RESEARCH ARTICLE

KNOWLEDGE AS A HOLISTIC, INTEGRATED APPROACH TO FUTURE URBAN DEVELOPMENT

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ARTICLE INFO	ABSTRACT
	The effect that modern technology and innovation has on societies and cultures today, as well as on the decision-making process of any place, is evident in our common everyday life. Each and every process that we as individuals undergo on a daily basis is interlinked with drivers based on knowledge and data compiled. Today, modern global practices emphasize that economic growth, as well, is more dependent on knowledge; knowledge being, in essence, the repertoire of information that is used in order to make better decisions. Accordingly, a new concept is being coined to term these fast-track cross cutting changes. This new integrated approach; the knowledge city, adds a new dimension to existing perspectives on cities, as it describes the interrelations between physical and intangible urban spaces. While there is a long history and vast body of knowledge about cities and its dynamics, the knowledge city perspective contributes to a better understanding of the multitude of critical elements such as urban planning, human resources and economic development as the main dimensions of a city, emphasizing that cities should be more accessible, attractive, connected and dynamic. This intricate weave of data leads to either a successful or a rundown city. However, the concept of "knowledge cities" is yet an emerging field of theory and practice. The purpose of this research is to look into the knowledge city concept and try to discuss the required indicators as a foundation for the planning process; a process which goes beyond conventional city planning approaches and deeper into urban planning, urban design and building design.

INTRODUCTION

"In most cities, utilities and services are constrained with fast population growth and working around aging infrastructure. The values, businesses and residents seen in new cities, have better experiences, improved services, and utilities that better use technology to meet changing needs – especially in the developing world."(Cityquest–KAEC Forum 2015). The world is changing faster than ever before. Knowledge cities are considered one of the global megatrends shaking up the city planning science, starting off with the term "intellectual capital" concept which was first coined to give a structure to the components of the theories that would govern the adoption of knowledge cities. This term (intellectual capital approach) consists of three main pillars; relational, human and organizational. According to recent research, there are several distinctions, derived from many parts of the world, for the term knowledge city. One main characteristic of knowledge cities directs attention to 'an economy, whether local or regional,

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driven by high value-added exports created through research, technology, and brainpower' (SGS, 2002). Cities that seek to position themselves as knowledge cities, must first invest in an in-depth analysis of the city's state, focusing on a clear vision and strategy to reach that goal, taking into consideration the necessary action implementation plans. Integrating partnerships between local, public and private sectors is mandatory for knowledge cities to achieve their set-up objectives, during which a focus on offering better urban living standards within high-quality spaces and smarter sustainable projects that are highly valued by creative talented workers, should not be forsaken. The concept behind knowledge cities focuses on the importance that the city acts as an urban area that bases its ability on the creation of wealth on the generation and exchange of ideas and the promotion of knowledge networks. These cities, in which both the private and public sectors, value and nurture knowledge, invest, support and promote in supporting knowledge dissemination and discovery (i.e., learning and innovation) while utilizing knowledge to create products and services that adds value and contributes to prosperity (Carillo, 2006). Cities around the world, mainly developed ones, are now moving towards economies that are predominantly based on their knowledge capabilities, with some, such as Melbourne, in Australia, more advanced than

others. Frequently cited examples of advanced knowledge cities include San Francisco (USA), Singapore (Singapore), Manchester (UK), Montreal (Canada), Helsinki (Finland) and Birmingham (UK). Research shows that another 60 cities worldwide have put initiatives in place that support and highlight their knowledge capabilities (World Capital Institute, 2014). Rapid urbanization has made way to complications in the urban structure in different forms, with urban cohesion posing as one of the main issues. Urban cohesion is facing multiple challenges as modern cities transform from industrial, hardcore societies, to knowledge, intellectual societies. This entails giving special consideration to details during the city planning process. For knowledge cities to become efficacious, they have to support culture, attractiveness and above all an innovative urban environment. Innovation, in this case, is mainly achieved by so-called "innovation engines" – simple urban elements integrated within the overall urban fabric of the city, such as a café, a library or any other form of open or closed urban spaces that aids in the development of human interaction. These interactions are maximized in the simple meetings between people that occur in the urban environment. Added interaction possibilities are enabled in public spaces such as squares, parks or pedestrian streets.

MATERIALS AND METHODS

The research is based on: I.Theoretical study of the concepts and principles of the knowledge economy and its implications for planning policies and strategies for the urban and functional configuration of the Knowledge City. II.Critical study of the experiences of knowledge cities in different regions of the world are presented, drawing on the most important principles and planning criteria adopted,

THEORETICAL BACKGROUND

The definition of a Knowledge City (KC) is complex, and various definitions have been recognized. The World Capital Institute (WCI) presents several definitions but summarizes the definition of a KC as "one that searches for the creation of value in all its areas and develops high standards of life, cultural support, and economic development, among other aspects" (Cityquest, 2015).

The knowledge city concept: Although relatively new, the knowledge cities trend is a worldwide global initiative that has become one of the new planning concepts adopted by many. One characteristic of a knowledge city directs attention to a local or regional economy that is driven by high value-added exports created through research, technology and brainpower (SGS Economics, 2002). These cities tend to invest heavily in education, training, and research more than regular cities in developed economies (SGS Economics, 2002), thus, the main advantage is that a Knowledge City is identified as being on a higher level of education and scientific research. Another description by Edvinsson in 2003 states that Knowledge Cities are purposefully designed to "promote knowledge feeding" through promoting access to knowledge-driven key factors and tools, to the inhabitants of these areas *(Edvinsson, 2003)*, For example:

- Access to all types of new communication technologies.
- Presence and interconnectivity of public libraries
- Promotion of cultural facilities and services in relation with central educational strategies.

- Existence of local newspapers and facilities to promote reading to enhance knowledge.
- Existence of a network of schools.
- Respects the diversity of cultural practices of its citizens.
- Places streets at the service of culture.
- Simplifies cultural activities of community organizations and establishments through providing suitable spaces and resources.
- Fosters face to face relation through existence of civic centers that are open to diversity.
- Provides the tools required for citizens from other territories to express themselves.

Creating a strong urban core which dually sustains and develops dynamic growth is a point worth contemplating whilst planning in the knowledge economy this may be through enabling economic strength in an attempt to address social exclusion and physical dereliction. Urban planners, designers and policy makers must come to terms with the evolution of this urban form and recognize the increasingly borderless nature of the contemporary city. Understandably, this does not mean that planning and design of physical urban spaces ought to be abandoned altogether but should encompass and extend to these new approaches. As the result of virtualization and dematerialization, the concept of the city itself has been undergoing a continuous state of change in the urban form. With the emergence of governance in our everyday life and its implementation in nearly all aspects, it has not gone by unnoticed in the urban planning world. However, it has yet to encompass the overall concept of urban cities to unveil them from the confines of the administrative realm to be better able to understand how they will function in the future. With the emergence of these new examples, cities can no longer be seen as static unitary bodies that cannot excel or function beyond their physical boundaries. Bearing that in mind, not only are the physical properties of the city being contemplated, but also the social and demographic context too. The world no longer harbors citizens from one sole place, but rather a diverse multitude of cultures and traditions, the purpose of these new urban formations should be able to cater to this diversity and rise up to the challenges being faced. With the establishment of this platform, cities are no longer urban boundaries that are set in concrete, but merely a web of extensive interactions developed and supported by communication networks. However, we cannot rule out altogether the importance of the physical and monetary aspect of the city. Transportation hubs, public areas and open spaces are still mandatory to interconnect citizens, potentially granting the diversity and frequency of human contacts essential for many urban activities. In 2003, *Bertolini* coined the term 'mobility environments' to such places. Their quality not only depends on the features of each location but also on the characteristics of their visitors. Urban planning and design should be effective, and adequate in conceptualizing this growing openness of the urban system needed, and be able to focus on this new urban dimension.

Thy Key Factors that constitute to knowledge

- **Technological:** levels of technology available, ICT infrastructures, and access to technology.
- **Strategic:** Strategic vision development plans.
- **Political:** political will and legislations.

- **Environmental:** Business environment and market needs, private sectors and NGOs.
- **Societal:** standard of living, education, cultural obstacles, and human rights.

Important traits: Knowledge cities are cities that rise above the ordinary traits available in most well developed cities of today. High quality of life, technology-embedded architecture, knowledge accessibility, research excellence as well as focus on a unified educational system, existence of dependable infrastructure that harbor communication technologies, access to business opportunities and commerce, and the provision of are some of the factors governing how we assess the livability of cities today. The above criteria conceptualizes that not every city at a given moment in time may qualify to become a knowledge city. These criteria must first be fulfilled before taking on the next step.

Urban form: The prevailing urban form in urban theories was the monocentric form, generally associated with a "centralized and continuous settlement" (Tsai, 2005), the city was then characterized as "one place", in the sense that the city together, with its physical, social and cultural values, was a whole. With the passing of time and theories, the city as "one place" increasingly failed to adequately describe urban morphologies, however, although the knowledge city is not monocentric, it advocates the city as "one place" in a different sense from that of before; all dwellers deserve the same services and features. The form and structure of the knowledge city differs substantially in many aspects from those of both the modern and the classical city, with knowledge zones and clusters being their main feature. Thus, a new set of planning policies, guidelines and governing rules for building the knowledge city is, therefore, necessary to take into account all these new physical and social challenges. To create a master plan of true quality for the Knowledge city, special attention should be paid to sense of place, functionality and innovation, implementation and phasing, future expansion and expansion traditions of the place in question.

The conceptual master plan of the knowledge city entails that:

- It is important for the Knowledge City to be self-sufficient.
- A population size of a million people would be ideal to support the operation of KC as an independent city; this supersized city should not be treated as one city, but rather as a collection of cities; referred to as "Constellation Cities."
- The surrounding environment should be integrated into the development of KC, maximizing connectivity as much as possible in order to create conditions that would be beneficial to the sustained growth of the city.

This master plan aims to lead to balanced integrated developments: one-third commercial and residential, one-third business and government amenities, and one-third public space with greenery and other social amenities." Urban forms planned for the 21st-century city should be able to fit the new network society and the rising knowledge economy along with activities characterized by the flow of information technology, people, goods and services all interconnected together through information networks. For such forms to play a role in the highly competitive market of world-class cities, the shift from the traditional industrial economy to this modern one; is inevitable. This shift should be based on knowledge, innovation, and services. The urban form must then be reconfigured so that it offers a high-quality urban living for skilled citizens. It should also attract and retain corporate retail companies, agencies and firms and develop a whole new set of commercial financial hubs. This integrated land use strategy allows high value, high-intensity knowledge resources to flourish within the KC, enabling a direct connectivity between manufacturing and light industrial zones. An ICT (Information Communication and Technology) super corridor must be developed along the main city spine and spread out through the corridor networks linking the main urban sub-centers knowledge hubs with regional high-tech clusters.

DESIGN PRINCIPLES

The design principles of the Knowledge city focus on inclusivity and equality. It is governed by high-end technologies that are adeptly evolving as we speak, thus the main principle of the knowledge city design lies in the ability of the city to adapt and evolve with this fast-paced evolution of technology and the vast amount of knowledge that is being handed out by the second. Aside from its adaptability, a successful city must offer security, whether it is commercial, infrastructure and efficiency, or basic services, a promising city as a whole should put the needs of its citizens at the forefront of all its planning activities"(Cities Alliance, 2007).

Main street spine: The main street of the Knowledge city forms the central backbone of the master plan, it acts as a neurological spine that monitors, utilizes and disseminates knowledge throughout the city, while the mixed uses and ground floor retail provide energy and life to the street, developing a rich retail ecosystem, including small independent shops and restaurants that provide employment and expand the number of residents invested in the city. This main spine should also harbor small-scale public spaces from plazas and micro-parks, to street side seating areas in an attempt to integrate local elements, from architectural styles to building materials, to enhance residents' emotional attachment and commitment to the city, and contribute to ecological and social sustainability. The main street should also have an integrated and rich landscape, with a double width curb free footpath on the sunny side of the street to provide high pedestrian connectivity at the street level and throughout public spaces. Flexible bylaws allowing for temporary uses, such as street fairs, pop-up sales, markets, and other commerce-friendly activities should also be governed in place (Steinberg. 2018). Activating streets helps to orient building facades and commercial activities to encourage more interaction with the public. Both the physical design and regulatory environment in a city can improve public safety. Providing safe, attractive pedestrian and cycling spaces that are not marginalized by car infrastructure encourages residents to spend more time in the streets and lead to healthy sustainable lifestyles.

Urban innovation engines: With the continuous emergence of knowledge and the fast pace at which it is being spread today due to modern technology. Innovation and creativity are core values that should be addressed in the knowledge city. Innovation is the process in which knowledge is transformed into value, and creativity is the process of turning ideas, once imaginary, into reality.

Table 1. Criteria that affect the Design of Knowledge Cities in regards to Urban Planning, Urban Design and Building Design

Criteria	Urban Planning	Urban Design	Building Design

Accessibility and Connectivity Encourages and facilitates the transfer and movement of knowledge to maximize participation and benefit	*Urban structure
	  *Networks and links
	  *Main street spine, corridor networks and aligning streets (Variation at street level)
	*Public transports:
	  *Light Rail,
	  *Train System,
	  *Public Busses
		*Urban grids and street pattern
		*Integrated network of green spaces, streets, squares and blocks
		*Publicly accessible and usable green spaces
			*Building entrance access to local services (shops, hospitals, etc.) And jobs.
			*Organizational and visual awareness
			- More people can access employment, leisure and education facilities via efficient, and visual connectivity
			- Interior and exterior space closely and neatly packed together"

Compactness and Quality of Place	*Mixed land use *The co-location of major education, research, science, health institutions with business and industry *More walking and cycling zones	*Complex compact urban spaces *Activating Streets and outdoor recreation activities(various activities such as shops, restaurants and cafés, making it a natural meeting point)	*Connect visually (organizational and visual awareness) *Interior and exterior space closely and neatly packed together" *All residential units should be close to more kinds of amenities.
Attraction	*Attraction promotes culture, science, entertainment, information and education, also works as a public meeting place and Green connectors *Public access to the water, Parks, Play spaces, Squares.	*Open space and landmarks *Maximally the aesthetics of the water and environmental values. *Activating Streets and outdoor recreation activities	*Variation in typologies and uses within blocks *Attract global projects
Dynamism and Interaction	*Urban structure which creates a more dynamic movement pattern between different areas	*Mixed-use and safe urban district: *Mix of residential and work places as well as public and commercial services	*Mixed building heights and typologies can result in a varied skyline
Integration	*Infrastructure networks *Mixed land use	*Social, cultural and environmental features: *High-quality public spaces, squares, facilities *Rich integrated landscapes	*Proactive innovation , educational (industrial and scientific research) and training projects, *Knowledge based industries including laboratories and workshops *Research and business within various fields *Knowledge clusters: in business, education, and research,
Flexibility and efficiency	*A flexible IT infrastructure: Alternative design systems solutions to respond to changes in the context	*A flexible zoning giving access to a multiple of different activities in the same area	*A flexible zoning giving access to a multiple of different activities in the same building *Adaptable to several functions *Modular layout *Heights open to several configurations and activities
Sustainability	*Dedicated bus/car pool lanes *Bicycle and motorcycle infrastructure *Pedestrian only streets *Pedestrian friendly streetscapes *Pneumatic waste transport system *Gray water Collection and Flows	*Open space: *Energy efficient, street lighting *Trees/Urban forestry *Smart waste bins (e.g. solar powered compactors) *Permanent pavements and green alleys	*Green buildings *Solar water heating *Building envelope *Efficient windows *Building design *Water efficient piping *Rooftop gardening and design *Rooftop photovoltaic systems *Energy efficient lighting *Power use sub-metering
Ecology for Innovation	*A digital infrastructure for communication and knowledge management	*Innovative conversations (e.g. physical, virtual, time and challenges space)	*Urban innovative engines such as museums, libraries, cafes and other public spaces
Education and Learning An emphasis on learning will enable the community and students to contribute and benefit from the knowledge-intensive activities.			

'Innovation engines' and "creativity tanks" are crucial elements of this new mobile urban environment. They are systems that can trigger, generate, foster, and catalyze creativity and innovation in the urban setting. These systems include people, relationships, values, processes, tools, and technological, physical and financial infrastructure (*Queensland, 2016).*

Urban grain: The urban grain and street pattern is predominantly generated by the geometry of the main street, acting as the master spine and alignment of the streets which interconnect it. These two urban grids intend to reach out to places of remote place-making like hospitals and universities encouraging connections and implying relationships (*ACIL Tasman, 2013).*

Connectivity: The idea behind knowledge cities focus on the interconnectivity of all areas, both internally to its constituent parts; it's surrounding commercial, industrial and residential communities, as well as to other knowledge cities and centers. The master plan anticipates future connections; aligning streets and open space linkages with neighboring land use.

It also emphasizes the importance of connecting major transport to local and regional centers.

Open space / landmarks: An outdoor series of inter-connected landscaped open spaces including parks and community services provides a unique setting in which to live and work. Open spaces provide and encourage informal meetings and chance encounters - a critical ingredient in the "knowledge spillovers" that drive knowledge economies. Coincident with major open space elements are special buildings, smaller in scale and unique in design that act as built form landmarks. Urban designers and advocates of place-making encourage small-scale granular interventions across neighborhoods. This can refer to materials used, sidewalk design, seating areas, landscaping, encouraging pop-ups or ephemeral installations, public markets, and other low-cost interventions. This level of planning can help avoid the failures of placeless developments to create communal spaces that help bind together a fine social fabric (*Deloitte, 2012).*

DESIGN OF BUILDINGS

Knowledge Cities are places where knowledge is created, exchanged, transformed and transferred. They embrace and

encourage knowledge and creative interactions through enabling urban planning and investment in science, education and creative institutions. They also promote innovation and critical thinking to act as a means to their sustainability. The city's capacity to rapidly transform that knowledge capital into innovative products, processes, and services, is paramount, especially with the amount of knowledge being compiled every day. Building value in new cities augments the importance of their role within wider urban systems. All new cities should offer their inhabitants, investors, and commercial assets, the right value for the investment required, and a lifestyle and 'opportunity set' that keeps them attractive over the long term (Steinberg. 2018).

Building form: Master plans of knowledge cities should accommodate the building form of a medium rise of between 4 and 10 stories, this constraint aims to embed the built environment within the natural one, meaning that the higher building form should only be erected on elevated land.

Building layout: The building layout promotes public realization and expands areas of influence through alleviation of awareness and organizational and visual perceptions utilized to create planned and unplanned encounters that support innovation internally and propose community areas. Adjacent places of work and research facilities foster interchanges, exchanges, and encounters. Internal connectivity between buildings is proposed to enhance socialization between workers and scientists through attractive, flexible and efficient buildings. The arrangement and layout of proposed buildings should provide the platform required to allow collaboration and interdisciplinary work (Wollongong, 2016). The architectural design of the city should consider structures that are adaptable to several functions, and of modular layout. Architectural systems open opportunities to several configurations and activities; its organizational principles on the use of gridded geometric layouts, as a platform for modular coordination, allows flexibility and creativity in the design of buildings.

Buildings that promote movement

- People crossing paths and moving from one function to another is the best opportunity for interaction, buildings should foster opportunities for comfortable and interesting walking experiences, allowing for easy transitions between the different layers of community and focus areas.
- People moving is also the best way to move knowledge.
- Encouraging the growth of universities that provide a young and dynamic population can create various businesses. Several new cities include university campuses and subsidized student residencies as main points of attraction and as feeders into local businesses. They thus hope to foster a diverse social fabric associated with successful, vibrant cities. Actively including a variety of residents, such as artists, writers, trades workers and so on, can stimulate and support business innovation in the wider economy (*Wollongong, 2016).*
- In knowledge cities, people must be in direct contact with each other to transfer experiences, ideas, and knowledge. This can be achieved through open spaces, recreational facilities, and public-areas to allow connections to happen frequently.

Indicators of the design of knowledge cities

- The city is a very complex issue but also highly dynamic
- Master plan consists of very balanced integrated developments.
- The urban grain and street pattern is predominantly generated by the geometries.

Table 1 refers to the design principles and criteria of the Knowledge City in regards to urban planning, urban design and building design

Conclusion

Knowledge cities are now the newest trend in urban planning and design, international standards, and best practices have come out worldwide to help promote this new idea and to enhance efficacy and efficiency of these new cities through integration of scientific, academic and economic activities aiming at fostering research, innovation and easier transfer of knowledge and applications' technology. The City's plans focus on the street-level quality of life, walkability, and place-making as well as efforts to promote sustainable development and ecological building designs.

Criteria for the knowledge city

- Promote the development of the community as an attractive and accessible place.
- Associate activities characterized by flows of information technologies, people, goods and services.
- Highly dynamic Complexity that places a strong emphasis on creating a "live, work, learn, play".
- Balanced integrated developments with its surrounding environment.
- Integrated land use strategy allows high value, high-intensity knowledge resources
- Transform knowledge into value. 'Innovation engines' are crucial elements of the urban environment that promote innovation. They are systems that can trigger, generate, foster, and catalyze innovation in the urban setting
- People must be in direct contact with each other to transfer experiences, ideas, and knowledge.
- The urban form must be reconfigured so that it offers a high-quality urban living for skilled knowledge workers.
- It must also attract and retain corporate headquarters of companies of world status caliber and develop a whole new set of commercial financial hubs of services.
- It is important for the Knowledge City to be self-sufficient.
- Integrate a multitude of critical elements such as urban planning, human resources, economic development, business incubation, and environmental management,
- Ecologically sustainable; low consumption of energy, material, water, and other natural resources

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