A THEORETICAL INTELLECTUAL CAPITAL MODEL APPLIED TO CITIES

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Abstract

New Management Information Systems (MIS) are necessary at local level as the main source of wealth creation. Therefore, tools and approaches that provide a full future vision of any organization should be a strategic priority for economic development. In this line, cities are "centers of knowledge and sources of growth and innovation" and integrated urban development policies are necessary. These policies support communication networks and optimize location structures as strategies that provide opportunities for social and democratic participation for the citizens.

This paper proposes a theoretical model to measure and evaluate the cities intellectual capital that allows determine what we must take into account to make cities a source of wealth, prosperity, welfare and future growth. Furthermore, local intellectual capital provides a long run vision. Thus, in this paper we develop and explain how to implement a model to estimate intellectual capital in cities. In this sense, our proposal is to provide a model for measuring and managing intellectual capital using socio-economic indicators for cities. These indicators offer a long term picture supported by a comprehensive strategy for those who occupy the local space, infrastructure for implementation and management of the environment for its development.

Keywords: intellectual capital, cities, information society, indicators, models, monitoring public policies.

JEL Classifications: C1, C23, F02, J24, O3, O57.

Introduction

In the knowledge economy, information and management systems are needed that aim to estimate and control intangible capital as the main source of wealth creation. The theme of Knowledge Cities (KC) has become a major topic of interest in the context of knowledge-based development (KBD). KCs, being multi-dimensional by nature, attract researchers from a wide variety of disciplines. Many cities around the world are in the process of

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adopting KBD approaches and, more specifically, of developing KC development strategies.

Cities are thus recognized as centers for the "production of knowledge, culture, information and innovation" in which there is a wealth of interaction between people, organizations and territories (CEMAT, 2006). Moreover, as Stanciulescu (2007) establish the configuration of Europe make that the competition between cities becoming freer and harder so urban marketing becomes an outstanding characteristic of the strategy of local economic development. In this sense, Tapardel and Alexe (2012) considering the main strategic directions and branding elements necessary to implement successfully the strategic planning process and the branding strategy in Bucharest.

There has been a proliferation of descriptions of the model of a knowledge society, but as Romeiro and Méndez (2008) rightly pointed out, despite their number, they do not give a sufficiently rigorous definition of the main object of study: the city as a collector and generator of knowledge. They note the lack of arguments to explain the capacity demonstrated by some cities to incorporate knowledge, build a creative economy or seek innovative solutions in the different areas affecting the life of their inhabitants. In this sense, Mota, Maçãs and Fernandes (2010) analyse the effects of new construction and reconstruction in the growth of mainland Portugal sub-regions; Negut, Di Comite and Neacşu (2010) identify an immigration model in Romania, with a special focus on economic immigration and Silva, Trigo and Antunes (2011) identify and analyse the formal institutional factors in the environment that constrain the creation of industrial enterprises in Covilha (Portugal), that is, studies that only consider specific aspects that affect the cities development.

An approach to the study and analysis of cities from the perspective of the knowledge society would seem particularly timely now, as it is one of the basic aims of the Lisbon Strategy. The Lisbon Strategy is a process intended to make the European Union the most competitive and dynamic economy in the world, based on the management of knowledge and innovation, capable of sustained economic growth, with more and better jobs and greater social cohesion (Malgesini et al., 2005). The four fundamental pillars of the process are:

- The transition towards a knowledge-based society and economy.
- Modernization of the European social model, by investing in human capital and combating social exclusion.
- The application of appropriate macro-economic measures.
- Protecting the environment.

As a result, tools that provide a complete future vision of any organization or institution are becoming an emerging need. It is only recently that researchers, as well as local policymakers, have started looking at the potential for formulating integrated strategies to bridge the knowledge divide and develop successful KCs. However, there is still a lack of integrated KC development strategies, which is an important problem for local authorities and decision makers worldwide.

These approaches are fully operable locally, as the progress of information technology is changing people's living and working conditions, their training, human development and is even a strong influence on where people decide to establish their residence. Today people can live and work anywhere, travel costs have decreased and housing prices have upwardly

converged. Faced with this situation, city governments must consider, among other things, responding to the following questions:
- How can we make the city more attractive to live in?
- How can we attract business?
- How can we promote, develop and capture entrepreneurial spirit?
- What changes must be made to adapt to the new changes?
- What types of structures should be developed?

These and other questions lead municipalities to consider what they would like their future to be, that is, integrated development strategies. They must have tools to consider and quantify potential intangible capital in order to make their cities a source of wealth, prosperity, welfare and future growth.

Hence, the objective of this article is to show the models applied to the intellectual capital of cities. In addition, we propose a model to measure and manage intellectual capital using socio-economic indicators for cities. These indicators provide a long term picture on the basis of a comprehensive strategy for those who occupy the local space, infrastructure for implementation and management of the environment for its development.

1. Background in the measurement of Knowledge Cities

The study and analysis of the measurement and evaluation of intangibles is a new and still fledgling field of research, especially in regard to the Intellectual Capital of Nations (Amidon, 2001; MAP, 2002). Very few studies have been conducted on this issue to date in the context of cities.

What is clear in this approach is that the climate of innovation and the processes of technological transfer are fundamental in determining the model of intellectual capital and its system of relations, in view of the support it provides for the creation and exchange of information and knowledge in different socio-economic spheres. The result is a set of regions or nations with the ability to generate value and social wellbeing in developed economies, conforming to the description of "intelligent nations" (Quinn, 1992). In the field of business there are different proposals and applications, at macro level, because of the current state of knowledge. Work is at a very early stage and to date there are no generally accepted methods for assessing results. Most of the proposals made are limited to a systematic compilation of data without any kind of reference framework for comparison.

Before we classify the different approaches, we need to specify the concept we are working with. Intellectual capital, from the business perspective, is a value which is not visible to traditional accounting information systems and which values assets based on their ability to generate value in the future. Since the work of Kaplan and Norton and that of Edvinsson and Malone, dating back to the mid nineties, the difference between the market value and book value of a company has been identified as intellectual capital and put down to factors of human capacity and organizational structure. Moreover, when we look more closely at the value of the intellectual or intangible capital of a territory, we only find a difference of scale compared to the approach applied to a company. Sánchez (2004) gives a brief review of the definitions of the concept, pointing out that for Bradley (1997) the intellectual capital of a country is the capacity it has to transform knowledge and intangible resources into wealth. Edvinsson and Stenfelt (1999) perceive intellectual capital as the value of the ideas

generated by a combination of human and structural capital, which makes it possible to produce and share knowledge. According to Malhotra (2000), the term refers to the set of hidden assets which underpin the growth of a country and drive stakeholder value. According to this view, intangible capital is part of the productive assets of a territory, the hidden or unapparent part, its value lying in factors related to the development of the inhabitants, their quality of life and wellbeing and technical progress.

At macro level, the models and measurements applied around the world to intangible or intellectual capital can be divided into two major blocks:

• Those specifically intended to measure and manage the intellectual capital of nations or regions.

• Competitiveness analyses and other studies related to the establishment of national or regional indicators.

Most of the first group uses the Skandia Navigator model as a starting point. This can be seen in the following cases:

• Rembe (1999) uses metrics to define a strategic plan for future generations in Sweden, considering different types of capital (measured via the variables appearing in parentheses): human capital (quality of life, life expectancy, education, etc.), market capital (tourism, balance of services, etc.), process capital (quality of management, information and communication technologies, etc.) and renovation capital (R&D, proportion of young people, etc.). This study paved the way for other similar initiatives in regions such as Israel (Pasher, 1999) and Malaysia (Bontis et al., 2002). In the latter study, the intellectual capital of the country's industrial and service sectors was analyzed using a very distinctive methodology, as a group of MBA students acted as a panel of experts and filled in a questionnaire. The results obtained allow us to establish some relationships between forms of capital with an acceptable level of statistical significance. The study of the Arab countries carried out by Bontis (2004) is also of interest and will be examined in greater detail below.

• Rodríguez et al. (2004) from the Centre for Research into the Knowledge Society have produced a model for the intellectual capital of the Madrid region based on the Intellectus model. It distinguishes five interrelated types of regional capital: human, organizational, technological, social and financial-economic. Indicators are proposed for each of them.

• Bossi et al. (2005) propose a model for intellectual capital in the public sector based on the establishment of indicators for five types of intangible assets: internal organization, external relations, human capital, social and environmental commitment, and transparency.

• López et al. (2008) propose a model applied for the European Union 25 regions, Lin and Edvinsson (2008) for 40 countries, Schiuma et al. (2008) for Italian regions, Alfaro et al. (2011) for the European Union and López et al.(2011) for 82 countries.

The studies focusing on competitiveness include the following initiatives:

• The Netherlands Benchmarking 2000 study by the Dutch Ministry of Economic Relations was designed to conduct a benchmark analysis of countries with higher levels of development than Holland and assess economic conditions in them. It is based on indicators of competitiveness, defining certain specific lines of work (macroeconomic climate, human capital, innovation climate, physical infrastructure, product market and financial market), developing indicators for each of them, along the lines of a SWOT analysis.

• Since 2000 the European Commission has published its "European Innovation Scoreboard" (latest version: European Commission, 2009), based on a wide range of

indicators covering structural conditions, knowledge creation, innovative efforts by firms, and outputs in terms of new products, services and intellectual property. The aim is to make a comparative analysis of the 27 member states of the European Union benchmarked against Croatia, Turkey, Iceland, Norway, Switzerland, Japan, Australia, Canada, the USA and Israel.

• Ernst and Young's model (1999), which was applied to New Zealand, focuses more on competitiveness. They present a set of fifteen relevant indicators to compare countries in terms of the knowledge economy. The recommendations produced would enable improvements to be made in public policies.

• Atkinson's model (2002) refers to the United States and attempts to measure and study trends in US economic policy with a view to establishing the best ways to adapt to the new circumstances. His index contains seventeen macro-economic indicators to comprehensively measure the degree to which state economies are structured according to the tenets of the New Economy.

• Also we must emphasize the research by World Bank (2006) on 120 countries, or Ståhle and Bounfour (2008) analysis that includes data for 51 countries for the period 2000 to 2005. Hervás et al. (2011) present a focus for identifying the convergence between the nations intellectual capital theory and the National Innovation Systems from the innovation systems literature. The aim of this research is providing a more robust theoretical framework to explore the drivers of intangibles and the policies which foster competitiveness through the development of the national intellectual capital platforms.

Generally speaking, all of these studies suggest that, just as for companies, there is no clear methodology or reference framework for measuring the intellectual capital of regions (Alfaro et al., 2011).

If we turn to the application of models for intellectual capital at local or municipal level, we find that there is even less literature on the subject. We may discern four different possible approaches:

• The first would be based on applying the models used in business with the necessary minor adjustments. This would be the case of Edvinsson and Malone's proposal (1997) to adapt the Navigator model for intellectual capital to municipalities. More recently Viedma et al. (2004) have argued for the introduction of a methodology to measure and manage the intellectual capital of cities based on the establishment of two models. One would be general and based on determining vision, assets, skill and indicators, along the same lines as Navigator. The other would be more specific, identifying the main industrial microclusters for each city. Questionnaires would be prepared for each one to generate the relevant indicators, which would then be compared to cutting edge microclusters in other cities. Following this business-based approach to analysis, the method was applied in the Castilla-La Mancha region, as described by Baños et al. (2005).

• Adapting intellectual capital models for territories or for the public sector to municipalities. These are comprehensive methods with a theoretical approach designed for the public sector in general, which could be transferred, with variations, to the municipal context. This is the case of the method proposed by Bossi et al. (2005), based on each municipality incorporating the indicators it sees fit, from the five categories mentioned above for intellectual capital in the public sector.

• Carrillo (2004) proposes a model based on an approach analyzing systems for knowledge management and development, establishing a classification for the capital of

knowledge cities. He thus distinguishes three main categories: metacapital, human capital and instrumental capital. This model has been used to assess the knowledge capital of cities such as Manchester in the UK, Legazpi in Spain and Monterrey in Mexico.

• There are also models which are really based on ranking cities by the quality of life there, measured by setting certain indicators, often without conducting a proper multi-variable analysis to measure intangible indicators, which may provide a better explanation of the differences. The survey of Spanish cities by El Mundo (1999) is a case in point. There are various comparative studies of interest, such as the international report by Mercer Human Resource Consulting (2012) on 221 cities in the world and the study by PricewaterhouseCooper (2012). The latter conducted a four-year study culminating in the first ranking of 26 cities, the performance of which he used to highlight the policies and measures that best enhanced the functioning of urban centers. In order to do so, the cities were analyzed using 10 general indicators (intellectual capital and innovation, Technology Readiness, Transportation and infrastructure, Health, safety and security, Sustainability, Economic clout, Ease of doing Business, Cost, Demographics and livability and Lifestyle assets) each in turn obtained by another set of variables (66 in total) of identical importance. The study used publicly available data mainly from three sources: 1) Global multilateral development organizations such as the World Bank and the International Monetary Fund, 2) national statistics organizations, such as UK National Statistics and the US Census Bureau and 3) commercial data providers.

• The KnowCis 2.0 methodology' by Ergazakis and Metaxiotis (2011) is intended to help a local authority to develop a strategy for a 'knowledge city'. The methodology consists of five phases: diagnosis; formulation of strategy; creation of a detailed action plan; implementation; and measurement/evaluation. The paper then presents a pilot application to Maroussi, a municipality in the northern suburbs of Athens in Greece. The main contribution is to select and formulate 'citizen-centered specific actions' to achieve the specific goals of the strategy.

In view of the above, the most promising option for us to adopt is to transfer the model proposed by Nevado and López (2006) for business, the great advantage being that it can be used as a management tool by organizations and is not restricted to measurement and evaluation. However, we shall also design a comprehensive *ad hoc* model for the local context. It will be based not only on specific studies but also on the analysis of competitiveness and other factors, all in line with the theoretical concept of intangible local capital and the nature of the location.

Finally, when transferring the model to the municipal context, it is important to bear in mind the need to incorporate a method to develop a new synthetic indicator for the intangible factors in the local context we are analyzing. In order to achieve this, it will undoubtedly be necessary to transfer the changes included in the accounting information system for the micro version to the information system for public accounts, from the viewpoint of intellectual capital.

2. Model for Estimating the Intellectual Capital of Cities (MEICC)

Our proposal is based on the model for measurement in the business context, but making the logical changes required to adapt it for use in municipalities.

As stated for other models (Roos, 1997; Rembe, 1999; Viedma et al., 2004), it would be desirable to establish the model's vision, the activities and projects to achieve it, define the set of intangible assets, identify indicators for each of them and assign these indicators to the intangible capital we have specified.

According to our methodology, we identify two types of capital: human and non-human, the latter needing to be adapted more when applying the model to municipalities. A number of other types of capital will also need to be included: unspecified types of capital not correctly identified or classified in the original breakdown. The proposal can thus be summarized in the following formulae:

$$ICC = \text{Human Capital} + \text{Structural Capital} + \text{Unspecified Capital} \qquad (1)$$

$$\text{Human Capital} = \text{Capacity} + \text{Ability} + \text{Development} \qquad (2)$$

Human Capital. The knowledge, skills and development of both individuals and social organizations to achieve objectives. It also includes cultural values, health and education, employment and quality of life at work, security, housing and climate.

$$\text{Structural} = \text{Process} + \text{Commercial} + \text{Communication} + \text{R\&D\&i} + \text{Environmental} \qquad (3)$$

Process Capital. Information systems, organizational structures, management systems, networks and interconnections, systems for social participation.
Commercial Capital. Service quality and national and international contracts.
Communication Capital. Image and relations with other entities and social agents or the media.
R&D&i Capital. Possibilities for innovation, research and the development of the city through investment and by exploiting existing capacity.
Environmental Capital. Social and environmental commitments.

The next step is to establish the indicators tables which will enable us to determine the local intangibles reflected in equations 2 and 3. To do this we introduce two types of indicators: absolute (AI) and efficiency indicators (EI). The latter filters costs budgeted by the local government according to the effective achievement of objectives, as shown in equation 4. Furthermore information on these indicators can be found in López et al. (2011).

$$C = \sum_{c=1}^{m} AI_c \cdot \sum_{i=1}^{k} w_{ci} EI_{ci} \qquad (4)$$

In this equation human or structural capital **C** is assessed by a group of **c** absolute indicators, filtered by efficiency **i** and weighted in turn by weighting **w**.

Table no.1: MEICC Human Capital Scheme

Intangibles	Absolute Indicators (AI)	Efficiency Indicators (EI)
HUMAN CAPITAL		
Individual		
Wellbeing Education Capacity Skill Development	Social costs (equality, health, housing, etc.) Total salary cost of qualified employees Spending on education Spending on training	Work-related fatalities Literacy Employment figures Inequalities in income Inequalities in income because of gender Life expectancy Immigration/emigration balance Level of education among immigrants Fatalities from transport accidents Crime rates Percentage with higher qualifications Absenteeism rates Percentage of employees receiving training Unemployment rate
Social		
Training Capacity Skill Development	Spending on training Spending on social development Spending on promoting projects	Number of social groups/inhabitant Number. of group members/inhabitant Number of volunteers/inhabitant Level of public spending to encourage the formation of social groups Level of public spending to support the work of social groups Level of public spending on training Level of spending by groups on training Level of public spending per association member. Level of private spending per association member. Number of initiatives/social group. Index of m^2 of public space ceded to social groups.

Source: Authors' material

The general scheme presented in this paper contains a provisional list of intangibles and indicators which will need to be monitored and developed according to the ideas in the model. The method will also need to be adapted to each city studied, maintaining the same general pattern to facilitate comparative analysis.

Table no.2: MEICC Structural Capital Scheme

Intangibles	Absolute (AI) Indicators	Efficiency (EI) Indicators

PROCESS CAPITAL:
 	
Information and management systems
 	
Organizational structure
 	
Structures for participation
	Public assets
	
	Business assets
	
	Spending on connectivity (social and technological)
	
	Incentives/subsidies
		Number of political parties in the city/inhabitant
		Number of political parties represented in the municipality/inhabitant
		Position in the transparency rating for local councils
		Rate of participation in elections
		   Quality index: certifications
		   Innovation index
		   Social connectivity
		   Business connectivity
		   Processes for social participation
		   Openness of business market
		   Number of land lines/inhabitant
		Number of mobile phone lines/inhabitant
		Number of ADSL connections/inhabitant
		   Proportion of SME/total businesses

COMMERCIAL CAPITAL: Portfolio of clients	Production of goods and services Provision of services	Quality of products and services Customer care services Index of external land, sea, air connections Indebtedness ratio Frequency of use of e-commerce (sales) Number of product innovations
COMMUNICATION CAPITAL Image and institutional relations	Communication and promotion costs	Market share Institutional agreements with government bodies Agreements with the private sector Communication projects Publicity campaign penetration rate Presence in national and international forums
R&D&i: Innovation, research and development	Investment in R&D&i	Centers of excellence in innovation: - Researchers/inhabitant - Higher education places/inhabitant Percentage of employees receiving training Rates of PC use (home and business) Intranet use by companies Frequency of use of e-commerce
ENVIRONMENTAL CAPITAL: Environmental social responsibility	Spending on the environment	CO_2 emissions Hectares of green spaces/inhabitant Tons of recycled waste/inhabitant Tons of uncontrolled waste disposal Percentage of all businesses with CSR policy (excluding SMEs)

Source: Authors' material

Nevertheless, based on the Tables no.1 and 2, and taking the calculation of the intangible components into account, we can make an assessment of the intellectual capital of a

particular city. However, the basic limitations of the system lie in the way in which the indicators are determined, not so much in the study of one city as in comparative analysis.

The implementation of the theoretical model can be made through direct information via local budget and surveys, but the cost increase. The other way would be through indirect information with official databases. The first option is most useful for studies of evaluation of a city, the second to make hidden wealth comparisons between cities.

This model can be adapted to the Urban Audit database for European cities (Eurostat). It is necessary to adjust the indicators. There is sufficient information for the analysis of the dimensions covered in the six capitals in Tables no.1 and 2, but primarily on efficiency indicators. This information would be normalized in percentage scale from per capita values. Subsequently, through an objective method, supported in principal components as proposed Lopez et al. (2011) would add the information. Finally, we obtain indexes for each capital, and a local intellectual capital index that would be comparable.

Local intellectual capital index provides a measure of hidden wealth of the city and a new indicator with a long run vision to compare to. This capital is essential to estimate the economic growth of cities and identify where there are the best conditions to sustainably grow.

3. Discussions and Conclusions

In this first approach to analyzing the intangible capital of a city, we propose a model derived from studies of business organizations from which conclusions can be drawn regarding material assets through the effective use of certain budget allocations accounted for as expenses. However, in order to fully calculate the economic growth of a region, we need to deal with the hidden productive capacity of goods and services, which we refer to as intangible capital, by capitalizing certain amounts normally considered expenses in the budgets of government bodies, or as a complement to tangible productive capacity through the action of other agents involved: businesses and the population.

Based on the indicators tables and taking the calculation of the intangible components into account, we can make an assessment of the intellectual capital of a particular city.

However, the basic limitations of the system lie in the way in which the indicators are determined, not so much in the study of one city as in comparative analysis.

A number of assessments of its application need to made and to this end we would propose the following aspects as research questions:

• The intellectual capital of more than one city can be evaluated using the general scheme of the model and the equations given. This value, calculated in monetary units (constant in the case of a series of studies carried out over time) may be expressed in per capita terms and/or compared to a city used as base 100 to establish national or international rankings.

• However, even though it is important to cover all the indicators stipulated, applying them to the local intangibles scorecard tool, not all of them can be used according to the model, given the conditions it imposes, especially regarding the efficiency indicator and its scale from 0% to 100%.

• In order to assess the indicators, public information will have to be taken into account. This will include the amounts allocated in the budgets of different government bodies to the development of the city and reports drawing on different statistical sources. If insufficient information is available, as is often the case, there are two viable alternatives, with different costs involved:

- Direct assessment, through a study drawn up by the team conducting the analysis; the cost of this will, however, increase in accordance with the number of cities in the sample.

- Indirect assessment, using indices based on the information available from regional and national sources, with the consequent reduction in the significance of the results. This is the first application level using Eurostat database (Urban Audit).

The tool will allow for a range of results, including:

• Analysis of the city's image as seen from outside.

• Ranking cities according to their intangible assets and their intra-country and inter-country features.

• Brand value of a city in the world regarding action such as skills development or environmental responsibility.

• Monitoring public policies which are being implemented.

• Medium term strategic planning in public policies.

In short, the cities of the future need to have tools that monitor their progress, bearing in mind that success lies in achieving a balance between social and economic strengths, so that people and infrastructure support each other. We could even say that cities are the most effective agents of what Edvinsson (2011) calls "Mindware". Therefore the aim is to develop the knowledge and focused analysis of an entire human network. This means that the city of the future must pursue the following goals: 1) Urban planning becomes the brain or neural planning of the city. And we will be looking at how to create synapses between brains by creating special mind zones rather than building building shopping centers. 2) Upgrade the skill of urban planners to the levels of neuroscience; 3) draw the maps of urban value creation to determine where value creation takes place in cities. This used to be the harbor, but in the city of the future, it will probably be the networks, which will not be captured by traditional statistics. Hence, we need to develop social and city intelligence to create maps to ascertain where value creation is taking place.

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