

Innovation Engines for Knowledge Cities: An Innovation Ecology Perspective

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Abstract

In recent years there has been an intensive research about the conditions which enable and catalyze knowledge development and innovation in the business world. At the same time, practitioners are experimenting with related concepts, methods and tools aimed at creating "Innovation Enabling Climates" in their organisations. We begin this paper by suggesting a model for such "Innovation Ecology". This model is composed of several dimensions, such as the physical space, the time space, the virtual space, the cultural space, the financial space and the human space.

A second new focus area in the research of knowledge development is the role of the city as a hub for intensive flows and exchanges of knowledge between its habitants and additional actors. Similar terms such as "Knowledge cities", "Intelligent Cities", "Educating Cities" and "Smart Cities" are being used.

We suggest weaving the learning from the business and urban worlds by attempting to apply the dimensions of innovation ecology models to knowledge cities. More specifically, we look at multiple traditional urban constructs, and show how they might (and sometimes have been for many years) significant drivers for creativity and renewal. Innovation is the process of turning knowledge and ideas into value. An "Urban Innovation Engine" is a system which can trigger, generate, foster and catalyze innovation in the city. Typically, it is a complex system that includes people, relationships, values, processes, tools and technological, physical and financial infrastructure. One possible unifying principle behind the dimensions of innovation ecology as well as innovation engines. We suggest that what Innovation Engines really do is to create Conversations – which are the foundation of most innovations.

We bring some examples and snap-shots from several Urban Innovation Engines such as the Museum, the Library, the Stock Exchange, the Café, the Brownfield, the Grand Fair, the Outlook Tower, and the Industrial District.

This paper is concluded with an attempt to provide a set of guidelines for creating a knowledge city using innovation engines as its building blocks, and innovation ecology elements as an important part of its operating system.

Keywords: knowledge cities, innovation management

Introduction

The town-planner J. Borja (1998) defined the city as "that European, Mediterranean, but also American, Asian, physical, political and complex cultural product that we have characterised in our ideology and our values as a concentration of population and activity, a social and functional mixture, capable of self-government and an area of symbolic identification and civic participation. The city as a place of encounter, exchange, where city equals culture and trade. A city of place and not a mere nexus of flux."

The world's burgeoning cities are a critical fact of the 21st Century - and represent one of the greatest challenges to the future. By the year 2050 cities with populations over three

million will more than double from 70 today to over 150. When knowledge is perhaps the most important factor in today's economy, there is a growing interest in the concept of the "knowledge city".

"Knowledge" and "Innovation" are strongly connected concepts. Debra Amidon tied the two together and defined "Knowledge Innovation" as *"the creation, evolution, exchange and application of new ideas into marketable goods and services for the excellence of an enterprise, the vitality of a nation's economy and the advancement of society as a whole"*(Amidon 1993). The process of innovation becomes expeditiously one of the ultimate managerial challenges of the next decade and beyond. It is at the heart of business survival, transformation and sustainability (Amidon, 1996). But, innovation is critical not only the business but also to civic domains, such as cities, and regions. The quest for innovation is relevant not only to economic sustainability but also to social and cultural life. Therefore, the creation of an organisational climate which enables and catalyzes innovation deserves special attention from both the academic community and the practitioners who leads all forms of organisations – be it businesses, cities, regions, non-governmental organisations etc. In this paper, a set of the elements of such a climate, called the principles of Innovation Ecology, is discussed.

Then, the paper argues that these principles can be embedded in the citizen and city life through "Urban Innovation Engines". Although the terminology is new, there are many historical examples of "knowledge cities" and "Innovation Engines". Thus, some of the snapshots reflect thousands years old experiences, while other represent contemporary initiatives.

The trigger for this paper was the three "Knowledge Café"s session at the combined Entovation 100 roundtable and Latin America Knowledge Development forum, Monterrey Mexico, November 2003. Three levels of the knowledge society were discussed: "knowledge Cities", "Knowledge Regions" and "Knowledge World".

What is a "Knowledge City"?

Leif Edvinsson defines Knowledge City as *"a city that purposefully designed to encourage the nurturing of knowledge"*.

An interesting list of characteristics of a knowledge city is included in position paper titled *"Culture, The Motor Of The Knowledge City - Strategic Plan of the Cultural Sector of Barcelona"* (Barcelona, 2003). The following table highlights some of the proposed criteria:

- A city that has instruments to make knowledge accessible to citizens.
- A network of public libraries that is compatible with the European standards.
- Access to the new communication technologies for all citizens.
- All cultural facilities and services with a central educational strategy.
- A city that has a newspaper- and book-reading level that is similar to the average European level.
- A city that has a network of schools connected with artistic instruction throughout its territory.
- A city that is respectful of the diversity of cultural practices of its citizens.
- A city that places the streets at the service of culture.
- A city that simplifies, through the provision of spaces and resources, the cultural activity of the community collectivises and associations.
- A city with civic centres that are open to diversity and that foster face-to-face relations.
- A city that makes available to citizens from other territories all the tools required for them to express themselves.

Table 1: Some characteristics of a knowledge city

There are already several cities that identify themselves as knowledge cities, or generated strategic plans to become knowledge cities. The list includes the following cities, for example:

- ❖ Monterrey City, Mexico – the new governor elected in 2003 set the explicit goal of becoming a knowledge city among his top 5 priorities.
- ❖ Melbourne, Australia – its strategic plan for 2010 emphasizes the path towards enhancing its position as a knowledge city (Melbourne 2003).
- ❖ Delft, the Netherlands – the city clustered its knowledge intensive projects included in the “delft knowledge city” initiative in 5 themes: soil & water, information technology, innovative transport systems, environmental technologies
- ❖ Barcelona, Spain – the activity of Barcelona Forum 2004, which manifests the cultural perspective which Barcelona took, is described later in this paper.
- ❖ Palmerston North, New Zealand – this relatively small city puts education in the heart of its “knowledge city” manifest .
- ❖ Calgary, Canada Calgary was named the co-recipient of the World’s Top Intelligent Community of 2002 by the World Teleport Authority’s Intelligent Community Forum. “Calgary was chosen for its strength in a variety of areas... however, the most compelling case was made by Calgary’s efforts to bridge the digital divide and bring technology access, and the benefits of effective use of technology to those in the community who are traditionally excluded”.

A note on terminology and scope: Although the focus of the paper is on “Knowledge Cities” it should be noted the same principles are applied also to other “Knowledge Zones” such as Knowledge Corridors, Knowledge Harbours, Knowledge Villages and Knowledge Regions. Thus, as suggested by, “Knowledge City” is an umbrella metaphor for geographical entities which focus on knowledge creation (Davis, 2004). When this paper mentions “Urban Innovation Engine”, it can be also apply to a regional Innovation Engine”, for example. The notion of “Knowledge City” is interchangeable to a certain degree with similar evolving concepts such as “Intelligent City” (Komninos, 2002), “Educating City” (Figueras, 2004), or “Smart City”.

The Ecology of Innovation

As was argued in the introduction section, Innovation is a critical challenge in the knowledge economy. In this section we present a set of principles for an organisational climate that fosters knowledge creation and innovation – the principles of Innovation Ecology. The research on this subject is well developed in the domain of formal business organisations, and therefore many of the references in this section refer to that world. However, it is suggested that the same principles can be applied also to not-business domains in general, and knowledge cities in particular. This argument will be elaborated in the next section.

According to George Por (2001), a successful work ecology is a *“complete, organic, Ecosystem. It integrates many disciplines together to produce a dynamic, holistic view of the workplace and its relationship to its environment. It addresses all elements that make up today’s high velocity, rapidly changing workplace, especially the way they interact in the form of work to produce the outcomes needed by the enterprise and its stakeholders”* (Ward A., 1999). It is a rich “stew” of interdependent elements, continuously interacting and adapting to produce outcomes that ensure the vitality and sustainability of the enterprise (Por, 1999).

Great leaders create conditions that bring out people's ability to produce extraordinary results. Central to that task is the creation of a climate for innovation, which is a force field that guides managers and intrapreneurs towards innovation – or against it (Pinchot & Pellman, 1999).

Innovation Ecology is the work environment (or a urban environment in the case of a knowledge city) , a setting that can enable, encourage, foster, and catalyse the generation of ideas and creation of value out of them (Hale 1996). It supports individuals, teams, and the whole organisation in the journey towards sustainable growth and success that are based on on-going innovation.

The Elements of Innovation Ecology

The Ecology of Innovation is a complex system composed of many interlinked elements. Here we list some of the more influential ones.

Element 1. TIME: New ideas require exploration before their value can be demonstrated to others. Innovative organisations give people the freedom to use some of their time to explore ideas without having to ask permission (Pinchot & Pellman, 1999). In many organisational surveys, "lack of time" appears as the #1 obstacle for innovation. The solution of 3M is well known: their 15% rule states that every employee can use up to 15% of his/her time on ideas not related to daily work and responsibilities (Kanter, Kao and Wiersema, 1997).

Element 2. ORGANISATIONAL STRUCTURE: Flat organisational structure, weak boundaries between departments, low emphasis on hierarchy, and perhaps even a loosely defined structure increase the chances that the organisation will enhance, rather than inhibit, the generation, flow and leverage of ideas. Organisational forms are of fundamental importance to innovation. Different kinds of innovation have different characteristics and require different organisational forms and managerial approaches in order to be successful (Damaskopolus, 2002). Integrated project teams, multi-disciplinary teams, virtual teams, future centres, and internal incubators are examples of forms that contribute to innovation.

Element 3. PHYSICAL SPACE: In an economy based on innovation, what better use can there be for space than to inspire creativity? Several innovative organisations believe that creative space – both the shared space and the private office – can significantly contribute to the organisational atmosphere of wild ideas, action, chaos, open mind, and barrier-breaking. (Liber, 2001, Ward V., 1999). The playful design of IDEO's Boston offices invites employees to play with ideas, think out of the box, and break the rules. At IDEO, they believe that at its best, space can inspire and amuse. The merging of fun and work is invigorating (Kelley, 2000).

Element 4. TOLERANCE of RISK: Innovative organisations promote risk taking. Innovation requires learning of new things, experimentation, and pushing the boundaries of the unknown. The leaders of such organisations invite and reward (clever) risk taking, and do not punish mistakes. Failures are taken as golden learning opportunities.

Element 5. STRATEGY: in an innovative environment, the vision and strategic intent of the organisation are clearly communicated to all employees. This joins all creative forces and energies and directs them towards the strategic benefit of the organisation (Pinchot, 1997).

Element 6. RECOGNITION & INCENTIVE SYSTEMS: Creative people are self-motivated. However, all innovation researchers, leaders and practitioners agree that rewarding innovation can contribute to its success. There is an open dispute about the appropriate mechanism to reward innovation. In some organisations, there are significant direct financial incentives related to the financial expected contribution of the innovation. For example, in Pfizer, the creative people enjoy a faster career path, salary increases and prizes for individuals and teams (Kanter, Kao and Wiersema, 1997). Others believe that the softer

ways are preferred: public recognition, attention from management, and symbolic signs of recognition.

Element 7. VIRTUAL SPACE: in many innovative organisations of the 21st century, technology has multiple supportive roles, such as facilitating collaboration between distant members and streamlining and catalysing the flow of ideas, as demonstrated forcefully by BT's ideas management Intranet system (Lakin 2001). A research of virtual scientific collaboration showed that they virtual conferencing provide the participants with adequate means of exchanging and creating knowledge, provided that a sense of "presence" and "being there" is created (Towell and Towell, 2001). Nonaka, when discussing the concept of Ba, a space for knowledge creation, suggests that it can also take a virtual form, a "Cyber Ba" (Nonaka, 1998)

Element 8. STRUCTURED PROCESSES vs. SPONTANEITY: Many studies have found that serendipity is a key to recurring innovation (e.g. Koeing 2000). Innovative companies must protect the possibility that surprises will occur. Serendipity, intuition, experience, scanning, and relations are sources of surprises (Cope 1998). At the same time, without a powerful process to capture the good ideas and turn them into value, most ideas will vanish without having a fair chance to make their way through a serious evaluation, development and testing funnel. Maintaining a degree of tension between structure and creativity can be useful, and the inherent conflicts between them should not be completely resolved (Brown and Duguid 2001). Here we need to emphasise that structured processes enhance the innovation capability of the organisation, but too much structure and bureaucracy can kill it.

Element 9. KNOWLEDGE MANAGEMENT: Management of the existing knowledge of the organisation provides a solid foundation for the creation of new knowledge (Ruggles, 1997). Effective treatment of the organisational knowledge resources (experience, expertise, history, lessons learned, best practices, to name some of the typical knowledge assets) is part of an Innovation Ecology.

Element 10. FINANCIAL CAPITAL: Serious innovation requires significant investment in translating brilliant ideas into viable products and services. Innovative organisations allocate considerable resources to the various innovation phases: understanding customer needs, researching the environment, developing products, and testing them in the lab and in the market. There are several models of internal incubation in which employees with good ideas receive significant resources to test them.

Element 11. DIVERSITY: Similar people will generate similar ideas. Some innovative organisations deliberately increase diversity in the work force. Diverse experiences, cultural backgrounds, professions, academic background, ages, and personalities contribute to the creation of fruitful dialogues based on multiple perspectives (Naimen, 1998).

Element 12. ATTENTION to the FUTURE: In a turbulent environment, there is continuous tension between the day-to-day challenges, tasks and problems and the need to focus on the future. In organisations that excel in innovation, the top priority issue is the future. In other companies, most management and employee attention is directed to fire fighting and short-term objectives. "The future is 14 second away" argues Leif Edvinsson (2003), and created Skandia future Center, with the explicit objective of "turning the future into an asset".

Element 13. CHALLENGE: Open ended, non-structured tasks engender higher creativity than narrow jobs. People respond positively when they are challenged and provided with sufficient scope to generate novel solutions (Ahmed, 1998).

Element 14. THE UNIFYING PRINCIPLE -CONVERSATIONS: According to Nonaka's spiral model of knowledge creation (1998), the process of is based on the conversion of knowledge:

- ❖ Combination: From explicit knowledge to explicit
- ❖ Internalization: from explicit to tacit

- ❖ Externalization: from tacit to explicit
- ❖ Socialization: from tacit to tacit.

Conversation (including contemplation, which is an inner conversation) is instrumental to these four knowledge conversion phases. Ideas are created at conversations (and contemplation) , and are enhanced and developed through conversations (Stewart, 2001). Alan Webber argues that “*Conversations inside and outside the company are the chief mechanism for making change and renewal an ongoing part of the company’s culture*” (quoted in Stewart, 2001). Therefore, they are a core element of an Innovation Ecology. A close examination of the other elements elaborated above shows that most of them support and enable conversations. For example, the physical space, the virtual space, the time space, the challenge space (which calls for meaningful conversations), diversity – all are important enablers of innovative conversations. Therefore, the conversation have a special role in the set of Innovation Ecology principles, as a unifying element.

Urban Innovation Engines



The school of Athens, Rafael (1509-1510)

An “Urban Innovation Engine” is a system which can trigger, generate, foster, and catalyze innovation in the city. Typically, it is a complex system that includes people, relationships, values, processes, tools and technological, physical and financial infrastructure (Dvir, 2003).

Using the terminology of Nonaka, an Innovation engine is a “ba”, a place which enables knowledge creation and innovation. The concept of ba was originally proposed by Japanese philosopher Kitaro Nishida (1970). Professor Ikujiro Nonaka adapted this concept for the purpose of elaborating

his model of knowledge creation which constitutes on the four phases of Socialization, Internalization, Combination and Externalization (Nonaka, 1998). Ba is a context, which harbours meaning. Thus, ba can be considered as a shared space that serves as a foundation for knowledge creation. "Ba" can be thought of as a shared space for emerging relationships. This space can be physical (eg. office, dispersed business space), virtual (e.g., email, teleconference), mental (eg. shared experiences, ideas, ideals) or any combination of them. Ba provides a platform for advancing individual and/or collective knowledge.

A close examination of the constructs of a typical city reveals that many of the city constructs can serve as Innovation Engines. However, not every University, or Library, or Industrial District, for example, do play the role of a true innovation engine. There is always a unique combination of intangible factors which turn a specific ordinary urban organ into an innovation engine. These factors have been described above as the principles of innovation ecology. This set might include, for example, a strategic intention, an explicit vision to use it as an innovation engine, exceptional leadership, a stimulating physical space, an urgent need or challenge, special team and.

The following section presents eleven generic innovation engines: the Café, the Big Event, the Library, the Museum, the Gate, the Future Outlook Tower, the University, the Capital

Market, the Digital Infrastructure, the Industrial District & Science Park, the brown-filled industrial zone and finally – the urban virtual space. This is not a comprehensive list – rather, it is used to demonstrate some of the principles of Innovation engines, and to show that they are (or can be) interwoven into the dynamics of any living knowledge city.

The Café and other third places



Jean Paul Sartre,
Parisian cafe

The first Innovation Engine we visit is the old good Café', since knowledge and ideas are created mainly through conversations. Historically, cafés provided stimulating environment for rich conversations which led to the creation of exchange of provocative ideas and breakthrough in diverse areas such as arts, philosophy, psychology and politics. Many of the influencing ideas of the 19 century

were created at the café's of Wien and Paris, for example (Dak, 2003).

It is only natural that the methodology of “Knowledge Café” was developed to support innovative brainstorming sessions.

The Café is an example of “Third Places” or “Great Good Places” which are the “*many public places where people can gather, put aside the concerns of home and work (their first and second places) and hang out simply for the pleasures of good company and lively conversation*” Oldenburg, 1999). Coffee shops, bookstores, bars and hair salon have a similar function – and sometimes can act as innovation engines.

REFLECTION: How do third places provide an Ecology for Innovation and related to the set of elements explained above? They provide the stimulating PHYSICAL space; they provide the relaxed TIME space; some of them provide DIVERSITY space; all provide the SPONTANEOUS knowledge creation processes; most provide safe opportunity for RISK TAKING; usually they excel at informal KNOWLEDGE MANGEEMENT; all provide the ecology for CONVESATION and inner conversations (contemplation).

The Big Urban Event

What is common to Paris 1900 and Barcelona 2004?

Both are fine examples of cities who used large-scale events as innovation engines. The “Paris Exposition Universelle de 1900” was an opportunity for many nations to present and share their scientific and cultural achievements. It was also a trigger to push forward the state-of-art in diverse areas - the Tour Eiffel is perhaps the most impressive manifestation of this in the area of innovative engineering.



Outdoor café, Pierre August
Renoir

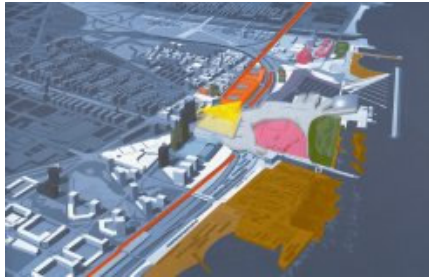


Knowledge café in the E100
roundtable & Latin America
Knowledge Development Forum,
Montevideo, 2002



The site of Paris exposition,
1900

The visioning and organisation of “Forum Universal de las Culturas 2004” is one of the many tangible steps of the city to realize its vision “Barcelona knowledge city”.



Layout of Forum Barcelona 2004

“Forum Barcelona will offer a new and creative space for reflection and experimentation in relation to the main cultural and social conflicts that humanity is faced with at the outset of the 21st century. These 30 hectares are filled with ideas, distributed throughout parks, streets, auditoriums, a swimming area and a marina. This huge area provides opportunities to watch and listen, to experiment, create and taste, to learn and discover, to get excited, but also to reflect. The activities that take place there are designed to respond to visitors’ concerns and satisfy their curiosity, regardless of nationality, age or educational background.” (Barcelona 2004)

(<http://www.barcelona2004.org>).

REFLECTION: The Innovation Ecology elements which are relevant to Café’s and Third Places (such as time, space, conversations, diversity) are also applicable to the case of the Big Events. However, more *principles* are demonstrated in the Big Event: the *strategic* intention of the city leaders, the *BIG CHALLENGE*, FINANCIAL CAPITAL and the ATTENTION TO THE FUTURE.

The library



Scholars at the old Alexandria library

Great Libraries are not only about archiving the intellectual achievements of the past generations but can serve as a place for innovation. The ancient library at Alexandria, which for a thousand years had been the western world’s most important



The new Bibliotheca Alexandrina.

center of learning. The Alexandria Library was nothing less than the summit of ancient scholarship. Its archives

and museum were filled with the intellectual riches of Mesopotamia, Persia, Greece, Rome and Egypt, and its research center was visited by many generations of scholars seeking to stimulate their minds and keep alive memories of the past.

Today, in an event that speaks of renewal Alexandria is trying to recapture the spirit of perhaps its richest legacy—the Great Library of Alexandria—by opening the new Bibliotheca Alexandrina.

REFLECTION: The reader probably knows libraries of two kinds- sleeping dead warehouses of books, and active and lively places where knowledge may be created and exchange, ideas may be generated through conversations, and innovation can occur. This is the case with all of the other urban institutions explored in the paper – each can be a dead place or play the role of a local innovation engine which applies some or all of the Innovation Ecology principles.

The Gate

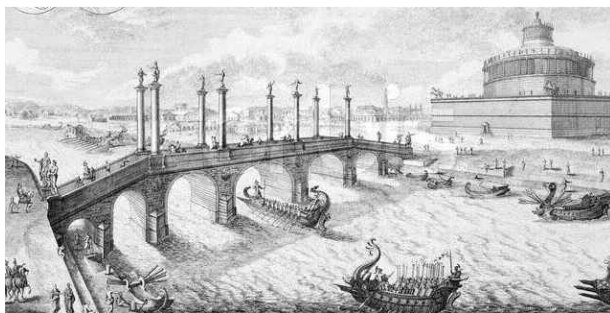


Airport is a central element of the innovation infrastructure of any modern city.

"...More recently, I have been looking to identify the major "knowledge cities" of the world. And as Steve Searle in New Zealand pointed out a starting point is to identify which cities have a University and an International Airport". (David Gurteen, <http://www.gurteen.com>).

The airport symbolize the opportunity for free flows of knowledge, ideas, different perspectives, expertise and innovation from and into the city. It

And in the past the marine port served a similar role. Think of Barcelona port, the departing point of so many exploration adventures and discoveries.



Old Rome



Barcelona city and port

"All roads lead to Rome"?

In the glorious days of the Roman empire, it was the sophisticated highway system which enabled the flow of ideas and knowledge between Rome and the rest of the Roman empire.

REFLECTION: the gate is the good example of an innovation engine which provides the element of **CONNECTIVITY** which is so critical in today knowledge economy. It should be noted that a gate is not necessarily of physical entity. The virtual urban portal provides connectivity and access to all citizens.

The Museum

Similarly to the case of libraries, great museums not



Bilbao – a plan for urban renewal



Guggenheim museum, Bilbao

only show past cultural achievements but can also serve as hosts and stimulators of innovation in diverse arts fields as well as in other areas.

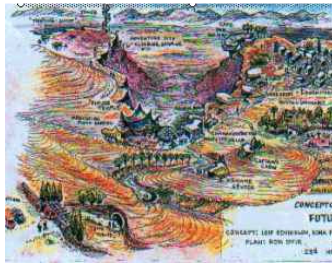
One of the best examples is the Guggenheim museum at Bilbao. which was a one of the most important ingredients in the plan to redevelop the city of Bilbao and transform this old industrial town into a knowledge city. Since it opened its doors in 1997, the museum hosted not only art events but many conferences in business innovation, intellectual capital and similar domains.

REFLECTION:

- ❖ What if 65% of the museum exhibition space will be dedicated to present future images and not past achievements or representations of contemporary art?
- ❖ What if 65% of the exhibits will be co-created by the visitors and not by established artists?
- ❖ What if the museum will open its gates 24 hours a day – the muse is still there, before 10:00 and after 17:00.

The Future Outlook Tower

Ericsson, the Swedish telecommunication corporation, established in 2000 a small unit called “Foresight group”. Ericsson Foresight is the corporate futures group, a long-term futures centre with a 10 year outlook. The group identifies emerging trends, invites creative ideas, creates scenarios and develops strategic options in a wide range of areas (Ericsson, 2004). Similarly to this organisational observation tower, knowledge cities may establish urban observation towers. One example is The New York Center for an Urban Future, a public policy organization dedicated to improving the overall health of New York City and serving its long-term interests (<http://www.nycfuture.org>).



Future center at Mitzpe Ramon – conceptual plan

The concept of Regional/Urban Future Centres includes 4 elements: a gallery for the creation and presentation of future pictures, an innovation laboratory, a market place for ideas, and a training Center for “future skills” (Dvir & Pasher, 2004). The “on-going citizens conversation” is at the heart of the concept.

REFLECTION

A word of caution: in order to serve as a true innovation engine, the tower must be strongly connected to the city’s citizens – as opposed to typical “ivory towers”. Creating a sense of common language and meaning is also important – in order to avoid the tower from the destiny of the tower of Babylon.

The University

University of California, Berkeley in San Francisco, the colleges of Oxford, MIT and Harvard at Boston, Le Sorbonne in Paris, Monterrey Tech at Monterrey, the Technion at Haifa. All are fine examples of the scale, quality and different kind of innovativeness that a good university can contribute to a city. In all visions and strategic plans of knowledge cities, the local universities play an instrumental role. However, beware of ivory towers. It is not enough to nourish the academic excellence of the university. The multi-faceted linked between the university and the city citizens – children, teachers, business people, artists, industrialists, etc – turn the university from a learning and research center into an innovation engine.



Brent Ericsson, the visionary of Ericsson foresight



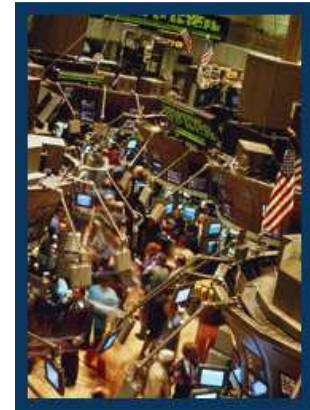
Sunday morning, Monterrey Tech

REFLECTION:

All existing universities already play the role of local (and sometimes international) innovation engines. The challenge is one of intensity – how well do they play this role? How well are they equipped for this? How good are their “outputs” (graduates, research results, breakthroughs, patents, impact on social and business innovation of their environment)? What percentage of their curriculum does address innovation, directly and indirectly? How fast do they turn ideas into reality?

The Capital Market place

In the six facets model of innovation developed in the NIMCube project, “Exploitation”, .i.e. the act and art of turning ideas into value, was identified as a critical element of innovation (Dvir et al, 2002). In order to allow large scale exploitation, significant financial resources are required. Therefore we believe that the stock exchanges, banks, joint venture funds and other financial institutions can serve as engines for innovation. However, the potential of these institutions to drive innovation should not be taken for granted – it requires smart, responsible and innovative attitude from all the stakeholders.



Wall street stock exchange, New-York

REFLECTION:

Designers at Barcelona’s Competitive Design Network coined the term InnoCracy - a democratic approach towards innovation. Although the capital market developed many new years in the recent 20 years, access to them is still limited, and entry barrier are high – perhaps too high if we believe that wider parts of the population can take part in the InnoCracy game.

Knowledge Intensive Industrial District and Science Parks



Zernike Science park

The importance of Knowledge Intensive industrial districts and science parks as engines for urban, regional and national innovation is well recognized by policy makers at all levels. Most strategic plans for “Knowledge Cities” emphasize their role (e.g. in Barcelona, Melbourne and Delft knowledge cities). Groningen is another European town defining itself as a “knowledge city”. For more than 400 years Groningen has been an important knowledge center in the Netherlands, which is a result of the presence of the University of Groningen. Zernike Science park complements the university as a driving force for

innovation.

REFLECTION:

Innovation parks exemplifies that the operation of Innovation Engines requires intensive and rich interactions between many stakeholders. In a typical Innovation Park the government, international corporations, education establishments, research institutes, financial funds and local professionals are all involved.

Brownfield sites

Brownfield sites are underused urban areas, generally dating from the first phase of industrialization. Many cities, including Chicago, London and Toronto are involved in large scale projects to revitalize brownfields and turn them into lively city places which involves culture, business, education, etc.

The Westergasfabriek is a former coal gasification plant which was built on farmland on the outskirts of Amsterdam in 1883. It supplied gas until the 1960's and played an important role in lighting the streets of the city in the early part of this century and providing gas for industry. In the recent years it was transformed into "park of the future".

Marc van Warmerdam, the Director of the famous Dutch music theatre company, captured the unique and important role that this former industrial site plays in sustaining and promoting cultural development in the Netherlands: "A lot of cultural activity and opportunity comes together in a project like this. Here you can bring commercial elements together with culture. What you need to further your work is to bring young, creative people together, in a large space. This is where it can happen – and these buildings in the Westergasfabriek make it possible". (Brownfields exchange, 1999).



Amsterdam
Westergasfabriek

Reflection:

The cast of brownfields as innovation engines exemplifies that innovation engines should not necessarily be designed and build from scratch. The alternative of reusing old institutions and revitalizing them as innovation engines is more feasible in many cases. It also bears the special quality of past-present-future link, which can intensify creativity.

The digital infrastructure

- Number of computers per capita.
- Percentage of population connected to internet
- Intensity of IT education at the kindergarten
- Number of teleworking employees

These are just few examples to some of the criteria or performance measures used by knowledge cities. Why?

Both researchers and policy makers believe that the IT intensity is the great divider between developed nations and cities, and those who are lagging behind. Thus, advanced IT infrastructure is considered as a critical condition for innovative city.

The "City of Knowledge" is a research project created in 2001 by economist, sociologist and journalist Gilson Schwartz, Visiting Professor at the Institute of Advanced Studies of the University of São Paulo, Brazil. Envisioned as a living network, it could be approximately described as a "digital city" built by "communities of practice" that develop new space-time frameworks for the production of cultural identities and collective intelligence (Schwartz, 2001)

En2Polis was designed by Entovation as the "International Knowledge City of the Future". It will be composed of several virtual urban institutions such as "Future Center", "knowledge exchange", "Innovation Olympics Stadium" and "Club Know" (Amidon, 2003).

REFLECTION:

In the context of a knowledge city, a particular challenge is the combination of virtual and physical Innovation Engines. For example, one possible approach is to have a virtual branch for each physical innovation engine, in order to exploit the complementary characteristics of the physical space with the “cyber ba”.

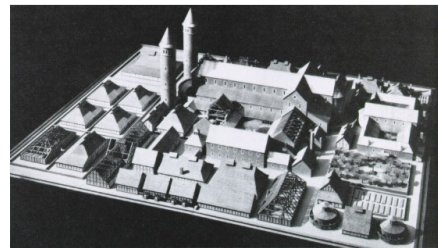
Other urban innovation engines?

How can cities turn other urban places and institutions into engines for innovation?

We believe that creative thinking based on collaborative efforts of all stakeholders – citizens, business people, policy makers, educators etc – can lead to interesting answers. For example the following urban places can become innovation engines: kindergartens, streets, piazzas, open markets, shopping malls, town halls.

Conclusion - how to build a knowledge city?

One of the projects of the Harvard Design School Project on the City was a how-to guide titled “*How to build a city: roman operating system*” (Andraos et al., 2001). The team of designers explored multiple old Roman cities and investigated their commonalities and architectural and social core concepts. They defined a leg-like set of building blocks such as the *Basiclica*, the *Capitolium*, the *Templa*, the *Theatrum*, the Forum, the *Limites*, the *Ceneturatio* etc. The manual starts with the following basic assumptions:



A typical roman city

“There are four main elements that you will need to understand for building, proliferation and networking of a city:

- 1. The city is compromised of standardized parts arranged in a matrix. These parts are the standard equipment included in the container of each city and are easily identifiable.*
- 2. The city is organized according to a series of general principles which are socially, culturally, and politically determined, and in most cases are manifested in clear architectural and urban examples.*
- 3. The city is the relationship of constantly changing flows superimposed onto a generic template.*
- 4. You will have the ability to customize your city according to local topographical, climatic or cultural conditions*

For all its apparent complexity, once you know the rules a city is easy to build”. (Andraos et al., 2001).

Can the same logic be applied to the creation of a knowledge city?

We don't think that a knowledge city “*is easy to build*”. There are considerable differences between a theoretical (or even a real) old Roman city and a modern city. Probably the most notable difference is that co-emergence and self-organizing principles dominate the development of most human settlements rather than synthetic planning. As suggested by many urban planners (e.g. Sola-Morales, 1997) “*a diffuse organicism can be the underlying model for understanding the transformations of cities. Just as the organs of a living being grow, adapt and transform themselves – in the same way the organs – the architectures – of the city grow, adapt and transform themselves in constant interaction with the natural or social environment*”. Sometimes, the organic development co-exists with a more planned one. However, we do adopt some of the ideas of the above structured logic suggested by the Roman City operating manual to the challenge of architecting a knowledge city. The guide might start with the following principles:

1. The planning should address the dynamics of knowledge development and economy of intangible assets, which are very different than the ones of the traditional economy which is based on tangible goods.
2. The role of the city is to provide its citizens with the enabling conditions which foster knowledge creation, knowledge exchange and innovation. These conditions are embedded in the set of "*Innovation Ecology Principles*" which were described earlier.
3. "*Innovation Engines*" accessible to the citizens are the urban organs which turn these enabling conditions into reality. Thus, they should be nourished.
4. In most cases you will not build nor a green field "knowledge city" neither brand new Innovation Engines. The challenge would be usually to transform ordinary existing (and maybe even aging) urban constructs and re-invent them as true innovation engines which apply the principles of Innovation Ecology.
5. The Innovation Engines must not become isolated ivory towers. They must be connected continuously to each other as well as be integrated in all city's flows.
6. Each city is characterized by different cultural, economical and political conditions. Therefore, the specific set of the city' innovation engines, and the form they will take will be customized to the unique urban circumstances, competencies, opportunities and challenges.
7. A viable "Knowledge City" or any of its Innovation Engine constructs will not be architected by a single professional or urban department. Rather, it will be the outcome of a collaborative process which involves the talent, insights and perspectives of all stakeholders – senior citizens, children, local business people, academic, council officials, artists, urban planning experts, to name some of them.

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