2009).

In these emerging paradigms, notions of a "learning economy," (Lundvall & Borrás, 1998; Lundvall & Johnson, 1994), and a "knowledge-based economy" (WBI, 2008) have been recurrent. Moreover, knowledge-based frameworks that involve RIS and/or clustering processes for development (Wolfe, 2002) assume learning as knowledge-generative and innovation-led, in which "social