Capital Cities: A taxonomy of capital accounts for knowledge cities

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Rethinking cities as evolutionary value systems

The urban experience

“An inhabited place of greater size, population, or importance than a town or village” is the *Merriam-Webster Dictionary* entry for “city”. Most definitions, unless referring to very particular usages (e.g.: *The City* as London’s financial district), convey the concept of a status granted to a relatively permanent, organized human settlement. The *Chambers Dictionary* includes as a definition the following: “…in various countries, a municipality of higher rank, variously defined…” Thus, a generic concept of city can be synthesized as a self-governed human settlement that has been granted a special status by virtue of its relative size, population, merits or strategic importance. In short, a city is a relatively permanent human settlement of relatively high importance.

The latest concept comes close to idea of *urban region*, a permanent and important human settlement that is not formally designated as a city, but that is functionally equivalent. Conurbated regions, sections of large metropolis, suburban areas, even highly urbanized rural or industrial areas that are home to relatively large and established communities are all equivalent to average small cities (say, between 100,000 and one million inhabitants) and aggregate into medium and large agglomerations with populations of up to 30 million¹. For the purpose of this paper, all such human settlements are equivalent to cities insofar as they provide fundamentally an urban experience to its inhabitants.
The telescopic nature of evolution

Such urban human experience constitutes a rather recent phenomenon in terms of human history. Nomadic tribes of hunters and gatherers account for a half-million years as a dominant form of human society, from the appearance of Homo sapiens sapiens 40,000 years ago to the development of the first Neolithic villages about 10,000 years ago and then the foundation of the first urban settlements on the Sumerian coast and along the Indus Valley about 3,500 BC (Morris, 1967). This covers about 75% of all human history, while both urban agricultural and urban industrial societies together account for the remaining 25%. During these last 5,500 years, agricultural societies became increasingly dominant, while nomadic civilizations progressively vanished until today, when only a few sporadic forms remain. Urbanization experienced a great leap during the Industrial Revolution, the last 200 years which account for only about 0.5% of human existence on Earth. Massive urbanization took hold in most countries throughout the 20th century. It is only with the advent of the 21st century that for the first time in human history over half of the world’s population is becoming a city resident. The urbanization of human experience is, as a dominant phenomenon, a reality of the new millenium.

Hence, the definite urbanization of human experience is taking place about 5,000 years after the appearance of the first cities, which in turn developed about 35,000 years after our species emerged and 500,000 years after the appearance of the first hominids. This “telescopic nature” of evolution will prove helpful in understanding the implications of a Knowledge-based Development (KBD) perspective on the current developmental perspectives of cities. Such an accelerated nature of evolution, where subsequent stages take shorter and shorter periods of time to complete, is exemplified in Table I, where four consecutive segments of evolution--astronomic, biological, human and urban--are depicted.
The acceleration of evolutionary change can also be seen from the perspective of Sagan’s *Cosmic Calendar* (Figure 2) and of Nierenberg’s *Earth’s History Clock* (Figure 3). Sagan divides the estimated 15 billion years since the origin of the Universe into an imaginary 12-month calendar. If the Big bang happened at the 1st second of January the 1st, then the first cities appeared in the last minute of December 31st, at 23:59:35 (i.e.: 5,500 years ago).

Nierenberg does something similar, dividing the estimated 4,600 years since the origin of the Earth into the 12 hours of a clock’s face. In both imaginary exercises the diminute scale of human civilizations and within these, of modern industrial societies, is equally overwhelming.
The powerful pattern that consistently emerges from these scales suggests we might be at the threshold of a novel evolutionary cycle. It raises also the question whether the present configuration, organization and life style of most urban centers might be more an inheritance of tribal, hierarchical and material-production patterns than an urban design and culture fit for the knowledge-based society (Graham, 2002). This idea is explored further towards the end of this paper. The *raison d’etre* for the concept of KC is that the space of possibilities for urban development goes far beyond the provision of better housing and transportation or “Business-as-usual Urbanism”. The concept of Knowledge City (KC) may continue to shed new light on Urban Studies and Planning (USP), even in avant-gard forms of *New Urban Studies* and *Post-urbanism*. 

<table>
<thead>
<tr>
<th>JANUARY</th>
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<tr>
<td>1st, 00:00:01: Big Bang 15 billion years ago</td>
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<td>Every month: 1,250 Million years  Every day: 40 Million years  Every second: 500 years</td>
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<td>Milky Way</td>
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<tr>
<td>Solar System 4,600 million years ago</td>
<td>First organic molecules 4,000 millions years ago  First algae and bacteria 3,600 million years ago</td>
<td>Sexual reproduction 2,000 million years ago</td>
<td>15: Cambrian explosion 31: - First humans 22:30 - Discovery of fire 23:46 - Domestication of plants and animals 23:56:20 - First cities 23:59:30</td>
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Figure 2. Cosmic Calendar (after Sagan, 1989)
Cities as capital systems

The understanding of human organizations – whether a tribe, a country, or a contemporary company – primarily as productive entities is fundamental to KBD. Production here denotes the generation of any form of collective value: a function in which there is a positive difference between total input value and total output value. Value denotes all objects of preference – either tangible or intangible – for a given community, such as material, artistic or relational. Hence, production as the basis of social organization refers to activities which increase social value.

“The colossal time-span over which geological processes operate is emphasized if one compresses the 4,600 million years of earth history into 12 hours on a clock face. The first 2 hours 52 minutes are obscure. The earliest rocks occur at about 02.52 hours but the planet remains a lifeless desert until 04.20, when bacterial and algal organisms appear. Aeons of time drag by until just after 10.30 when there is an explosion of invertebrate life in the seas. Dinosaurs wander the land at 11.25 only to be replaced by birds and mammals 25 minutes later. Hominids arrive about half a minute before noon. The last tenth of a second covers the history of civilization” (Hierenberg, op. cit).
From that perspective, all forms of human organization throughout history constitute value collectives or human value systems insofar as they intend to provide the best possible balance of total value for willingly participating individuals. Value-balance tends to evolve from a focus on the most fundamental means for survival and welfare, to an increasing array of desired intangibles, such as education, culture and other forms of human development. This does not necessarily involve a linear progression, for discontinuities, regressions and leapfrogging may occur.

Hence, the key factor that makes a city exist is neither size nor importance, nor any other parameter on the basis of which a particular human settlement is commonly distinguished above others. Rather, it is the fact that a significant community of people organize their lives around a recognizable value system and decide to settle down and stay together. Given the current transition from industrial to knowledge-based production, cities as value collectives are becoming increasingly knowledge-based. Hence, for the purpose of this analysis, contemporary cities are regarded as emerging Knowledge-based Value Systems (Carrillo, 1998).

Such value systems will continue to sustain their cohesive faculty (i.e.: will continue to exist as cities) insofar as the balance of collective value is positive. Conversely, constituent units such as families, companies or colonies will decide to move to, stay in or abandon a particular city according to their particular value balance relative to perceived alternatives. Nomadic civilizations also involved a trade-off in pre-urban history, where integration to nature, agility and a sense of belonging ranked high at a cost of comfort, permanence, possession and individuality. A trade-off that is being revisited today.

Whereas the individual value perspective is fundamental for the understanding of KBD phenomena such as the attractiveness of knowledge talent, the present analysis focuses on the aggregate or collective value system of a city: the universe of value categories shared by most citizens. While major physical assets, which have so far been the central focus of urban planning continue to receive attention, special emphasis is placed on the intangible capital -or knowledge commons- of cities. Both types of assets become integrated into a single value structure. Such a consolidated value structure –
including all significant forms of social value- is referred to as a City’s *Capital System* (Carrillo, 2002).

**Evolution of production systems**

In the construction of a well-defined capital system—whether for a company, a government office, an NGO or a city—it becomes necessary to look at the generic array of value elements that are required to sustain the production function. Simplified to the irreducible form of an input/process/output system, all production systems consist of: i) an *input capital* that is the given value base with which the system begins to operate (in the case of cities, the set of favourable circumstances that led to the foundation of a city: water supply, orography, climate, etc.); two *process capitals*: ii) the *agent capital* which performs production (in the case of contemporary cities, basically its functional population) and iii) the *instrumental capital*, which constitutes all the means of production (in the case of cities, most of the traditional objects of urban planning such as layout, water supply and sewage, etc.); finally, some form of value exists as iv) *product capital* (*surplus yield* from primitive farming was a critical condition for the transition from nomadic to urban societies). To sum up, all value-creation systems include an input capital, process capitals (agent capital plus instrumental capital) and an output capital. Hence, all human societies can be described as production systems. All operate on the basis of an input, an agent, an instrument and a product capital. Table I illustrates how different societal forms include these elementary forms of capital. Subsequent types of production are arranged in two major eras: the physical-based production era (all types existing from the first civilizations to the industrial societies) and the knowledge-based production era (starting now).
For each of the major production systems there were distinctive forms of division of labour, political organization, social control, technological development, artistic expression, knowledge codification and transmission, and overall cultural integration. These generic structural elements interacted with other space-and-time-specific variables such as historical conditions, military and political dominance, ethnic and linguistic blending, trade routes, regional cultural environment, natural and man-induced catastrophes, ideological movements, etc., that contributed to generate and shape the particular value blend giving each city its unique character (Graham, 2002).

Cities are thus evolving entities, both as production systems and as varying arrays of cultural, political and economic capital systems obtaining a positive value balance as collectives and offering individual citizens a positive trade off. The focus on production systems as a foundational element accounts for the typology of cities across history, geography and cultures.
Defining knowledge cities

Current KC concepts

Knowledge cities (KCs) are creations of the new millenium. Even if references to KCs can be traced back to about a decade ago (Ryser, 1994; Knight, 1995) and even if some ancestral cities as well as some newer ones have by origin a strong association with knowledge and wisdom, was only at the down of the 21st century that cities round the world started giving increasing attention to KBD (cfr. contribution by González et al. to this issue). Since current programs deliberately construed as KCs are still in the planning or in early stages of implementation, few best practices can be recognized yet. There is little in terms of development and assessment frameworks for KCs and therefore little consensus as to what the design requirements, the development parameters and the very concept of KC may be. With regard to KCs, we are at what Thomas Kuhn would refer to as a pre-paradigmatic stage. The intention of this article is to provide a generic framework for designing, implementing and assessing KC programs.

Table II shows some of the terms that have been used to characterize different forms of KBD or demi-KBD as applied to different developmental demarcations. Most combinations can be found in practice. Besides these combinations, there are also some integrated terms such as "Ideopolis", "Brainport", "Technopole" and "Ba". Also, the concepts of "cross-city" (a greater metropolitan area conglomerate) and "meta-city" (several meanings); as well as several Knowledge demarcations ("K-x"), such as "K-Twin cities", "K-Conurbation", and "K-Alliance/Network" (Local, Interregional, International, Global). The KC concept admits all associated denominations, since all relevant KBD conglomerates are urbanized regions and therefore, all –unless larger and, hence, containing more than one urban region, such as a country or a continent-- can be reasonably described as knowledge-urban regions and ultimately, as KCs.
The amount and diversity of KC concepts, most of them rather improvised, can be arranged in three groups or stages, depending on how close they come to the concept of KBD. All can be sorted in terms of the explicit or underlying concepts of “Knowledge” and “Development” on which they are based and, therefore, the KBD concept they sustain. Table III shows the generic characteristics of KCs in these stages. While all three can generate social value, Stage III does represent the distinctive potential and full KBD perspective of Social Capital Systems and therefore the ultimate concept of KC.
The contribution by González et al. to this issue provides examples of current programs which, according to available information, can be categorized under stages I, II or III. Since the development of social capital attainable through stages I and II can be subsumed under stage III, the rest of this article will concentrate on the latter and regard it as a synonym of KBD.

Hence, when referring to KCs, the unit of analysis is the city in the broadest sense described earlier and stage III KBD becomes the framework of analysis. Therefore, a Knowledge City can be defined as a permanent settlement of relatively higher rank in which the citizenship undertakes a deliberate, systematic attempt to identify and develop its capital system in a balanced, sustainable manner. All other initiatives, such as technoparks and e-programs can, from this perspective, be regarded as stage I and II KBD programs, eventually leading to a full KC initiative (stage III KBD).

**K-cities levels of analysis**

From a KBD perspective, deploying a KC strategy consists primarily of i) making explicit the value system to which a city responds, ii) identifying the critical dimensions of such a system in everyday life and iii) converting such dimensions into an operational system of indicators and policy-making. The city capital accounts thus become the central instrument for strategy formulation, policy implementation and overall accountability.
If all theories are value-laden, development frameworks carry a substantial load of tacit and implicit values. Not only every development framework needs to be clear about the axiological bases on which it stands, but in addition each methodological decision should state the preference system on which it rests. Therefore, making the value system of a city explicit is not enough for the construction of its system of capitals. Each external assessment must also be able to identify the value coordinates to which a particular city responds. Benchmarks and comparative analyses should take into account the specific developmental conditions of a given city. Some of these levels of analysis include:

- **Age and history.** The age of some cities runs in millennia, while others are barely a century old. Experiences accumulated in collective memory are a powerful determinant of a city’s possibilities, as is its layout. What was once a treasured factor, such as a strategic location for defense, may now be a liability and vice versa.

- **Endogenesis vs. Exogenesis.** Some cities have been built from within, responding mainly to internal forces, whereas others have been largely shaped by external forces, such as domination by foreign rule, immigration, *etc.* Although all contain a blend of both, it is important to understand where current value elements originated (Graham, 2002).

- **Critical incidents.** Most cities have undergone a number of experiences which have left scars on their current configuration. Some have been totally destroyed by natural or man-induced action and re-founded, in some cases, several times. Others have experienced the superimposition of a new urban layer⁴. Still others have been occupied by an alien power, with the displacement of the original inhabitants or their submission by use of force. Others have been divided, sometimes into several quarters. Finally, some have been absorbed on and off by alternating nations or cultures, due to border redefinitions or political reconfigurations. Critical incidents have also been benign, such as economic booms, the merging on equal grounds or the peaceful assimilation of multiple ethnic and cultural streams.
• Relative level of development. There are no *a priori* bases on which all cities can be compared or rated in terms of KBD. Even if consensus were built on the general applicability of a framework such as the one presented here, the relative weight of each capital can be established only with reference to the specific importance it has in a given city’s context. Nevertheless, it may be possible to achieve consensus on some basic standards, such as human rights, environmental protection, social cohesion, etc. in similar fashion to what has been happening at other levels of global organization. In any case, it becomes fundamental to make explicit the city’s own value system as the grounds for assessment and comparison. In this respect, not all capitals are given the same weight in terms of developmental perspectives in Addis Abeba as in Adelaide, in Ankara as in Antwerp, or in Bangkok as in Bogota. Comparisons are possible and meaningful, and in fact desirable, once the capital system of each city is established and clearly referenced to its distinctive value base.

**Urban capital dimensions**

As mentioned before, Capital Systems are applicable to all forms of human organization. Having originated, as all KM did, in a business environment, it soon expanded from commercial enterprises to public management, international agencies and NGOs. In the case of commercial enterprises, each sector of the economy, industry and line of business has characteristic capital dimensions. Cities, too, have some capital dimensions of their own. Some of these dimensions derive from space and time coordinates. The main capital dimensions resulting in the present balance or *State of The City* seem to emerge at three historical moments: i) those capitals which pre-existed the foundation of the city, mainly the natural settings determined by geographical position; ii) those capitals which are the product of human activity throughout history and have left a mark—whether physical, social, economic or cultural; and iii) those capitals which constitute the current *fitness* or evolutionary potential of that city, in terms of collective competencies for sustainability. These dimensions can be distributed as follows:
One of the driving forces of the KM movement has been the need to identify and value knowledge capitals (also "intangible assets" or “intellectual capital”) and to capitalize on them. At the organizational level, there have been multiple frameworks, mostly inductive exercises, to categorize knowledge capital dimensions and convert them into operational indicators. There are also several proposals of KC indicators. The contribution by González et al in this issue tracks the most visible exercises and compiles them into a general list of KBD dimensions and indicators. That compilation provides an idea of what people have been looking at so far in terms of KC indicators but does not provide a comprehensive system of indicators, let alone a consistent one.
Like any formal system, capital systems must aim to fulfill two fundamental criteria: completeness and consistency. The first requirement means that it covers all significant categories; the second, that the inclusion of one does not imply the exclusion of another. These two requirements also imply –unlike most existing knowledge capital indicator inventories- that the categories must be homogeneous, i.e. that all categories are generated from a well-defined set of dimensions. In particular, financial and material capitals must be included in the same universe of natural dimensions as all other social knowledge capitals.

A taxonomy of capital accounts for knowledge cities

A Generic System of Capitals (applicable to all human organizations) is proposed and discussed elsewhere, with particular reference to KBD (Carrillo, 2002)\(^5\). From that Generic System, and considering the levels of analysis as well as the specific capital dimensions of cities discussed before, a General Taxonomy of KC Capitals can be constructed. Table IV is a summary of such a KC Capitals Taxonomy, to which a more detailed disaggregation immediately follows. This disaggregation is by no means complete\(^6\), but it aims at being generic at the upper levels of aggregation.
Table IV. Basic categories of a generic KC Capital System

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategories</th>
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<tbody>
<tr>
<td><strong>Meta-capitals</strong></td>
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<tr>
<td>- Referential</td>
<td>• Identity: clarity and differentiation</td>
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<td></td>
<td>• Intelligence: external entities and events</td>
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<tr>
<td>- Articulation</td>
<td>• Relational: social integration and cohesion</td>
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<td></td>
<td>• Financial: economic sustainability</td>
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<tr>
<td><strong>Human Capitals</strong></td>
<td></td>
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<tr>
<td>- Individual base</td>
<td>• Health: biological inheritance and physical development</td>
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<td></td>
<td>• Education: wholistic personal development</td>
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<tr>
<td>- Collective base</td>
<td>• Live culture(s): wealth of cultural inheritance</td>
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<td></td>
<td>• Evolutive capacities: cultural fitness</td>
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<tr>
<td><strong>Instrumental Capitals</strong></td>
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<tr>
<td>- Tangible</td>
<td>• Natural: exiting before the settlement</td>
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<td>• Artificial: created or incorporated by settlers: infrastructure</td>
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<tr>
<td>- Intangible</td>
<td>• Organization and production systems in: Non-electronic repositories</td>
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<td></td>
<td>• Organization and production systems in: Electronic repositories</td>
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Disaggregation of the Generic KC Capital System

- **Meta-capitals**
  - Referential
    - Identity: clarity and differentiation
    - Intelligence: external entities and events
  - Articulation
    - Relational: social integration and cohesion
    - Financial: economic sustainability

- **Human**
  - Individual base
    - Ethnic diversity
    - Health
    - Education and learning
    - Socio-economic
  - Collective base
    - Live culture(s)
      - Languages
      - Religions
      - Customs
      - Clothing
      - Food
      - Celebrations and rituals
    - Evolutive capacities
      - Diversity
      - Tolerance
      - Participation

- **Instrumental**
• Tangible
  • Geographic (given)
    o Longitude and latitude
    o Orography, hidrography, soil composition, tectonics,
    o Climate, Natural Assets and Liabilities
  • Environmental
    o Air
    o Soil, vegetation
    o Water: sources and dependency
    o Ecological sustainability
  • Infrastructural
    o Landscaping
    o Underground infrastructure
      ▪ Pipelines
        • Water
        • Sewage
        • Gas
        • Oil
      ▪ Wiring
        • Electricity
        • Telephone
        • Wired telecoms
    o Urban structure
      ▪ Zoning, districts, neighbourhoods
      ▪ Commons, parks, squares
      ▪ Streets and civil infrastructure
        • Highways, avenues, streets
        • Bridges, tunnels
      ▪ Traffic configuration
    o Extra-city transportation
      ▪ Roads
      ▪ Airports
      ▪ Docks
      ▪ Train and bus stations
    o Intra-city transportation
      ▪ Public transport networks
        • Underground
        • Urban train
        • Buses
• Intangible or symbolic
  • Public institutions, systems and procedures
    o Authority appointment procedures
    o Government systems and procedures
      ▪ Legislative
      ▪ Executive
      ▪ Judiciary
  • Private institutions, systems and procedures
    o Commercial institutions
    o NGO’s
  • Information Platforms
    o Manual registration, processing, storing, retrieval and distribution systems
      ▪ Print media
    o Electronic registration, processing, storing, retrieval and distribution systems
      ▪ E-government
As the system disaggregates further and further, it becomes more and more specific to a given city. Hence, these categories have general applicability only at the uppermost levels. It is each city’s privilege and responsibility to build its own distinctive capital system, a responsibility that may be facilitated but never delegated. The more endogenous and participative the exercise, the more meaningful the result. The process can certainly benefit from benchmarking and external sources. KC’s Capital Systems can be nourished from Urban Rights Charters, such as those proposed by Borja (2003), and The European Charter of Rights On City Safeguards (Saint-Denis, 2002; extracted by Fiori, in Borja, op.cit.).

Cities of the Knowledge Era

The megacities prospect

Graphic visualizations of future cities often depict a sort of technologically stylised projection of current cities. Huge skyscrapers, beehive-like human conglomerations, all connected by some gravity-defying transportation network. Massive and standardised as a general rule, but with life-patterns very similar to today’s.7. Certainly, the demands on housing, jobs and services faced by many cities, given current trends in population growth, are enormous. Even if some regions have reached a stable population (balancing an ever-increasing life expectancy), migration and other phenomena exert a substantial strain on the size and density of cities. Until global population peaks, as hoped, by 2025 and the demographic curve has its subsequent
impacts (elderly peak during the second half of the 21st century), this will be a critical consideration for most of the world’s regions.

Still, forecasts for future cities tend to take for granted the continuity of the model of human life that became dominant by the end of the 20th century: the industrial capitalist model. Such a model implies, amongst other assumptions: i) the individualization and private ownership of most material goods and services; ii) a hierarchical distribution of wealth and power; iii) the physical presence of individuals for the performance of most core activities, such as work, education and leisure; iv) a production pattern involving massive inputs, large production centres, massive outputs and consequently vast waste disposal, etc. From this perspective, cities can only become bigger and bigger, demanding increasingly greater inputs and generating growing outputs and waste. The end prospect for any such approach is inevitable collapse, as cities surpass the manageable limits for superimposed growth. For many ancient cities and civilizations, such a limit was the inexorable depletion of natural resources within a radius close enough to balance access cost. For contemporary and future megacities the limits are not just physical and economic, but also the social, cultural and psychological limits to intolerable overcrowding, some of which may increase exponentially as size increases. Vulnerability to terrorism and epidemics, lack of social identity and cohesion, violence, intolerance and control, etc. all tend to increase with overcrowding.

**Urban life in a knowledge era**

Looking at the transition from a *Material-production Era*—encompassing all of prior human history—to a *Knowledge-production Era* (Fig. 1), we become aware of a number of major changes that are bound to have an impact on the patterns of human activity and urban living. Some such changes, to be discussed subsequently, include:

- Dematerialization: a lesser volume of material inputs and outputs
- Environmentalism: a greater concern with sustainability
- Experience upgrade: the rise of the k-worker and the k-citizen
- Virtuality: the capacity (*virtus*) to attain the same results without the conventional means (*e.g.*: another space/time)
Essentialism: the understanding and pursuit of ever more fundamental values. The trend towards the systematic reduction of material inputs is a current reality. Even if absolute demand is still growing and will continue to do so for some time, it is countered by strong forces stimulating de-materialization as the transition from industrial to knowledge-based production takes hold in most regions. Some of these forces are economic, such as the energy crises that started in the 70s and the productivity pressures generated by the quality movement: Both meant the production of more with less and the reduction of input waste and cost. Some are technological, such as new materials and nanotechnology. Some others are cultural and political, such as recycling and organic living. Some integrate all of these factors into public policy initiatives, such as the European Union’s Factor X Movement, aiming at reducing material demands to 1/20th of 2000 levels by 2020 (Robèrt et al, 2000).

A greater concern and more effective actions for stopping irreparable damages to the biosphere by human action are evident. It is not clear whether all these efforts will be enough to prevent the global degradation of air, water and soil. Some damages, such as the extinction of countless species seem irreversible. Nonetheless, the environmentalist movement has taken hold worldwide and is gaining weight in the value systems of all nations, regions and cities committed to sustainable development and has been expressed in agendas for action such as the Kyoto Protocol (Newman and Kenworthy, 1999; Brown, 2001; Beatley, 2002; Schor and Taylor, 2003).

A further trend associated with the emergence of Knowledge Societies is the growing demand for the Knowledge Worker, which has received increasing attention (Drucker, 1994; Florida, 2003). This phenomenon is paralleled by the less noticed emergence of the Knowledge Citizen, which refers to the profile of a city dweller who is distinctively better educated (not necessarily in academic terms), well-informed, participative, critical, and politically active; seeks a better quality of life; has healthier habits and is less dependent on consumption; gives more weight to artistic expression and cultural activities; is more diverse and tolerant; is more competent in human relations. At first, these may be just by-products of a form of production (knowledge-intensive jobs) which increasingly demand such values and competencies (intellectual as well as emotional).
At a growing rate, these characteristics involve an experience upgrade, insofar as people seek to live more balanced and meaningful lives. Virtuality is another trend that is still little understood and anticipated, but that has already pervaded many social practices and is bound to gain ubiquity (Rheingold, 1994). The most immediate impact is the reduction in displacements made possible by the Internet and by wireless telecommunications. Not only work, schooling and shopping patterns are changing substantially. Some of the most distinctive features of the industrial city, such as commuting, suburban residence, central districts, and zoning in general are fading. Instead, distributed work and learning, e-services, empty office space, and zone reconversions are fast becoming commonplace. Yet, the most transcendental aspects of the virtual experience are only beginning to become manifest. In the foreseeable future, the most important aspects of the knowledge-urban experience will no longer require presence and simultaneity, and therefore the current patterns of transportation, scheduling, configuration, zoning and infrastructure (9). Simultaneously, the privilege of human contact: concurrence in transportation and public space as the lifeblood of the city, would be managed no longer as inevitable chores, but as fulfilling options.

The final trend is the growing preference of knowledge citizens for more fundamental aspects of their value scale. In the introduction, cities were reconceptualized as collective value systems. In subsequent sections the transition of cities as value structures throughout different material-based societies and into the knowledge-based society was observed. The evolution of the individual’s values as possibilities evolved, was also recognized. Alongside those values, social configuration, practices and institutions also evolved and with these the physiognomy of cities. Therefore, the fundamental transformation that knowledge cities bring as human preferences and activities are reallocated cannot be neglected. Contrary to the received view of megacities, a trend towards urban minimalism, revaluation of commons (greens and public spaces as well as knowledge commons) environmental care, minimal individual material possessions (obtaining experiences, rather than acquiring objects), can be envisaged (Landry, 2000). On the edge of the virtual and essentialist city, human experience transcends the original motivations for settling down, to become global and
minimalist at a time. The No-City\textsuperscript{10} as an ideal becomes the most powerful vision for human communities in terms of the re-expression of the lost values of nomadic life in the context of the knowledge-intensive civilization. Unrelenting search, critical thinking, permanent discovery, detachment both from things and fixed ideas are the grounds for creativity and innovation. If a truly creative class is emerging, it should not fear these values.

Transition patterns and breaking points

The transition from industrial cities to KCs, like other major changes in urban history, will blend generic historical conditions with particular ones. For the first time in history, a number of factors such as those analysed throughout this article, are generic in nature and global in reach. Environmental, technological, commercial and financial realities have now a global dimension. But these realities are far from the homologation of civilizations and the entropy of history, certainly not the history of cities. Paradoxically, the downfall of globalism as an ideology is evident not only in the catastrophic results of financial homologation programs by the Bretton Woods institutions, but also in the resurgence of regionalisms and the revaluation of indigenous cultures (Saul, 2004). “Think globally, act locally” becomes a pertinent motto for knowledge citizens.

If de-materialization is to be paralleled by the converse increase in knowledge-intensity of societies\textsuperscript{11}, it becomes clear that we are right at the transition point. De-materialization may continue until probably reaching a lower limit, while knowledge-intensification may continue in unexpected ways. Given that the emergence of the knowledge society is synchronous with the definite urbanization of humanity\textsuperscript{12}, KCs are becoming the scenario for possibly the most transcendental change in human evolution. Figure 4 describes a transition pattern from material-intensive civilizations (particularly the industrial capitalist society) to knowledge-intensive civilizations. The relative weight of both becomes inverted, with the crossing point happening about now. The shift of GDP base from mainly-industrial to mainly knowledge-based in an increasing number of countries after WWII and the very emergence of the concept of Knowledge Cities constitute indications of this trend. The concept of urban development evolves from
economic growth \( (i.e. \) capital accumulation) to value balance \( (i.e. \) dynamic equilibrium of capitals).

The emergence of KCs as a breaking point in human evolution has been argued throughout this article on the basis of a number of signs indicating the discontinuity of the current state of affairs. As a matter of fact, unless such emerging discontinuities are consummated, the very survival of life on Earth may be at risk. The emergence of de-materialization both as a disruption of industrial capitalist societies and as a driver towards KCs is fundamental for the understanding of the significance of the current evolutionary crossroads. Figure 5 depicts a hypothetical pattern on a nominal time scale by which forms of production and associated forms of civilization were triggered by critical events, given an appropriate context. As a new form of collective life became dominant, new conditions prepared the ground for subsequent disruptions to take place.
For far longer than the whole history of cities, the Neolithic village was a semi-permanent human settlement forced to move continually by the fast depletion of the soil. As agricultural techniques improved, a surplus agricultural yield meant several things: i) an input ("investment") capital was available to "finance" labour for building, crafts and services; ii) a technological capital allowed for cultivating land without depleting its nutrients and for carrying out irrigation; iii) social bonds and rules of coexistence congregated early settlers into urban agricultural civilizations with written records starting about 3,500 BC and lasting through 1800 or 96.36% of urban history. On a grand scale, this pattern repeated itself several times in ever-shorter periods: the industrial urban society started only 200 years ago and is rapidly approaching its demise. The emergence of KCs might be starting another such cycle, but this time involving a qualitative difference: the transition from the material-based value system, to the knowledge-based, where intellectual, emotional and relational factors are as critical components as physical infrastructure and survival factors continue to be. The clear
signs of transition towards knowledge-based societies starting at the end of WWII suggest the immediacy of a major qualitative change, much like other similar transitions:

The life of the hunter-gatherer, of moving with the seasons and living off a cycle of food sources, was first adopted by *Homo erectus* about 1 million years ago and it continued through the archaic *Homo Sapiens* and the emergence of *Homo sapiens sapiens*, and down to the invention of agriculture only 10,000 years ago. Within 8,000 years at least half of the population had shifted to the new way of life. By 200 years ago, the self-sufficient hunters and gatherers had dwindled to less than 10% of the Earth's population. The speed of transition is as dramatic as the nature of the change. (The Commonwealth Institute, 1985, p. 30)

This syncopated pattern of change, with a slow beginning, fast acceleration and relatively sudden end, rather than suggesting the death of the city suggests a cycle of regenerations and necessary deaths, of subsequent life renewals much in the fashion of Kelly’s (1999) cycles of innovation. Cities exhibit such resilience and self-regenerating capacity:

Is the city dead? Now it is globalization that is killing it. Before there was the development of the metropolis, that emerged with the Industrial Revolution. And before that the baroque city, that expanded beyond the Medieval kingdom. Periodically, when historic change appears to accelerate and is perceptible in the expanding forms of urban development, the death of the city is decreed. Borja (2000), p. 23.

**KBD as a disruptive paradigm**

Change in nature comes in different forms. There is evolutionary change with characteristic bifurcations. There are sudden leaps, exponential accelerations, and cyclical changes. There is also revolutionary, retrogressive and catastrophic change (Myers, 1990). Individuals, as well as societies, also experience change throughout their lifetimes in several, often disruptive, ways.

Throughout this paper, the case has been made for the contribution of KM to Urban Planning and Studies in terms of KBD and particularly the contribution of Capital Systems to the study, design, development and assessment of KCs. Yet, such a case would be somehow futile, if it fails to generate the sense of urgency and discontinuous
change that leapfrogging into a Level-III KC implies. UPS Models have become increasingly receptive to the idea of holistic and sustainable development. A case for City-KBD holds insofar as KC frameworks leverage the evolution of cities to new realms. In other words, the case for KCs is as substantial as KBD proves to be a disruptive paradigm.

During the course of this paper, several analytical dimensions of cities have been suggested as critical triggers in the transitions towards KCs. To conclude, two sources of tension built into cities as value systems and the possibility that these may be solved in the transition to KCs will be discussed. These are the animal/human and the individual/collective tensions.

The animal/human tension refers to the apparent opposition between natural instinct and civilized rationality that permeates most human civilizations (Griffith, 2003). The need to enforce the rules of urban coexistence seem to have induced a polarization of the corporeal and the psychological, denigrating the first and idealising the second. Western culture in particular, and hence westernized cities, carry the mortgage of the mind/body dichotomy and the subsequent alienation of mankind from nature. The received denial of the animal and natural bases of human life awaits a solution in a knowledge culture capable of accommodating all dimensions of human existence. Such solution, often contradicting the cannons of established moral and religion, are becoming increasingly well established on the basis of sobiobiology and evolutionary psychology (Small, 1995; Wilson, 1998). Indeed, a capital system—and with it, KM and KMD—is meaningful only insofar as it is homogenous, and homogeneity is only attainable within a continuum perspective of the natural universe (Liedloff, 1985). A KC System of Capitals encompasses all relevant dimensions of an urban experience. Therefore, a KC Capital System should aim at integrating the physical with the cultural, the organic with the psychological, the emotional with the rational. The minimalist vision of future cities presented here may come close to recovering a balance with nature (both extra-city and intra-city) that not only existed in the pre-urban world, but that occurred in those middle-ground demi-cities that were (and to some extent still are) nomadic encampments on the one hand and the feudal-manorial blend of town and country on the other (some New Urbanism and Post-urbanism trends aim at recovering the local village in suburban
areas, favouring pedestrian walks, ecological balance, integration with nature, open commons). As mentioned earlier, for any knowledge-based community the promise of the city (the attainment of its value-system) becomes ever more feasible as virtualization, essentialism and distributed patterns of life prevail.

The second tension, the individual/collective, is not independent from the first. As primeval urban settlements responded to bare survival values such as defense and food, a physically strong and highly centralized leadership prevailed. During critical times, some as widespread and lasting as the lower Middle Ages, urban life meant the rendering of will to a lord in exchange for protection. The promise of the city, the values of a higher existence, were kept out of reach in an ethereal safe by the very same powers which managed production:

“Social ethos and organization enforced submission to the common good of earthly survival and heavenly reward; the true city, civitas Dei, was not of this world.”

The history of cities is largely the history of the emancipation of their citizens and the pursuit of self-regulation, the collective ownership of the ideal, the accountability of city management. Yet, the physiognomy of each city and the less visible configuration of its power structure have bequeathed to some extent the ethos of hierarchical power and differential rights. The emergence of the knowledge citizen is an opportunity to regain and leverage equal opportunities and self-determination for individuals. As citizens become better informed and more responsible, governments are bound to become more transparent and accountable. A KC’s Capital System exhibits the declared values and associated responsibilities for each. A KC’s Capital System is the true city in this world.

The possible resolution of these tensions by the trends towards virtualization and minimalism, on the one hand, and by a more responsible role of knowledge citizens, on the other, can be catalyzed by the Capital System. The Capital System becomes an instrument for social responsibility and social accountability. Any city government truly committed to its residents should welcome the formulation of its own, distinctive Capital System, as a means to build a consensus on the value structure that provides identity and cohesion to that community and focuses its developmental efforts. KCs are
becoming the scenario for probably the most substantial development in human evolution. History, the history of the human species as a conscious creature, may be just about to start. We cannot help being seduced by the implications of recovering the collective dream and making it accountable to public knowledge:

We are all overwhelmed by a strange love, the secret love of future and its unknown face … The City overwhelms us with the terrible duty of hope
-Jorge Luis Borges\textsuperscript{14}
References


Endnotes

1 According to the City Population website http://www.citypopulation.de/World.html (updated 2004-05-01), there are now 421 agglomerations in the world with a population of 1 million or more and 24 with 10 million or more, lead by Tokio (33,850,000), Mexico City (22,000,000), Seoul (21,850,000) and New York (21,800,000).

2 Eamonn Healy used this concept and the resulting acceleration into the “neohuman”, while interviewed in Richard Linklater’s film Waking Life (Fox Searchlight, 2002). Carl Sagan (1989) made an extensive didactic use of the idea.

3 Much as in medieval cities, when lords competed to draw the most creative talent in war, medicine, arts, and entertainment (Serviá, 1995, p. 61), today’s cities are competing deliberately to attract the most qualified talent in knowledge-based business creation and development.

4 The first excavations of the Hissarlik hill by Schliemann in 1870 in search of the mythic Troy on the basis of the Homeric texts discovered not one but nine cities, superimposed in a vertical register of 3,000 years (Garnett, 1967).

5 The Generic System of Capitals taxonomy, including the original definitions and an explanation is available at http://www.worldcapitalinstitute.org.

6 A more detailed disaggregation and some actual cases are available at http://www.knowledgecities.com.

7 A recent educational TV series projects Megacities as the paradigm towards which urban planning is evolving.

8 Californians throw away more than 5 million tons of food scraps each year. See http://www.ciwmb.ca.gov/FoodWaste/ The implications of urban waste management are complex, with important international programs addressing this issue. See http://www.gdrc.org/uem/waste/waste.html and http://www.worldbank.org/urban/solid_wm/swm_body.htm and also http://uwmrc.cjb.net/.


10 In the same sense as “no-banks” (i.e.: alternative organizations providing financial services), “no-business” (e.g.: ‘free’ goods and services delivered by Internet with no apparent profit) and other instances have been named to designate functionally equivalent entities but lacking conventional features.

11 All societies have a knowledge base, but their relative weight is different. The knowledge society is that in which over 50% of production is based on processing of information rather than matter and energy.

12 This includes all knowledge-intensive communities, whether living or not in relatively large human urban conglomerates. Under the perspective of virtualization and essentialism, the once polarized experiences of rural and urban living would become increasingly alike.

13 “City”, Encyclopaedia Britannica article, p. 4.